國際海洋資訊

International Ocean Information

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氣候危機下的北極海洋研究

Arctic Ocean Research Within the Context of the Climate Emergency

英國海洋資訊

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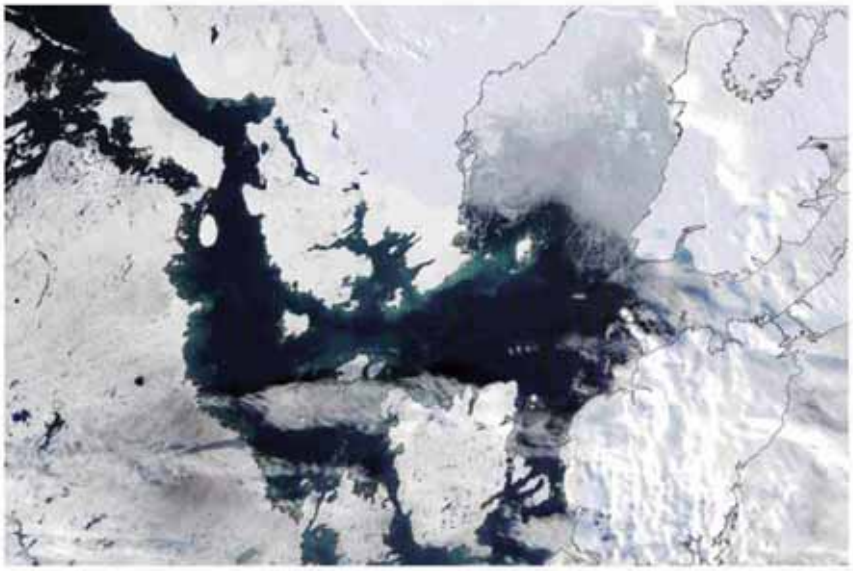
與國際接軌 提升我國極地研究量能

主任委員：李仲威

本期介紹海洋國家英國在海洋治理方面的重要策略，在組織、法規及產業面，英國的海洋事務管理主要依據《海洋與海岸許可法》（Marine and Coastal Access Act 2009），以此建立綜合性的海洋管理架構，由海洋管理組織（Marine Management Organization, MMO）協調各部關於海洋管理與開發之合作，其負責制定海洋計畫與管理，在「海洋空間規劃」的架構下提供離岸風場開發的海事許可申請，也針對在海洋保護區內無需海事許可執照之海灘娛樂及水上活動擬定相關規範，英國如何妥善保護、改善海洋環境，同時進行永續性的海洋活動與發展，可供我國參考。

而英國海外領地遍及熱帶到南極圈，為強化海外領地之海洋保護區，其推動號稱全球最大規模的海洋保育計畫：藍帶計畫（Blue Belt Programme），在7個海外領地執行大洋探勘、生物多樣性保護、在地海洋保護區管理及永續漁業等管理策略，並應用海洋監測技術以落實管理；不過，英國在2010年將印度洋領地的查哥斯群島（Chagos Archipelago）設置為海洋保護區，則牽涉到模里西斯漁權以及馬爾地夫大陸礁層延伸問題，當事國的作法及國際法庭的裁決亦值得一讀。

我國則在北極研究上跨出了嶄新的一步，於2021年8月由國家海洋研究院、國立中央大學地球科學學院與波蘭哥白尼大學三方攜手，在冷岸群島（Svalbard）的斯匹次卑爾根島（Spitsbergen）研究站上進行陸域觀測站試驗及北冰洋資料蒐集研究，研究議題包含陸域地震波量測冰原及海面微型浮球。不僅開啓了國內極地海洋科學研究之濫觴，更期望未來臺灣能提升極地海洋研究量能，逐步與國際接軌！



圖說／為了能夠瞭解全球氣候危機對於北極海的影響，多國合作進行大型跨國極區觀測計畫（圖為北極海，2021年10月仍尚未結冰）

圖片來源／Arctic Lows, NASA Earth Observatory https://earthobservatory.nasa.gov/images/148974/late-bloomers-in-the-arctic

氣候危機下的北極海洋研究

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關鍵字／北極、海面浮球、融冰、海表溫度、氣候危機

受到人類活動及二氧化碳排放影響，全球進入氣候危機（Climate Emergency），聯合國政府間氣候變遷委員會（Intergovernmental Panel on Climate Change, IPCC）於2021年第6次氣候變遷評估報告——物理科學基礎報告[1]提出從2010年至2019年間的平均溫度，已較1850年至1900年平均溫度高出1.07℃。並於2018年發布「地球暖化1.5℃」特別報告指出，如果依據現在全球升溫速率，預測全球從2030年至2052年溫度將高出1.5℃[2]，顯示全球熱化（Global heating）的現象正逐漸發生。在全球升溫情況下，導致北極圈海冰覆蓋面積越來越少，融冰速度越來越快。極區研究[3]顯示自1994年至2017年期間，地球已經失去了28兆噸的冰，其中有58%是發生在北半球，包括北極海冰約7.6兆噸、格陵蘭冰原的冰蓋約3.8兆噸。從衛星觀測北冰洋海冰密集度（Sea ice concentration）資料顯示（圖1），2020年海冰密集度約7.28百萬平方公里，與2000年相比，海冰密集度低約2.19百萬平方公里。也因北極冰層與冰河融解，加劇全球海平面上升的趨勢[4]，上升幅度約為每年1.8mm。然而，北極海冰融化不僅僅衝擊到極區的陸地、大氣、海洋、生態、當地種族活動等，更影響到全球天然資源、經濟與軍事戰略，如石油天然氣的豐富蘊藏量及開採、開通新貿易航道。

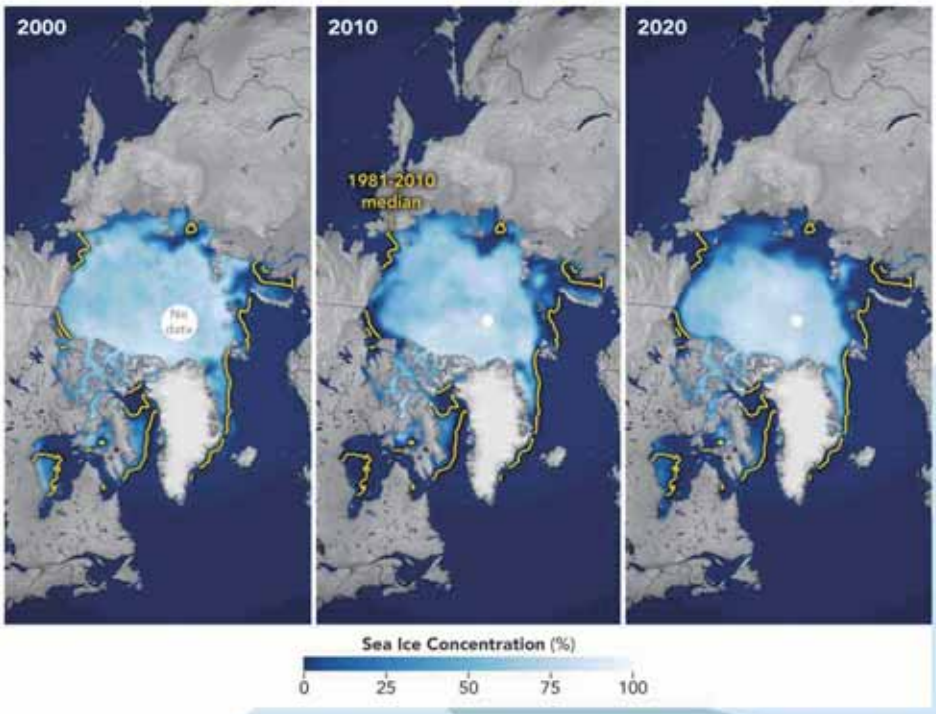

圖1／由左至右分別為2000年、2010年、2020年7月份北極海冰密集度變化趨勢
圖片來源／Arctic Lows, NASA Earth Observatory

全球氣候危機對北極海的影響

2019年IPCC發布「氣候變遷中的海洋與冰凍圈（亦稱冰雪圈、冰圈或冷圈）特別報告」[5]，強調全球氣候危機將對海洋與極區影響甚大，提出目前觀測在海洋、氣候變遷衝擊與永凍土的影響、討論氣候模式模擬預測的結果與風險等趨勢下，如何做出保護海洋及降低氣候危機之行動。在海洋方面，使用現階段溫室氣體排放量模式，推估海洋溫度會持續增加，海洋溶解氧對照2006年基準，至2015年水準降低3～4%、酸鹼值減少0.3。然而海洋升溫可能導致海洋溶氧降低造成海洋生物缺氧死亡、海洋酸化導致海水中碳酸鈣減少使得珊瑚礁不易進行鈣化，導致骨骼密度較低、更為易碎與損害。即使全球升溫侷限於1.5°C，升高的水溫將使珊瑚遭受大面積的損失及局部滅絕情形。對於極區的影響而言，永凍土層富含約1.7兆噸有機碳[6]，相當於2倍大氣含碳量，因此當氣候升溫，這些永凍土層解凍，會將有機碳釋放到大氣，增加大氣的含碳量，進而造成海冰融化、覆蓋面積減少，對於極區原住民活動範圍與生態系棲地等退縮減少造成很大的衝擊。2021年8月北極圈格陵蘭島受到異常氣候影響，降雨量創下1950年以來最大的紀錄，這些警訊顯示北極融冰速度加劇。未來如大規模融冰，海平面高度可能逐漸上升，將增加臺灣沿海低窪地區海水溢淹的風險。

為了能夠瞭解全球氣候危機對於北極海的影響，國際上進行跨國大型極區觀測計畫，如2019年「北極氣候多學門研究漂流觀測」（Multidisciplinary drifting Observatory for the Study of Arctic Climate, MOSAiC）計畫為目前史上規模最大的國際北極冰層探測計畫，利用德國破冰船極星號錨泊在海冰上，進行為期1年的北極海洋科學調查，蒐集了大氣、海洋、海冰、生態系統等相當珍貴的資訊，希望作為未來理解北極環境的變化、提供海洋數值模式建構和預測之基礎，以助評估氣候變遷對北極地區和全世界的衝擊。國立中山大學方盈智助理教授為國內少數專精於北極海洋物理研究學者，亦是有機會參與2019年MOSAiC航次唯一的臺灣海洋研究學者。方盈智助理教授指出另一個北極海聯合觀測研究計畫為「The Synoptic Arctic Survey (SAS): A Developing Multi-Nation Interdisciplinary Survey of the Arctic Ocean」，此計畫為多國合作案（美國、加拿大、瑞典、日本、韓國、德國、挪威、俄羅斯、丹麥、中國），參與國研究團隊將各自申請破冰船航次，規劃於2022年至2023年於北極海不同區域進行綜觀性（synoptic）的觀測（圖2）。目的是對現今北極海大區域生化與物理參數做出一次完整的探測並記錄現今的狀況，而不像以往由少數團隊於某個小區域進行研究。所採得的資料將會與過去40年來所收集的歷史資料比對，進而推估氣候變遷下，北極海區域的變動。重點科學問題乃：一、物理機制的變動；二、非北極海生物物種的遷徙與入侵；三、當地碳循環的現況變化。

圖2／北極海聯合觀測航次規劃路徑（白線）
圖片來源／https://synopticarcticsurvey.w.uib.no/

北極海海洋觀測國際合作

國內首次北極研究於2021年8月由國家海洋研究院、國立中央大學地球科學學院與波蘭哥白尼大學三方攜手於冷岸群島（Svalbard）（圖3）進行國內首次北極圈研究，於斯匹次卑爾根島（Spitsbergen）上研究站進行陸域觀測站試驗及北冰洋資料蒐集研究，研究議題包含陸域地震波量測冰原及海面微型浮球。

國立中央大學地質研究團隊指出，於野外作業經常性聽到冰川崩裂的巨大聲響，因此本次研究規劃布放地震儀觀察冰川裂解造成的冰震行為[7]。過去研究[8]證實在斯匹次卑爾根島發現地震儀訊號呈現如地震發生時的震盪，並透過攝影機同步捕捉到冰震情況（圖4）。國家海洋研究院與國立中央大學共同規劃投放由國立中央大學自行研發之海面微型浮球（圖5），藉由浮球進行海流、波浪特徵變遷及海表溫度觀測，探討北極海快速融冰現象。浮標底部有溫度感應器，可以偵測海水溫度；內部電路板設計包括可偵測浮標的流速與浪高，裡面還有兩個方形衛星傳輸跟GPS定位天線，以進行資料逐時回傳及由軌跡推算漂流速度。國立中央大學錢樺教授指出，近年經由衛星觀測北極海冰覆蓋的資料發現，海冰消失速度遠較先前所有海洋數值模擬預測來得更快更劇烈，相關研究推論，其原因應與北極海波候變遷及其引致的正回饋機制有關。圖6為浮球布放於冷岸群島西岸，位於格陵蘭海北側的佛拉姆海峽（Fram Strait，為北冰洋及北大西洋水體交換的水道之一）之海上布放軌跡及海洋表面溫度觀測結果。

海面微型浮球自2021年8月28日起透過衛星通訊即時回傳數據，在國家海洋研究院即可知道即時北極海洋觀測資訊，沿著漂流路徑獲得海面溫度、流況、浪況等觀測資訊。初步觀測成果顯示，冷岸群島沿岸海水表面溫度約7～7.5°C，與佛拉姆海峽相比溫度較暖2～4°C。與2020年衛星觀測海表面8月平均溫度6.75～6.9°C相比較，呈現變暖趨勢；流速和緩，約每秒0.2～0.6公尺持續往北漂移，受到格陵蘭海域不同洋流分支帶動，部分浮球隨著西斯匹次卑爾根洋流（West Spitsbergen Current，為北大西洋暖流分支）往北漂流進入北冰洋，少數浮球受到大西洋反流（Return Atlantic Current, RAC）往西漂流，與過去研究[9]該海域大西洋反流路徑（圖7）相似。海面浪況約1.5～3公尺屬惡劣海象，國立中央大學錢樺教授團隊提出：海浪拍打碎海冰將加速融化外，海冰本身也會使海浪的能量持續傳播，並造成更大範圍的破壞。此外，海冰減少意味著海水面積增大，海浪的波高及波長變得更大，使海冰的生成減少。

