國際海洋資訊

International Ocean Information

6
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藍色經濟、海洋觀光及永續藍色金融國際研討會及政策對話精要

Regional Conference and Policy Dialogue on Blue Economy, Ocean Tourism, and Sustainable Blue Financing

世界氣象組織2019年全球氣候狀況聲明

WMO Statement on the State of the Global Climate in 2019

海洋委員會 Ocean Affairs Council 發行

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目錄 Contents

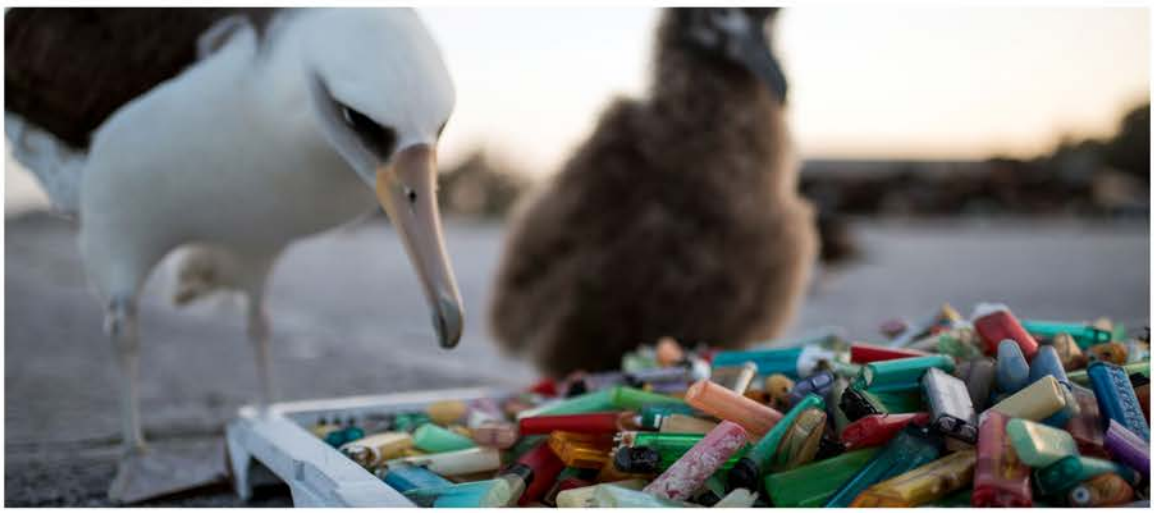
與「日」俱新
並肩海洋永續路

主任委員：李仲威

同為亞洲海洋國家的一員，臺日雙方在海洋治理、產業發展以及研究議題方面各有所長，本期介紹日本海洋政策、研究以及產業方面的亮點。「組織焦點」介紹統籌海洋政策的「日本綜合海洋政策本部」及相關權責機構，法規面則介紹最新一期的「海洋基本計畫」，來認識日本如何面對「新海洋立國之挑戰」。

在全球都重視海洋廢棄物議題的此刻，臺日在海廢治理的政策更可互相參照，本期介紹雙方海廢行動方案之比較，日本行動方案強調科學研究的重要性、更透過國際援助以強化海廢治理，我國「向海致敬」政策跨部會盤點並整合海洋垃圾清理能量，則是我們踏出深耕海洋的第一步。日本的海洋研究以及發展藍色經濟亦值得一觀，日本國立研究法人海洋研究開發機構（JAMSTEC）擁有地球模擬器、海上鑽探船、深潛器以及各類型研究船隊等核心設備與其相關之研究功能與定位；「藍色經濟、海洋觀光及永續藍色金融」國際研討會上，各國如何發展有效的藍色金融機制來養護海洋資源及振興海洋經濟，亦為本期焦點。

「專題報導」第1篇介紹世界氣象組織（WMO）最新的「2019年全球氣候狀況聲明」，聲明中提出溫室氣體濃度增加、海平面上升、海洋酸化等氣候指標，以及熱浪、野火等高衝擊事件；而第2篇則闡析我國「臺灣淺堆」面臨的生態浩劫，盜採海砂破壞了海洋生物的棲地，更使得海洋生態系逐漸崩毀。不論是天候或海洋生態的變化，都是大自然的警訊，呼籲人們正視氣候變遷以及受影響的生態環境。因此我們更應該以全球思維，劍及履及地採取行動，以維護永續的海洋！



圖說／廢棄的垃圾雜物流入海洋後，不僅影響海洋生物的習性，更可能造成海洋生態系的破壞

圖片來源／David Slater / NOAA

https://www.flickr.com/photos/onms/28250723916/

世界氣象組織2019年全球氣候狀況聲明

撰文／陳璋玲（國立成功大學海洋科技與事務所教授）
關鍵字／世界氣象組織、氣候變遷、高衝擊事件

世界氣象組織（World Meteorological Organization, WMO）發布2019年全球氣候狀況聲明，該聲明呈現最新氣候科學知識，氣候變遷造成的高衝擊事件，以及和高衝擊事件相關的風險。2019年全球氣候創下有記錄以來的次高、溫室氣體濃度增加、海平面上升、海水酸化，以及海冰覆蓋面積減少。不斷加劇的氣候變遷和極端氣候事件危害人體健康、糧食安全、人民生計、社會經濟，以及生物多樣性等，造成人員傷亡、飢餓、人口遷徙、海洋生態系破壞等問題。全球已偏離實現《巴黎協定》設定的暖化幅度抑制於1.5°C或2°C的目標。基此，從政府、人民團體、企業領導人到每位地球住民，都必須正視氣候變遷事實，並採取緊急行動，以遏止氣候變遷造成更壞的情形發生。

全球氣候訊息指標

一、溫度

2019年全球平均溫度比工業革命前的水準（即1850～1900年的基準值）高1.1±0.1°C，是有儀器記錄以來溫度次高的年份，僅次於2016年。若將2016年聖嬰現象造成溫度增加的因素排除，則2019年創下歷史新高溫度紀錄。過去5年（2015至2019年）是有記錄以來最溫暖的5年，而過去10年（2010至2019年）也是有記錄以來最溫暖的10年。自從1980年代以來，每個連續10年都比前一個10年更溫暖（圖1）。

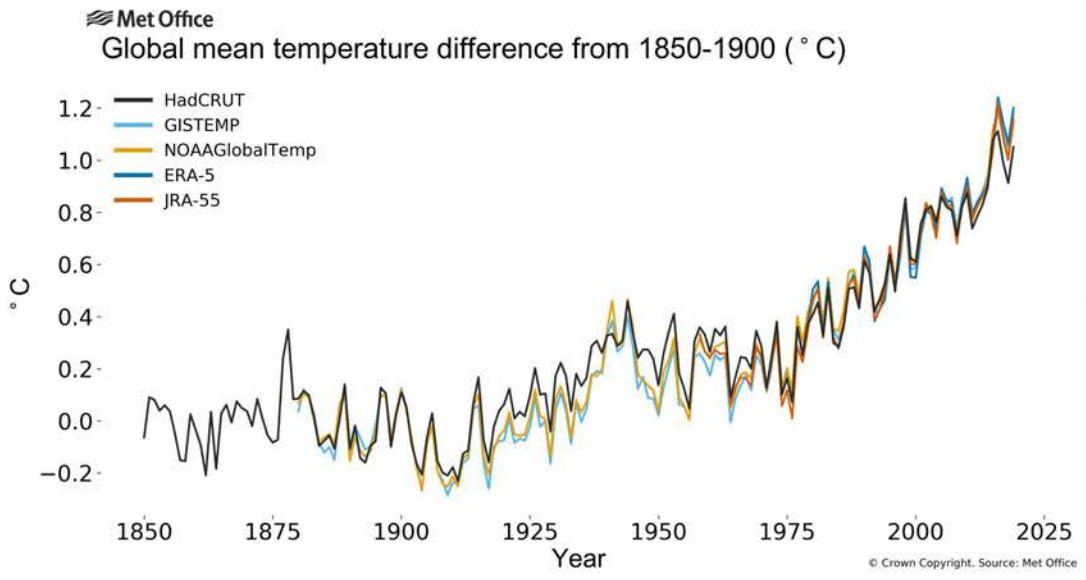


圖1／全球年平均溫度自工業革命以後逐年快速增加
圖片來源／Met Office
https://public.wmo.int/en/media/press-release/wmo-confirms-past-4-years-were-warmest-record

二、溫室氣體

2018年全球溫室氣體濃度創下紀錄新高：二氧化碳濃度達百萬分之407.8±0.1、甲烷濃度達十億分之1869±2、一氧化二氮濃度達十億分之331.1±0.1，分別代表工業前水準的147%、2259%和123%。雖然2019年資料需至2020年年底才可得知，但有些測量站（如夏威夷的茂納羅、塔斯曼尼亞的格林岬）的即時監測資料顯示2019年的二氧化碳、甲烷和一氧化二氮濃度持續上升。

三、海洋

海洋吸收地球系統約90%的熱量。海洋熱含量（Ocean heat content）指海洋吸收的熱，為全球暖化的重要指標之一。熱含量愈大，表示地球愈來愈熱。水深 700 公尺和2,000公尺以淺的海洋熱含量持續上升，2019 年創歷史紀錄新高（圖 2）。海洋變熱造成海水膨脹，加上陸地冰圈之融化，導致海平面上升，影響海岸地區。2019年海平面持續上升，已達到1993 年1月有記錄以來的最高值。過去 27 年期間，預估海平面上升速度為每年平均上升 3.24±0.3 公釐，但隨著時間之推移，海平面上升速度愈益增加。

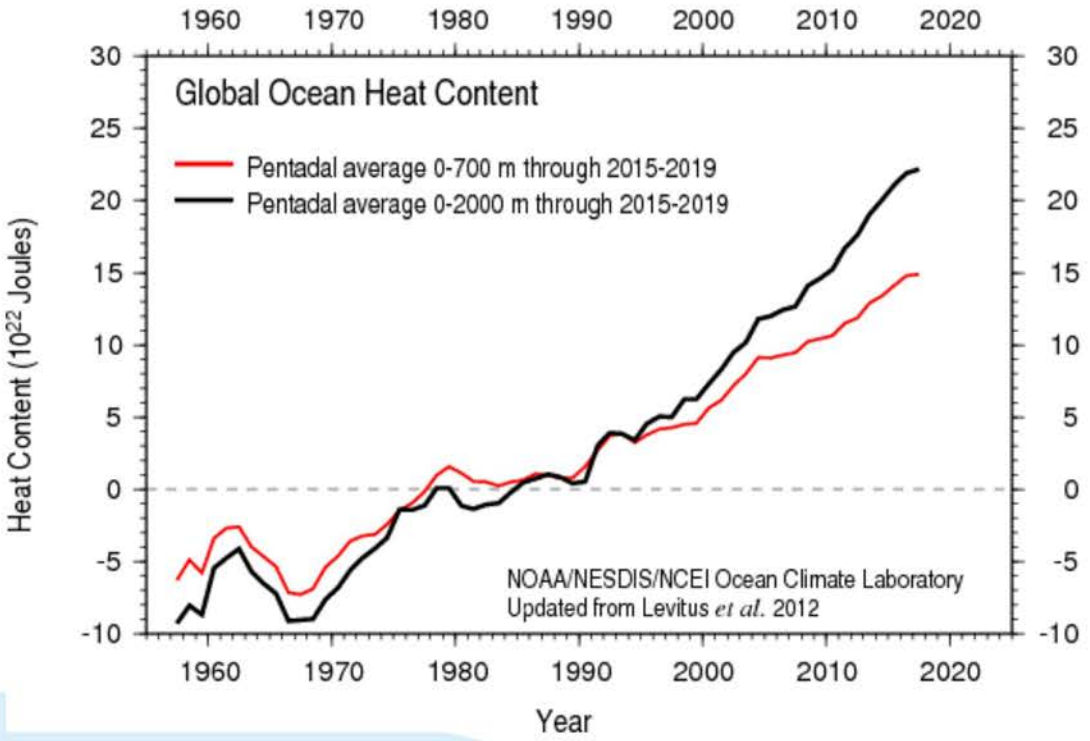


圖2／水深700公尺和2,000公尺以淺的海洋熱含量持續上升

圖片來源／https://www.nodc.noaa.gov/OC5/3M_HEAT_CONTENT/

從2009到2018年，海洋每年吸收全球二氧化碳排放量的23%，此雖有助減緩氣候變遷所帶來的衝擊，但也改變海洋化學性質，使海水酸性增加，稱之為海洋酸化現象。過去20至30年的觀測資料顯示自1980年代末期以來，每10年海洋酸鹼值減少0.017～0.027。

觀測及數值模擬資料顯示海水含氧量持續減少，自19世紀中葉以來，海水含氧量預估減少1%至2%。海水含氧量減少將改變海洋生物的多樣性、組成、豐度和分布。甚至有研究指出含氧量減少造成珊瑚更脆弱。

四、冰凍圈

冰凍圈（cryosphere）是指水以固態存在的地區，亦即水凍結成為冰或雪。冰凍圈主要出現在北極和南極，但亦有可能出現在其他區域，如高山地區。冰凍圈是氣候變遷的重要指標之一。海冰面積呈季節性變化，冬季時面積較大，而夏季面積較小。自1979年有衛星監測海冰面積資料以來，北極在所有月份之同一月份之海冰覆蓋面積長期呈現逐漸縮小的趨勢，尤其在夏季末期減少最多。2019年3月13日，北極出現最大海冰覆蓋面積為14.78百萬平方公里，是記錄中第7小面積；9月18日出現最小海冰覆蓋面積為4.15百萬平方公里，為記錄中第2小面積。

短期氣候變動的驅動力

聖嬰-南方振盪（El Niño-Southern Oscillation）及印度洋偶極（Indian Ocean Dipole, IOP）這兩個因子有助瞭解2019年的氣候狀況。聖嬰-南方振盪是全球氣象年間變動的重要驅動因子之一，它是發生在赤道太平洋地區的一種不規則周期的盛行風變化和海水表層溫度變化，會影響大部分熱帶和亞熱帶地區的氣候。東太平洋赤道區域海水變暖，和信風減弱，即聖嬰現象；東太平洋變冷，信風增強，即反聖嬰現象。2019年聖嬰現象微弱，海水表面溫度僅達到或略高於聖嬰現象的溫度閥值，氣壓變化不明顯。

印度洋偶極係指印度洋表層水溫呈現不規則變動的現象，正偶極是東印度洋表層水溫較低，西印度洋表層水溫較高的現象，此現象的相反即為負偶極。這種海水表層溫度梯度的變化會影響印度洋附近大陸的氣候。2019年初期，印度洋呈現輕微正偶極現象，5月至10月正偶極現象愈益明顯，最後成為1960年有可靠記錄以來，最強正偶極的一年。

圖說／氣候變遷造成海水酸化影響海洋生態系
圖片提供／陳璋玲

圖說／全球暖化造成海平面上升（圖為美國Cape Hatteras National Seashore）
圖片提供／陳璋玲

2019年高衝擊事件

氣候變遷會造成不同種類的高衝擊事件（high-impact events），又稱極端事件（extreme events）或極端氣候事件（extreme weather events），包括熱浪、乾旱、暴雨、熱帶氣旋、暴風雪，和野火等。2019年即發生許多高衝擊事件。舉例來說，2019年6月底及7月底發生兩件嚴重熱浪事件。前者主要發生在法國南部，溫度高達46°C，西歐大部分地區亦受到影響。後者熱浪事件影響的範圍較廣，涵蓋德國（42.6 °C）、荷蘭（40.7 °C）、比利時（41.8 °C）、盧森堡（40.8 °C）及英國（38.7 °C）。北歐國家亦受到熱浪影響，赫爾辛基於7月28日即達紀錄最高溫度（33.2 °C）。此外，熱浪加上長時間乾旱，和史無前例的野火規模息息相關。澳洲上百萬公頃土地被野火燒燼，破紀錄的強烈野火亦燒燼西伯利亞和其他北極地區等地。

高衝擊事件相關風險

高衝擊事件和脆弱度、暴露度、人類適應能力與自然系統間複雜的互動關係決定風險的大小。高衝擊事件可能導致人體健康、糧食安全、人民生計、社會經濟、基礎建設、生物多樣性，以及生態系統服務等受到危害的風險。例如，極度高溫影響人類之健康，造成傷亡人數增加，尤其是老年族群。此外，高溫亦造成載體攜帶疾病的風險增加，如蚊子傳播登革熱病毒。相較2018年的同期時間，2019年的登革熱病例即大量增加。

另有關糧食安全風險部分，必須注意全球氣溫上升和降雨型態的改變會影響陸地生態系，包括森林、草地，和農作土地與收成等。氣候變異和極端氣候事件是造成最近全球飢餓增加的主要原因。2018年全球有超過8.2億人口（即每9人有1人）面臨饑餓，其中撒哈拉以南地區是飢餓最嚴重的區域，尤其是內亂嚴重的國家，例如剛果民主共和國、南蘇丹、奈及利亞。2015至2018年期間，這個地區的營養不良人口增加高達2千3百萬人。基此，完成2030年永續發展議程設定的零飢餓目標將是巨大的挑戰。

即刻救援臺灣淺堆的生態浩劫

撰文／鄭明修（中央研究院生物多樣性研究中心研究員）
關鍵字／南淺、海洋生態、漁業經濟

澎湖漁民重要的漁場「南淺」，近年來有大批中國抽砂船抽砂，嚴重破壞海底生態，威脅到澎湖漁民賴以維生的漁業資源，迫切需要加強取締，儘快遏止非法抽砂，以維臺灣淺堆生態環境與漁業資源的永續利用。

臺灣淺堆的生態環境

臺灣淺堆又稱為臺灣灘、南淺、臺灣淺灘、Formosa bank，位在澎湖群島西南方，約在臺灣海峽南部為一扇狀；位置於東經117° 40’－119° 20’、北緯22° 30’－23° 20’的區域（圖1），其中心距離馬公約80海浬、北界距離七美島約30海浬。根據顧文舒（2017）論文指出，此區沉積物為末次冰期時中國東南部河流在此區堆積的三角洲；海床底質以粗顆粒沉積物的石英為主，愈靠近中國及澎湖群島，其長石比例愈高。此處水深40公尺以淺，最淺處僅8.6公尺，為一面積約13,000平方公里的廣大沙波（sandwave）。沙波在海底床高度3～25公尺，波長介於300～1,000公尺，方向為北北西－南南東和西北西－東南東，大致垂直於潮流的方向。根據澎湖資深潛水者過去的捕魚經驗，臺灣淺堆有很多珊瑚礁魚類；由於過去並無學者以潛水方式調查珊瑚礁分布，我個人曾搭機從窗外觀察臺灣淺堆海底有裙礁分布地形，推測本區可能有很好的珊瑚礁生態環境。