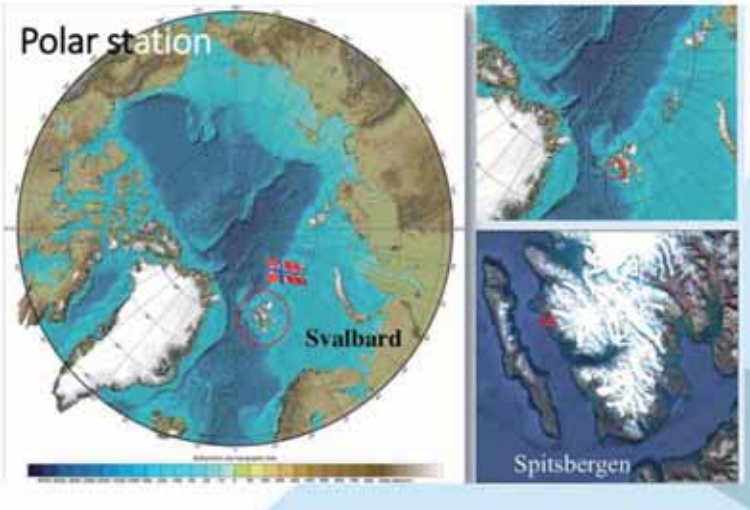

圖3／冷岸群島於北冰洋地理位置
圖片提供／國立中央大學

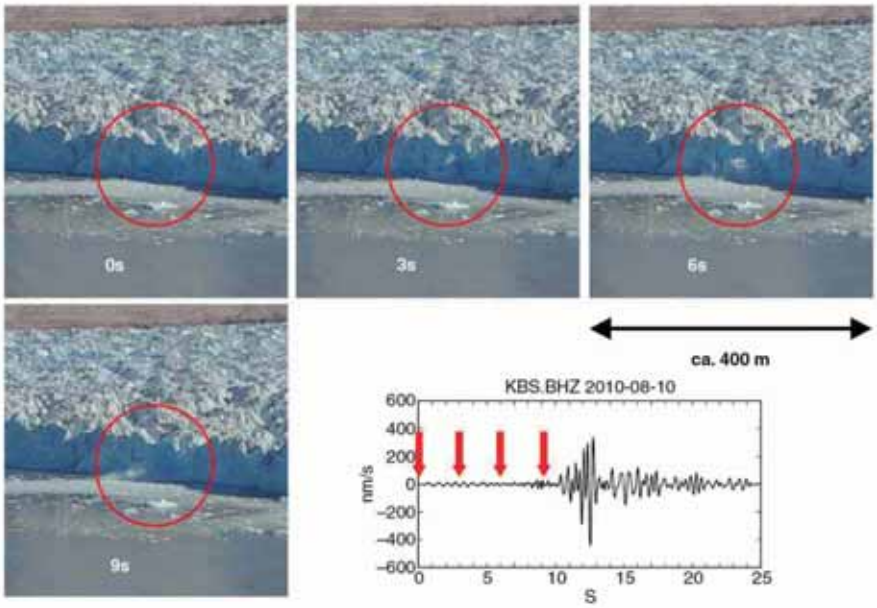

圖4／透過攝影機同步捕捉到冰震時，地震儀訊號呈現如地震發生時的震盪
圖片來源／[8]

圖5／海上準備布放海面微型浮球及布放後漂浮情況
圖片提供／國立中央大學錢樺教授團隊

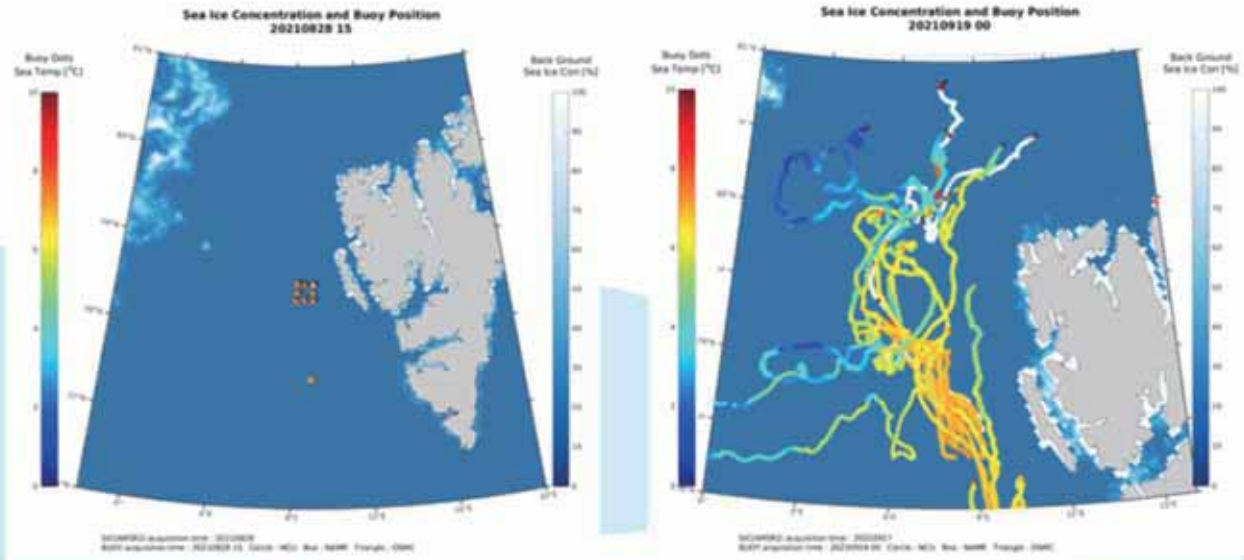

圖6／海面微型浮球海上布放軌跡及海洋表面溫度觀測結果（背景顏色為衛星觀測海冰密集度，浮標點位之軌跡顏色為海水溫度）：（左）原始布放位置；（右）漂流21天後表面微型浮球漂流軌跡
圖片提供／國立中央大學錢樺教授團隊

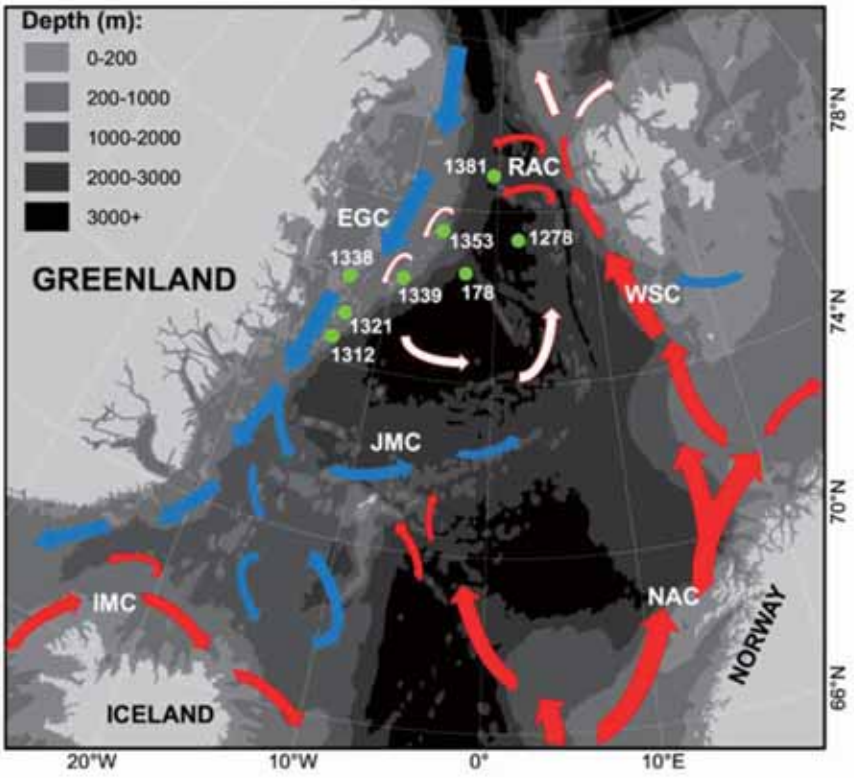

圖7／格陵蘭島與冷岸群島海域周邊海流分布圖。紅色箭頭為大西洋表面流：挪威大西洋流（Norwegian Atlantic Current, NAC）、伊爾明厄洋流（Irminger Current, IMC）、西斯匹次卑爾根洋流（West Spitsbergen Current, WSC）、大西洋反流（RAC）；白色箭頭為大西洋次表層水；藍色箭頭為北極表面流：東格陵蘭流（East Greenland Current, EGC）、加那利洋流（Jan Mayen Current, JMC）

圖片來源／[9]

未來展望

我國目前對於極區的海洋研究及科學家相當鮮少，國家海洋研究院希望藉由與國立中央大學、波蘭哥白尼大學之海洋科學國際合作，作為開啓北極海洋環境監測、蒐集極區水文基礎資料之開端，藉此引領及提升國內極地海洋科學研究，並把後續相關研究結果提供給政府未來研擬國內極地海洋政策及發展極區藍色經濟之參考。現階段國家海洋研究院除與波蘭進行極地國際合作，未來規劃與美國伍茲霍爾海洋研究院（Woods Hole Oceanographic Institution）、阿拉斯加大學費爾班克分校（University of Alaska Fairbanks）、德國AWI極地與海洋研究所（Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung）等國際上頂尖極地海洋研究單位進行跨國合作與學術交流，以期未來臺灣在極地海洋研究量能逐步接軌國際。

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英屬印度洋海域劃界爭端研析

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關鍵字／模里西斯、馬爾地夫、查哥斯群島、海域爭端

國際法院（簡稱ICJ）對於爭執的訴訟程序管轄基礎是基於當事國的同意，但是Peter Malanczuk教授指出《聯合國海洋法公約》（簡稱《公約》）的情況不同，締約國只要批准，就自動成為《公約》爭端解決條款的當事國[1]。而《公約》第15部分的設計機制讓仲裁成為強制程序的原始設定，至2021年為止，共有6案提交仲裁請求臨時措施，12案提交仲裁審理。另外，本文研析之英屬印度洋海域劃界爭端案（Dispute Concerning Delimitation of the Maritime Boundary Between Mauritius and Maldives in the Indian Ocean），若當事國同意，可轉由其他法庭管轄。到目前為止，共有6案轉交由聯合國海洋法法庭（簡稱ITLOS）管轄[2]。

爭端的起源—查哥斯群島（Chagos Archipelago）

模里西斯原為法國的殖民地，1814年割讓給英國。英國在1965年時，將查哥斯群島從模里西斯分離，劃入英屬印度洋領地（The British Indian Ocean Territory, BIOT），模里西斯後於1968年才獨立。英國一直主張擁有查哥斯群島的主權，只有不再作為防衛用途時，才會將群島歸還模里西斯。2010年4月1日英國在群島設立海洋保護區（Marine Protected Area, MPA），影響到模里西斯的漁民無法入漁。另一方面，馬爾地夫在2010年7月26日向大陸礁層界線委員會（Commission on Limits of Continental Shelf, CLCS）提出延伸大陸礁層的申請文件。由於查哥斯群島與馬爾地夫距離不足400浬（517公里，約279浬）[3]，勢必產生海域重疊的現象（圖1），但馬爾地夫卻拒絕談判。在背腹受敵情況下，模里西斯先後於2010年12月20日與2019年6月18日對英國及馬爾地夫提出仲裁程序。

常設仲裁法庭2015年3月15日仲裁結果出爐，模里西斯對英國提出的查哥斯群島海洋保護區仲裁案（Arbitration Regarding the Chagos Marine Protected Area between Mauritius and the United Kingdom of Great Britain and Northern Ireland），法庭裁定英國設立的MPA違反《公約》第2條第3項、第56條第2項及第194條第4項規定[4]。由於查哥斯群島的主權歸屬仍然未解，2017年6月22日聯合國大會（簡稱聯大）要求ICJ發表諮詢意見。2019年2月25日ICJ發表如下諮詢意見（Legal Consequences of the Separation of the Chagos Archipelago from Mauritius in 1965）[5]：

一、查哥斯群島分離後，模里西斯才獨立，模里西斯的非殖民化沒有合法完成；

二、查哥斯群島為模里西斯不可分割的一部分，英國繼續管理已經構成違法行為（unlawful act），有義務儘快結束管理；

三、所有聯合國會員國有義務與聯合國合作完成模里西斯的非殖民化。

2019年5月22日聯大再度通過73/295號決議，要求英國在6個月內撤回行政管理，使模里西斯完成非殖民化，並呼籲所有的會員國與聯合國合作以確保模里西斯儘速完成非殖民化，但是馬爾地夫及英國在決議中仍然投下反對票[6]。

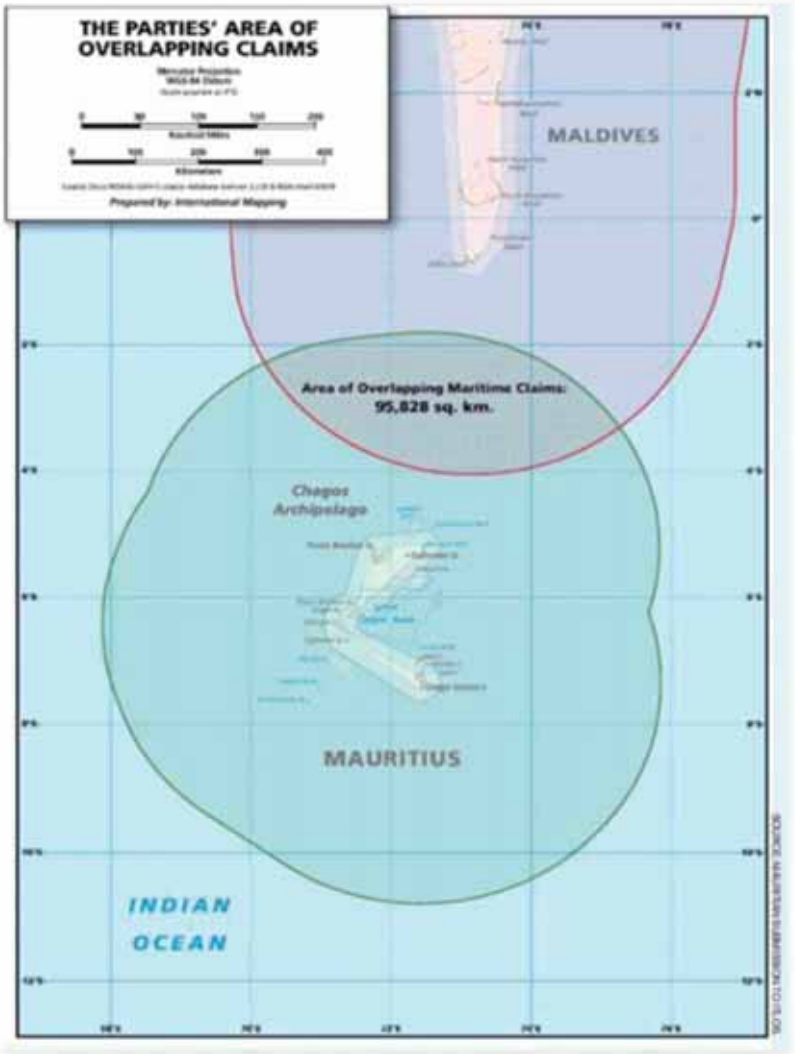

圖1／模里西斯查哥斯群島和馬爾地夫主張的專屬經濟區
資料來源／[7]

爭端當事國相關交涉

模里西斯通知馬爾地夫提出仲裁程序前，曾進行多次交涉，但是馬爾地夫的態度反覆不定。馬爾地夫向CLCS提出延伸大陸礁層的申請後，模里西斯除表示反對外，並主動前往馬爾地夫首都馬力進行會談，當時馬爾地夫曾表示不將查哥斯群島的專屬經濟區座標列入考量，願意修正有關座標，然後作為附件（addendum），附在申請文件之後[8]。2011年3月12日馬爾地夫總統訪問模里西斯時，兩國發出聯合公報（Joint Communiqué），同意以雙邊協定的方式解決海域劃界問題。但是一直沒有附件加入申請文件之後，2011年3月24日模里西斯對聯合國秘書長發出照會，抗議馬爾地夫的延伸大陸礁層已經侵害到模里西斯的專屬經濟區相關權利。

ICJ於2019年提出諮詢意見後，2019年3月7日模里西斯再次邀請馬爾地夫在4月進行第二次會談，但是馬爾地夫沒有回應，因此模里西斯於2019年6月18日通知馬爾地夫提交仲裁程序。不過2019年9月

24日兩國同意根據《公約》附件六第15條第2項規定締結特別協定，同意轉由ITLOS設立特別分庭（簡稱「分庭」）解決彼此海洋劃界爭端。ITLOS庭長與雙方當事國代表討論程序性問題，包含馬爾地夫提出初步反對的權利。

馬爾地夫的初步反對

2019年12月18日馬爾地夫提出5項初步反對（表1），主張分庭對於模里西斯的權利主張不具管轄權及不可受理，應予駁回：

表1／馬爾地夫主張5項初步反對內容及特別分庭裁定結果

初步反對	內容	分庭裁定
第一項	馬爾地夫主張英國是本案程序中不可缺的第三方。	一致駁回
第二項	分庭對於查哥斯群島的主權爭端沒有管轄權。	8:1駁回
第三項	當事國沒有根據《公約》第74條及第83條進行談判，所以分庭沒有管轄權。	8:1駁回
第四項	當事國間不存在爭端，所以分庭沒有管轄權。	一致駁回
第五項	模里西斯的訴求構成濫用程序。	一致駁回

資料來源／[9]

馬爾地夫第一項初步反對理由：在查哥斯主權爭端解決前，英國有權行使《公約》沿海國的權利，英國不同意且未參加本程序，根據貨幣黃金原則，分庭不能行使管轄權。

第二項反對理由：要斷定模里西斯的權利主張，必須先斷定查哥斯群島的主權，根據《公約》第288條第1項的規定，分庭只對《公約》的解釋或適用有管轄權，對於主權爭端沒有管轄權。即使ICJ的諮詢意見表示英國有義務要完成模里西斯的非殖民化，英國不會因此而失去群島的主權。

第三項反對理由：模里西斯與馬爾地夫尚未依照《公約》第74條及第83條進行談判，談判也沒有失敗，所以不應訴諸第15部分所規定的程序，故分庭不能行使管轄權。

第四項反對理由：模里西斯從未明確指出兩國之間存在何種爭端，馬爾地夫同意轉由分庭審理，不代表同意兩國之間存在爭端。

基於前4項理由，馬爾地夫主張模里西斯的訴求構成濫用程序。

模里西斯的異議

模里西斯則要求分庭做出以下4項裁決：

一、駁回馬爾地夫的初步反對。

二、分庭對於模里西斯的申請有管轄權。

三、沒有任何行使管轄權的障礙存在。

四、分庭應該著手模里西斯與馬爾地夫間的海洋劃界。

模里西斯主張查哥斯群島是否為模里西斯的一部分，與模里西斯的非殖民化是否合法的問題，為不可分割的問題。一旦ICJ的諮詢意見決定非殖民化問題是否合法，也同時決定了哪一國為查哥斯群島合法的主權國。模里西斯主張，一個違反國際法的行為不能給予違反者創設法律的權利（ex injuria non oritur jus），因此，英國沒有查哥斯群島的主權。所以在《公約》的意義上，模里西斯是與馬爾地夫進行海洋劃界的沿海國無誤。

從2011年至2019年間，馬爾地夫均未遵守雙方承諾，亦無履行《公約》第74條與第83條義務，解決海域劃界問題。馬爾地夫也未遵守2019年3月22日的聯大第73/295號決議，即所有的會員國有義務和聯合國合作完成模里西斯的非殖民化，因此馬爾地夫不能援引英國主張有主權為由，拒絕談判。另一方面，模里西斯通知馬爾地夫提交仲裁前就存在爭端，也為了討論可能重疊的延伸大陸礁層和就海域劃界交換意見進行會晤。

分庭裁定

分庭對於馬爾地夫提出的5項初步反對，全部予以駁回（表1）。首先，分庭發現模里西斯是以查哥斯群島沿岸國為前提，提出權利主張，但是馬爾地夫不同意這個前提。

分庭認為第一項及第二項反對必須同時檢視，解決查哥斯群島的法律地位，就能解決英國是否為不可缺的第三方問題。分庭同意，聯大決議沒有要求以ICJ的諮詢意見來解決群島的主權爭端，但不代表諮詢意見對於主權問題沒有相關性或暗示[10]。根據ICJ諮詢意見，英國分離查哥斯群島為不法行為（wrongful act），繼續行使行政管理已經構成違法行為，所以在查哥斯群島的海洋劃界中沒有任何法律利益[11]。而模里西斯則有充分的理由被認為是查哥斯群島的沿海國，即使非殖民化的過程還未完成[12]。

第三項及第四項初步反對的駁回係模里西斯嘗試要與馬爾地夫進行談判，馬爾地夫也有意進行會談與進行交換意見，但是卻以查哥斯群島並非由模里西斯行使管轄權為由，拒絕與模里西斯進行談判。兩國已經符合《公約》第74條及83條規定，有關國家如在合理期間內未能達成任何協議，應訴諸第15部分所規定的程序，因此，分庭全數駁回馬爾地夫的反對。

結論

如ICJ所言，尊重自決權是一個「對一切的義務」（obligation erga omnes），所有國家都有保護該權利的法律利益[13]。而本案的國際法意義是，非殖民化與領土主權相關。英國當時為模里西斯的管理當局，雙方並非國與國的關係，沒有割讓領土的國際協定存在的可能。管理當局未獲得非自治領土當地居民的同意，不能任意分割其領土。不法的分割及模里西斯的非殖民化過程未合法完成，根據違反國際法的行為不能創設法律權利的國際法原則，即使英國持續堅持擁有群島的主權，英國不能合法擁有群島的主權。

其次，ICJ提出諮詢意見雖然沒有拘束力，仍有法律效力[14]。英國拒絕遵照聯大決議收回殖民管理，再次凸顯國際現實中，大國不遵守國際法，而國際社會卻無法加以制裁的問題。

最後，本案再次顯示出仲裁程序作為《公約》強制爭端解決程序的原始設定，其未來的重要將有增無減。當爭端一方提交仲裁程序時，當事者絕不能相應不理，必須積極與提訴國尋找滿意的強制爭端解決程序，積極為自己辯護，才是正確的作法。

註：轉交ITLOS管轄之6案，除本案外，尚包含The M/V "SAIGA" Case, Case Concerning the Conservation and Sustainable Exploitation of Swordfish Stocks in the South-Eastern Pacific Ocean, Dispute concerning delimitation of the maritime boundary between Bangladesh and Myanmar in the Bay of Bengal, The M/V "Virginia G" Case, Dispute concerning delimitation of the maritime boundary between Ghana and Côte d'Ivoire in the Atlantic Ocean等5案。

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[3] Dispute Concerning Delimitation of the Maritime Boundary Between Mauritius and Maldives in the Indian Ocean (Mauritius / Maldives), Preliminary Objections, Judgment (Jan. 28, 2021), 19-20, para. 56.

[4] Ibid., 23-24, para. 69.

[5] Ibid., 24-25, para. 71.

[6] Ibid., 25-26, paras. 74-75.

[7] International institute for Law of the Sea Studies (Dec. 7, 2019), Dispute Concerning Delimitation of the Maritime Boundary Between Mauritius and Maldives in the Indian Ocean (Mauritius / Maldives) http://iilss.net/dispute-concerning-delimitation-of-the-maritime-boundary-between-mauritius-and-maldives-in-the-indian-ocean-mauritius-maldives/ (Oct. 4, 2021)

[8] Dispute Concerning Delimitation of the Maritime Boundary Between Mauritius and Maldives in the Indian Ocean (Mauritius / Maldives), Preliminary Objections, Judgment (Jan. 28, 2021), 22-23, para. 66.

[9] International Tribunal for the Law of the Sea (Jan. 28, 2021). Dispute Concerning Delimitation of the Maritime Boundary Between Mauritius and Maldives in the Indian Ocean (Mauritius / Maldives), Preliminary Objections, Judgment, 98-100, para. 354. https://www.itlos.org/en/main/cases/list-of-cases/dispute-concerning-delimitation-of-the-maritime-boundary-between-mauritius-and-maldives-in-the-indian-ocean-mauritius/maldives-2/ (Nov. 1, 2021)

[10] Ibid., 51, para. 168. 有關「法律上拘束力」與「法律效力」的概念，請參閱丘宏達著，陳純一修訂（2012），《現代國際法》[修訂三版]：104。

[11] Ibid., 52, para. 172 and 73, para. 247.

[12] Ibid., 74, para. 250.

[13] Ibid., 52, para. 172

[14] Ibid., 62, para. 205.

英國長期離岸風電產業策略規劃

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關鍵字／離岸風電、淨零排放

離岸風電早已成為英國達成2050淨零排放目標的關鍵工具，本文探討英國離岸風電的長期規劃，以為臺灣離岸風電政策推動之參考，本文主要參考英國政府與風能產業共同成立的離岸風電產業理事會（Offshore Wind Industry Council, OWIC）及非營利組織可沛達中心（ORE Catapult）合作之離岸風電規劃報告[1]。

圖1／英國大加巴德離岸風場（Greater Gabbard wind farm in England）
圖片來源／chpv.co.uk/SSE/RWE (CC BY-ND 2.0)
https://www.flickr.com/photos/deccgovuk/9456785683/

國際能源總署最新的世界能源展望報告（World Energy Outlook 2021）[2]指出，雖然各國在太陽能、風力能及電動汽車等新能源經濟已蓬勃發展，然其進展仍遠遠不足以在2050年將全球碳排放量降為零排放目標。過去2年來，全球經濟發展受到COVID-19疫情影響深遠，但受益於各國寬鬆的經濟政策及科技創新，使得全球風力能及太陽能等再生能源成長迅速。

2020年全球風力發電機組的裝置容量達到創紀錄的93百萬瓩（GW）。然而，目前的成長率仍遠遠落後於淨零排放的路徑，到2050年，全球風力發電占比約達43%。如果要達到淨零排放的目標，全球風力發電裝置容量必須在未來10年成長4倍[3]，如此全球才可能在2030年布署380GW離岸風電，以及2050年更積極的2,000GW規模。

英國是少數將2050年前達到溫室氣體淨零排放之承諾納入《氣候變遷法》（Climate Change Act）的先驅國家之一，資料顯示自1990年以來，英國溫室氣體排放已下降43.5%，主要原因是大量利用風力能與太陽能等再生能源取代燃煤發電所致。風力發電較太陽能發電更容易受地形環境之影響，然因技術持續進步，使得離岸風電成為全球再生能源發展的重點。英國在2019年再生能源裝置容量首度超越化石燃料，其中風力發電功不可沒，尤其是有不少超大型離岸風場併入電網。

2020年英國約有44%的電力來自再生能源，預估於2030年將有40GW的風力發電裝置容量。離岸風電早已成為英國達成2050淨零排放目標的關鍵能源，本文探討英國離岸風電的長期規劃，相關的規劃係整理自OWIC及ORE Catapult共同合作對於達成2050淨零排放目標進行不同離岸風電規劃之報告，以下彙整其規劃的重點，以為臺灣推動離岸風電政策之參考。

規劃模型及情境設計

英國海域的離岸風電潛力介於600GW到1,000GW間，本報告規劃2050年離岸風電設置量至少在50GW到70GW之間，最高可至150GW。主要的規劃模型有二，其中能源系統環境模組（Energy System Modelling Environment, ESME）係用於評估離岸風電對政治經濟衝擊與能源成本最佳化配置，而對於長短期能源系統營運之不確定風險因子評估，則是由儲存與彈性模組（Storage and Flexibility Model, SFM）模擬。

受到2050年淨零排放目標的影響，該研究規劃二種不同的情境：一是積極方案（Further Ambition, FA），另一是其他淨零方案（Alternative Net Zero, ANZ）。其他淨零方案，有增加規劃非能源的相關措施，例如飲食習慣的改變，或是減少航空器的碳排放。本方案將使2050年碳排放為零，且對能源系統的減碳壓力相對較小。相對地，積極方案對能源系統的減碳壓力較大，以增加離岸風電為核心，並無規劃額外的減碳措施，因此碳排放量在2050年仍有4%（圖2）。

圖2／不同情境方案設計下2050年離岸風電規劃量
圖片來源／[1]