漁業資源豐富

臺灣淺堆是澎湖最大傳統漁場，其底棲性魚類已知有199種（楊鴻嘉，1974），其中澎湖主要漁業經濟物種有土魠魚、鎖管（俗稱小管）、臭肉鰕、沙鮻、白帶魚、藍圓鰺（巴浪）等都是在此孕育產卵。根據臺灣水產試驗所報告指出臺灣淺堆和澎湖群島正位於臺灣海峽中央，在夏季有來自中國南海之季風流及黑潮支流北上影響，會經常性產生湧昇流現象（upwelling），形成富含營養鹽（葉綠素A含量高，基礎生產力高）的冷水團。根據翁進興（Weng, etal., 2020）報告指出土魠魚產卵季節為3至8月，而且是以臺灣淺堆為最主要產卵場。其次在1970～1990年間，鎖管和臭肉鰕為澎湖主要漁獲，產量占全省之90%，為澎湖經濟命脈，其作業漁場就在臺灣淺堆附近。這些主要漁獲種類屬於大量群聚之多獲性洄游魚類，牠們以此為孵育產卵場，顯示海洋生態環境條件最為適合，若因大量抽砂改變海底棲地和水文條件，將使這些洄游魚種遷移，甚至導致滅絕。目前這裡也有很多底棲性高價物種，如石斑魚、寒鯛、旭蟹……等，也會因棲地劣化或生態系崩毀而致物種消失。

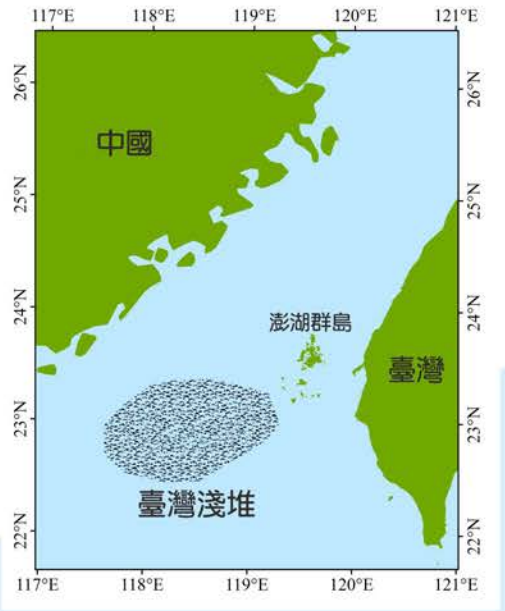


圖1／臺灣淺堆的地理位置圖
圖片提供／鄭明修

最大危機是抽海砂

根據澎湖漁民和保育團體多年觀察，發現近年來臺灣淺堆經常聚集衆多中國鐵殼抽砂船和搬運船，每天可能高達數十萬噸砂被採走，將引發海底砂石層結構變動，造成附近海域水文浩劫，更毀壞千千萬萬隻海洋生物的棲地，這是臺灣淺堆面臨海洋生態系崩毀的前兆。

因為臺灣淺堆位於海峽中線處，多年來幾乎是海峽兩岸的互不管區域。隨著中國經濟跳躍式成長，各地基礎建設所需砂石嚴重短缺，從中國河川和沿海抽砂已不夠使用，而且中國政府也嚴令禁止，因為抽砂會破壞河川生態，導致河岸和海岸退縮，因此抽砂船作業範圍從福建沿海一直往海峽中線推進，近3年則已越過中線，進入臺灣淺堆和澎湖七美附近海域。抽海砂的暴利誘使抽砂船和運砂船越建越大，甚至出現許多5～6萬噸級運砂船。早年中國的滾輪式底拖網漁船，已經把海底珊瑚礁生態摧毀殆盡，如今再加上百艘抽砂船的違法盜砂，澎湖淺堆的海洋生態環境已需即刻救援。

海巡署強力取締

海洋委員會海巡署於2019年10月24日派出4艦2艇和澎湖縣政府人員攜手雷厲風行展開取締大行動，在臺灣淺堆海域取締扣留中國籍4,266噸級「豐溢9969」抽砂船、27,711噸級「長鑫36」運砂船與27位船員返回馬公，並報請澎湖地檢署指揮偵辦。全案創下全國首例、首次引「中華民國專屬經濟海域及大陸礁層法」第18條、第20條及「土石採取法」第36條來究辦。澎湖地檢署更是史無前例將27名中國船員全部收押，全案移送地方法院辦理。

2020年2月8日中華民國司法史上首次以「中華民國專屬經濟海域及大陸礁層法」審判中國籍抽砂船非法盜採海砂，全案偵結，判決2名船長各有期徒刑6個月及25名船員徒刑各5個月，並裁處「豐」、「長」兩船及不法所得砂石16,500公噸全部沒入。2月12日海巡署派遣2艦4艇戒護，將「豐」、「長」兩船分別送往興達港及高雄港泊靠，後續將由地檢署公告拍賣。這次判決宣示意義極為重大，也深具指標性，重申捍衛臺灣國土資源及維護海洋生態的決心。

從2018年起海巡署在強力執法上大有斬獲，特別是在2019年一整年取締中國船舶案件數高達456件，扣留越界漁船人數586人，其中以越界捕魚81艘和盜抽海砂的漁船7艘，驅離中國漁船高達1,684艘，查扣裁罰總金額超過新臺幣6,825萬元，如今有司法做後盾以查扣、判刑、罰鍰、拍賣船隻的有效作為，相信持之以恆的強勢作為才能挽救臺灣淺堆的生態環境。

保衛臺灣淺堆，不能只靠強硬執法

暴利之所趨，臺灣淺堆恐無寧日。畢竟強力執法之外，仍需要跨部會合作來共同守護海洋環境及自然生態。從司法面來看，坊間熟知中國籍漁船有互助會組織，只要有一艘船被查扣，其他船就能如數湊出保釋金，所以才能頻頻越界，視罰金罰鍰為無物。本案澎湖地方法院卻只對兩名船長各處以6個月有期徒刑，25名船員5個月有期徒刑，可易科罰金。判決後不用數日即繳納完畢，若以易科罰金每日新臺幣1,000元計算，每名船員僅約15萬，船長約18萬，合計426萬，這樣的裁罰金額並不算高，遏阻效果有限。

依據桃園市議員楊家偎（2020）的估計，海砂每立方公尺售價200元港幣（約新臺幣780元），而本案違法抽取所得1.65萬噸（約1.1萬立方公尺），相當於市價新臺幣858萬。所以一次販賣海砂所得就足以繳納船員保釋金，而且還有賺頭，因此就算這艘船被沒入，幕後集團業者透過旗下其他船舶盜砂的收入，都足以彌補虧損，如此豈能嚇阻犯罪？建議未來若有類似案件，受理的法院除了要沒入海砂、扣船拍賣船隻外，更要合理提高被告的有期徒刑，從重量處，修法提高易科罰金標準增為每日2,000元或3,000元，才能對幕後抽砂業者有效嚇阻。

結論與建議

雖然臺灣淺堆擁有豐饒的漁業資源，但是大多數國人卻是毫無所悉，而且相關海洋生態的科學調查報告更是貧乏。早期只有水試所劉建隆自1967年開始調查臺灣淺堆鰹魚及鎖管漁場調查報告，才有後續幾年調查資料（盧再和等，1989），而且是伴隨澎湖漁船以棒受網和扒網捕撈。近年來由於鰹魚和鎖管資源銳減，澎湖漁民則以捕土魠魚的流刺網作業為主，尤其土魠魚有澎湖白金之稱，為澎湖漁民帶來豐厚收益；其次以延繩釣、底刺網、一支釣、蟹籠來採捕底棲生物。隨著中國抽砂船大舉盜砂，海床生態環境巨變，底棲性漁業資源幾乎滅絕，迫切需要即刻救援。眾所周知維護海洋環境健康為政者責無旁貸，未來不只是要加強取締非法，也應該藉由兩岸的瞭解與互信，共謀臺灣淺堆健康的海洋環境。綜合現況與未來願景，茲有下列4點建議：

一、跨部會整合法務部、海委會（海巡署）、內政部、外交部、陸委會等單位通力合作修法因應、強力執法。
二、儘速啓動兩岸共同打擊抽砂船，防止臺灣淺堆海床日益遭受破壞。
三、建議農委會和海委會編列預算，進行海底生態環境與漁業資源長期監測調查計畫。
四、強化「海洋偵監」與提升「執法能量」，部署海域巡邏定翼飛機或直升機，才能即時從空中偵監廣大海域，並且滿足「及時」救援或執法的需求，讓派船更經濟、巡邏更有效（廖英雁，2020）。

衷心期盼政府相關單位能有更多合作，才能研擬更有效對策，來守護臺灣淺堆這一片湛藍國土，維護我國經濟海域完整及保護海洋生態環境，確保我國經濟海域海洋資源之永續發展。

圖2／（左）2020年4月19日在南淺水深28公尺處拍到約50公分體長的龍虎石斑魚；（中）南淺水深25～28公尺礁盤的珊瑚景觀；（右）南淺的經濟魚類很多種，圖中的黑星笛鯛魚群頗為常見
圖片提供／鄭明修

臺日海洋塑膠廢棄物治理行動方案比較

撰文／顏寧（澄洋環境顧問執行長）
關鍵字／海洋廢棄物、海洋塑膠、海廢、行動方案

海洋廢棄物（以下簡稱海廢）議題已成為近年來世界熱門的環境議題之一，海洋塑膠垃圾的相關研究與治理對策為各國政府、學術研究機構、石油化學產業、零售業與各民間環保團體亟欲投入的新興領域。本文回顧臺灣與日本對海洋廢棄物治理的脈絡，以及比較兩國之行動方案，作為未來區域治理與臺灣積極參與全球海洋垃圾削減課題之參考。

圖說／沖刷上岸的海洋垃圾大多由塑膠製成

圖片來源／Eric Dale/USFWS

https://www.flickr.com/photos/183382590@N08/49276361977/

臺灣海廢治理脈絡

臺灣過去長期缺乏統籌海洋事務之主管機關，海洋污染議題未獲應有之重視。在海洋委員會海洋保育署（簡稱海保署）成立前，海洋污染防制相關業務主要隸屬於環保署管轄。廢棄物管理處（簡稱廢管處）自2002年即陸續推動塑膠袋、免洗餐具、托盤等塑膠製品限用政策與規範，但直到2017年宣布限制塑膠微粒之前，相關減塑政策或規範跟海洋廢棄物並沒有直接相關。2010年，環境衛生及毒物管理處（簡稱環管處）啓動海岸環境清潔維護認養計畫，包括推動海岸認養、成立Facebook「揪團來淨灘」粉絲團等環境維護工作。2014年起，水質保護處發布〈陸源污染造成海洋垃圾之因應對策〉，隔年提出〈海漂垃圾處理方案〉，開始針對海洋垃圾定期舉辦工作會議，並展開水下垃圾清運與調查。

臺灣民間環境保護團體從2000年後開始關切海洋垃圾議題，主要活動為透過與國際盟友經驗交流、學習海外淨灘垃圾統計和調查方法、舉辦研討會和工作坊、辦理淨灘活動，以及推動相關減塑措施。荒野保護協會從2008年開始籌辦淨灘，也積極教育民衆，著手記錄淨灘數據。2010年後，更多民間團體（NGO）、學校與社團組織加入淨灘行列。近幾年更因社群媒體興起，新成立的NGO如RE-THINK或網紅如台客劇場等，透過Facebook與YouTube號召民衆淨灘，屢屢上千人到場響應。淨灘場次與人數從2010年前每年30～40場，一路躍升到近3年每年1萬場、約21萬人次的浩大規模，相關媒體報導的篇幅也迅速增加，國民對海洋垃圾的關注度也隨之大幅躍升。

圖說／近年來許多民間團體、學校與社團組織加入淨灘行列

圖片來源／Flickr-TEIA (CC BY-NC-ND 2.0) https://www.flickr.com/photos/teia/45260250645/

2017年，有感於海廢問題越來越嚴重，環保NGO組成聯盟，開始遊說環保署應建立一跨部會的上位政策綱領。歷經半年密集討論研議後，2018年初共同發布〈臺灣海洋廢棄物治理行動方案〉（後簡稱臺灣海廢行動方案），從「源頭減量」、「預防與移除」、「研究調查」與「擴大合作參與」4大面向，公私協力推動76項行動。環保團體提出過往淨灘數據，強調吸管、塑膠袋、免洗餐具與手搖杯長年居海岸垃圾之冠，與環保署共同規畫相關減量時程表。而後，陸續發布第2階段塑膠袋限用、吸管限用與擴大免洗餐具管制規範。2018年，更增加海保署、漁業署與4個環保團體，透過海廢平台定期會議，確立相關行動進展。

日本海廢治理脈絡

日本從30年前，民間團體JEAN（Japan Environment Action Network；日本環境行動網絡）即推廣淨灘，並引入國際淨灘行動（International Coastal Clean-up）。2003年，JEAN邀請因嚴重海廢困擾的離島代表，舉辦第1屆「島嶼廢棄物高峰會」，其後發展成為全國性的「海廢高峰會」，每年由不同的地方政府主辦，邀請受海廢問題影響的利害關係人一同討論。2006年，民間團體凝聚地方訴求並展開國會遊說，而中央為回覆地方政府提案，則設立海廢相關省廳會議。

2009年，在民間團體持續推動下，日本通過海廢治理專法〈海岸漂流物處理促進法〉（後更名為〈海洋垃圾對策促進法〉）。2010年，以該法為基礎的「基本方針」出爐，地方政府依此制定區域計畫，推動各地區的海廢回收、處理和預防計畫。

依照母法，由環境省統籌海廢對策，擬定政府基本方針、辦理局長級的海廢對策促進會議，以及主導海廢對策專家會議。環境省推動以下活動：1.移除和預防日本沿海的海洋垃圾；2.監測日本沿海和海洋中海洋垃圾（包括微塑膠）和其中有毒物質的數量和分布；3.與其他亞洲國家進行國際合作，並建立全球國際框架來應對海洋垃圾。另外，農林水產省和國土交通省則從管理海岸的立場來推動海廢的移除。外務省則透過國際合作，推動周邊國家一起討論，針對周邊國家漂來的海廢進行必要之外交因應。在地方政府層級，則由環境省發展地方政府的地域計畫，設立全國海廢對策促進協議會。

〈海洋垃圾對策促進法〉主要著墨於海廢的移除與最終處置，但在減塑相關政策卻付之闕如。2018年加拿大在七大工業國峰會（G7）上提出〈海洋塑膠憲章〉（Ocean Plastic Charter），但是日本政府因為「尚未制定國內法律」而拒絕簽署該協議，隨後引發日本民間的批評。隔年，在日本主辦的G20峰會舉辦前，日本政府發布了〈海洋塑膠垃圾對策行動方案〉，以及與G7〈海洋塑膠憲章〉目標相近的〈塑膠資源循環策略〉，作為處置塑膠廢棄物的整合方法。會後，20工業國領袖共同發布「藍海宣言」（Osaka Blue Ocean Vision），強調2050年前削減海洋塑膠垃圾的決心。

臺日行動方案比較

臺灣海廢行動方案的4大面向，主要參考自2011年聯合國環境規劃署（UNEP）與美國國家海洋暨大氣總署（NOAA）發布之〈檀香山策略〉。行動方案由環保署進行統籌，重點則為廢管處所推動的相關減塑規範。而民間環保團體以長達10年、公民科學所累積的淨灘數據，促成環保署研擬吸管、免洗餐具等一次用塑膠製品從2019年至2030年的減塑時程表。

從海廢治理平台進展到海廢行動方案，臺灣民間團體在整體海洋塑膠垃圾治理政策之形成上扮演了關鍵的角色。以「研究調查」中的海岸快篩調查為例，2019年民間團體綠色和平與荒野保護協會，從四季環臺海岸快篩調查結果，點出13段海岸垃圾熱點，獲媒體大篇幅報導。除了推動環保署與相關海岸權管單位展開協商，會同各縣市政府總動員清理海岸垃圾、廢棄漁具、漂流木等3大類廢棄物。也間接促成行政院提出「向海致敬」政策，跨部會盤點與整合海岸垃圾之清理能量。

「向海致敬」是臺灣首次高層級提出治理海洋廢棄物的上位政策，顯示海洋廢棄物的議題愈益受到政府與民眾關注。相較於日本，臺灣展現蓬勃的公民社會能量，近年從公部門到企業與NGO皆致力減塑。未來能否持續透過公私協力，從陸源減少垃圾入海，強化海洋廢棄物相關監測調查，並透過國際交流，貢獻臺灣海廢治理經驗，值得關注。

日本人均塑膠製造量僅次於美國，為全球第2；但過去日本塑膠回收率卻僅23%。相較於臺灣行動方案以「源頭減量」為亮點，日本行動方案著重加強廢棄物處理、清除，以及替代傳統塑膠材料的開發與創新。而日本〈塑膠資源循環策略〉則是提出減少、回收及再生的3R策略。目標在2030年減少25%一次用塑膠、回收60%容器和包裝、增加1倍塑膠回收料用量、使用200萬公噸生質塑膠，以及2035年達到有效循環使用100%塑膠廢料。日本行動方案與策略均以鼓勵產業開發更多替代或生物可分解材質，在減量上卻未像臺灣有太多之著墨。

此外，日本在行動方案裡強調，科學研究作為有效治理海洋塑膠議題的重要性。過去日本多次以觀測船調查日本沿近海、遠洋、南冰洋與深海的微塑膠；更透過各地方政府的長期監測調查，以掌握河川、湖泊、海岸的垃圾排出量與垃圾來源。另外其行動方案中也提及，日本可透過國際援助，提供發展中國家（如孟加拉、緬甸、多明尼加等）相關資金與技術協助，強化海廢治理。這兩點為臺灣行動方案較缺乏的部分，未來期待海保署與國家海洋研究院，能主導更多海廢相關之研究與調查。