英國2050能源結構

相較於目前離岸風電裝置容量10GW，2050年的裝置容量至少在50GW到70GW之間，其成長量相當驚人。當然在此情境下，總能源系統的成本相對是較高的，但是可以達成英國能源轉型的政策目標。以圖3為例，125GW（ANZ）情境下，在冬天風力充足的夜間，對離岸風電的用電需求量高達93GW，而在風力較不充足時，其尖峰電力需求仍高達91GW，此時需求的缺口，以具99%碳捕捉能力的燃氣複循環機組（CCGT+CCS）和氫能機組加以支援。未來在達到低碳時代且具經濟效率的能源結構方面，應注意以下各項重要因素：

一、能源多樣化：因應離岸風量在特定期間低風量的特性，應考量其他再生能源（太陽能）及核能發電的組合。

二、乾淨的火力電廠：CCGT+CCS和氫能機組是電力調度不可或缺的能源。

三、核能：核能的布署在長期規劃亦占有重要的角色，主要因為低碳排放及低發電成本特性，不過在離岸風電大量建置後，對核能需求大幅降低（由37GW降至8GW），反而有可能損及核能原規劃的最適發電量規模（成本）。

四、氫能無所不在：未來CCGT+CCS主要用於支援尖峰用電需求，而氫能則是用於各產業即時的需求、運輸需求、暖氣需求等，預估在2050年氫能需求高達200個十億度（TWh）。

五、運輸與供暖：對此二者的需求，在不同情境之間的變動不大。

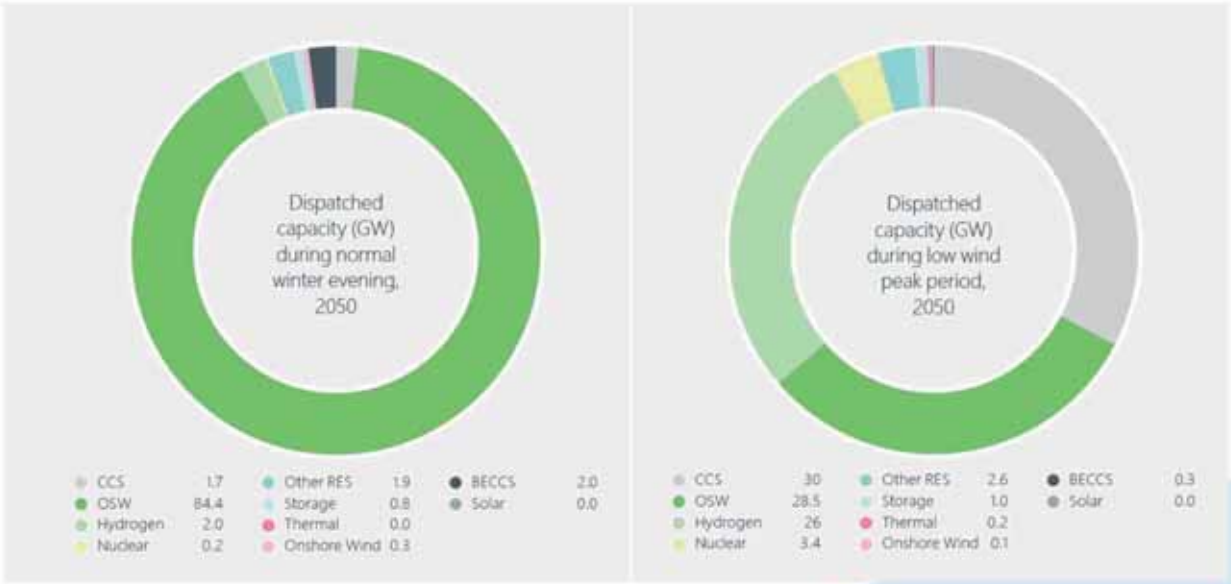

圖3／125GW（ANZ）情境設計之2050年離岸風電規劃量
圖片來源／[1]

能源儲存與電力供應彈性

未來的能源系統要如何提供具成本效率且又可靠的能源呢？其關鍵在於能源儲存技術。能源備用容量是要因應再生能源間歇性發電的特性，2050年受到離岸風電大幅增加及核能下降的影響，備用容量的能源主要是氫能機組及CCGT+CCS二種的電廠。例如在125GW（FA）情境下，需要100GW的火力發電

廠及18GW的儲能設備，只為了支援少數特定時間的尖峰用電需求。在大量使用離岸風電系統時，也可以透過需求面管理的方式，降低對備用電廠的需求，以減少發電成本支出，例如建築物（區域型）的暖氣儲存技術，電動車充電管理也是方法之一（不在尖峰用電期間進行充電）。如果上述的技術或政策措施推動得宜的話，大約可以減少 30% 的離岸風力的發電量（100～190TWh），且備用電廠的投資成本也同步下降。

能源技術系統的考量

電力系統營運、相關的服務或是電力輸送管線基礎設施也會對離岸風電設置規模產生影響，電力系統需要很多技術組合，離岸風電對電力系統的影響主要集中在二個方面，一是電網壅塞問題，如何將大海中大量的電傳輸到岸上，需要大規模的電網設施的投資；二是如果沒有傳統電力的備援，過多的再生能源（風力）發電的電力系統易產生電力不穩定的現象。以上二種課題，可以由智慧電網加以解決，說明詳如表1。

表1／英國離岸風電有關的電力傳輸課題與解決方式

離岸電力輸送	→ 東部海岸輔助線路即將啟用。 → 電力網併聯好處多，可在特性不一的能源市場維持運轉能力和協同合作功能。 → 離岸電網可更有效率，直接將風能銷售至價格最高處。
智慧電網解決方案	→ 各種技術已經到位，困難點在於找到適當的治理安排來運用這些技術，並與傳統能源系統服務公平競爭。 → 營運模式：由許多能自我調控的電池組成的電網，可能運作更為可靠，但較不符合規模經濟。
風場和輔助服務	→ 風場的調控應用如果具備創新，可能會有幫助，但不一定是最符合經濟效益的解決方案。 → 離岸風電產業可支援能源系統業者設計產品和服務。

資料來源／[1]

離岸風電產業課題

英國離岸風電預估在2030年設置將超過40GW，如何規劃相對應的產業政策與管理法規是健全離岸風電產業的基石。但是在目前的市場環境下，大規模的離岸風電發電量，會造成電力需求低的時期的躉購電價下滑，減少業者的收入。當長期逐步增加離岸風電設置後，此一問題影響將更大。邁向零碳轉型的路徑上，需要妥善規劃離岸風電市場，以解決電力供需之平衡課題，重要的措施包括電網相關輔助設備、電力市場營運模式。為達成淨零排放目標，在所規劃的未來能源市場架構下，需要對電力市場改革進行檢視，尤其短期內需要全面探討現在的電力市場模式，包括電力拍賣制度、增加電力系統的需量反應及電力儲存的彈性、建立營運不良電廠的退場機制、創新的政策規劃、檢討非法規上的政府干預措施、建立碳交易市場、建立公平且反映成本的電網收費制度等。

創新的必要性

離岸風電在英國2050淨零排放政策，扮演重要的角色。不論能源產業或其他方面，需要制定相關創新的政策，整合大量的離岸風電對於技術、組織、市場、政策與法規上的創新，都是非常重要的一環（表2）。例如透過有效的智慧電網管理政策，可以穩定離岸風電供給量，同時採取全面的最小成本最適化管理政策（需求面管理），可以有效降低對離岸風力發電量之依賴（30%），減低隨著離岸風電機組大量設置之收入（電價）減少的衝擊。淨零排放政策目標，是全力發展離岸風電重要的願景與動力，改善躉購電價更是不可或缺的經濟政策。

表2／英國離岸風電成功關鍵與創新做法

電力系統營運支援	→ 將現有解決方案以創新方式運用（例如新的電力系統運作方式、同步補償器、在區域智慧電網納入儲電營運）。 → 風場以及其相連網路的電網支援能力（例如系統慣量、快速反應、電壓支援、故障電流、全黑啟動等）。
發電	→ 風電機組產氫對於快速發展負載循環具有靈活的能力（例如營運支援、快速啟動）。 → 所有運作條件下的碳捕捉和封存率有所改善（例如低碳含量和升降載時）。 → 核能發電設計，具備更高的負載彈性及／或產氫能力。
電力和熱能需求	→ 電解成本降低、改善營運以及在嚴苛的離岸環境設點。 → 儲電單位成本降低（電池和熱機械）。 → 提高國內熱能儲存的能源強度，以及以符合成本效益的方式與熱能網路連動。 → 電動車智慧充電系統的互通性，以及支援接受度的提供。
新的氫氣系統	→ 安全裝置的規則和標準。 → 鼓勵採用氫氣設備的獎勵措施。
電氣併網	→ 輸氫和供氫網路設計（例如可用符合成本效益的氫氣網路取代離岸風場的併網需求）。 → 設計、基礎建設、離岸電力網路營運成本的降低。
市場創新	→ CfD設計逐漸鼓勵採用離岸風能，以在支援電網營運方面有更多的能力。 → 創新的市場設計，以推動需求彈性能完全實現。 → 未來的能源市場架構會釋出創新機會，並提供高度競爭的環境，對於參與者也有清楚定義能源市場結果。
政策創新	→ 離岸風能私募資金的多元化，以及提供創新政策的彈性解決方案，以減輕風險；移除障礙和驅動融資流動性。 → 由政府推動離岸風場策略選址的規劃。 → 設計將能源系統規劃納入考量，以及具備在能源部門之間轉換機會的離岸輸電機制。

資料來源／[1]

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英國海洋管理相關機構介紹

撰文／詹昊棠（國立高雄科技大學海洋事務與產業管理研究所助理教授）
關鍵字／海洋與海岸許可法、海洋管理組織、能源與氣候變遷部、海事與海岸警衛署

英國是一個海洋國家，隨著對海洋的探索與認知不斷擴大，英國政府對海洋事務的管理需求也逐漸增加。1999年前，英國缺乏統一的綜合性海洋與海岸帶管理政策架構，而是由各地方政府自行設立相關管理辦法，導致海洋與海岸帶管理方案和法律體系複雜且零碎、地域和海洋管理及跨區域管理也缺乏協調，進而無法形成整體的海洋與海岸帶管理政策[1]。2002年，英國政府頒布以實現海洋環境願景為主題的《海洋管理報告》（Marine Stewardship Report），在報告中明確表示英國需要能管理所有海洋活動的新方法，並需要透過立法來確保該方法能正確實施。2009年英國為實現海洋環境與海洋經濟的永續發展，重申英國對海洋環境的願景為「潔淨、健康、安全、有成效和生物多樣化的海洋」，同年批准實施《海洋與海岸許可法》（Marine and Coastal Access Act 2009），該法涉及海洋管理開發和保護各面向，並建立綜合性海洋管理架構以更好地因應未來海洋治理的挑戰。本文將簡介英國重要的海洋管理相關組織，包含海洋管理組織（Marine Management Organization, MMO）、能源與氣候變遷部（Department of Energy & Climate Change, DECC）、海事與海岸警衛署（Maritime and Coastguard Agency, MCA），其主要功能詳述如下。

海洋管理組織（MMO）

英國的《海洋與海岸許可法》包含11個部分（圖1）：一、海洋管理組織（MMO）；二、專屬經濟海域、聯合王國海域及威爾斯海域（Exclusive Economic Zone, UK Marine Area and Welsh Zone）；三、海域規劃（Marine Planning）；四、海域許可（Marine Licensing）；五、自然保育（Nature Conservation）；六、近海漁業管理（Management of Inshore Fisheries）；七、漁業（Fisheries）；八、執法（Enforcement）；九、海岸通行（Coastal Access）；十、雜項（Miscellaneous）；十一、補充條款（Supplementary Provisions）[2]。在海洋管理方面，該法引進新的海洋管理體系，包含為實現英國政府海洋環境戰略目標的總計畫體系和規定各海域治理應採取的海洋具體發展計畫[3]。為解決分散式海洋管理的問題，英國政府於2010年根據《海洋與海岸許可法》，由環境食品與鄉村事務部（Department for Environment, Food and Rural Affairs, DEFRA）下資助成立一個非政府部門公共機構（non-departmental public body），即為「海洋管理組織」，並規定MMO做為英國政府履行多項海洋保護功能的專門單位，以達到英國海洋永續發展之目標。

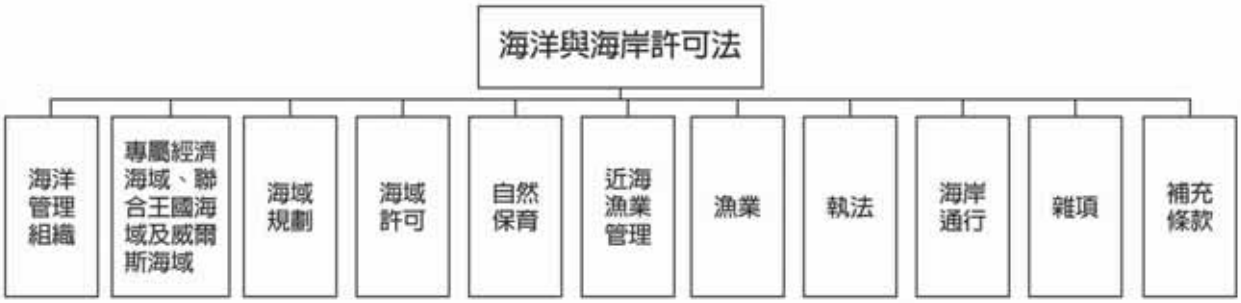

圖1／英國《海洋與海岸許可法》架構
資料來源／[2]

MMO設立之前，英國的海洋管理和海洋開發規劃按不同類型分別由能源部、工業部、國防部、DEFAR、農漁糧食部、科學教育部、工程和物理科學研究委員會及自然環境委員會等部門負責實施或進行協調工作，並沒有設置專門負責海洋管理和海洋開發工作的統籌機構或組織。MMO的設立能有效地解決分散在不同管理體制下各機構之間的相互管理責任不明、執法體系分散、海洋開發利用缺乏有效秩序等問題。重要的是，MMO設立後並沒有完全取消先前負責英國海洋管理與海洋開發的各個部門或組織，而是以綜合管理為主的基礎，由MMO透過協議、備忘錄等方式與負責各職能的部門或組織保持密切合作與聯繫，進而促進各部間的協調合作，避免多頭管理的情況出現[4][5]。

依據《海洋與海岸許可法》，MMO對海洋與海岸帶管理進行改革，包含確立規劃政策、海洋漁業管理與資源保育、自然保護、海域規劃和再生能源的生產與設置。MMO的職責也包含歐洲海事與漁業基金、港口秩序、海洋漁業、海事許可、漏油、野生動物與棲地保護、漁船許可等許多與海洋使用相關事務之管理職責。其中，以海域規劃最為重要。由《海洋與海岸許可法》導入海域規劃的概念進行海域管理，英國政府利用該方法來指導或影響海域使用上的決策。因此，許多在海上進行的活動或新型態的海上活動均需要獲得授權或許可，例如：海岸及海洋開發、離岸風場設置、波浪與潮汐能開發及海上疏浚等[6]。

當MMO開始制定海域規劃時會利用海域空間資訊及其用途等資料，並不斷檢視其作用，這過程有助於建立海域規劃的資料庫。資料庫包含：各海域特性的評估結果、可使用的數據和所需要的數據、各海上活動間相互作用、各海域目前的使用情況及新興與未來的使用、和未來海域開發方案。海域空間分析與規劃能辨識出海上活動間已知或常見的使用衝突，因此MMO能透過海域規劃設計並提供最適合的管理方案[7]。當計畫被採納後，MMO將持續監測其執行效果，每3年審查各項計畫的執行成效，並在必要時修改或更換相關計畫。當計畫需要修改或更換時，MMO也會遵循標準程序進行——範圍界定、方案規劃、計畫準備與評估、諮詢、計畫修改與執行（圖2）。在過去10年間，MMO發展出一套可信任的海洋規劃、許可和監管架構以維持英國海洋環境與海洋經濟的永續發展。MMO已重新檢視其管理職責，並希望在2030年前能達成以下目標[8]：

- 實現永續海洋開發
- 提供永續的捕魚機會
- 保護海洋棲地和野生動物
- 管理海洋支持基金
- 提供監管支持和保證
- 支持全球海洋保護

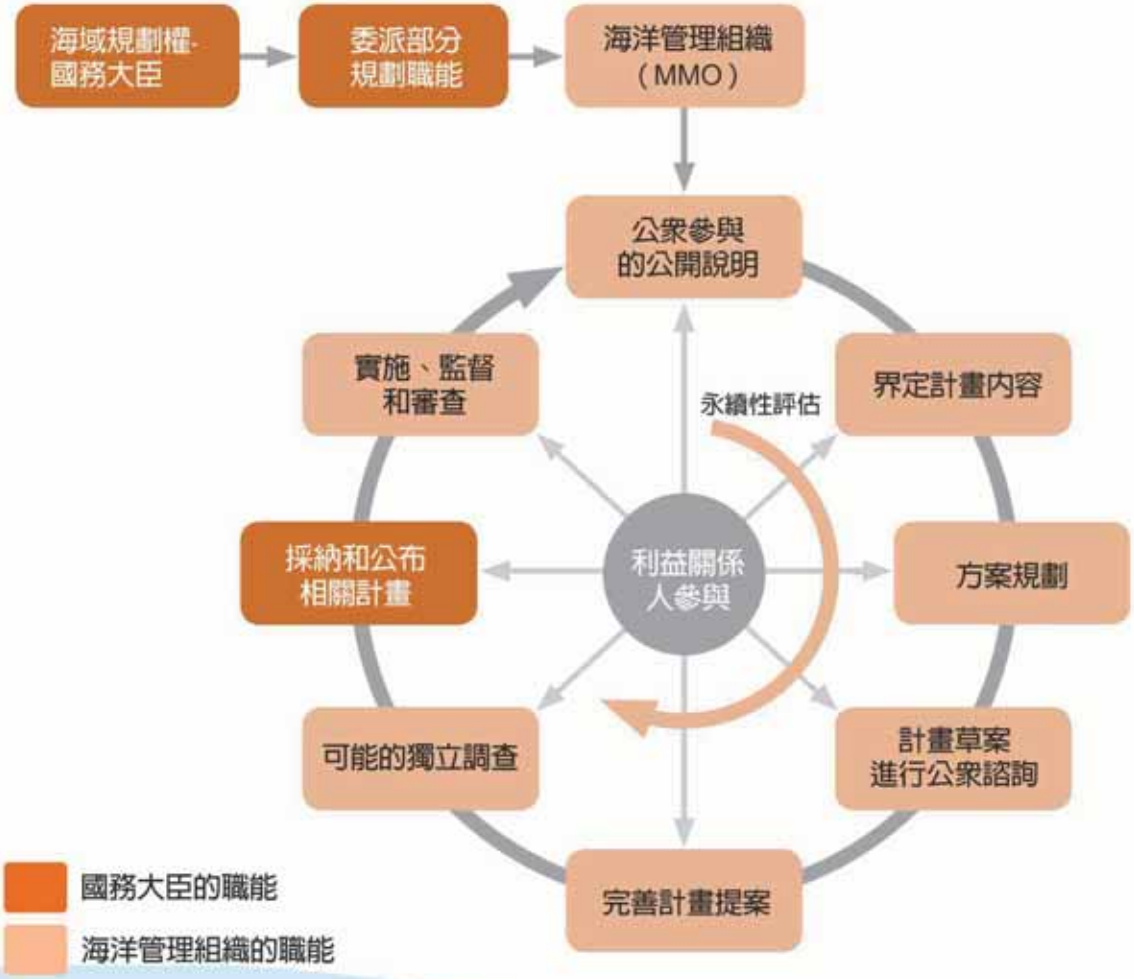

圖2／MMO在海域規劃過程中的功能
資料來源／https://www.coastwisenorthdevon.org.uk/sites/default/files/MMO-brochure.pdf

能源與氣候變遷部（DECC）

英國政府為適應氣候變遷，英國議會於2008年11月通過了世界上第1個《氣候變遷法》（Climate Change Act），同時設定具有法律約束力的溫室氣體排放量減少的目標，以減少溫室氣體的排放——以1990年的溫室氣體排放量為基準，2050年前全國要將溫室氣體的排放量降低到比基準再減少80%的水準。《氣候變遷法》的立法通過被視為歷史性的一步，並廣泛地獲得政治領導人、媒體、環保主義者、工會和企業的支持。《氣候變遷法》已成功擔任英國作為氣候變遷領導者的核心角色[9]。

《氣候變遷法》帶來兩個制度上的創新：氣候變遷委員會（Committee on Climate Change）的成立和建立能源與氣候變遷部（DECC）。氣候變遷委員會是一個由專家組成的非政府部門獨立機構，其主要功能為針對因應氣候變遷議題向英國政府與議會提供專業建議。委員會就英國碳預算給予建議，並向議會定期報告關於英國在溫室氣體減排的進展[9]。DECC創建於2008年，致力於確保英國擁有安全、潔淨、可負擔的能源供應，並促進國際行動以減緩氣候變遷[10]。為此，英國政府將英國的能源政策（先前由商業、企業和管理改革部〔Department for Business, Enterprise and Regulatory Reform, BERR〕負責）和氣候變遷減緩政策（先前由DEFRA負責）交給DECC。首先，DECC根據兩大目標提出氣候變遷的因應政策，並立法針對英國的再生能源和不可再生能源進行監管（1998年《石油法》；2008年、2010年和2011年《能源法》；2008年《氣候變遷法》）。該作法反映出氣候變遷與能源政策是密不可分的。此外，DECC也保留其對英國大陸礁層上的各種石油和天然氣開發的許可、探勘和監管的責任[4]。

海事與海岸警衛署（MCA）

海事與海岸警衛署（MCA）是隸屬於運輸部（Department for Transport, DfT）下的執行機構，其願景是成為世界上最優秀的海事安全組織，推動英國朝向更安全的生活、更安全的船舶和更乾淨的海洋等目標邁進。MCA的主要作用在於預防海岸與海上發生生命財產損失、制定海事事務的法規與指南和為航海人員提供各項認證。MCA在整個英國的海洋環境中發揮著重要的安全維護作用，並致力於達成運輸部的促進經濟成長和經濟發展機會，改善海上航行環境以提供安全、可靠和永續的運輸過程和促進效率等目標。其主要工作包含[11]：

- 制定法規和指南並為船舶和航海人員提供認證。透過MCA的調查和檢驗制度，以落實船舶安全、安全保護、污染防治和航海人員的健康、安全及福利等。
- MCA為全英國提供24小時海上和海岸緊急搜救（Search and Rescue, SAR）應變能力。
- 透過與策略夥伴（政府的海事安全與環境策略和英國船舶註冊處）的合作共同改善海事安全、促進經濟成長和儘可能減少海事部門對環境所產生的衝擊和影響。

自2020年開始，MCA提交了一份內部計畫書（The Big Three），該計畫書概述未來3年要達到的主要目標。這主要目標包含3大主題[11]：

- **安全和永續性**：與合作夥伴共同改善海事安全和環境影響，減少海岸地區的死亡人數。
- **海事成長**：提供更高品質的服務以提高英國海事服務的聲譽，並為英國船舶註冊處和其他海事部門吸引更多的顧客。
- **海事創新**：與產業界、政府部門和學術界合作開發與利用新的方法、機會和技術，使英國能引領海事創新領域。

結論

英國政府自1999年以來，在海洋與海岸帶管理政策已經發展為國家綜合管理架構。特別是在頒布《海洋與海岸許可法》後，由國家層級進行海域規劃和海洋保護區的制定，代表著英國海洋與海岸帶管理政策成功轉型為國家統籌規劃和海洋綜合管理的架構。而英國政府也體認到利益關係人與組織在參與各種海洋事務管理政策的決策過程中，也同樣可以發揮重要的作用。透過立法能為統籌管理機關提供強且有力的法律支持，因《氣候變遷法》而成立的DECC也是明顯的例子。英國政府將與因應氣候變遷議題密不可分的能源政策和氣候變遷減緩政策交由DECC負責，並提出整體性氣候變遷因應策略。整體且綜合的海洋管理架構意味著對衆多的海洋事務議題進行管理。然而，由英國的海洋管理架構來看，由單一機構負責整體性的海洋事務管理是不可能的，特別是在國家層級。因此，就英國海洋管理相關機構的例子來看，各項海洋事務議題與活動仍需透過不同的政府部門進行監管，由專法與專責機關負責監督目標的執行與關鍵機構間的協調合作，才能更進一步的完善我國海洋環境與海洋事務管理。

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英國海外領地藍帶計畫推動及海洋監測技術

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19世紀擁有「日不落帝國」之稱的英國政府，至今於大英帝國外仍擁有14個領土，現稱為英國海外領地（UK Overseas Territories）[1]，這些海外領地的地理範圍橫跨太平洋、大西洋、南冰洋、印度洋，遍及熱帶到南極圈，人煙罕至，蘊藏豐富海洋資源。英國海外領地海洋保護區超過 400 萬km^2，面積相當於17倍大的英國，且約為地球海洋的1%。然而，由於海外領地居住人口甚少，面對專屬經濟海域受到非法、未報告及不受規範（Illegal, Unreported and Unregulated, IUU）漁業，以及全球氣候變遷，亟需外部資源及人力的支援。因此，英國政府宣示提供長期支援，計劃將散布於海外領地的海域串聯成橫跨4個大洋的藍帶海洋保護區。

圖1／Pitcairn Islands珊瑚礁調查
圖片來源／GOV.UK
https://marinescience.blog.gov.uk/tag/blue-belt-programme/

英國藍帶計畫

英國政府投入超過2千萬英鎊（約新臺幣7億9千萬元），結合環境、漁業和水產養殖科學中心（Centre for Environment, Fisheries and Aquaculture Science, Cefas）的科學研究能力，以及海洋管理組織（Marine Management Organization, MMO）的監控執法量能，並與外部學術單位、非政府組織及權益關係人合作，在7個參與計畫的英國海外領地（太平洋1處、印度洋1處、大西洋4處及南極1處），於2016年至2020年共5年首度執行藍帶計畫（Blue Belt Programme），號稱是全世界最大規模的海洋保育計畫。

表1／參與藍帶計畫的7個英國海外領地

名稱	地理位置	領地面積	定居人口	特殊生物資源
皮特凱恩群島	南太平洋	47km²	54	原始珊瑚環礁、海鳥重要繁殖地、座頭鯨
英屬南極洲領地（未獲國際承認）	南極圈	170萬km²	0	企鵝重要棲息地
南喬治亞和南桑威奇群島	南大西洋	3,755km²	0	企鵝重要棲息地、洄游性鯨豚
特里斯坦庫涅群島	南大西洋	98km²	261	海鳥重要棲息地、特有種生物、龍蝦出口產業
聖赫勒納島	南大西洋	122km²	4,000	海龜、鯨豚等大洋洄游路線、特有種蝴蝶魚
亞森欣島	南大西洋	90km²	873	海鳥及海龜重要棲息地
英屬印度洋領地	印度洋	60km²	0	海洋生物多樣性熱點

資料來源／GOV.UK [1][2]；本研究整理

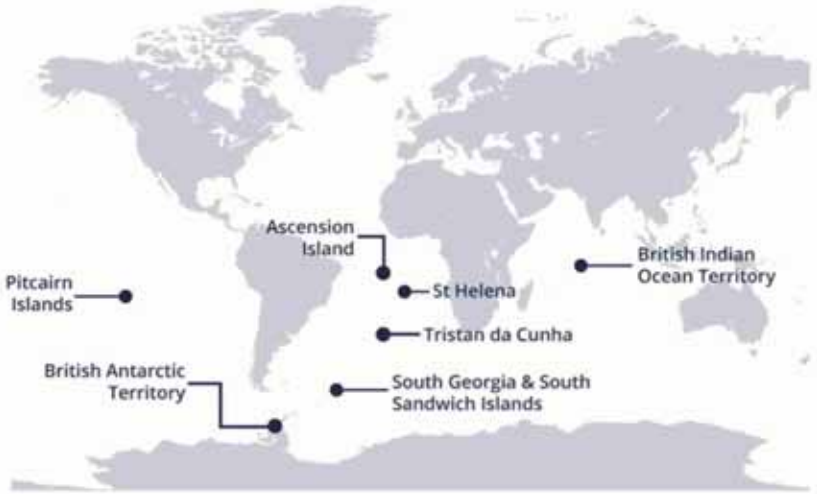

圖2／英國藍帶計畫地理範圍橫跨太平洋、大西洋、南冰洋、印度洋
圖片來源／GOV.UK
https://www.gov.uk/guidance/the-blue-belt-programme