結語

比較臺日治理海洋塑膠廢棄物的行動方案，雖然臺灣的科學研究腳步較慢，不過，環保署、海保署、漁業署與民間團體共同合作的「海廢治理平台」，短時間內就推動政策與發布行動方案，清晰地訂出一次用製品減塑時程表，以及遍地蓬勃發展的淨灘和減塑行動，是讓其他國家驚豔的進展。日本的行動方案著眼於海洋廢棄物的清除與循環利用、塑膠材料的創新和產業的再發展，其細緻長期的研究調查和國際援助能量，值得臺灣借鏡。

亞太海洋合作的重要契機——「藍色經濟、海洋觀光及永續藍色金融」國際研討會及政策對話精要

撰文／黃俊揚（笹川和平財團海洋政策研究所研究員）
關鍵字／藍色經濟、海洋觀光、藍色金融

本文介紹2020年2月25～27日，由亞洲開發銀行研究所（Asian Development Bank Institute, ADBI）、笹川和平財團（The Sasakawa Peace Foundation）海洋政策研究所（Ocean Policy Research Institute, OPRI）以及臺灣國際合作基金會（International Cooperation and Development Foundation, TaiwanICDF），在南半球的斐濟以「藍色經濟、海洋觀光及永續藍色金融」為主題共同舉辦的國際會議。

圖說／「藍色經濟、海洋觀光及永續藍色金融」國際研討會及政策對話與會者合影
圖片提供／OPRI-SPF

前言

亞洲開發銀行年會於2019年首次移師到太平洋島國斐濟召開，決議是亞銀宣布「海洋金融倡議（Ocean Financing Initiative）及健康海洋行動計畫（Healthy Oceans Action Plan）」，並將於2025年前投入50億美元協助推動相關計畫。

2020年2月25日至27日，在炙熱的南半球斐濟，由亞洲開發銀行研究所（ADBI，簡稱亞銀研究所）、笹川和平財團海洋政策研究所（OPRI）以及臺灣國際合作基金會（TaiwanICDF，簡稱國合會）以「藍色經濟、海洋觀光及永續藍色金融」為主題，共同舉辦的國際會議。本次國際會議係亞銀研究所及海洋政策研究所的研究與培訓課程的一環，共有來自亞洲、太平洋島國及美國等共計15國的產官學界近百人次參與。會中包含15篇學術論文報告及政策對話。在為期3天的會議中，與會的各國學者及官員一同探討如何發展有效的藍色金融機制來養護海洋資源及振興海洋經濟。

台灣駐斐濟代表處黎倩儀大使受邀以貴賓身份致詞，介紹國合會發展藍色經濟的概念，與斐濟及馬紹爾合作進行水產養殖與海洋復育計畫，提升水產品產量以確保蛋白質營養來源；另與帛琉合作以科技進行珊瑚礁養護與海洋治理。海洋政策研究所主任研究員前川美湖也在致詞時提到今年有包括聯合國海洋會議等許多海洋重要會議將展開，是海洋熱點議題的超級年，區域間的合作能加速各項議題目標的達成及成為知識平臺。其中也特別感謝國合會在海洋永續發展方面的雙邊合作，以及駐斐濟代表處對本次會議提供的各項必要協助。代表臺灣政府出席本次會議的海洋委員會副主任委員莊慶達，在開幕後首場座談會以「藍色經濟與氣候調適」為主題發表專題演講，並介紹海洋委員會成立的宗旨，以及呼應聯合國第14項永續發展目標—「海洋生態」所制定之各項工作目標。國合會在太平洋島國中提供各項援助發展的長期耕耘，各方也有目共睹，會議期間的特色成果展示版，也吸引與會人員駐足品讀與合影。


圖說／（左）政策論壇；（中）海委會莊副主委發言；（右）會場參與者來自於各國政府海洋相關部會
圖片提供／OPRI-SPF

會議內容匯整

一、氣候變遷調適下的藍色經濟

位於美國華府的史汀生中心（Stimson Center）是每年重要海洋會議—「我們的海洋會議（Our Ocean Conference）」的主要發起成員，也積極參與聯合國海洋會議的提案與倡議。本次由Jack Stuart研究員報告「氣候及海洋脆弱性指標（Climate and Ocean Risk Vulnerability Index,

CORVI）」跨國研究計畫。目前CORVI計畫與海洋政策研究所正共同逐步搜集加勒比海及南太平洋島國的資料，也計畫擴大研究範圍至南亞及東南亞。其研究方法為利用專家評估指標，將海洋風險分為「生態風險」、「政治風險」及「經濟風險」3大類，其中共10大項指標為問卷訪談各領域專家後，針對各項指標進行比較衡量海洋威脅的綜合評比。本研究的重要意義在於以海洋威脅的指標進行全球性的統整，而不以發展程度的絕對數字來評比。此項指標有助於建立可視化的綜合比較，也能讓更多金融或保險組織能夠相對給予適切的評價。本項研究尚屬萌芽階段，也會持續在各國進行，並預計於聯合國海洋會議中報告成果，希望更多的國家及研究機構能共同參與，以共同推廣應用海洋脆弱性指標。

二、藍色金融架構

藍色金融在海洋領域尚屬較新穎的觀念。這樣的系統可以讓為海洋環境較友善的產業募集所需要的資金來發展。根據英國氣候債券倡議（Climate Bonds Initiative, CBI）2019年度的報告，綠色金融在市場上已經有近1,676億美元的規模，然而在海洋方面的應用仍十分有限。澳洲墨爾本大學的Raghu Dharmapuri Tirumala教授所提出的架構是建立在傳統亞洲開發銀行所制定的綠色金融之上，以減輕一定的利率作為誘因，加速藍色金融市場的形成。海洋政策研究所吉岡渚代表報告了該所與國立高雄大學財經法律系的吳行浩教授的共同研究案「提倡藍色金融規範」，此藍色金融架構中各種相關角色都有其定位屬性與互動範圍，由分析其利益關係中可闡釋互利效果。例如強調海洋保護的NGO及NPO組織，與開發銀行的種種互動獲取資金；另一方面則是民間企業所扮演的角色，在相對能夠大幅獲利的產業，例如海洋風力能源產業，是否有提撥藍色金融之義務，或承購一部分的藍色債券作為海洋發展的第一桶金。相較於綠色金融的環境指標，監測海洋發展、需要投入更多的科學成本，因此各島國等開發中國家，更需要和海洋相關的研究智庫進行緊密的合作，以及提供更適切的分析，並且促進金融流通。

三、海洋災害管理及海洋治理

海洋災防管理的量化分析對金融來說也是相當重要的參考指標。海洋政策研究所田中元研究員，利用日本北海道南部的地理資訊系統（GIS）以及災害潛勢圖來分析海嘯對各地的產業別及建築物的損害，並估算重建所需之成本及各個產業重建對社會產生的影響。研究發現沿岸都市對水產食品製造業的重建補助，能對社會經濟產生最大效益，並促使其他漁業復甦。本實證研究的發揮空間很大，並能作為其他國家相對脆弱產業的政策參考，以期能對事前減災有更大的貢獻。澳洲臥龍崗大學（University of Wollongong）的澳洲國立海洋資源及安全中心（Australian National Centre of Ocean Recourses and Security, ANCORS）的Michelle Voyer資深研究員，報告海洋經濟統整的藍色治理概念，強調各方面組織的整合及沿海管理，並且於詳盡調查與監測的海洋資訊基礎上，構成全球海洋帳目（Global ocean account），方能從社會、經濟活動及海洋保育中逐步定位其發展過程並進行各項目標的掌握及處理。

四、區域焦點案例

聯合國開發計畫署（United Nations Development Programme, UNDP）的駐印尼經濟學家Rima Prama Artha博士報告UNDP在印尼地區所從事的評價項目。印尼政府與民間主要銀行整合將伊斯蘭基金、企業社會責任（CSR）及相關全球基金共20億美元，以在地用語設置綠色金融（Green Sukuk）。

其後將領域延伸至海洋範疇，並希望此基金能擴大民間參與公共建設（Public-Private Partnership），並針對各項申請計畫進行3類型影響進行加權評比，分別為環境（50%），經濟（25%）及社會（25%），重點發展領域為永續漁業、海洋可再生能源、海洋廢棄物管理、海洋生態復育及災害管理。同時印尼中央銀行的Alvin Joeshar及Resona銀行的Ahmad Pakihadina Rahmatulloh並分別就政府與民間相關配套措施提供詳盡的解說，顯示產官學界的密切合作。

五、政策對話

政策對話部分首先由斐濟鄉村及海洋發展部David Kolitagane主任委員發表主題演講，除強調海洋經濟的活用與發展息息相關之外，並肯定以實證研究進行政策建議，在各種量化分析中能夠讓政府配套措施更完善。亞銀亞太區氣候變遷因應專家Hanna Uusimaa也報告亞銀提出的健康海洋行動計畫，也和各國及各組織代表針對內容釐清及討論。海委會莊副主委並與各國的代表同臺，並報告臺灣的紡織業如何將廢棄塑膠寶特瓶作為運動衣之原料，推廣至全世界。其中並提出以船運系統協助太平洋國家，進行塑膠廢棄物的運送與統整收集，除落實塑膠廢棄物的回收之外，更可將其轉化為經濟產物。斐濟鄉村及海洋發展部Kolitagane主任委員聽到後也迅速呼應臺灣，表示當地也深為廢棄物處理所困擾，希望能和臺灣討論解決方案，保持密切聯絡，並期待南太平洋的處理計畫能夠實現，亞洲開發銀行專員也表示此類的環境計畫具有相當大的經濟潛力，特別是這些資源回收及再循環利用中所產生之經濟效果能促進經濟發展，更有助於亞洲開發銀行提供融資或援助的判斷根據。

結語與建議

閉幕式中，亞銀研究所研究副主席Peter Morgan指出，本次會議讓各國代表及學者們不管在議程中或是場外餐會都有很充分的討論，代表著健康海洋、藍色經濟與金融的活絡發展能成為國際間非常受歡迎的話題，本次會議的發表報告在經過修正後將投稿做為Marine Policy國際期刊的「藍色經濟及金融」特刊，希冀能獲得更多的學術及政策討論。國合會駐斐濟李泰昌團長也代表致詞，以農技團種植的芭樂與所有成員分享，傳遞臺灣的水果外交，眾人皆大歡喜。

根據CBI研究指出，亞太已成為環境金融成長最快的區域，如何利用逐漸提升的環保意識及活絡市場，建構與海洋共存並讓資源永續發展的制度至關重要。為有效達成目標，以智庫推動雙邊及多邊的政策緊密連結為最大的關鍵，特別是日本與臺灣在科技、人才及外交都有高度的互補，為命運共同體，更需要在海洋永續發展的共有價值基礎下，培育海洋人才，強化國際參與及向國際傳達明確的保護海洋永續發展的訊息。下次的會議預期將於2020年11月在澳洲臥龍崗大學ANCORS召開，屆時希望藍色經濟與藍色金融研究，能夠激盪出更豐富的智慧結晶。

日本綜合海洋政策本部與海洋相關的權責機構

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岡田順子（神戶大學海事科學研究科准教授）
關鍵字／綜合海洋政策本部、海洋基本法

2001年1月日本進行了大幅度的行政機構縮編改革，簡化為「1府12省廳」，即是以內閣總理大臣（首相）為首的內閣府，和總務省、法務省、外務省、財務省、文部科學省、厚生勞動省、農林水產省、經濟產業省、國土交通省、環境省、防衛省和警察廳。經過重組合併後，本文介紹日本涉及海洋相關的權責單位。

日本海洋概況簡介

日本為一島國，包括北海道、本州、四國、九州、沖繩本島、以及6,852個大大小小的離島所組成，其中有登記戶籍的離島有314個；海岸線長度位居世界第7，總人口的一半居住在沿海地區（維基百科，各國海岸線長度列表，2020年1月，檢自https://reurl.cc/3DY1x1(Apr. 8, 2020)）。

另外，日本是世界上唯一將海洋紀念日訂為國定假日的國家，每年7月的第3個星期日訂為「海洋紀念日（海の日）」，其主旨是感謝海的恩惠，同時也祈願海洋國家日本的繁榮，可見海洋對日本的重要性。

日本與海洋相關的權責單位

過去日本涉及海洋事務與管理的省廳很多，造成職權分化情形嚴重，無法適時做出決策，也跟不上國際海洋事務之潮流。2001 年1月日本進行了大幅度的行政機構縮編改革，與海洋有關的省廳經過重組合併後，現在主要有關海洋政策的相關單位還有：

圖說／日本內閣官房廳舍

圖片來源／つ (CC BY-SA 3.0)
https://zh.wikipedia.org/wiki/File:Naikakufu1.jpg

一、綜合海洋政策推進事務局（Headquarters for Ocean Policy）

內閣府在2007年依據〈海洋基本法〉（依據平成19年第33號第38條法律）成立「綜合海洋政策本部（総合海洋政策本部）」，統籌日本所有的海洋政策，具體負責策劃、擬定、調查、審議及推動日本的中長期海洋政策和海洋基本計畫，並協調各省廳間有關的海洋行政事務。

並在「綜合海洋政策本部」事務局之上，設置由10名海洋專家組成的「諮詢會議（参与会議）」，透過會議進行提出意見書，持續有效的對海洋事務進行綜合管理和調查、審議、並制定海洋基本計畫。

綜合海洋政策本部由日本總理大臣（內閣首相）擔任本部長，內閣官房長官和國土交通大臣擔任「綜合海洋政策本部」副本部長，而國土交通大臣兼任海洋政策擔當大臣，負責擬定海洋政策基本計畫相關事宜。

二、內閣官房（Cabinet Secretariat）

預防恐攻，防止國際犯罪，對人、物的進出加強管制，在內閣官房下設有「內閣官房次官（官房副長官補）」針對各種突發狀況的因應以及危機處理。下面設有「機場・港灣水際危機管理團隊」，在各機場、港口邊設有「機場・港灣危機管理負責人（空港·港湾危機管理官·担当官）」、「機場・港灣保安委員會（空港·港湾保安委員会）」，以利強化邊境的治安與危機處理。

三、國土交通省（Ministry of Land, Infrastructure, Transport and Tourism）

國土交通省的職責相當於臺灣的交通部。其掌管的事務相當廣泛，包括國土規劃與開發、基礎設施建設、交通運輸、氣象、海事安全、觀光事業推動等。下設有「海事局」與「港灣局」，主要負責業務範圍包括海洋測量、氣象觀測、海事、海運、船舶、海上保安、港灣、海洋利用、防止海洋污染、海上交通安全、海岸管理、下水道、國土規劃、城市規劃、海洋及海岸帶管理等。

「海上保安廳」屬於國土交通省下特別設立的「獨立法人（外局）」，海上保安廳主要的任務是維持海上治安，確保海上交通安全、海難救助、海上防災、海洋環境保護、海上交通整理、海圖製作等海洋資訊（水路）業務、航路標識管理，以及與外國合作、交流，使海洋環境更加安全。其下面設有「海洋情報部」擁有日本海洋數據資料庫，為海洋科學研究機構提供各種海洋訊息。

四、文部科學省（Ministry of education, culture, sports, science and technology）

文部科學省相當於臺灣的教育部，下亦設有「科學技術・學術政策局」、「研究振興局」、「研究開發局」。主要負責規劃、制定與海洋科學技術、地球科學技術、環境科學技術等有關的研究。其「研究開發局」下面設有「海洋地球課」，主要負責氣候暖化等相關的研究。

五、農林水產省（Ministry of Agriculture, Forestry and Fisheries）

農林水產省下面的「水產廳」，主要負責船舶管理、漁業和水產資源的管理以及推進水產產業振興。水產廳下面設的「捕鯨室」，負責控制每年捕鯨的數量，以在日本捕鯨文化與國際社會反對聲浪中取得平衡。

六、經濟產業省（Ministry of Economy, Trade and Industry）

經濟產業省下有「資源能源廳（資源エネルギー庁）」，其下設有「節能與新能源部（省エネルギー·新エネルギー部）」、「資源燃料部（資源·燃料部）」、「電力・煤氣事業部（電力·ガス事業部）」，負責海洋能源資源等相關業務。

七、環境省（Ministry of Environment）

環境省下設有「環境保健部」、「地球環境局」、「水・大氣環境局」、「自然環境局」等。「地球環境局」主要負責防止地球暖化、制止臭氧層破壞問題。「自然環境局」負責設定海洋保護區域、保護海洋生物的多樣性、保護珊瑚礁等使命。

八、外務省（Ministry of Foreign Affairs of Japan）

外務省主要具有經濟、國際協助、國際法、領事等4個機能，下設有「綜合外交政策局」的「宇宙．海洋安全保障政策室」負責處理海盜問題。另外，「國際法局」的「海洋法室」是負責海洋的安全保障；「經濟局」的「漁業室」，負責國際漁業問題、特別政府涉外的海洋漁業相關業務；「國際合作局（国際協力局）」的「地球規模課題審議官」，其下面的「專門機關室」主要承擔國際海事機構（IMO）相關的業務，而「地球環境課」下面的「海洋環境保護（海洋環境保全）」單位則是負責海洋環境的保護，與國際條約的實施與運用（參考下圖）。

圖說／外務省組織內有關海洋政策之部門
資料來源／本研究整理

九、防衛省（Ministry of Defense）

防衛省設有「海上幕僚監部」，掌管海上自衛隊的軍政・軍令。海上幕僚監部的海上幕僚長，專為負責管理海上自衛的防衛・教育訓練．裝備以及人事案，以及進行海洋安全技術相關計畫案，海上防災對策計畫案，海洋資訊通訊的技術開發，及海上安保活動的執行。

日本過去更因為海洋事務相關省廳職權的分化、各部門的不協調，促使「綜合海洋政策推進事務局」成立，組織也由「內閣官房」移到「內閣府」（日本經濟新聞，〈総合海洋政策本部、内閣官房から内閣府に移管〉，2017年4月，檢自https://reurl.cc/ZObn2V（Apr. 8, 2020）），權限足以統籌所有的海洋政策與海洋事務。由此可見，〈海洋基本法〉的正式實施以及「綜合海洋政策本部」的成立，意味著日本已經開始注重加強海洋資源開發，順應世界海洋管理發展趨勢，邁向海洋大國。

日本國立研究開發法人海洋研究開發機構（JAMSTEC）簡介

撰文／賴堅戊（國家海洋研究院海洋產業與工程中心研究員）

關鍵字／國家海洋研究機構、JAMSTEC、地球模擬器、地球號、深潛器、研究船

本報導旨在介紹JAMSTEC法定地位的推移及其核心研究能量，希望能提升我們對鄰近國家海洋科研機構的瞭解及作為國家海洋研究院未來選擇標竿機構之參考。

日本海洋研究開發機構的設立，最早可追溯至1971年10月1日以特別認可法人成立了海洋科學與技術中心（Japan Marine Science and Technology Center, JAMSTEC）。而後，隨著日本公法人制度的調整，於2004年4月改制為獨立行政法人海洋研究開發機構（Japan Agency for Marine-Earth Science and Technology, JAMSTEC），並在2015年4月修正公告「獨立行政法人通則法」後，成為國立研究開發法人機構。

設立宗旨與任務

根據2019年1月訂定之「國立研究開發法人海洋研究開發機構法」，JAMSTEC的設立宗旨為「秉承和平與福祉的理念，全面拓展海洋之基礎研究和開發，並促進海洋學術研究合作，以提高海洋科學技術水平」。而其法定任務則包含：1.拓展海洋基礎之研究與開發；2.研發成果的傳播與應用；3.促進大學等研究單位在海洋領域的學術研究，如研究船的共同利用與維運等；4.研發科儀設備，並支援相關學術研究；5.培訓與海洋科學技術相關的研究人員和工程師，提升人力素質；6.收集、整理、儲存及提供國內外海洋科學技術的資料與資訊；7.執行前述6項任務所衍生的業務等7項。

圖1／JAMSTEC 2004至2019年度之人力與預算推移

圖片來源／依JAMSTEC官網資料重繪

組織與規模

JAMSTEC以法人形式進行運作，由理事長與理監事組成經營管理層，並設置地球環境、海洋機能利用、海域地震火山、附加價值資訊創生、超先進研究開發、研究平臺營運開發、專案計畫團隊等7大研究發展部門，以及8個研究支援部門。研究機構本部位於橫須賀市，並於橫濱市、青森縣陸奧市、高知縣南國市、沖繩縣名護市及東京都等地分別設立研究所、中心或事務所。

在人力資源方面，JAMSTEC於2019年4月底之全職工作人員，計有理監事5人、研究職系312人、技術職系208人、船員39人、事務職系168人、支援・補助人力214人，合計共946人，同年之預算為358億日圓。而根據過去15年間之預算與人力統計（圖1），為因應東北大震災後之海洋研究調查需求，2012年預算總額高達806億元，而人力於2015年時達到1,067人。

海洋調查與研究設備

作為日本的海洋與地球探測之核心研究機構，JAMSTEC以地球模擬器、地球號鑽探船及深海6500載人深潛器（SHINKAI 6500）等3大設施，及優異的研究船隊支援日本國內及國際海洋相關合作研究計畫而名聞國際。

一、地球模擬器的功能及其全球地位

JAMSTEC自2002年3月起為解析及預測全球暖化下的氣候變遷、闡明地震與地球內部變動，啓動了名為「地球模擬器」的世界最高速電腦計畫。其貢獻不僅僅在聯合國政府間氣候變遷委員會（IPCC）報告書編成，更包括在材料、儀器設備、醫藥品開發等面向的運用。現行運用的第3代地球模擬器於2015年更新，該模擬器是由NEC公司的超級電腦SX-ACE組成，其最大理論性能達1.3PFLOPS。未來將投入解決地球環境問題與地殼變動、地震發生機制及海嘯災害預測等問題。

二、地球號的功能及其全球地位

日本為了進一步發展成為海洋大國和科技強國，爭取在地球科學領域發揮主導角色，在2005年完成一艘56,752船噸的海上鑽探船地球號（D／V ChiKyu）的建造工作，其最大可容納200名乘員，包括50名科研人員及50名協助鑽探作業的技術人員。

圖2／（左）日本JAMSTEC的地球號鑽探船；（右）日本JAMSTEC的深海6500深潛器
圖片來源／JAMSTEC官網
https://www.jamstec.go.jp/chikyu/e/about/
https://www.jamstec.go.jp/j/about/press_release/quest/6k/

地球號致力於執行和生命之謎、全球變遷、氣候變遷和地球歷史等議題有關且鑽探計畫由整合海洋鑽探計畫（International Ocean Discovery Program）核批之任務。先進的地球號上提供更安全可靠的鑽探技術與設備，同時配備了多重感應元岩心記錄器、X光層析成像掃描器、分光測色器等精密儀器，供科學家對岩心進行初步研究。地球號曾在2014年的南海海槽鑽探試驗中創下海底下3,058.5公尺的最大鑽探深度紀錄。其鑽探之岩心多送至高知岩心研究所保管於4°C的冷藏庫中，保管之岩心累計總長已超過120公里。

三、深潛器的功能及其全球地位

深潛器，如美國的阿爾文號（Alvin）、法國的鸚鵡螺號（Nautile）、俄羅斯的和平I／II號（MIR I／II）等，在1986年至1998年間近距離觀察了北大西洋3,810公尺海底的鐵達尼號殘骸，揭開了沉船的神秘面紗，也間接促成了1997年底鐵達尼號電影的問世。

世界上約有13艘載人深潛器，主要是由美國、法國、俄羅斯、日本和中國等國所開發，用來執行水下考察、海底勘探、海底開發和打撈等任務。一般而言，海洋油氣探勘的深潛器其設計作業深度多在4,000公尺以淺，能抵達5,000公尺以深的深潛器則多為科研目的而建造。如果以下潛深度排名，目前日本JAMSTEC的深海6500曾在1989年8月下潛到6,527公尺深，排名第3。這個紀錄保持了將近23年，才被中國的蛟龍號超越。由深海6500的下潛記錄顯示，從1990年至2018年已出勤1,529次，除了在日本周遭海底的探測任務，還曾前往馬里亞納海溝、大西洋中洋脊、西南印度洋脊等處進行探測，足跡遍及三大洋，為瞭解地球內部運動、揭開生命的進化歷程、深海生物利用保育和闡釋熱與物質循環等提供了重要觀察。

有感於世界各國在深海探勘競爭白熱化，JAMSTEC在2014年發表深海12000的開發計畫，預定在2023年奪回最強深潛器的地位，抵達海洋最深處。

四、研究船營運

除了地球號，JAMSTEC還維運了其他6艘研究船，各船規格、運作目的等訊息彙整如表1。研究船依其設計分別肩負深潛器支援、大洋域海洋調查、海底資源探勘及日本東北海域海洋科學調查等作業，支持JAMSTEC及日本國內公開徵求之海洋研究課題。而維繫研究船隊維運的海洋科學探測服務工作，包含航運技術及調查技術專業，除了白鳳丸以接收自東京大學的船員進行操船外，其餘研究船多以委託專業的海洋科研調查合作公司協助營運。

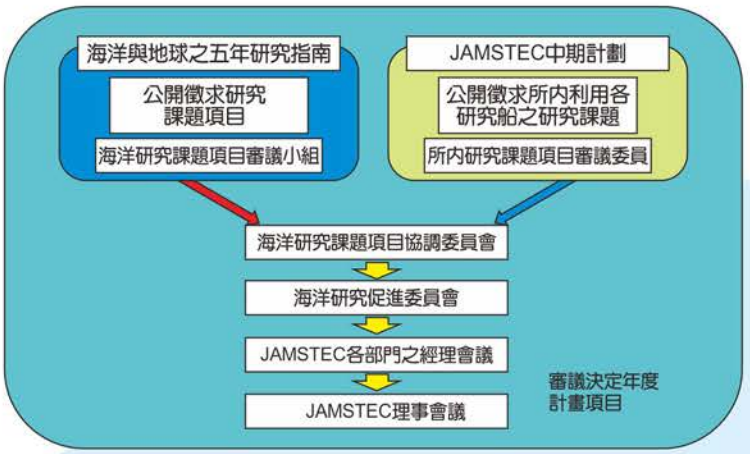

圖3／日本研究船探測航次研究課題項目審議流程
圖片來源／https://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu5/013/siryo/__icsFiles/afieldfile/2016/01/25/1366045_04.pdf

表1／日本JAMSTEC研究船隊一覽表

船名	よこすか YOKOSUKA	かいれい KAIREI	みらい MIRAI	かいめい KAIMEI	白鳳丸 HAKUHO	新青丸 SHINSEI
						
船舶運用主要目的	潛水調查船支援母船	大水深海底調查	大洋域海洋調查	海底資源調查	大洋域海洋調查	東北海洋科學據點形成
竣工時間（年）	1990	1997	1997	2016	1989	2013
長x寬（m）	105x16	106x16	128x19	100. 5x20. 5	100x16	66×13
總噸數（噸）	4,439	4,517	8,706	5,747	3,991	1,635
滿載吃水（m）	4.7	4.7	6.9	6.0	6.3	5.0
航速（節）	16	16	16	12	16	12
額定人數（科研員）（名）	60 (15)	60 (22)	80 (46)	65 (38)	89 (35)	41 (15)
主要裝備	MBES/SBP ADCP 重力、磁力計 聲學導航系統 XBT/XCTD	MBES/SBP MCS 重力、磁力計 觀測絞機 聲學導航系統 XBT/XCTD	MBES/SBP 採水系統 ADCP 都卜勒氣象雷達、觀測絞機 重力、磁力計 無線電探空儀 氣象觀測裝置 聲學導航系統 XBT/XCTD CTD系統	MBES/SBP 重力、磁力計 CTD系統 採水系統 XBT/XCTD 觀測絞機 ADCP 聲學定位裝置 氣象觀測裝置 三軸多頻道震測系統、40m活塞岩心器、海底設置型鑽探裝置、Power Glove 3,000m級ROV、貨櫃實驗室 試料分析、DPS	PDR/MBES /SBP CTD系統 採水系統 觀測絞機 ADCP 重力計 XBT/XCTD 計量魚探器 聲學定位裝置 氣象觀測裝置	MBES/SBP /PDR 重力計 磁力計 XBT/XCTD CTD系統 採水系統 觀測絞機 聲學定位裝置 計量魚探器 氣象觀測裝置 可搬式觀測裝置（潔淨實驗室、探空貨櫃、SCS/MCS 空壓機） DPS
船舶特徵	SHINKAI 6500及 AUV URASHIMA 等作業母船	ROV KAIKOU 7000等海床探查作業母船	北極海觀測及西太平洋、印度洋等浮標布放作業	三軸多頻道震測系統、海底採樣設備等作業船	全國大學研究機構共同使用之泛用型海洋調查船	全國大學研究機構共同使用之泛用型海洋調查船
航運合作	日本海洋事業(Nippon Marine Enterprises, Ltd.)				自主航運	日本海洋事業
調查合作	日本海洋事業、Marine Works Japan					

資料來源／改譯自JAMSTEC海洋工學中心網頁

註：ADCP：聲學都卜勒流速剖面儀，MBES：多音束聲納，SCS：單音束聲納系統，DPS：船舶動力定位系統，SBP：海底淺層剖面儀，MCS：多頻道震測系統

JAMSTEC的中長期研究目標

JAMSTEC目前執行中的計畫為2019年4月起為期7年之中長期計畫。該計畫除依據獨立行政法人通則法、科學技術基本計畫、安倍政府「以人為中心的社會」的Society 5.0計畫及聯合國永續發展目標SDGs等，整合「海洋、地球和生命」的思維，傳播科學知識，期望人類社會可以幫助地球的未來。

JAMSTEC本期計畫發展主軸包括促進海洋基礎科學技術之研發和建構海洋機構的核心科學技術兩大面向，推動1.全球環境變遷現況和預測；2.可持續有效利用海洋資源；3.海域地震與火山活動；4.應用數值技術在促進和優化海洋和地球資訊；5.具挑戰性的原創海上鑽探船—地球號（D／V ChiKyu）的建造和先進技術的開發；6.加強跨組織合作，促進研發成果的社會回饋以及7.大型研發基礎設施的使用和數據推廣等研究發展。

結語

日本JAMSTEC即將迎來50週年慶。過去數十年來，JAMSTEC持續投入海洋的調查與研發及資料的收集分析，並與國內海洋相關學術研究單位攜手合作，將日本的海洋研究推向世界領先地位。此外，JAMSTEC亦積極將海洋知識與資訊轉譯成科普內容，向大眾散布海洋的知識與技術。值此嚴重特殊傳染性肺炎停課期間，JAMSTEC立即推出「JAMSTEC for Students」的多媒體網路，向居家自主管理的日本兒童傳送海洋知識。JAMSTEC這樣的海洋研究開發機構，不僅在科學探索及學術研究上為日本、為人類積累了深厚的底蘊，更為「親海、知海、愛海、用海」提供了築夢與圓夢所需的養分。

JAMSTEC一直致力於讓日本成為世界上海洋科技最先進和創新的國家，以及強化海洋的觀測與調查，同時亦積極推動跨越學術領域和國界藩籬，整合技術和研究思想，加速具商業化的開放式創新，有系統地解決在地關注或全球性問題。如2019年的海洋放射性調查無人船，即是整合了JAMSTEC和日本原子能研究開發機構（JAEA）以及福島縣濱通（Hamadōri）地區的產業，從多元角度研發解決核災事故後的重要海洋監測課題，相當值得借鏡。

最後，由JAMSTEC所擬定其研究與聯合國永續發展目標的連結（詳參https://www.jamstec.go.jp/sdgs/e/），可一窺其透過各種研究和開發，瞭解人類的行為如何影響地球系統，透過瞭解地球這個以海洋為中心的多樣化和複雜的巨型系統的實際情形並預測其未來，積極為解決國際社會的共同課題作出貢獻。

日本第三期海洋基本計畫簡介

撰文／于惠蓉（國立高雄科技大學航運管理系副教授）
關鍵字／海洋基本法、海洋基本計畫

日本為了實現新的海洋立國之政策目標，依聯合國國際海洋法公約之相關規定，在國際合作下和平、永續開發利用海洋、保護海洋環境、確保海洋安全，於平成19年（2007）制定了〈海洋基本法〉，並於內閣設置了綜合海洋政策本部。依此〈海洋基本法〉之規定，日本政府應制定海洋基本計畫，並應每5年檢討修訂之。

日本綜合海洋政策本部於平成20年（2008）制定了第1期海洋基本計畫，平成25年（2013）制定了第2期海洋基本計畫，於平成30年（2018）制定了第3期海洋基本計畫。

目前日本正執行第3期海洋基本計畫，該計畫概要如下（參考內閣府，海洋基本計畫(第3期)，2018年5月，檢自https://reurl.cc/R4rYyz (Apr. 1, 2020)）：

計畫架構

該計畫由前言及3大部分所構成。前言係概說〈海洋基本法〉施行10年後之回顧及海洋情勢之現況。第一部分總論係在現況認知下，說明海洋政策之應有方針，包括今後10年之海洋政策理念、目標及海洋施政之基本方針。第二部分各論係針對今後5年制定各項具體的海洋施政策略，包括應集中實施之策略及應由相關機關合作實施之策略等。第三部分為綜合性及計畫性執行策略之注意事項。

海洋政策的理念、目標及施政策略之基本方針

日本〈海洋基本法〉規定了6大基本理念，亦即海洋開發利用與環境保護間之調和、確保海上安全、強化海洋有關之科學知識、海洋產業之健全發展、海洋之綜合管理、海洋之國際合作。本計畫則是以此6大基本理念為基礎，檢視以往海洋政策執行之情況，並考量世界情勢變化下制定。日本以「新海洋立國之挑戰」為名，制定以下海洋政策之具體目標：

一、邁向穩定開放的海洋，守護國家與國民。
二、充分利用海洋、豐厚國家、為後代厚植海洋。
三、挑戰未知的海洋、改善技術、掌握海洋。
四、積極和平領導建制海洋之國際規範。
五、親近海洋、培育海洋人才。

策略與措施

本計畫列舉約370項之策略與措施，簡述如下：

一、全面的保障海上安全

確保海上安全包括：確保領海等國家的海洋權益、穩定使用重要海域及強化海洋之自由利用與國際海洋秩序。

二、促進海洋的產業利用

促進海洋的產業利用包括：促進海洋資源、能源之開發、強化海洋產業國際競爭力、擴大海洋產業之利用、確保海上運輸、水產資源管理及建構成長型之水產業。

三、維護與養護海洋環境

維護與養護海洋環境包括：確保海洋生物多樣性、氣候變遷與海洋酸化之因應、海洋垃圾之因應、防止海洋污染、監控放射性物質、海洋開發利用與環境保護之協同發展。

四、強化科學知識

強化科學知識包括：促進海洋科技研究開發、海洋調查觀測之維持與強化、海洋科學技術共通基礎之充實與強化。

五、北極政策之促進

促進北極政策包括：強化北極區域之研究與觀測體制，促進北極區域科學技術之國際合作，培育解決北極區域問題之人才，積極參與國際規則之制定、促進兩國間或多國間之合作、積極參與及貢獻促進北極研究計畫（ArCs）。

六、國際合作

國際合作方面包括：海洋秩序之形成與發展、海洋之國際合作（如海洋調查、防災救難之援助等）。

七、海洋人才培育及增進國民對海洋的瞭解

海洋立國專門人才的培育與確保、對於兒童及青年之海洋教育、增進國民對於海洋之理解。

為促進及監督本計畫之執行，日本綜合海洋政策本部與綜合海洋政策促進事務局合作，成為日本政府的指揮中心。採用PDCA（Plan, Do, Check, Act）品管循環制度，掌握及評估策略之執行進度，使策略有計畫地且綜合性地推展，並採用工程管理所使用的各項檢測指標。此外並強調產官學等相關人間之職責及相互合作之重要性，督促資訊應適時公布及透明化，以利各單位間之合作。

Achieving Ocean Sustainability Together with Japan

Translated by Linguitronics

Minister of the Ocean Affairs Council: Chung-Wei Lee

As members of Asian ocean countries, both Taiwan and Japan have their own respective strengths in ocean governance, industrial development, and research. In this issue, we highlight Japan's ocean policies, research, and industry. "Organization Focus" introduces the Japanese Headquarters for Ocean Policy and related competent institutions which formulate ocean policies. On the regulatory side, we introduce the latest issue of "Basic Plan on Ocean Policy," in which we see how Japan faces the "new challenges of establishing an ocean nation."