藍帶計畫的推動，不僅是協助英國海外領地，更是英國政府為處理全球廣大海洋議題的核心領導行動，他們以科學調查為基礎，展示藍帶計畫對於過漁、物種滅絕、塑膠污染及氣候變遷等全球廣大海洋議題之效益。同時，英國政府藉由支援超過400萬km²英國海外領地海洋保護區，以展現其承諾2030年達成設立30%海洋保護區倡議之決心。

強化海外領地海洋保護區管理

藍帶計畫目標為提升海洋環境科學研究、建立及實施以科學證據為基礎訂定合適之海洋管理策略（包含監控及執法）、提供支援以確保管理策略的長期性及永續性。以下為英國強化海外領地海洋保護區策略及成果之摘要整理：

一、與科學研究單位合作進行南大西洋探勘

- 赴特里斯坦庫涅群島（Tristan da Cunha）與聖赫勒納島（St Helena）執行2項大洋探勘任務，1萬海浬航程中完成英國海外領地人力培訓，並完成10萬km²海床地圖（包含12座海底山）。

- 赴南喬治亞和南桑威奇群島（South Georgia & the South Sandwich Islands）執行2項大洋探勘任務，拍攝約4千張照片及30小時影片供研究分析，且提供500件生物標本典藏至博物館，並運用於「達爾文生命之樹」基因體計畫。

二、瞭解及保護生物多樣性

- 參與當地藍帶計畫座談會的組織及發布。
- 建立模式預測海洋保護區內脆弱棲地的位置。
- 應用大洋探勘成果，例：海床地圖製作可提升海洋保護區的劃設。
- 提供特里斯坦庫涅群島新船執行沿岸生物多樣性監測，並翻新漁業巡邏船。

三、強化管理權

- 支援當地行政部門進行海洋保護區管理首次5年期回顧。
- 為當地制定海洋保護策略所需，提供重要棲地、重要物種及威脅等資訊。
- 為協助議會採取最合適的立法模式，執行政策分析。例：提供分析、證據及建議，以支援亞森欣島（Ascension Island）當地議會決策於其專屬經濟海域100%劃設為海洋保護區。
- 資助當地法律顧問，以產出所須法規幫助當地於其海域有效管理及執法。
- 支援當地發展海洋管理及行動方案，以永續管理及監測海洋保護區。

四、管理人為衝擊

- 協助各海外領地與英國海事與海岸警衛署（Maritime and Coastguard Agency, MCA）及英國外來種防治中心（GB Non-Native Species Secretariat）等合作單位，瞭解跨英國海外領地在面對海洋緊急污染事件及外來入侵種的應對能力。
- 支援聖赫勒納島發展策略以管理海洋保護區內的人為活動，包含海洋遊憩、水質及抽砂等。
- 支援皮特凱恩群島（Pitcairn Islands）建立鯨豚觀察執行規範，製作手冊及傳單給當地社區和遊客，並支援社區島上實際訓練。
- 於英屬印度洋領地（British Indian Ocean Territory, BIOT）四周執行水質調查，其結果將有助當地行政部門管理人為活動。

五、支援永續漁業管理

- 承接當地全方面的漁業動態回顧。
- 與科學家合作發展衛星監控支援執法，作為大洋探勘的替代方法。
- 蒐集或部署照相系統在研究船及商業漁船上，以實證管理建言的成效。
- 建立當地漁業部門人員船艦保養、海上生存技術、相關規範與執法及數據管理等能力。
- 協助當地依照國際大西洋鮪類資源保育委員會（International Commission for the Conservation of Atlantic Tunas, ICCAT）進行量測，對洄游物種的區域管理提供有價值的科學證據。
- 追蹤超過1,500隻魚的游行路徑，並訓練當地人員使用電子追蹤技術以支援進行中的監測。

六、支援管理規範及強制執法

- 派遣海巡人員加入在跨英國海外領地的巡邏。

- 建立蒐集與記錄漁船活動資訊的程序，以支持當地的規範及執法。
- 提供島上及線上人員訓練，例：提供當地漁業部門人員法規與執法訓練，並額外支援科學觀察家訓練以監測捕魚作業。
- 藉由資助聖赫勒納島駐島專員、海洋執法警察、漁業警察等各1位，以及建置新實驗室1間，建立當地海洋科學研究及監測能力。
- 建立藍帶計畫監控及情資中樞。於當地非法捕魚漁船的逮捕、拘留、起訴等跨機關行動上，持續提供不斷的情報及支援。
- 研究目前／未來可應用於非法活動的辨識技術，例：應用超過1億4,200萬km^2面積的衛星影像，針對目標監控活動進行風險管理；進行空中無人機（Unmanned Aerial Vehicles, UAVs）試驗，以提升其效能於支援現場巡邏並辨識非法捕魚漁船。

海洋監測技術應用

英國海外領地極為偏遠且幅員廣闊，為了達到監測並落實管理，MMO及Cefas與顧問於2019年發表了一份技術應用的文獻回顧[3]，包含現有技術以及英國政府、歐盟自2005年起資助的新創技術，並就各海外領地所需將多個技術綜合應用於藍帶計畫中。這些技術最終目標為建立出一套海事安全技術串流系統，以提供資訊運用於漁業管理，打擊IUU漁業等非法情事。

現有技術包含空中無人機、被動水下聲景監測（Passive Acoustic Monitoring）、水面無人載具（Unmanned Surface Vessels, USVs）、生物遺傳分析、耳石或鱗片微化學分析、形態測量分析、穩定同位素分析、衛星遙測、自動識別系統（Automatic Identification System, AIS）監控分析、地面／浮標雷達、Argo剖面浮標、攜帶式模組化電戰系統（Modular Electronic Warfare System, MEWS）偵測船舶雷達及高頻電磁波輻射等。

另一方面，藍帶計畫與Blue Abacus合作，使用誘餌式遠端水下攝影系統（Baited Remote Underwater Video Systems, BRUVS）[4]，以誘餌吸引大洋表層洄游性魚類靠近，具有類似集魚器（Fish Aggregation Device, FAD）的聚魚效果的特性，目標物種包含鯊魚、鮪魚、鬼頭刀等魚類，這些物種多屬食物階層的頂級消費者，且全球數量皆在減少中。BRUVS的優點之一為可在不傷害魚群的情況下，蒐集魚類豐度等數據，並有助於改善英國海外領地長期缺乏其專屬經濟海域遠洋漁業資料的情形。

圖3／誘餌式遠端水下攝影系統布放示意圖
圖片來源／GOV.UK
https://marinescience.blog.gov.uk/2021/04/03/pulling-back-the-blue-curtain-in-the-uk-overseas-territories/

英國藍帶計畫的下階段規劃

2016年至2020年間英國藍帶計畫的效益，仍在各海外領地延續影響中。在此計畫的協助下，2021年9月特里斯坦庫涅群島官方發布了5年海洋管理計畫[5]，並簽署成立大西洋最大的海洋保護區，為當地立下海洋環境管理的里程碑。在群體倡議下，英國政府號召新的英國海外領地加入，並將持續與英國海外領地、外部學術單位、非政府組織及權益關係人持續合作，支援現行管理計畫、監控、規範及執法之實施。另外，透過支援基礎設施及人力培訓，建立英國海外領地內的能力及技術，以使計畫能長期執行，確保高度生物多樣性及獨特的原始海洋環境能維持被保護，並展示現行海洋保護區及綜合管理制度的效力。

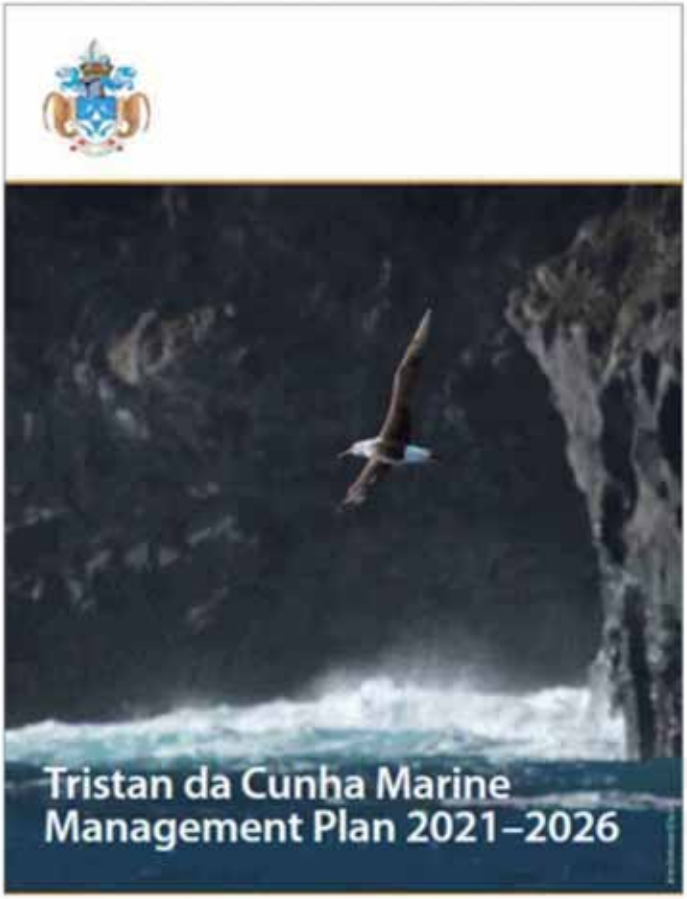

圖4／特里斯坦庫涅群島發布5年海洋管理計畫
圖片來源／Tristan da Cunha Government & Tristan da Cunha Association
https://www.tristandc. com/wildlife/news-2021-09-21-mmp.php

結論

根據海洋保育署統計至2021年5月資料，我國海洋保護區共46處，總面積約為5,264km²，占臺灣水域8.17%[6]，其中離臺灣本島距離較遠、不易抵達的保護區，屬東沙環礁國家公園。至於臺灣國境之南的南沙太平島，國家海洋研究院於2021年與中央研究院生物多樣性研究中心合作，進行珊瑚礁及海龜調查，並規劃未來於南沙太平島建置海洋研究站，將借鏡英國藍帶計畫，強化海洋生物多樣性的調查研究，提供科學數據基礎，以支援管理規範及強化執法，確保我國南海原始、獨特及多樣化的海洋環境能夠永續。

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海上活動之管理指引介紹－英國無須特許制之海灘娛樂及水上活動管理指引

撰文／林饒幰（國立高雄科技大學海洋休閒管理系副教授）
關鍵字／無須申請海事許可執照之海洋休閒娛樂活動、海事許可豁免制度、海洋管理組織

海洋管理組織（Marine Management Organization, MMO）是英國負責保護與管理水域的非政府公共執行機構，擁有制定法規與海洋規劃政策的權力，針對英國國內海洋保護區（Marine Protected Area, MPA）、海洋保育區（Marine Conservation Zones, MCZ）、特殊科學價值地點（Sites of Special Scientific Interest, SSSIs）、特別保護區（Special Protection Areas, SPA）和特別棲地保護區（Special Areas of Conservation, SAC）內無須申請海事許可執照之海灘娛樂及水上活動，進行直接或間接的規範管理，實現海洋保護區的保護目標。本文主要介紹「英國無須海事許可執照之海灘娛樂及水上活動管理指引」（Management of marine non-licensable activities in England），內容包含休閒海釣的誘餌收集與海灘娛樂等岸上活動以及以帆船和摩托艇等為活動基礎的水上活動之管理（本文內容主要摘錄自Management of marine non-licensable activities in England [1]）。

法規沿革

英國議會制定2009年《海洋與海岸許可法》（Marine and Coastal Access Act 2009），並創立海洋管理組織（MMO）。於高潮線以下及受潮汐影響範圍之海域與河流內進行海事活動，都需向MMO申請海洋許可證，但對環境影響較小或暫時性的海事活動可以依據海事許可豁免（Marine Licensing exempted activities）[2]，在確保符合相關資格標準的情況下，以事前報備方式獲得豁免。

針對「海洋管理組織」與「其他管理部門」在規範管理無須海事許可執照活動上經常出現職權重疊之情況，因此透過制定「英國無須海事許可執照之海灘娛樂及水上活動管理指引」，說明MMO的職權範圍，並根據更好的管制原則來進行海岸與活動管理，減少規則的累贅，尤其是避免不必要的管理規則重疊。

英國海灘娛樂及水上活動管理關鍵機構介紹

一、近海漁業和保育局（Inshore Fisheries and Conservation Authorities, IFCA）

《海洋與海岸許可法》第155條，賦予近海漁業和保育局制定轄區內海洋漁業資源開發的法規，包括海上垂釣和誘餌挖掘等休閒捕魚活動。

二、港務局（Harbour Authorities）

大多數港務局僅針對船舶航行制定法規，但基於保育管理的職權與目標，港務局可依據「海港修正命令」（Harbour Revision Order）或「海港授權命令」（Harbour Empowerment Order）來劃定港口限制航行之區域。

三、地方主管機關（Local Authorities）

根據英格蘭2016年《地方法》（Alternative Procedure），區議會和倫敦自治市議會等地方當局有權制定和修改與「海濱」相關的法規，包含海濱活動與海濱遛狗。除另有特別的規定外，地方主管機關必須依照合適的海洋政策如「海洋計畫」或「海洋政策聲明」，針對低潮線以上的陸域活動做出是否授權或強制決策的決定。

四、海洋管理組織（MMO）

MMO依法制定海洋保育相關的管理法規來促進英國海洋保育區（MCZ）的保育目標。包括海洋保育區內的「人員禁止或限制進入管制」、「任何的移動與活動規範」、「禁止或限制任何船舶停泊與錨定的行為」；並在場域急需迫切保護的情況下，制定緊急和臨時性的管理法規。MMO為了保護歐洲海洋場址（European Marine Site, EMS）被視為稀有、特殊或受威脅的動／植物與棲息地，設立特別棲地保護區（SAC），以及保護重要鳥類物種的特別保護區（SPA）。

五、法定自然保育機構（Statutory Nature Conservation Bodies）

「自然英格蘭」（Natural England）是英國政府成立的自然環境顧問單位，擁有針對特殊科學價值地點（SSSIs）的潮間帶場域和國家自然保護區（National Nature Reserves, NNRs）制定法規的權力。可以向英國國務卿請求「特殊自然保育命令」（Special Nature Conservation Order, SNCO）來保護自然環境。並於命令生效後代表政府發出具法律效力的「停止通知」來宣告不得進行特定活動。

英國海灘娛樂及水上活動管理策略

根據海洋娛樂活動管理的研究（NECR242），歸納出下列3大管理策略面向：

一、現地使用權管理（On-site access management）

- 標示特殊（定）活動的指定區域。
- 規定指定的使用權與位置。

二、民衆與使用者的教育及宣傳

- 利用標誌告示牌、文宣出版品（指南）來傳達管理策略與法令規範。
- 執行與實踐自律守則。
- 管理員（看守人）的監控。
- 提供教育及資訊給當地俱樂部、訓練中心與在地居民。

三、法律制定與執行

- 由監管機構，地方主管機關與土地擁有者制定相關的法律章程。
- 許可證制度或執照條件規範。

MMO專責管理之無須特許制海洋活動

MMO負責管轄的無須特許制之海洋活動，包含：「海濱散步與遛狗」、「動力與非動力陸上活動載具」、「一般海灘休閒娛樂活動」、「陸地上觀察野生動物」、「海岸探索」、「誘餌收集」。然而，現行許多的海濱活動皆有其所屬的主管機關來執行活動管理。MMO建議以不增加更多管理層級的方式進行活動管理，減少MMO與其他主管機關管理重疊的情況。

一、海濱散步與遛狗

「公共空間保護令」（Public Spaces Protection Orders, PSPOs）賦予地方主管機關與土地所有權人針對所管轄海岸或潮間帶區域內海濱散步與遛狗活動管理的權力，並有義務將保護令的內容與罰則告知民眾。

二、動力與非動力陸上活動載具

海濱活動所使用之陸上活動載具包含：具動力的全地形四輪摩托車（ATV）、輕量化多用途車輛（LUV）、越野化改裝兩輪街車或四輪房車；以及以帆為動力方式的非動力陸上風帆、風箏越野車和風箏越野滑板。

根據《道路交通法》（Road Traffic Act 1988）規定機動車輛不得行駛於海濱地區；以帆為動力的陸上活動載具必須在平坦且規劃路線的廣闊的沙灘上行駛。管理所有風箏運動的政府機關與英國民間機構英國沙灘和陸地遊艇俱樂部聯合會（BFSLYC）是陸上風帆活動的諮詢機構。此兩個機構皆對以帆為動力的陸上活動載具制定安全相關的行為準則與作業規範。包含限制活動範圍與活動時間及季節。俱樂部成員必須遵守生態保護措施，並在俱樂部自行監督管理下進行非動力陸上風帆和風箏越野車活動。

三、一般海灘休閒娛樂活動

本文定義的一般海灘休閒娛樂活動是指在海濱從事海灘遊戲、漫步、日光浴、潮池探索和游泳。大多由當地主管機關與環境非政府組織進行管理，透過告示板、指示標誌來防止踩踏沙丘或標示生態敏感區，以文宣出版品（文宣摺頁）來傳達與鼓勵管理員及志工遵守行為準則，達成減少活動對海洋與沿岸環境及野生動物之影響。

四、陸地上觀察野生動物

指由陸地上觀賞海洋哺乳動物、姥鯊和鳥類等一系列的海洋物種。在英國沒有政府機關管理商業野生動物觀賞活動。管理案例如：位於Winterton-Horsey Dunes的SSSIs，雖未被指定用於保護海豹，但卻是一個陸地上觀察野生動物的示範案例。其由數個公、民營組織合作發起的「海豹管理員計畫」，鼓勵遊客尊重每年11月至1月間自願關閉海灘的做法，保護灰海豹族群免受公眾的干擾。由100位志工組成看守隊，在現場與網路上提供海豹觀察的指導；以及宣傳農村守則（Countryside Code）和攝影師行為守則。教導現場遊客進行海豹計數與附加的監測與調查工作，提升遊客對灰海豹的認識和觀察。並在旅遊旺季後執行淨灘活動，為海豹繁殖季節做好準備。

五、海岸探索（Coasteering）

海岸探索是一項穿越潮間帶、潮下帶和海濱岸上區域的冒險探索活動，以攀爬、步行、游泳和跳水的方式完成旅程，無需借助船隻、衝浪板或其他大型浮具。在英國也沒有政府機關管理海岸探索活

海岸探索活動經驗與活動指南，與英國登山委員會（British Mountaineering Council）簽訂自願協議，管理海岸探索活動，避免海岸探索活動在敏感時期對海鳥和海豹的干擾。

六、誘餌收集（Bait collection）

在英國誘餌收集活動被歸類為海洋漁業資源，屬於近海漁業和保育局的管轄範圍，「自然英格蘭」負責管理SSSIs與自然保護區內誘餌收集活動。誘餌挖掘被定義為「捕魚」，從事捕魚活動必須取得主管單位頒發的許可證，雖然目前英國已將此一活動列為英國無須特許制之海灘娛樂及水上活動，但地方主管機關針對誘餌挖掘的管理與法規限制仍有所不同。

誘餌收集活動管理大致分為下列4大面向：

- 禁止任何誘餌收集活動。
- 授權與評估：未經授權與事前評估，禁止誘餌收集活動。
- 總量管制：將海洋蠕蟲（Annelida）的收集總量限制在上限1公斤／天。
- 設立專屬採集區：垂釣者收集自己使用的魚餌，並禁止魚餌轉售。

結論

在英國政府對海洋的「清潔」、「健康」、「安全」、「生產力」與「生物多樣性」目標推動下，透過「英國無須海事許可執照之海灘娛樂及水上活動管理指引」，減少MMO與其他主管機關管理重疊的情況，以不增加新的管理層級方式，達到保護和改善海洋環境之目的，並透過「現地使用權管理」、「民眾與使用者的教育及宣傳」、「法律制定與執行」之管理機制與策略，實現永續性的海洋活動與發展，進而保護英國海域的脆弱棲息地和物種。

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Aligning with International Standards and Enhancing Taiwan's Polar Research Capability

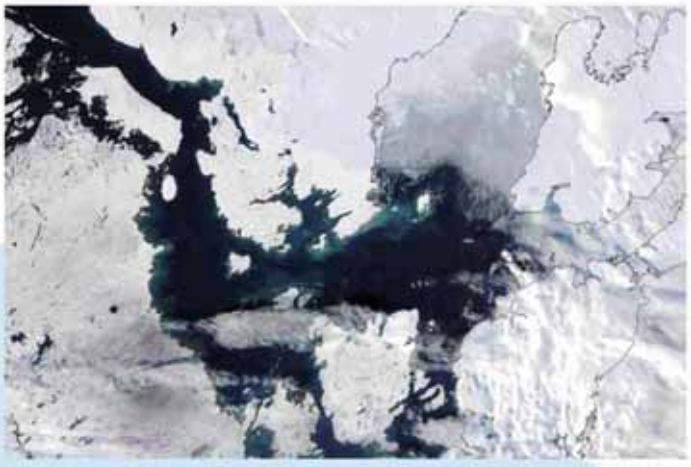
Translated by Linguitronics

Minister of the Ocean Affairs Council: Chung-Wei Lee

This issue introduces important ocean governance strategies in the United Kingdom, a maritime nation. Across aspects of organization, regulations and industry, the management of marine affairs in the UK is mainly based on the Marine and Coastal Access Act 2009, which established a comprehensive structure for marine management. The UK's Marine Management Organization (MMO) coordinates the cooperation of various ministries on marine management and development, and is responsible for the formulation and management of marine plans. Under the framework of "Marine Spatial Planning" (MSP), it provides maritime permit applications for offshore wind farm development, and also manages non-licensable beach recreational and water activities in Marine Protected Areas (MPAs). Taiwan can find a useful reference in the UK's proper protection and improvement of its marine environment, performed while carrying out sustainable marine activities and development.

The UK Overseas Territories span a massive area, from the tropics to the Antarctic circle. In order to enhance the MPAs of its overseas territories, it has rolled out the world's largest-scale marine conservation program: the Blue Belt Programme. The Programme implements management strategies such as ocean exploration, biodiversity protection, local MPA management, and sustainable fisheries in the 7 overseas territories; it also applies ocean monitoring technologies to implement management. However, the establishment of an MPA in the Chagos Archipelago in the central Indian Ocean in the British Indian Ocean Territory in 2010 involved fishing rights in Mauritius and the extension of the Maldives' coral reefs. The practices of the countries concerned and the decisions of the International Court of Justice are also worth reading.

Taiwan has taken a new step into Arctic research. In August 2021, the National Academy of Marine Research, the School of Earth Sciences of National Central University, and Nicolaus Copernicus University in Poland joined forces to conduct land observations and experiments at the Spitsbergen research station on Svalbard and collect Arctic Sea data for research. Research topics include land seismic wave measurement on ice sheets and surface drifters. This research has not only opened the doors to polar marine scientific research in Taiwan, but also looks forward in expectation of Taiwan increasing its polar marine research capability and gradually aligning with international standards!



In order to understand the impact of the global climate emergency on the Arctic Sea, large-scale, international polar region observation projects were carried out in cooperation with many countries.(The picture shows the unfrozen Arctic Sea in October 2021)
Source/ Arctic Lows, NASA Earth Observatory
https://earthobservatory.nasa.gov/images/148974/late-bloomers-in-the-arctic

Arctic Ocean Research Within the Context of the Climate Emergency

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Translated by Linguitronics
Keywords: Arctic, sea surface float, melting ice, sea surface temperature, climate emergency

With the global climate emergency resulting from human activities and CO_2 emissions, the United Nations Intergovernmental Panel on Climate Change (IPCC) pointed out in its "AR6 Climate Change 2021: The Physical Science Basis" [1] that it released in 2018 that the global mean warming between 2010 and 2019 is 1.07°C higher than the global mean warming from 1850 to 1900. Also, its special report "Global Warming of 1.5°C "in 2018 indicate that it is predicted that global mean warming will reach 1.5°C from 2030 to 2052 based on the current global warming rate [2], indicating that there is a gradual phenomenon of "global heating". Under the condition of global warming, the area covered by sea ice in the Arctic Circle is shrinking, and the rate of melting is accelerating. Polar region research [3] shows that the Earth lost 28 trillion tonnes of ice from 1994 to 2017, of which 58% occurred in the northern hemisphere, including about 7.6 trillion tonnes of sea ice in the Arctic, and about 3.8 trillion tonnes of ice cover in the Greenland ice sheet. Sea ice concentration data of the Arctic Ocean from satellite observations (Figure 1) show that the sea ice concentration in 2020 is about 7.28 million square kilometers, which is about 2.19 million square kilometers smaller than that in 2000. The melting of the Arctic ice and glaciers has also intensified the trend of rising global sea levels [4], which is about 1.8mm per year. However, the melting of Arctic sea ice not only impacts the land, atmosphere, ocean, ecology, and local ethnic activities of the polar regions, but also affects global natural resources and economic and military strategies, such as the rich reserves of oil and gas and the exploitation and opening of new trade routes.

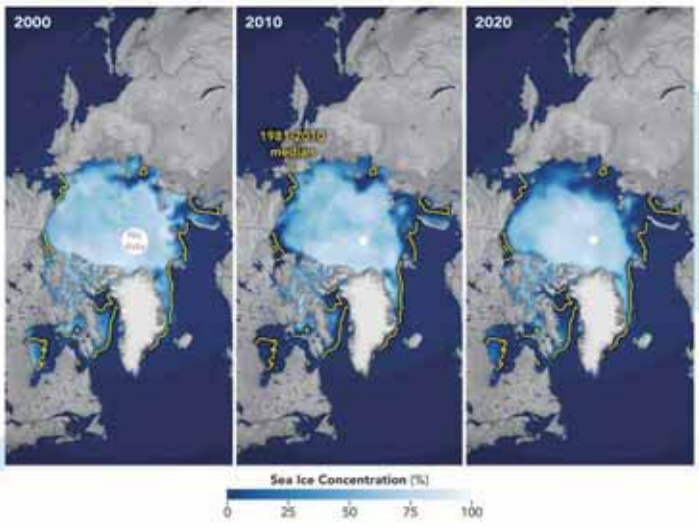

Figure 1/ From left to right, the changing trends of Arctic polar sea ice density in July 2000, July 2010, and July 2020
Source/ Arctic Lows, NASA Earth Observatory

The Impact of the Global Climate Emergency on the Arctic Ocean

In 2019, the IPCC released the "Special Report on the Ocean and Cryosphere in a Changing Climate" [5], in which it emphasized that the global climate emergency will have a massive impact on the ocean and polar regions. The report also raises current ocean observation, the impact of climate change on permafrost, and model simulation results and risks, as well as other trends; and how to take actions to protect the ocean and mitigate the climate emergency. Using the current level of greenhouse gas (GHG) emissions, the model estimates that ocean temperatures will continue to increase. Compared with the levels from 2006 to 2015, the dissolved oxygen in the ocean has decreased by 3% to 4%, and the pH value has decreased by 0.3. However, the warming of the ocean will lead to mass mortality by hypoxia (the reduction of dissolved oxygen) and ocean acidification cause the difficulty of the coral reef system to calcify in water with a low concentration of calcium carbonate, resulting in lower skeletal density and higher fragility and damage. However, when global warming is limited to 1.5°C, almost all warm-water corals will suffer widespread loss and local extinction. The polar regions will also be impacted. Its permafrost is rich in organic carbon, at about 1.7 trillion tonnes [6], which is equivalent to twice the atmospheric carbon content. Therefore, when the climate warms, these permafrost layers will release the carbon into the atmosphere, thus increasing the atmospheric carbon content. The melting of sea ice and the reduction in ice coverage have greatly impacted the activities of the indigenous peoples in the polar regions, with the scope of their activities in decline and their ecosystem habitats shrinking. In August 2021, Greenland in the Arctic Circle was affected by abnormal climate, with a rainfall that was the largest since 1950. These warning signs indicate that the rate of melting in the Arctic has accelerated. In the future, if there is large-scale melting of ice, sea levels may gradually rise, which will increase the risk of seawater intrusion into the low-lying coastal areas of Taiwan.