As the world is paying attention to the issue of marine debris, Taiwan and Japan can reference each other's policies in terms of marine waste governance. In this issue, we compare the two countries' marine waste action plans. Japan's action plans emphasize the importance of scientific research, as well as strengthening marine waste governance through international support. While in Taiwan's "Tribute to the Sea" policy, various agencies assess and integrate the capabilities of marine debris cleanup, serving as a first step in laying the foundation for ocean governance. Another highlight is Japan's marine research and blue economy, in which the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) sets its position in core equipment such as earth simulators, offshore drilling vessels, submersibles, research vessels, and related research. And another focus of this issue is the "Regional Conference and Policy Dialogue on Blue Economy, Ocean Tourism, and Sustainable Blue Financing," through which we discuss how countries develop effective blue finance mechanisms to conserve ocean resources and revive ocean economies.

In Part I of our "Special Report," we introduce the latest Statement on the State of the Global Climate in 2019 from the World Meteorological Organization (WMO), which discusses climate indicators such as increases in concentrations of greenhouse gases, rise in sea levels, ocean acidification, and high-impact events like heatwaves and wildfires. In Part 2, we analyze the ecological catastrophe faced by the Formosa Bank, where sea sand stealing has damaged the marine habitat and is causing the gradual collapse of the ocean ecosystem. Changes in the climate and ocean ecosystem are nature's warning signs, and they appeal to the people to face the issues of climate change and the affected ecosystem. That is why we have even more reason to strive together and take action to maintain a sustainable ocean!

Abandoned garbage that flows into the ocean not only affects marine life, but also damages the marine ecosystem

Image by David Slater / NOAA (CC0)

https://www.flickr.com/photos/onms/28250723916/

WMO Statement on the State of the Global Climate in 2019

Chung-Ling Chen (Professor, National Cheng Kung University)
Keywords: World Meteorological Organization, climate change, high-impact events

The World Meteorological Organization (WMO) released the statement on the state of global climate in 2019. This statement presents the knowledge of latest climate science, the high-impact events driven by climate change and their associated risks. In 2019, the temperature reached the second high, the levels of greenhouse gases increased, the sea level rose, the ocean acidity increased and the sea ice extent decreased. Accelerating climate change and extreme weather events threaten human health, food security, livelihoods, economies and marine ecosystems, leading to deaths and injuries, starvation, population displacement and disruption of marine ecosystems. The globe is currently way off track to meeting either the 1.5℃ or 2℃ targets that the Paris Agreement calls for. In light of this, everyone – from government, civil society and business leaders to individual citizens – need to heed climate change facts and take urgent actions to halt the worst effects of climate change.

Global climate indicators

I. Temperature

The global mean temperature for 2019 was 1.1±0.1°C above pre-industrial levels. It is noted that the 1850-1900 baseline was used as an approximation of pre-industrial levels. The year 2019 is the second warmest in instrumental records, second only to the record set in 2016. Without the role of El Niño in the warming increase observed in 2016, 2019 would have been a record year. The past five years, 2015-2019, are the warmest on record, and the past decade, 2010-2019, is also the warmest on record. Since the 1980s, each successive decade has been warmer than any preceding one (Figure. 1).

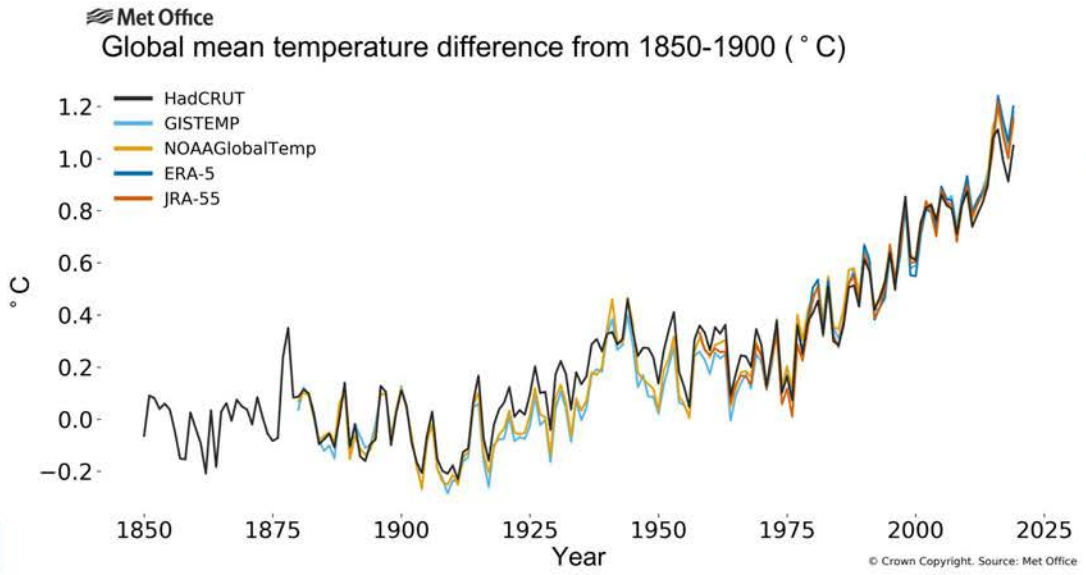

Figure 1/ The global mean temperature is increasing compared to the pre-industrial levels
Source / Met Office
https://public.wmo.int/en/media/press-release/wmo-confirms-past-4-years-were-warmest-record

II. Greenhouse gases

Greenhouse gases reached record levels in 2018 with carbon dioxide (CO_2) at 407.8±0.1 parts per million (ppm), methane (CH_4) at 1869±2 parts per billion (ppb) and nitrous oxide (N_2O) at 331.1±0.1 ppb. These values constitute, respectively, 147%, 259% and 123% of pre-industrial levels. While global average figures for 2019 will not be available until late 2020, real-time data from some specific locations, including Mauna Loa (Hawaii) and Cape Grim (Tasmania) indicate that levels of CO_2 , CH_4 and N_2O continued to increase in 2019.

III. Ocean

The ocean absorbs around 90% of the heat that is trapped in the Earth system. Ocean heat content (OHC) refers to the heat absorbed by the ocean. It is one of key indicators of global warming. The higher the OHC, the warmer the earth. In 2019, OHC in the upper 700 m and in the upper 2,000 m continued to rise, reaching record-high levels (Figure. P3). Thermal expansion from ocean warming, combined with melting of ice on land, leads to sea level rising, which affects coastal areas. In 2019, the sea level continued to rise, with the global mean sea level reaching its highest value since the beginning of the record in January 1993. The average rate of rise is estimated at 3.24±0.3 mm yr^{-1} over the past 27 years period, but the rate has increased over time.

In the decade 2009-2018, the ocean absorbed around 23% of annul CO_2 emission. While this helps to alleviate the impact of climate change, it alters the chemistry of the ocean and thus increases the acidity of the ocean, called as ocean acidification. Observations over the last 20 to 30 years show a clear decrease in average pH, with a decline of the average global surface ocean pH of 0.017-0.027 pH units per decade since the late 1980s.

Both observations and numerical models indicate that oxygen is declining in the ocean. Since the middle of the last century, there has been as estimated 1%-2% decrease in the global ocean oxygen inventory. Low levels of oxygen in the ocean will alter the diversity, composition, abundance and distribution of marine life. Even studies showed that coral reefs are recognized vulnerable to major oxygen loss.

IV. Cryosphere

Cryosphere refers to the places where water is in its solid form, frozen into ice or snow. The cryosphere mostly exists in the areas around the North Pole the Arctic and the South Pole the Antarctic. But it can also be found in other locations on Earth such as high mountain areas. The cryosphere is one of key indicators of climate change. The sea ice extent shows seasonal variations with the size bigger during wintertime and smaller during summertime.

Since 1979 when the sea ice extent data is available by the satellite survey, Arctic sea ice has seen a long-term decline in all months, with the largest relative losses in late summer. On 13 March 2019, the Arctic saw the maximum daily sea-ice extent with 14.78 million km^2, which was the 7^{th} lowest maximum on record. On the other hand, on 18 September 2019, the minimum daily sea-ice extent is 4.15 million km^2, which was the second lowest on record.

Drivers of short-term climate variability

The El Niño-Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) are two major factors that can help to understand the climate of 2019. The El Niño-Southern Oscillation is one of important drivers of year-to-year variability in global weather patterns. The ENSO is an irregularly periodic variation in prevailing winds and sea-surface temperatures over the tropical eastern Pacific Ocean, affecting the climate of much of the tropics and subtropics. El Niño is characterized by warmer than average

sea-surface temperatures in the eastern Pacific and a weakening of the trade winds. On the other hand, La Niña is characterized by cooler than average sea-surface temperatures in the eastern Pacific and a strengthening of the trade winds. The 2019 El Niño conditions are weak with sea-surface temperatures reaching or slightly exceeding typical El Niño thresholds as well as the atmospheric change not being evident.

The IOD is an irregular oscillation of sea-surface temperatures in the Indian Ocean. The positive phase of the IOD is characterized by cooler than average sea-surface temperatures in the eastern Indian Ocean and warmer than average sea-surface temperatures in the west. The negative phase has the opposite pattern. The change in the gradient of sea-surface temperatures across the Indian Ocean affects the weather of the surrounding continents. In 2019, the IOD started positive and became progressively more positive from May to October, ultimately becoming one of the strongest positive IOD events since reliable records began around 1960.

High-impact events in 2019

Climate change is causing a wide range of high-impact events, which are also called as extreme events or extreme weather events, including heat waves, drought, heavy rainfall, tropical cyclones, severe storms, and wildfires. The year 2019 saw numerous high-impact events. As an illustration, the two most significant heatwaves occurred in late June and late July. The former one reached its maximum intensity in southern France, where a national record of 46.0°C. It also affected much of western Europe. The latter one was more extensive, with national records set in Germany (42.6°C), the Netherlands (40.7°C), Belgium (41.8°C). Luxembourg (40.8°C) and the United Kingdom (38.7°C). The heat also extended to the Nordic countries, where Helsinki has its highest temperature on record (33.2°C) on 28 July. Furthermore, heatwaves, combined with long periods of drought, were linked to wildfires of unprecedented size. This was the case in Australia, where millions of hectares were set ablaze, and in Siberia and other Arctic regions hit by wildfires of record intensity.

Risks associated with high-impact events

The risks depend on the complex interactions between the high-impact events (e.g., heat waves, drought, tropical cyclones and wildfires) and the vulnerability, exposure and adaptive capacity of human and natural systems. These high-impact events pose risks to human health, food security, livelihoods, economies, infrastructure, biodiversity and ecosystem services. As an illustration, extreme heat conditions threaten human health, taking an increasing toll on people, particularly aging populations. In addition, they also increase the risk of vector-borne diseases, such as mosquitos transmitting the dengue virus. In 2019, the world experienced a large increase in dengue cases, compared with same period in 2018.

As for the risk regarding food security, it is noted that rising global temperature and changing rainfall patterns have already affected terrestrial ecosystems such as forests and grasslands, as well as agricultural lands and crop yields. Climate variability and extreme events are among the key drivers of the recent rise in global hunger. Over 820 million, or one in every nine people in the world, suffered from hunger in 2018. The situation is most acute is sub-Saharan Africa, where the number of undernourished people increased by more than 23 million between 2015 and 2018, particularly in countries affected by conflict such as Democratic Republic of Congo, Republic of South Sudan and Nigeria. In light of this, it is an enormous challenge to meet the Zero Hunger target of the 2030 Agenda for Sustainable Development.

Urgent Mitigation of the Ecological Disaster on Formosa Bank

Ming-Shiou Jeng (Research Fellow, Research Center for Biodiversity, Academia Sinica)
Translated by Linguitronics
Keywords: bank, maritime ecology, fishing economy

In recent years, a large number of Mainland Chinese sand-pumping vessels have been dredging sand from South Bank, an important fishing ground for fishers from Penghu. This has significantly damaged the ecological environment of the seabed and threatens the fishing resources on which Penghu fishers depend for their livelihoods. There is an urgent need to strengthen the ban on such operations and stop illegal sand pumping as soon as possible to maintain the sustainable use of the ecosystems and fishing resources on Formosa Bank.

The Ecological Environment of the Formosa Bank

The Formosa Bank, also known as South Bank, is located southwest of the Penghu Islands, where it forms a fan-like shape in the southern part of the Taiwan Strait. Located in the area covering 117°40'–119°20' east longitude and 22°30'–23°20' north latitude (Figure 1), the center of the Formosa Bank is approximately 80 nautical miles from Magong, and its northern border about 30 nautical miles from Chimei Island. According to Wen-Shu Koo (2017), the sedimentary deposit carried to this area by the southeastern rivers of China in the Last Glacial Period formed a river delta. Quartz, a course sediment, is the main substrate of the seabed here; the closer to China and the Penghu Islands, the higher the proportion of feldspar in the seabed. The water depth in this area is shallower than 40 meters, with the shallowest part being 8.6 meters; it is a large sandwave field that covers approximately 13,000 square kilometers. On the seabed, the sandwaves are 3 to 25 meters in height and 300 to 1,000 meters in length. The directions of the sandwaves are NNW to SSE and WNW to ESE; they are nearly perpendicular to the direction of the tidal current. According to the accounts of past fishing experiences reported by experienced divers in Penghu, the Formosa Bank is home to numerous coral reef fish. No academics had done an underwater survey of the coral reef distribution here, therefore, I personally took a plane and observed the distribution of fringing reef formations on the Formosa Bank from the window. I speculate that this area may have a great coral reef ecosystem.

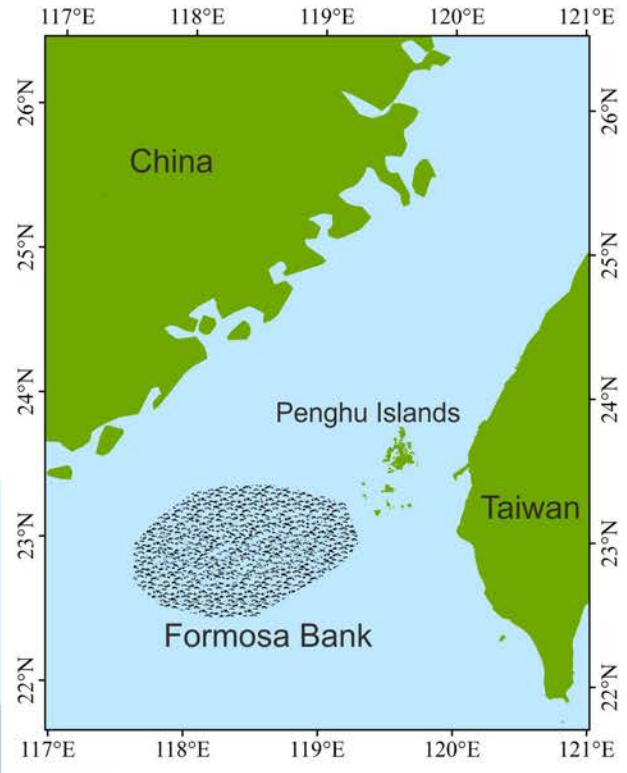

Figure 1/Geographical Location of Formosa Bank
Image by Ming-Shiou Jeng

Abundant Resources for the Fishery Industry

The Formosa Bank is the biggest traditional fishing ground in Penghu. So far, 199 species of benthic fish have been discovered here (H. C. Yang, 1974). Among them, the main species that contribute economically to the fishery industry include the Spanish mackerel, myopsina (small squid), round herring, sillaginidae, largehead hairtail, and decapterus maruadsi (mackerel scads), all of which spawn or are bred here. Reports from Taiwan's Fisheries Research Institute indicate that, because the Formosa Bank and the Penghu Islands are located right in the middle of the Taiwan Strait, in the summer they are influenced by the monsoon current and the Kuroshio current flowing northerly from the South China Sea. This regularly produces upwelling, which forms cold water masses rich in nutrient salts (rich in Chlorophyll A and supports high primary production). Jinn-Shing Weng, et al. (2020) reported that the spawning season of the Spanish mackerel is from March to August, and that the Formosa Bank is the species' main spawning ground. Moreover, from 1970 to 1990, Penghu's fishery industry chiefly consisted of small squid and round herring, which accounted for 90% of the entire province's production and formed the economic lifeline of Penghu. The fishing ground for these species is right near the Formosa Bank. These main commercial fish species are migratory fish that gather in massive schools and are caught in large quantities. The Formosa Bank is their brooding and spawning ground, indicating that the marine ecological environment of the Formosa Bank constitutes optimal conditions. If extensive sand dredging changes the seabed habitats and hydrographical conditions, these migratory fish will move away or even die out. There are also many high-value benthic species, including the grouper, azurio tuskfish, and spanner crab, all of which will also disappear due to habitat degradation or ecological collapse.

The Pumping of Sea Sand is the Biggest Danger

Years of observation by Penghu fishers and conservation organizations have revealed that numerous iron sand-pumping vessels and carrier vessels have been regularly gathering on the Formosa Bank in recent years. It is likely that they remove up to hundreds of thousands of tons of sand each day, which will trigger structural changes in the sand and gravel layer of the seabed. This will in turn cause hydrological disasters in the nearby waters and destroy the habitats of tens of thousands of marine creatures. This is a precursor to the collapse of the Formosa Bank marine ecosystem.

Because the Formosa Bank is located on the centerline in the Strait, neither side of the Strait has administered this area for many years. As the economy of Mainland China has been growing rapidly, various regions are faced with serious shortage of sand and gravel for infrastructure construction. The sand extracted from Mainland China's rivers and coasts is not enough, and the Chinese government has strictly prohibited sand pumping, as it can damage the ecosystems of rivers, which can lead to the recession of riverbanks and coasts. As a result, the operations of sand-pumping vessels have been expanding from the coast of Fujian to the centerline of the Strait. In the past three years, the operations have expanded beyond the centerline and entered Formosa Bank and the waters near Chimei Island of Penghu. Huge profits from sand pumping have spurred larger and larger constructions of sand-pumping vessels and carrier vessels; many carrier ships that can load 50,000–60,000 tons have even appeared. In the early years, bottom trawling boats from Mainland China had nearly annihilated the coral reef ecosystems on the seafloor. Today, with hundreds of sand-pumping vessels illegally stealing sand, the marine ecosystem of Penghu's banks is in need of immediate rescue.

Bans Strengthened by the Coast Guard Administration

On October 24, 2019, four ships and two small vessels sent by the Coast Guard Administration of the Ocean Affairs Council joined hands with the Penghu county government personnel as they began

enforcing the ban with resolution. In the waters of the Formosa Bank, they detained the 4,266-ton sand-pumping vessel "Feng Yi 9969" and the 27,711-ton carrier vessel "Chang Xin 36," along with the 27 crew members. They were brought back to Magong; and the investigation was directed by the Penghu District Prosecutors Office. In Taiwan, this is the first case in which Article 18 and 20 of the Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China and Article 36 of the Sand and Gravel Excavation Act were cited. The Penghu District Prosecutors Office even took the unprecedented step of taking all of the 27 Chinese crew members into custody; the entire case was transferred to the district court.

On February 8, 2020, for the first time in the history of the Republic of China jurisdiction, the Law on the Exclusive Economic Zone and the Continental Shelf of the Republic of China was used to bring the matter of illegal sea sand stealing by Mainland Chinese sand-pumping vessels to trial. In the end, the two captains were sentenced to six months in prison each, and each of the 25 crew members were sentenced to 5 months in prison. The two ships, "Feng" and "Chang," along with the illegally obtained 16,500-metric-ton sand and gravel were confiscated. On February 12, the Coast Guard Administration dispatched two ships and four boats to escort "Feng" and "Chang"; one of the two ships was escorted to be berthed at Singda Harbor, and the other one at the Kaohsiung Port. The auction for these ships will be announced by the district prosecutors office. The announcement of this ruling is of great significance and regarded as an important benchmark. It reaffirmed Taiwan's determination to guard land resources and protect marine ecosystems.

Since 2018, the Coast Guard Administration has been making great achievements, especially throughout 2019; that year saw 456 cases in which Mainland Chinese vessels were cracked down on, and the detaining of 586 crew members who crossed the border. Among which, 81 vessels had crossed the border to fish; 7 vessels had illegally pumped sand; and 1,684 Mainland Chinese vessels were forcibly removed. The total amount of penalty exceeded NT$68.25 million. Today, seizures, sentencing, fines, and ship auctions are effective measures supported by the legal and judicial systems. It is believed that persistent and aggressive measures are what will save the ecosystems of the Formosa Bank.

The Protection of the Formosa Bank Cannot Just Rely on Vigorous Law Enforcement

Formosa Bank may not see peaceful days when people are driven by profiteering. After all, in addition to tough approaches to law enforcement, inter-ministerial cooperation is also needed to cooperatively protect the marine environment and ecosystems. Judicially speaking, it is generally known that there are mutual aid associations for Mainland Chinese vessels. When one vessel is detained, other vessels will gather the amount of bail money needed. This allows vessels to cross the border frequently and disregard fines. However, in this case, the Penghu District Court only sentenced the two captains to a six-month prison term each, and the 25 crew members to a five-month prison term each, which could be commuted to fines. The bail payments were completed within a few days after the ruling. If the prison term was commuted to NT$1,000 a day, each crew member needed only about NT$150,000, and each captain about NT$180,000, making a total amount of NT$4.26 million in penalties. Such penalties are not considered high, and thus the deterrent effect is limited.

According to the estimation by Chia-Liang Yang (2020), a Taoyuan city council member, the price of sea sand per cubic meter is HK$200 (equivalent to about NT$780). In this case, 16,500 tons (about 11,000 cubic meters) of sand was obtained through illegal pumping, which is equivalent to NT$8.58 million at market price. Therefore, one single sale of sea sand would be enough to obtain the bail money for all of the crew members, while also deriving a profit. This means that even if the ship was confiscated, the incomes generated through illegal sand pumping by other vessels of the organizations behind the

operations would be enough to make up for losses. Given these conditions, how will crimes be deterred? It is recommended that, for similar cases that transpire in the future, the managing court should not only confiscate the sea sand, detain and auction the vessels, but also reasonably increase the defendants' prison terms. The laws should be amended so that the commutation of sentences to fines be increased to NT$2,000 or NT$3,000 a day, which will effectively deter the operators behind sand pumping.

Conclusion and Recommendations

Although the Formosa Bank hosts rich fishing resources, most people of the country remain unaware of it. In addition, there are very few scientific research studies and surveys relevant to the marine ecosystems in this area. It is only because Tsien-Lung Liu from the Fisheries Research Institute began investigating surveys on the fishing grounds for round herrings and small squid on the Formosa Bank in 1967 that survey data continued to emerge in subsequent years (Tzay-Her Lu et al, 1989). Such data came along with the harvests of fishing boats with stick-held dip nets and seine nets. Due to the sharp decline in round herring and small squid in recent years, catching Spanish mackerels with gill nets has become Penghu fishers' main line of sustenance. Spanish mackerel, which is referred to as "Penghu platinum," generates huge profits for Penghu fishers. Secondary to that, benthic creatures are captured through long-line fishing, bottom gillnetting, pole-and-lines fishing, and cage-crabbing. Due to the large-scale illegal sand pumping conducted by Mainland Chinese vessels, the ecosystems on the seabed have changed drastically. Benthic fishery resources have almost died out; there is an urgent need for immediate rescue. As we all know, maintaining the health of the marine environment is an unshakable responsibility of politicians. In the future, we should not only strengthen the ban on illegal activities, but also work together to maintain the health of the Formosa Bank's marine environment through mutual trust and understanding between the two sides of the Strait. Putting together the current state and visions for the future, the following four recommendations are formulated:

I. Inter-ministerially integrate governing bodies, including the Ministry of Justice, Ocean Affairs Council (Coast Guard Administration), Ministry of the Interior, Ministry of Foreign Affairs, and Mainland Affairs Council to cooperatively make law amendments in response to these situations and enforce the law.

II. Mainland China and Taiwan should join efforts as soon as possible to crack down on sand pumping vessels and prevent the seabed of the Formosa Bank from receiving increasing damage.

III. It is recommended that the Council of Agriculture and Ocean Affairs Council prepare budgets for the execution of long-term monitoring and survey plans on marine ecosystems and fishery resources.

IV. "Maritime reconnaissance and surveillance" and "law enforcement capacity" need to be strengthened and elevated so that deployed sea patrol fixed-wing aircraft or helicopters can monitor the vast ocean from the air in real time. In addition, the needs of "immediate" rescue or law enforcement should be met so that vessel dispatching and patrolling can be more economical and effective (Ying-Yen Liao, 2020).

With great sincerity, it is hoped that relevant government agencies will cooperate more to develop countermeasures that are more effective with the aims of guarding Taiwan's blue territory—Formosa Bank, maintaining the integrity of Taiwan's economic sea areas, protecting marine ecosystems, and ensuring the sustainable development of Taiwan's economic sea areas and marine resources.

Comparing Taiwan's and Japan's Action Plan of Marine Debris Governance

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Translated by Linguitronics
Keywords: marine debris, marine plastic, action plan

Marine debris has become the most discussed environmental issue in recent years. Research and countermeasures relevant to marine plastic are an emerging field that various countries' governments, academic research institutions, petrochemical industries, retail industries, and environmental protection organizations desperately want to gain in-depth understanding on. This paper reviews the contexts of Taiwan's and Japan's management of marine debris, compares the two countries' action plans, and uses them as references for future regional governance and Taiwan's international participation.

Plastics make up most of the marine debris that washes ashore
Image by Eric Dale/USFWS
https://www.flickr.com/photos/183382590@N08/49276361977/

The Context of Taiwan's Marine Debris Management

For a long time in the past, Taiwan lacked competent authorities that managed marine affairs, and the issue of marine pollution received little attention. Before the Ocean Conservation Administration (OCA) of the Ocean Affairs Council was established, work related to marine pollution prevention was mainly under the jurisdiction of the Environmental Protection Administration(EPA). In 2002, the Department of Waste Management (DoWM) began promoting policies and setting standards for the usage restrictions on plastic items, including plastic bags, disposable tableware, and trays. However, before the announcement of restrictions on plastic particles in 2017, the relevant plastic reduction policies or regulations were not actually directly related to marine debris. In 2010, the Department of Environmental Sanitation and Toxic Substance Management (DoES&TSM) launched the Coastline Environment Cleanup, Maintenance, and Adoption Plan, which involved promoting coastline adoption, establishing the Facebook page "Beach Cleanup Groups," and other environmental protection work. In 2014, the Department of Water Quality Protection announced the Countermeasures Against

Marine Debris Caused by Land-based Pollution. In the following year, the "Floating Marine Debris Management Plan" was proposed, meetings dedicated to marine debris began to be held regularly, and underwater debris removals and investigations were launched.

Civil environmental NGOs in Taiwan have been giving attention to the issue of marine debris since 2000 at the earliest. The main activities they engaged in were exchanging experience with international allies, learning overseas beach cleanup statistics and survey methods, organizing seminars and workshops, organizing beach cleanups, and promoting plastic reduction policies. In 2008, The Society of Wilderness began organizing beach cleanups, actively educating the public, and recording beach cleanup data. After 2010, more civil organizations, schools, and societies joined beach cleanup efforts. In recent years, with the rise of social media, newly established NGOs, such as RE-THINK, and internet celebrities, including TKstory, have been encouraging the public to engage in beach cleanups, and their efforts were heard and heeded by thousands of people. Before 2010, the number of beach cleanup events was around 30-40 per year, and in the past three years, the number increased to almost ten thousand events every year, each being held at large scales and involving about 210,000 participants.

By 2017, the extent of marine debris issues had become more and more severe. Environmental NGOs formed an alliance and began lobbying the Environmental Protection Administration to establish an inter-ministerial top-level policy program. After six months of frequent discussions, the Action Plan of Marine Debris Governance in Taiwan (MDAP) was announced in early 2018. The public and private sectors joint hands to promote 76 operations formulated based on four main aspects: "source reduction," "prevention and removal," "research and investigation," and " cooperation and outreach." Environmental protection groups reported that, according to beach cleanup data from the past, straws, plastic bags, disposable tableware, and hand-held cups have been the most commonly seen trash on shores for many years. They also worked with the Environmental Protection Administration to formulate the timeline of single-use plastic utensils' reduction. Afterwards, the second phase of plastic bag and straw usage restrictions was announced, and the scale of disposable tableware control was expanded. In 2018, the OCA, Fisheries Agency, and four environmental protection organizations also joined the platform. Relevant progressive operations were formulated through regular meetings of the Marine Debris Governance Platform.

The Context of Japan's Marine Debris Management

Thirty years ago, in Japan, the civil organization JEAN (Japan Environment Action Network) started promoting beach cleanups and introduced the International Coastal Clean-up. In 2003, JEAN invited representatives of offshore islands, who were troubled by severe marine debris issues, to carry out the first Island Debris Summit, which was later developed into the national Umigomi (marine debris) Summit. The summit is organized by a different local government each year, and stakeholders affected by marine debris are invited to join the discussions. In 2006, civil organizations collected the demands of local regions and began lobbying the National Congress. In response to the proposals from local governments, the central government set up governmental meetings for marine debris-related matters.

In 2009, with the continuous promotional efforts of civil organizations, Japan passed marine debris management legislation, The Law of Promotion for Coastal Floating Debris Management (later renamed The Law of Promotion for Marine Debris Disposal). In 2010, the "fundamental policies" based on the aforementioned law were introduced. Local governments formulated regional plans based on the fundamental policies and promoted marine debris recycling, management, and prevention plans.

In accordance with the law, the Ministry of the Environment coordinated countermeasures for marine debris, formulated governmental fundamental policies, organized director-level meetings of promotion for marine debris countermeasures, and hosted expert meetings on marine waste countermeasures. The following operations were promoted by the Ministry of the Environment: 1.Removal and prevention of marine debris along the coasts of Japan. 2. Monitoring Japan's coastlines as well as the amounts and distributions of debris (including microplastics) and toxic substances present in the ocean. 3. Engaging in international cooperation with other countries in Asia, and establishing an international framework to tackle marine debris worldwide. In addition, the Ministry of Agriculture, Forestry and Fisheries and the Ministry of Land, Infrastructure, Transport and Tourism promoted marine debris removal from their standpoint of coastal-management. Through international cooperation, the Ministry of Foreign Affairs promoted the involvement of neighboring countries in discussions and diplomatically responded with respect to marine debris that had drifted to Japan from neighboring countries. At the local government-level, the Ministry of the Environment developed regional plans for local governments and established the National Marine Debris Measures Promotion Council.

The Law of Promotion for Marine Debris Countermeasures mainly focuses on the removal and final management of marine debris, yet it still lacks policies related to plastic reduction. In 2018, Canada proposed the Ocean Plastic Charter at the Group of Seven summit (G7), but the Japanese government refrained from signing the charter because "it had yet to formulate such laws in Japan." This decision subsequently stirred up criticism from Japanese citizens. The following year, before the G20 summit hosted by Japan, the Japanese government announced the Action Plan for Countermeasures Against Marine Debris and the Plastic Resource Recycling Strategy, which has goals similar to the "Ocean Plastic Charter." They serve as an integrated method for managing plastic waste. After the summit, G20 leaders issued the Osaka Blue Ocean Vision together, stressing their determination to reduce marine plastics by 2050.

Comparing Taiwan's and Japan's Action Plans

The four major aspects of Taiwan's marine debris action plan are mainly formulated based on the Honolulu Strategy released by the United Nations Environment Programme and US National Oceanic and Atmospheric Administration in 2011. The action plan was coordinated by the Environmental Protection Administration, and its emphasis was on the relevant plastic reduction regulations promoted by the Department of Waste Management. Ten years' worth of beach cleanup data gathered by civil organizations and citizen science was used by the Environmental Protection Administration to draft the 2019-2030 schedule for single-use plastic items, such as straws and disposable tableware.

Throughout, starting from the Marine Debris Governance Platform to developing the MDAP of Taiwan, Taiwanese civil organizations have played a key role in the overall policy making of marine plastics management. Taking the rapid assessment of coastal debris (under "research and investigation") as an example, in 2019, civil organizations Greenpeace and The Society of Wilderness identified 13 hotspots for coastal debris found by the four-seasons rapid assessment survey around Taiwan's coastline, which received extensive media coverage. As a result, the Environmental Protection Administration started to consult relevant coastal governing bodies, and also worked with various county and city governments to remove three main types of waste: coastal debris, abandoned fishing gear, and driftwood. Indirectly, they also prompted the Executive Yuan to introduce the Tribute to the Sea policy, which initiated inter-ministerial surveying and integrated coastal cleanup capacity.

Tribute to the Sea is the first high-level policy on the management of marine debris proposed by a high-level governing body. This shows that the issue of marine debris has been receiving increasing attention from the government and the public. In contrast to Japan, Taiwan has seen the vigorous energy of its civil societies. In recent years, the public sector, enterprises, and NGOs have all committed themselves to reducing plastics. It will be worthwhile to see whether Taiwan can continue to utilize cooperation between public and private sectors to reduce marine debris caused by land-based pollution, strengthen marine debris-related monitoring and investigation, and share Taiwan's marine debris management experience through international interactions.

Japan's plastic production is second only to the US, placing Japan at number two in the world. However, Japan's plastic recycling rate was only 23% in the past. In contrast to the way that "source reduction" is highlighted in Taiwan's action plan, Japan's action plan puts more emphasis on strengthening debris management and removal, as well as the development of innovative technologies that replace traditional plastic materials. Japan's Plastic Resource Recycling Strategy proposed the "3R Initiatives"–reduce, reuse, and recycle. The strategy aims to reduce 25% of single-use plastics, recycle 60% of containers and packaging, double the usage amount of recycled plastic materials, use 2 million metric tons of bioplastics by 2030, and achieve the effective use of 100% of plastic waste by 2035. Japan's action plan and strategies encourage industries to develop more alternative or biodegradable materials, but unlike Taiwan's action plans, they have not placed much attention on reduction.

In addition, Japan emphasized in its action plan the importance of using scientific research to effectively tackle the issue of marine plastics. For multiple times in the past, Japan used observation vessels to survey microplastics in the waters along Japan's coasts, distant seas, the Antarctic Ocean, and deep oceans. Long-term monitoring and investigations conducted by various local governments of the country have also created good understanding of the amounts of waste and sources of waste in rivers, lakes, and coasts. Furthermore, Japan's action plan also mentioned that the country can provide financial and technical assistance to developing countries (such as Bangladesh, Myanmar, and the Dominican Republic) through international aid to strengthen the management of marine debris. These two points are what is lacking in Taiwan's action plan. Since the OCA and the National Academy of Marine Research have been established, it is hoped that they will direct more research and investigations related to marine waste inthe future.

Conclusion

Comparing Taiwan's and Japan's action plan of marine debris governance, although Taiwan's scientific research is progressing at a slower pace, the EPA, OCA, Fisheries Agency, and Taiwanese NGOs have formed the Marine Debris Governance Platform. Within a short period of time, they were able to promote policies, launch action plans, release clear schedules for reducing single-use plastic, and carry out beach cleanup and plastic reduction activities that have developed rapidly in various regions. These are amazing steps that have impressed other countries. Japan's action plan focuses on the removal of marine debris, innovation of plastic materials, and further development of industries. Its meticulous long-term research and investigation, as well as its capacity to provide international aid, are worthy of emulation in Taiwan.

A Key Opportunity for Asia-Pacific Cooperation: Highlights from the "Regional Conference and Policy Dialogue on Blue Economy, Ocean Tourism, and Sustainable Blue Financing"

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Translated by Linguitronics
Keywords: Blue economy, ocean tourism, blue financing

This article outlines the international conference on Blue Economy, Ocean Tourism, and Sustainable Blue Financing, hosted by the Asian Development Bank Institute (ADBI), the Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF), and International Cooperation and Development Foundation (TaiwanICDF), in Nadi, Fiji during February 25-27, 2020.

Regional Conference and Policy Dialogue on Blue Economy, Ocean Tourism, and Sustainable Blue Financing
Image by OPRI-SPF

Introduction

In 2019, the Asian Development Bank (ADB) hosted the annual meeting to the Pacific island country – Fiji for the very first time, signifying the ADB's announcements for its Ocean Financing Initiative and Healthy Oceans Action Plan, as well as investment of US$5 billion by 2025 to promote related projects. From February 25 to 27, 2020, the ADBI, the OPRI-SPF, and TaiwanICDF collaboratively hosted an international conference on "Blue Economy, Ocean Tourism, and Sustainable Blue Financing" in the warm weather of Fiji. The conference is part of ADBI's and OPRI's research, capacity building and sessions. Nearly 100 people attended with backgrounds of industry, government, and academia from 15 countries, including Asian and Pacific countries and the US. The conference consisted of 15 academic reports and policy dialogues. During the 3-day conference, scholars and officials from different countries discussed how to develop blue financing measures to nurture ocean resources and to promote ocean economy.

Ambassador Jessica C. Lee, Representative of the Taipei Trade Office (TTO) in Fiji, was invited to deliver a speech. She introduced TaiwanICDF's projects that utilize blue economy concepts and the aquaculture and restoration projects in collaboration with Fiji and the Marshall Islands to improve aquaculture product yield and ensure sources of protein. Another project is a collaboration with Palau for coral reef conservation through advanced technology and ocean governance. Dr. Miko Maekawa, Senior Research Fellow of the OPRI-SPF, mentioned during her opening speech that many key ocean meetings will be hosted this year, which will make this year a "super" year for oceans; such conferences include the United Nations (UN) Ocean Conference. Cooperation between areas can speed up the achievement of goals and create knowledge platforms. She also expressed gratitude to the TaiwanICDF for cooperation in sustainable ocean development, and to the TTO in Fiji for much needed assistance in the conference. Dr. Ted C. Chuang, Deputy Minister of Taiwan's Ocean Affairs Council, participated as Taiwan's governmental representative. He made his presentation in the first meeting after the opening on the topic "Blue Economy and Climate Adaptation," in which he introduced the vision of the Council and its major tasks that echo the UN's Sustainable Development Goal 14 (SDG14)—Life below water. TaiwanICDF's long-term dedication in supporting Pacific islands was also confirmed by all parties present. A display board was specially set up during the conference to exhibit project outcomes, and many participants were drawn to the board for further study or a photo.

Left: Policy forum; Middle: Deputy Minister Ted C. Chuang of Taiwan's Ocean Affairs Council delivering his talk;
Right: participants came from various government ocean agencies
Images by OPRI-SPF

Conference summary

I. Blue economy with adjustments made for climate change

The Stimson Center in Washington, DC, is one of the main founding members of Our Ocean Conference, a major annual ocean conference, that participates actively in UN Ocean Conference projects and initiatives. Mr. Jack Stuart presented in this conference the Climate and Ocean Risk Vulnerability Index (CORVI), a cross-national research. The CORVI project is currently operated in partnership with the OPRI-SPF, collecting data gradually from the Caribbean and South Pacific island countries. Plans are under way for expanding the study areas to South Asia and Southeast Asia. The research uses expert evaluation index that groups ocean risks into ecological, political, and financial risk categories. The 10 main indicators include surveys of experts from different disciplines, and provide a general comparative ocean risk assessment for each indicator. The significance of this study is to form a global compilation of ocean risks, instead of an evaluation based on absolute development data. The index helps create visualized overall comparisons, allowing more financial or insurance organizations the opportunity to offer proper evaluations. The study is still in its early phase and will continue in various countries, with results expected to be presented at the UN Ocean Conference. It is desired that more countries and research institutes may join in to apply the ocean risk vulnerability index in more aspects.

II. Structure of blue financing

The application of blue financing is a relatively new concept in the ocean industry. The system allows ocean environment-friendly sectors to raise funds for development. According to the 2019 annual report by UK organization Climate Bonds Initiative (CBI), the market for green financing is already near US $167.6 billion, but marine applications are as yet quite limited. Professor Raghu Dharmapuri Tirumala of the University of Melbourne, Australia, proposed an analytical structure based on traditional green financing created by ADB. The blue finance accelerator estimates specific interest rate reduction as an incentive to accelerate formation of the blue finance market. Ms. Nagisa Yoshioka from OPRI-SPF presented the joint study between OPRI and Professor Hsing-Hao Wu from Department of Economic and Financial Law, National University of Kaohsiung. The study advocates for blue financing regulations, and roles within the system all have their own properties and scopes of interaction. Mutual benefits are described through analysis of their interests. For example, NGOs and NPOs focused on marine protection obtain funds through various interactions with development banks. Alternatively, there is the role of private businesses. For sectors that may gain relatively large profits, such as offshore wind farm, a contribution to blue financing should be obligatory by initiating the first fund ocean development. In contrast to green financing environment indices, the detection of ocean development requires much more scientific input. Therefore, developing island nations need to work more closely with ocean-related research think tanks, providing evidence-based analysis and promoting financial circulation.

III. Ocean disaster management and ocean governance

Quantitative analysis of ocean disaster risk management also serves as important reference for financing. Mr. Hajime Tanaka from OPRI-SPF utilized GIS and hazard maps in Southern Hokkaido region of Japan, to proceed impact assessment of tsunamis on industry-specific buildings in different areas as well as reconstruction cost estimate. The simulation results show that the capital-use subsidies for the seafood production industry in coastal cities have the largest benefit on society and economy, and will promote the revitalization of other fishery-related industries. The empirical research has a wide scope for application, and can serve as a reference for policy-making in other countries regarding relatively vulnerable industries, in hopes of contributing to disaster prevention. Senior Research Fellow, Dr. Michelle Voyer of the Australian National Centre of Ocean Recourses and Security (ANCORS), University of Wollongong, Australia, presented the concept of blue governance as guided by blue economy, highlighting the integration of various organizations and coastal management. A global ocean account should also be created based on comprehensively surveyed ocean information to gradually identify the development processes of society, economic activities, and ocean conservation, and assess and address each goal.

IV. Regional focus

United Nations Development Programme (UNDP) resident economist – Dr. Rima Prama Artha presented the evaluation projects by the UNDP in Indonesia. The Indonesian government collaborated with major private banks to combine Sukuk funds, corporate social responsibility (CSR), and related global funds of US$2 billion to establish the Green Sukuk, green financing in the local language. In the future, its scope will be extended to oceans. It is expected to help broaden public-private partnership, with each application assessed in 3 weighted categories, environment (50%), economy (25%), and society (25%). Main development areas are sustainable fishery, renewable ocean resources, ocean waste management, marine ecology restoration, and disaster management. Meanwhile, Mr. Alvin Joeshar of the Central Bank of Indonesia and Mr. Ahmad Pakihadina Rahmatulloh of Resona Bank gave thorough introductions on related public and private sector measures, displaying close collaboration among industry, government, and academic circles.

V. Policy dialogue

The policy dialogue began by Mr. David Kolitagane, Permanent Secretary from Fiji's Ministry of Rural and Maritime Development, who delivered the keynote address in which he emphasized the relation between ocean economy utilization and development and confirmed that policy recommendation through empirical research will improve governmental measures through various quantitative analyses. Ms. Hanna Uusimaa, Climate Change Specialist from the ADB Pacific Department, explained the ADB Action Plan for Healthy Oceans, clarifying and discussing its content with state and organization representatives. As governmental representative, Taiwan's Ocean Affairs Council Deputy Minister Chuang, who reported how Taiwan's textile industry used disposed plastic bottles as raw material for sportswear and promoted the textiles to the world. He also proposed in his talk to assist Pacific countries with sea freight systems for plastic waste shipping and integrated collection. Besides being recovered, the plastic waste can be further transformed into economical products. Fiji's Ministry of Rural and Maritime Development Permanent Secretary Kolitagane responded immediately to the Taiwan proposal, declaring challenges for local waste disposal and looking forward to keeping close contact and discussing solutions with Taiwan, anticipating the realization of the South Pacific processing plan. Specialists from ADB agreed that this type of environmental plan has much economic potential, especially where the resource recycling process creates economic benefits to economic development. It also serves as a basis to help ADB decide whether to provide funding or support.

Conclusion and Recommendations

At the closing ceremony, ADBI Vice Chair of Research, Dr. Peter Morgan acknowledged that state representatives and presenting scholars had adequate discussions during the conference, both within scheduled conference sessions and at dinner parties. This means that vivification and development of healthy oceans, blue economy, and blue financing can become popular subjects internationally. Once revised, the reports presented in this conference shall be officially sent to the international journal Marine Policy for a special issue on the topic "blue economy and finance," in hopes of gaining even more academic and policy discussions. The leader of TaiwanICDF in Fiji, Mr. Dominick Lee made a speech as well, and shared guavas grown by the agricultural technical mission with the audience in "Fruit diplomacy" on all sides.

CBI research shows that the Asia Pacific has become the area where environmental financing is developing fastest. How we can leverage the rising awareness for environment conservation and market vitalization, establishing regulations that coexist with the ocean, and allow sustainable resource development, is essential. To achieve this effectively, it is most critical to promote two- or multi-sided close policy connections through think tanks. Especially as Japan and Taiwan are highly complementary in terms of technology, human resources, and foreign affairs, their destinies are entwined. So, it is ever more necessary to nurture marine talent, strengthen international participation, and deliver the clear message of protecting ocean sustainability to the world, all based on the shared value of sustainable ocean development. The next conference will be held at ANCORS, University of Wollongong, Australia, in November 2020, when it is expected that research on blue economy and blue finance will shine with an abundance of intellect.

Japan's Headquarters for Ocean Policy and Ocean-related Government Agencies

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Keywords: Headquarters for Ocean Policy, Basic Act on Ocean Policy

In January 2001, Japan underwent a large-scale government streamlining reform. This article will introduce the 10 ministries and agencies related to maritime affairs after the restructuring and merging.

Introduction to Japan's oceans

Japan is an island country made up of Hokkaido, Honshu, Shikoku, Kyushu, Okinawa, and 6,852 remote islands in varied sizes, according to household registries, 314 of the island are populated. The country's coastline is the 7th longest in the world, and half of the Japan's total population lives in coastal areas (Wikipedia, 2020. Retrieved from https://reurl.cc/3DY1xl, Apr. 8, 2020).

Furthermore, Japan is the only country in the world that have national holiday that memorializes the ocean. Which is at the third Sunday of July is "National Ocean Day", and its main intention is to thank the ocean for its graces while praying for the prosperity of Japan, a maritime nation. The importance of the ocean to Japan is apparent.

Agencies involved in ocean policies in Japan

At the past several government agencies were involved in the management of Japan's maritime affairs, so responsibilities were severely split up, decisions could not be made in time, and international trends in ocean issues were out of reach. In January 2001, Japan underwent a large-scale government streamlining reform. After the restructuring and merging, agencies that are now related to maritime affairs include:

Cabinet Office Building (Japan)
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https://zh.wikipedia.org/wiki/File:Naikakufu1.jpg

I. Headquarters for Ocean Policy

In 2007, the Cabinet Office established the Headquarters for Ocean Policy as per Japan's Basic Act on Ocean Policy (Article 38, Act No. 33, 2007). The Headquarters oversees all of Japan's ocean policies, specifically the planning, formulating, inspecting, reviewing, and promoting of Japan's mid- to long-term ocean policies; implements the Basic Plan on Ocean Policy; and coordinates administrative affairs between maritime ministries and agencies.

Also, 10 marine specialists have formed a "participating council" that is above the Headquarters for Ocean Policy. The council offers comments through meetings to maintain effective general management, survey, and review on ocean affairs, it was the council that established the Basic Plan on Ocean Policy.

The Japanese Prime Minister is Director-General of the Headquarters for Ocean Policy, and the Chief Cabinet Secretary and Minister of Land, Infrastructure, Transport and Tourism serve as vice directors-general. The Minister of Land, Infrastructure, Transport and Tourism are also Minister for Ocean Policy, in charge of affairs with regard to formulating the Basic Plan on Ocean Policy.

II. Cabinet Secretariat

The Cabinet Secretariat prevents terrorist attacks, guards against international crime, control the access of human and objects. An Assistant Chief Cabinet Secretary, is a part of the Cabinet Secretariat, is in charge of emergency response and crisis management. The Airport/Seaport Border Crisis Management Team under this Assistant Chief Cabinet Secretary has managers of Airport/Seaport Crisis Management and Airport/Seaport Security Committees set up in airports and seaports to assist in improving seaside security and crisis management.

III. Ministry of Land, Infrastructure, Transport and Tourism

Japan's Ministry of Land, Infrastructure, Transport and Tourism has responsibilities that are equivalent to Taiwan's Ministry of Transportation. It is in charge of various issues, including national land planning and development, building of infrastructure, transportation, meteorology, maritime safety, and tourism promotion. The Ministry's Maritime Bureau and Ports and Harbours Bureau are responsible for ocean surveys, meteorological observation, maritime affairs, marine transport, ships, ocean security, port and harbour management, ocean use, prevention of ocean pollution, marine traffic safety, seacoast management, sewage management, national land planning, urban planning, ocean area management and coastal area management.

The Japan Coast Guard is a specially estimated external bureau under the Ministry of Land, Infrastructure, Transport and Tourism. The Japan Coast Guard's chief missions are including maintaining ocean security, ensuring maritime traffic safety, coastal rescue operations, preventing marine disasters, protecting ocean environments, managing maritime traffic, sea mapping and related oceanographic information (waterway) affairs, maritime route marking and management, and collaborating and exchanging with foreign countries to improve ocean environment security. The Hydrographic and Oceanographic Department under the Coast Guard is in possession of Japan's oceanographic database and provides various of oceanographic information to marine scientific research agencies.

IV. Ministry of Education, Culture, Sports, Science and Technology

The Ministry of Education, Culture, Sports, Science and Technology is equivalent to Taiwan's Ministry of Education. Agencies under this Ministry are including the Science and Technology Policy Bureau, the Research Promotion Bureau, and the Research and Development Bureau. They are in charge of the planning and drafting of research on marine science and technology, earth science and technology, and environmental science and technology. The Ocean and Earth Division is under the Research and Development Bureau is in charge of research on global warming and related issues.

V. Ministry of Agriculture, Forestry and Fisheries

The Fisheries Agency under the Ministry of Agriculture, Forestry and Fisheries is responsible for ship management, fishery and aquatic product resource management, and promotion of fishery industry development. The Whaling Affairs Office under the Fisheries Agency controls the number of whales that are capture each year, finding a balance between Japan's whaling culture and the waves of protest from around the world.

VI. Ministry of Economy, Trade and Industry

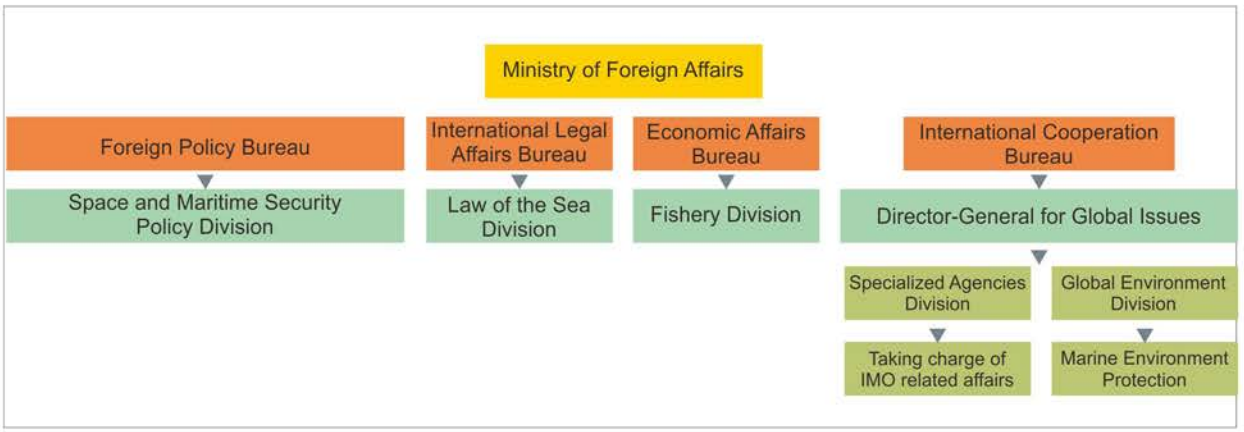
The Agency for Natural Resources and Energy and its Energy Conservation and Renewable Energy Department, Natural Resources and Fuel Department, and Electricity and Gas Industry Department are Under The Ministry of Economy, Trade and Industry, involved in marine energy resource affairs.

VII. Ministry of Environment

Units under the Ministry of Environment include the Environmental Health Department, the Global Environment Bureau, the Water and Atmospheric Environmental Management Bureau, and the Nature Conservation Bureau. The Global Environment Bureau is in charge of preventing global warming and decreasing ozone depletion. The Nature Conservation Bureau is in charge of establishing marine protected areas, preserving marine biodiversity, and protecting coral reefs.

VIII. Ministry of Foreign Affairs

The 4 main functions of the Ministry of Foreign Affairs are economy, international assistance, international law, and consular affairs. The Space and Maritime Security Policy Division under the Ministry's Foreign Policy Bureau handles piracy issues. The Law of the Sea Division within the International Legal Affairs Bureau is in charge of maintaining ocean security. The Fishery Division under the Economic Affairs Bureau is in charge of international fishery issues, especially ocean fishery issues in relation to the government and foreign countries. And under the Director-General for Global Issues within the International Cooperation Agency, the Specialized Agencies Division takes charge of International Maritime Organization (IMO) related affairs, while the Global Environment Division is responsible for marine environmental protection and the implementation and utilization of international agreements (refer to figure below).



Units within the Ministry of Foreign Affairs that are related to ocean policy
Consolidated by this study

IX. Ministry of Defense

The Maritime Staff Office under the Ministry of Defense controls military administration and orders for the Japan Maritime Self-Defense Force (JMSDF). Within the Maritime Staff Office, the Chief of Staff specializes in managing the JMSDF's defense, training, equipment, and human resources, as well as planning ocean safety technology projects, planning at-sea disaster prevention projects, developing ocean information and communication technology, and performing ocean security activities.

Due to the splitting up of duties and lack of coordination between Japan's ocean-related government agencies in the past, the Headquarters for Ocean Policy was established and reorganized to be lie within the Cabinet Office rather than the Cabinet Secretariat (Nikkei, 2017. Retrieved from https://reurl.cc/ZObn2V, Apr. 8, 2020), and it has authority to supervise all ocean policies and ocean affairs. The official implementation of the Basic Act on Ocean Policy and the establishment of the Headquarters for Ocean Policy, have indicated that Japan has started to focus on improving development of ocean resource, and following the global maritime management trends; moving towards being a great maritime nation.

An Introduction of Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Jian-Wu Lai (Research Fellow, Marine Industry and Engineering Research Center, National Academy of Marine Research)

Keywords: National Oceanographic Research Institute, JAMSTEC, Earth Simulator, D/V ChiKyu, deep submersible, Research Vessel

The purpose of this report is to introduce the recent organizational development of JAMSTEC and its core competencies, in the hope of enhancing our understanding of marine scientific research institutions in neighboring countries and as a reference for setting benchmark institutions.

The establishment of a national marine research and development organization in Japan can be traced back to the establishment of the Japan Marine Science and Technology Center (JAMSTEC) on October 1, 1971 as a specially recognized corporation. Subsequently, with the adjustment of Japan's public corporation system, it was transformed into JAMSTEC as an incorporated administrative agency in April 2004, and was transformed into a national research and development agency under the authority of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) after the amendment of the "Act on General Rules for Incorporated Administrative Agencies" in April 2015.

Purpose and mission

Under the Act on JAMSTEC, National Research and Development Institute passed in 2019, the JAMSTEC was established with the mission to "support our society in achieving this goal, through developing new scientific and technological capabilities which contribute to the sustainable development, and responsible maintenance, of a peaceful and fulfilling global society." The agency is to perform the following operations to attain the objective: 1. conducting experiments and research in science and technology; 2. disseminating the results obtained by carrying out the operations stated in the preceding item and promoting their utilization; 3.providing the facilities and equipment of the agency for public utilization with persons who conduct experiments, research and development in marine science and technology; 4.developing scientific equipment and support related academic research; 5.training researchers and technicians in marine science and technology and enhancing their level of expertise; 6.collecting, organizing, storing, and providing data and information on marine science and technology in Japan and abroad; 7.performing operations incidental to the operations stated in the preceding items.

Organization and scale

JAMSTEC operates as a legal entity, with a executives team and seven research and development departments, including the Research Institute for Global Change (RIGC), Research Institute for Marine Resources Utilization, Research Institute for Marine Geodynamics (IMG), Research Institute for Value-Added-Information Generation (VAiG), Institute for Extra-cutting-edge Science and Technology Avant-garde Research (X-star), Super-cutting-edge Grand and Advanced Research (SUGAR) Program, Advanced Science-Technology Research (ASTER) Program, Kochi Institute for Core Sample Research (KOCHI), Institute for Marine-Earth Exploration and Engineering (MarE3) and Project Teams, as well as eight research support departments. The research institute is located in Yokosuka City, and has established research institutes, centers, and offices in Yokohama City, Rokio City, Aomori Prefecture, Nankoku City, Kochi Prefecture, Nago City, Okinawa Prefecture, and Tokyo, respectively.

In terms of human resources, JAMSTEC's full-time staff at the end of April 2019 included 5 executives, 312 researcher, 208 technician, 39 crew members, 168 affairs staff, and 214 support and subordinate staff, making a total of 946 staff, with a budget of ¥35.8 billion yen for the same year. According to the budget and manpower statistics for the past 15 years (Figure 1), the total budget in 2012 was as high as ¥80.6 billion yen, and the manpower reached 1,067 people in 2015, in order to respond to the needs of the 2011 Tōhoku earthquake and tsunami Northeast Earthquake marine research survey.

Marine survey and research equipment

As Japan's core research institution for marine earth exploration, JAMSTEC is internationally known for its three major instruments, the Earth Simulator, the D/V ChiKyu, and the SHINKAI 6500 Deep Submersible, and for its excellent fleet of research vessels that support Japanese and international cooperation programs.

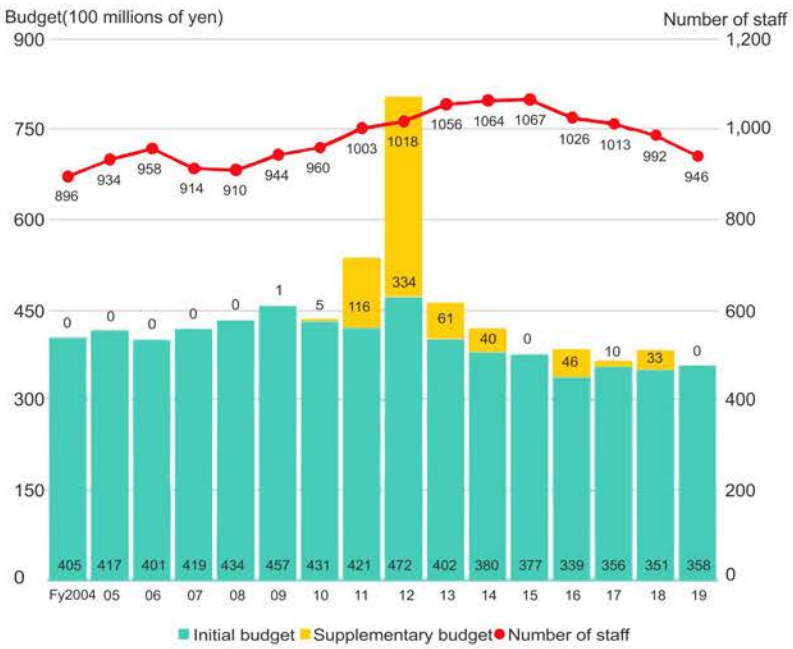


Figure 1/ Changes in JAMSTEC manpower and budget from 2004 to 2019
Source / http://www.jamstec.go.jp/e/about/suii/

I. Earth simulator

Since March 2002, JAMSTEC has been working on a project called "Earth Simulator", the world's fastest computer for analyzing and predicting climate change, in the Earth. Its contribution is not only compiled in the report of the Intergovernmental Panel on Climate Change (IPCC), but also in the use of materials, instruments, equipment, pharmaceutical development and other oriented applications.

The third-generation Earth simulator, updated in 2015, consists of NEC's SX-ACE supercomputer with a maximum theoretical performance of 1.3 PFLOPS, and will be used to address environmental problems and crustal changes, earthquake occurrence mechanisms and tsunami disaster prediction.

II. D/V ChiKyu

In 2005, Japan completed the construction of the D/V ChiKyu, a 56,752-ton offshore drilling vessel with a capacity of 200 crews (including 50 scientists and 50 drilling technicians), in order to further develop into a marine and technology power.

The D/V ChiKyu is committed to carrying out work on issues related to the mystery of life, global change, climate change and Earth history, and the drilling program is approved by the International Ocean Discovery Program (IODP). The D/V ChiKyu provides more reliable and safe drilling technology and equipment, and is equipped with precision instruments such as multi-sensor core logger (MSCL), X-ray CT scanner, optical emission spectrometry and other precision instrument for scientists to conduct preliminary studies of the core on board. The D/V ChiKyu previously set a record for the largest drill depth of 3,058.5 meters under the seafloor during a NanKai trough drill test in 2014. Most of the cores drilled were sent to the Kochi Institute for Core Sample Research for storage in a cold storage facility at 4℃. The total length of the cores in storage exceeds 120 km.

Table 1 / Principal specifications of JAMSTEC Research Vessels

Name	YOKOSUKA よこすか	KAIREI かいれい	MIRAI みらい	KAIMEI かいめい	HAKUHO 白鳳丸	SHINSEI 新青丸
						
Completion	1990	1997	1997	2016	1989	2013
Length×Beam (m)	105×16	106×16	128×19	100.5×20.5	100×16	66×13
Gross tonnage (tons)	4,439	4,517	8,706	5,747	3,991	1,635
Speed (knots)	16	16	16	12	16	12
Accommodation (Researchers)	60(15)	60(22)	80(46)	65(38)	89(35)	41(15)
Major Mission Equipment	MBES/SBP ADCP Gravimeter Magnetometer Hydro acoustic navigation system XBT/XCTD	MBES/SBP MCS Gravimeter Magnetometer Winch system Hydro acoustic navigation system XBT/XCTD	MBES/SBP Water sampler ADCP Doppler radar Winch system Gravimeter Magnetometer Radiosonde Maritime meteorological observation system Hydroacoustic navigation system XBT/XCTD	MBES/PDR Gravimeter Magnetometer CTD system Water sampling XBT/XCTD Winch system, ADCP Transponder system Meteorological observation system Three-mode multi-channel seismic system 40 meter-long piston corer system BMS Power grab sampler 3,000 meter-class ROV Container laboratory Analytical and experimental equipment Anti-rolling system	PDR MBES/SBP Water sampler Winch system ADCP Gravimeter XBT/XCTD	MBES/SBP/PDR Gravimeter Magnetometer XBT/XCTD CTD system Water sampler Winch system Hydroacoustic navigation system Fish-finder Maritime meteorological observation system
Ship characteristics	Supporting SHINKAI 6500 & AUV URASHIMA	Supporting ROV KAIKOU 7000	Arctic Sea Observation and Buoy Deployment in	Geophysical Survey Ship	General-purpose R/V for academy research	General-purpose R/V for academy research
Sailing	Nippon Marine Enterprises, Ltd.				JAMSTEC	NME
Deck work	Nippon Marine Enterprises、Marine Works Japan					

ADCP: Acoustic doppler current profiler. MBES: Multibeam echo sounder SCS: Single-channel seismic survey system
DPS: Dynamic positioning system SBP: Sub-bottom Profiler MCS: Multichannel seismic survey system

III. SHINKAI 6500

Deep submersibles research vehicle such as the Alvin, the Nautile, and the MIR I/II took a close look at the wreckage of the Titanic at 3,810 meters below the sea floor in the North Atlantic between 1986 and 1998, unveiling the mystery of the shipwreck and leading to the film Titanic.

There are about 13 manned deep submersibles in the world, mainly developed by the United States, France, Russia, Japan and China, to carry out Underwater investigation, seabed exploration, seabed development and salvage missions. Generally speaking, the design depth of deep submersibles for oil and gas exploration is within 4,000 meters, while those that can reach more than 5,000 meters are mostly built for scientific research purposes. In terms of dive depth, the current Japanese JAMSTEC SHINKAI 6500 dived to a depth of 6,527 meters in August 1989, placing it third. This record stood for nearly 23 years before it was surpassed by the Chinese submersible "Jiaolong". The dive record by SHINKAI 6500 shows that she made 1,529 trips between 1990 and 2018, inaddition to exploratory missions to the seabed around Japan, she also traveled to the Mariana Trench, Mid-Atlantic Ridge, Southwest Indian Ridge, etc., covering all three oceans, providing important observations for understanding the Earth's internal movements, unraveling the evolutionary history of living organisms, deep-sea bioavailability conservation and interpreting the thermal cycle.

In response to the increasing competition in deep-sea exploration around the world, JAMSTEC announced the SHINKAI 12000 development plan in 2014, which is expected to regain the position of the most powerful deep submersible by 2023 and reach the deepest part of the sea.

IV. Research vessel operations

JAMSTEC operates not only the D/V ChiKyu, but also six other research vessels. The information of each vessel and its operation is summarized in Table 1. The research vessels are designed to support deep submersible support, oceanographic survey, submarine resource exploration, and marine scientific survey in the northeastern area of Japan, and support the marine research topics of JAMSTEC and the domestic marine research. The marine scientific survey service that supports the operation of the research vessel includes the professional marine navigation and survey technology. Except for R/V Hakuho Maru, which is operated by the crew received from the University of Tokyo, most of the research ships are entrusted by professional marine scientific research support cooperative companies to assist in the implementation.

With the exception of the R/V Hakuho Maru, which was manned by crews transferred from the University of Tokyo in 2014, most of the other research vessels were executed with the assistance of a professional marine research investigation support company.

Medium-term Objectives

JAMSTEC's current ongoing plan is a seven-year medium-term plan starting in April 2019. In addition to the Act on General Rules for Incorporated Administrative Agencies, Basic Plan for Science and Technology, the Abe administration's Society 5.0 plan for a "human-centered society," and the United Nations Sustainable Development Goals (SDGs), the plan integrates the idea of "oceans, earth, and life" and spreads scientific knowledge in the hope that human society can help the future of the planet.

JAMSTEC's current program development focuses on the promotion of basic research and development in marine science and technology and the establishment of a core institution for marine science and technology, which includes 1. understanding the current status of global environmental change and predicting the future; 2. understanding material circulation and origin of resources in oceans to ensure sustainable use; 3. Elucidating earthquakes and volcanic activity in marine water to aid disaster mitigation; 4. Probing unknown causal relationships hidden in Earth system; 5. Pioneering original research and technological development aimed at the future, and 6. the use of large-scale R&D infrastructure and data dissemination.

Concluding Remarks

JAMSTEC will soon be celebrating its 50th birthday. Over the past decades, JAMSTEC has continued to support research and development and data collection and analysis of marine surveys in Japan, pushing Japan's marine research to a world leading position. It also actively translates marine knowledge and information into popular science content to disseminate marine knowledge and technology to the public. During COVID-19, JAMSTEC is launching the "JAMSTEC for Students" online multimedia campaign to disseminate marine knowledge to Japanese children who are self-isolate at home. Marine research and development organizations such as JAMSTEC have not only accumulated a deep foundation in scientific exploration and academic research for Japan and humanity, but also provided the nourishment needed to build and realize dreams of "being close to the sea, knowing the sea, loving the sea and using the sea.

The National Research and Development Agency is committed to maintaining Japan's leading position in the world in basic science research, while at the same time actively promoting the integration of technology and research ideas across academic fields and national boundaries, accelerating open innovation with commercial value, and systematically addressing local or global issues of concern. For example, the Marine Radiological Survey USV released in 2019, which integrates JAMSTEC and the Japan Atomic Energy Research and Development Agency (JAEA) as well as the industries in the Hamadori region of Fukushima Prefecture, is quite worthy of reference as it develops and solves the important issue of marine monitoring after a nuclear disaster from multiple perspectives.

Finally, the link between JAMSTEC's research and the UN Sustainable Development Goals (https://www.jamstec.go.jp/sdgs/e), as drawn up by JAMSTEC, shows that it actively contributes to solving common problems of the international community by understanding how human behavior affects the Earth system through various research and development, by understanding the realities of the Earth as a diverse and complex system centered on the ocean and predicting its future.

Overview of Japan's Third Stage Basic Plan on Ocean Policy

Hui-Lung Yu (Associate Professor, Department of Shipping & Transporation Management, National Kaohsiung University of Science and Technology)
Translated by Linguitronics
Keywords: Basic Act on Ocean Policy, Basic Plan on Ocean Policy

In 2007, Japan passed its Basic Act on Ocean Policy on the basis of international ocean law and established the Headquarters for Ocean Policy under its Cabinet Office, the purposes of the act and headquarters being to achieve Japan's national policy goal of becoming a maritime nation while working alongside other nations, in a peaceful and sustainable way, in the utilization of ocean resources, protection of ocean environments, and preservation of ocean safety. On the basis of the Basic Act on Ocean Policy, the Japanese Government has formulated a Basic Plan on Ocean Policy, and reviews and amends the Act every 5 years.

Japan's Headquarters for Ocean Policy developed the first stage of its Basic Plan on Ocean Policy in 2008, the second stage in 2013, and third in 2018.

An overview of the third Basic Plan on Ocean Policy, currently under way, is below (Cabinet Office, Basic Plan on Ocean Policy (stage 3), 2018. Retrieved from https://reurl.cc/R4rYyz, Apr. 1, 2020):

Plan framework

The plan consists of an introduction and three major sections. The introduction gives an overview of the 10 years since enactment of the Basic Act on Ocean Policy, as well as the current situation of the ocean. The first section, general remarks, picks up from the current situation acknowledged in the introduction to describe the prescribed ocean policy, including ocean policy concepts, goals, and basic ocean policy measures for the next 10 years. The second section establishes specific ocean policy implementation strategies for the next 5 years, including those that should be integrated and those that should be implemented in collaboration with related agencies. The third section notes matters for general and scheduled strategy execution.

Ocean policy concepts, goals, and basic ocean policy measures

Japan's Basic Act on Ocean Policy contains six basic concepts, namely harmonization of the development and use of the oceans with the conservation of marine environment, maintaining the safety and security of the oceans, improvement of scientific knowledge of the oceans, sound development of marine industries, comprehensive governance of the oceans, and international partnership with regard to the oceans. With the above mentioned concepts in mind, the Plan determines specific ocean policy goals as below, titled "The challenge of a new maritime nation."

I. Toward open and stable seas. Protect the nation and its citizens.
II. Apply the seas to help the nation prosper. Pass on the seas to posterity.
III. Challenge unknown seas. Improve technology and enhance awareness of seas.
IV. Take the lead to realize peace. Create international standards for seas.
V. Familiarize people with seas. Develop human resources with knowledge of the ocean.

Plan policies and measures

The Plan lists approximately 370 policy items and measures, summarized as below:

I. Comprehensive maritime security
Securing national interests in Japan's territorial waters, securing stable use of Japan's important seas, and strengthening the international maritime order to ensure freedom of ocean use.

II. Promotion of marine industries
Promoting the development of ocean resources and energy resources; strengthening the international competitiveness of ocean industries; expanding ocean industry utilization; and ensuring the development of maritime transport, water resource management, and the aquatic product industry.

III. Maintaining and conserving marine environments
Ensuring ocean biodiversity, responding to climate change and ocean acidification, responding to marine litter, preventing marine pollution, monitoring radiation, and reconciling marine development and use with the environment.

IV. Improving scientific knowledge
Promoting marine science and technology research and development, maintaining and improving ocean surveys and observations, and supplementing and strengthening shared fundamental marine science and technology.

V. Promoting Arctic policy
Strengthening the Arctic research and observation system, promoting international collaborations for Arctic science and technology, training professionals to solve Arctic issues, actively participating in international regulation establishment, promoting cooperation between two or more countries, and actively participating and contributing in Arctic Challenge for Sustainability (ArCs).

VI. International collaboration and cooperation
Formulating and developing maritime order, international cooperation on the ocean.

VII. Developing human resources with ocean knowledge and advancing citizens' understanding of the ocean
Training and securing of specialist human resources to support the maritime nation, educating children and young people about the ocean, and advancing citizens' understanding of the ocean.

To promote and monitor the Plan's implementation, the Headquarters for Ocean Policy is collaborating with the Administration Office of the Headquarters for Ocean Policy to become a control center within the Japan government. The plan, do, check, and act (PDCA) quality control cycle shall be utilized to control and evaluate the operational process of each policy, pushing each policy forward comprehensively as scheduled, with engineering management indices employed for inspection. Also, the importance of responsibilities and cooperation between industry, government, and academic personnel shall be highlighted. Information shall be monitored for proper disclosure and transparency to assist in collaboration between different agencies.

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