In order to understand the impact of the global climate emergency on the Arctic Ocean, large-scale, international arctic observation projects have been conducted. The 2019 Multidisciplinary Drifting Observatory for the Study of Arctic Climate (MOSAiC) project was an historic international research expedition of Arctic ice. The team drifted through the Arctic Ocean on the German icebreaker Polarstar for marine scientific surveys over a one-year period, collecting precious information on the atmosphere, oceans, sea ice, and ecosystems. It is hoped that in the future, the survey can help understand the Arctic ocean environmental changes and provide a basis for the construction and prediction of numerical ocean models to help assess the impact of climate change on the Arctic Ocean as well as on the world. Assistant Professor from National Sun Yat-sen University, Dr. Ying-Chih Fang, who was the only Taiwanese scientist to participate in the 2019 MOSAiC cruise. He pointed out another international joint observation and research project of the Arctic is "The Synoptic Arctic Survey (SAS): A Developing Multi-Nation Interdisciplinary Survey of the Arctic Ocean". This project is a joint multi-national project (the US, Canada, Sweden, Japan, Republic of Korea, Germany, Norway, Russia, Denmark, China). The research teams of the participating countries will apply for icebreaker voyage plans from 2022 to 2023 to make synoptic observations of different areas of the Arctic (Figure 2). Its purpose is to conduct a complete detection of the biochemical and physical parameters of the large Arctic Ocean and record its current state. It will be unlike previous research conducted by a small number of teams in small areas. The collected data will be compared with historical data collected over the past 40 years to estimate the changes from climate change in the Arctic Ocean. Key scientific issues are: I. Changes in physical mechanisms; II. Migration and invasion of non-Arctic marine species; III. Changes in the current state of the local carbon cycle.

Figure 2/ Planned route for joint observation voyages in the Arctic Ocean (white line)
Source/ https://synopticarcticsurvey.w.uib.no/

International Cooperation on Ocean Observation in the Arctic Ocean

The first Arctic research project in which Taiwan institutions were involved was in August 2021; it was conducted jointly by the National Academy of Marine Research (NAMR), the School of Earth Sciences of National Central University (NCU), and Nicolaus Copernicus University in Poland. The first Arctic Circle research was conducted in Svalbard (Figure 3); land observation station experiments were conducted on the research station on Spitsbergen and Arctic Ocean data collection was performed for research. Research topics include land seismic wave measurement on ice sheets and surface drifters.

The geological research team from NCU pointed out that they could often hear the huge sound of glaciers collapsing during field work. Therefore, a seismograph was placed to observe the ice shock caused by glacier collapse [7]. Previous study [8] has confirmed that the seismograph signal recorded on Spitsbergen Island manifested like the vibrations experienced when an earthquake occurs; a camera was used to simultaneously capture the state of the ice shock (Figure 4). The NAMR and NCU planned to jointly launch surface drifters developed by NCU (Figure 5). The drifters observe changes in ocean currents, wave characteristics, and sea surface temperature, to investigate the phenomenon of rapid ice melting in the Arctic Ocean. On the bottom of the drifter is a temperature sensor, which can measure sea surface temperature. The internal PCB design allows it to detect the drift speed and wave height. There are also two square-shaped satellite transmission and GPS positioning antennas for periodic data transmission and estimation of the currents derived from the trajectory. Professor Hwa Chien of NCU pointed out that in recent years, satellite observations of ice coverage on the Arctic Ocean have found that the sea ice is disappearing much faster and more severely than all previous ocean models have predicted. Research has postulated that the reason for this is likely related to climate change in the Arctic Ocean and the resulting positive feedback mechanism. Figure 6 shows the drifters deployed on the west shore of Svalbard, located in the Fram Strait (one of the waterways for the exchange of water between the Arctic Ocean and the North Atlantic Ocean) in the north Greenland Sea.

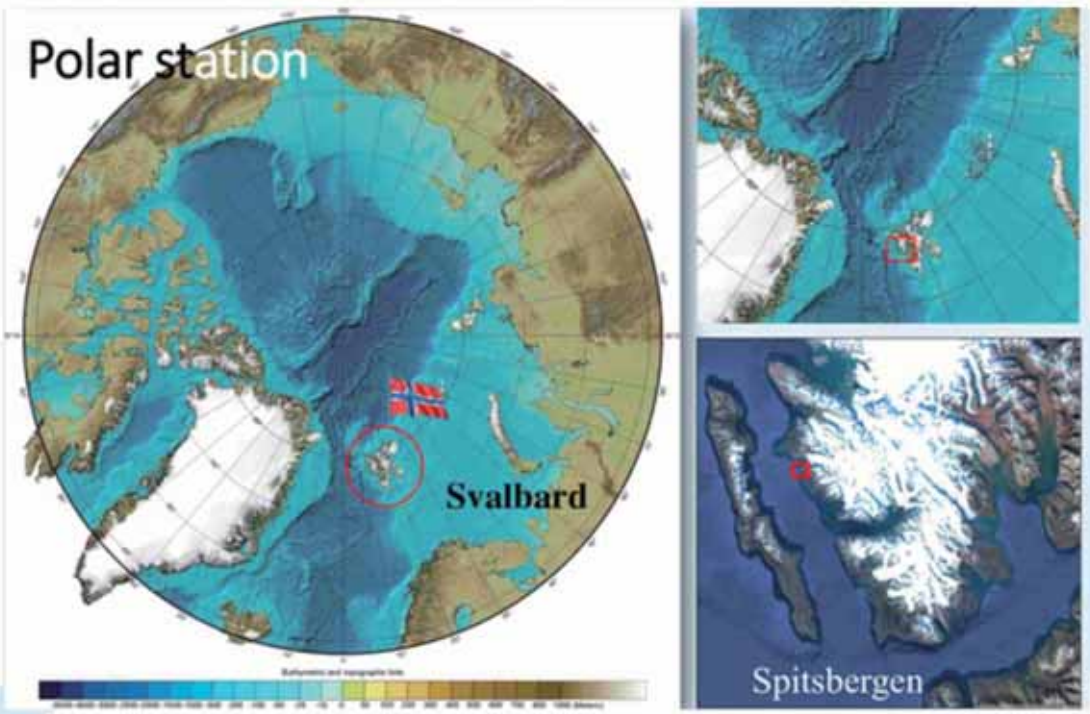

Figure 3/ Geographical location of Svalbard in the Arctic Ocean
Image by National Central University

Beginning in August 28, 2021, the surface drifters have sent data back in real-time through satellite communications. The real-time observation information can be obtained at the NAMR, and observation information such as sea surface temperature and current and wave conditions can be obtained along the drift path. Preliminary observation results show that the surface temperature of the sea water along Svalbard is about 7 to 7.5°C, which is 2 to 4°C warmer than that of the Fram Strait. This shows a warming trend when compared with the average temperature of 6.75 to 6.9°C on the sea surface observed by satellites in August 2020. The current speed is still moderate; the drifters flow northward at about 0.2 to 0.6 m/s. Some of the drifters floated northward into the Arctic Ocean along the West Spitsbergen Current (a branch of the warm North Atlantic Current). A small number of drifters drifted westward due to the countercurrent of the Atlantic Ocean, which is similar to the path (Figure 7) of the countercurrent of the Atlantic Ocean in this area from past research [9]. There are sea surface wave conditions of about 1.5 to 3 meters, which are harsh sea conditions. The team of Professor Hwa Chien from NCU have proposed: The breaking of sea ice by waves will accelerate melting; in addition, the sea ice itself will continue to propagate the energy of the waves and cause more extensive damage. In addition, the reduction of sea ice means that the area of the sea will increase, wave heights and wavelengths will become larger, and the generation of sea ice will be reduced.

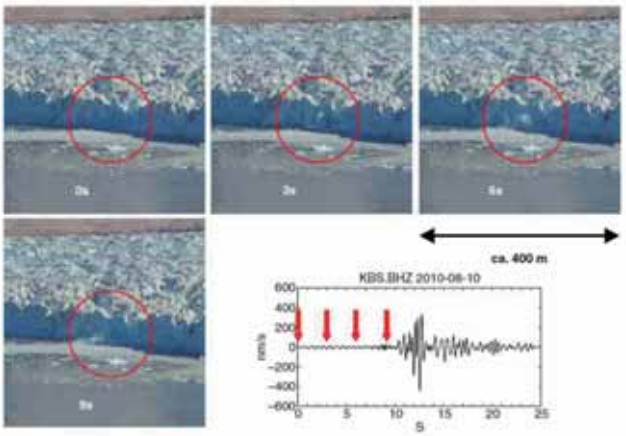

Figure 4/ As ice shocks are captured by the camera, the seismograph signal manifests like the vibrations experienced when an earthquake occurs

Source/ [8]

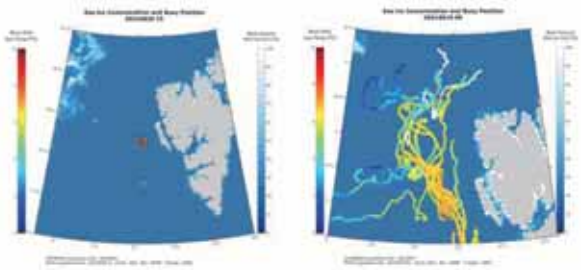

Figure 6/ The trajectory of the surface drifters and the sea surface temperature observation results (background color is the sea ice concentration from satellite observation): (Left) Original deployment position; (Right) Drift trajectory of the sea-surface micro buoys after 21 days

Images by Team of Professor Hwa Chien from National Central University

Figure 5/ Preparing to deploy the surface drifters and the float state after deployment

Images by Team of Professor Hwa Chien from National Central University

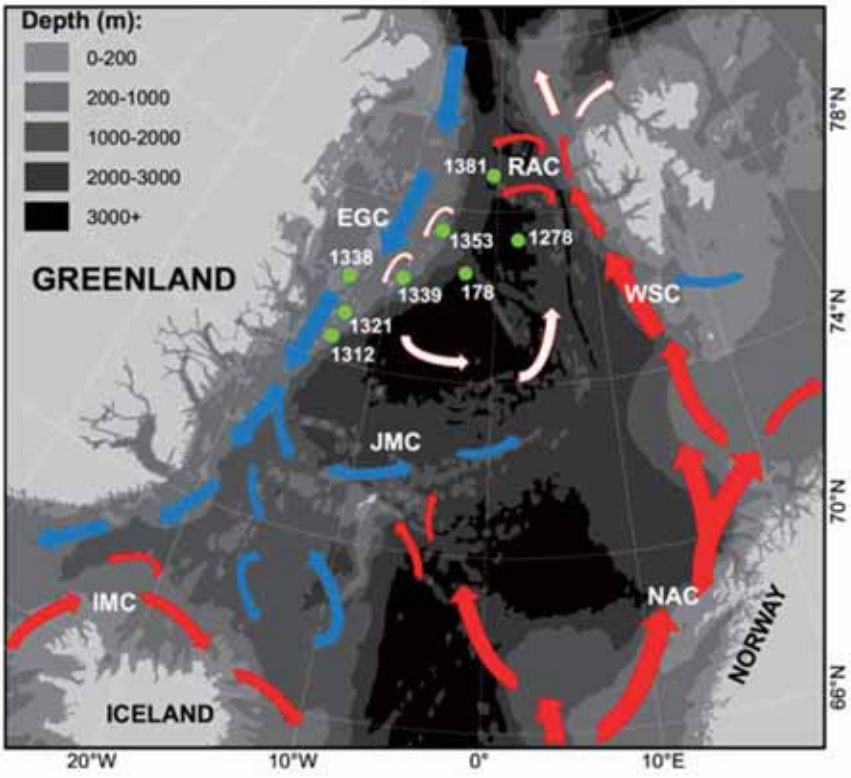

Figure 7/ A distribution map of currents around Greenland and Svalbard. The red arrows are the Norwegian Atlantic Current (NAC), the Irminger Current (IMC), the West Spitsbergen Current (WSC), and the Return Atlantic Current (RAC); the white arrows are the Atlantic subsurface water; the blue arrows are the Arctic surface current: East Greenland Current (EGC), and Jan Mayen Current (JMC)
Source/ [9]

Future Prospects

At present, there are very few Taiwanese marine researchers and scientists engaged in the polar regions. The NAMR hopes to use the international cooperation with NCU and Nicolaus Copernicus University in Poland as a starting point for monitoring the Arctic marine environment and collecting basic hydrological data from the polar regions. Through such work, it will guide and improve Taiwanese polar marine scientific research, and provide subsequent research results to the government for research on polar marine policies and the development of the polar region blue economy. At this stage, in addition to the polar international cooperation with Poland, there are future plans to cooperate with top polar research units, such as the Woods Hole Oceanographic Institution and the University of Alaska Fairbanks in the United States and Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung in German, with a view to gradually align Taiwan's polar marine research capability with that of the international community.

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Analysis of Dispute Concerning Delimitation of the Maritime Boundary in the British Indian Ocean Territory

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The International Court of Justice (hereinafter "the ICJ") cannot exercise its jurisdiction in contentious proceedings without the consent of the States concerned, but Professor Peter Malanczuk indicates that the 1982 Law of the Sea Convention (hereinafter "UNCLOS") automatically makes each ratifying state at the same time party to the dispute settlement provisions [1]. Furthermore, the formulation of UNCLOS Part XV makes the Arbitral Tribunal a default forum for compulsory dispute settlement. As of 2021, six applications have been filed to the Arbitral Tribunal for prescribing provisional measures, and twelves for adjudication. On the other hand, just as the present case, any application can be transferred to any one of the forums if the parties to the dispute so agree. As of 2021, six applications have been transferred to the International Tribunal for the Law of the Sea (hereinafter "the ITLOS") [2].

The Origin of Dispute - the Chagos Archipelago

Mauritius had been one of the French colonies until it was ceded to the United Kingdom in 1814. In 1965, The United Kingdom had separated the Chagos Archipelago (hereinafter "the Archipelago") from Mauritius to form the British Indian Ocean Territory (BIOT) before Mauritius gained independence in 1968. The United Kingdom continues its sovereignty claims over the Archipelago and undertakes to return it to Mauritius when the Archipelago is no longer needed for defence purposes. On 1 April 2010, the United Kingdom unilaterally announced the creation of a Marine Protected Area (hereinafter "the MPA") in and around the Archipelago, which violated its obligation to ensure the fishing rights of Mauritius. On the other hand, on 26 July 2010, the Maldives made a submission regarding the extended continental shelf to the Commission on the Limits of the Continental Shelf (hereinafter "the CLCS"). As the distance between the Archipelago and the Maldives is less than 400 nautical miles (517 kilometers, about 279 nautical miles) [3], there is a potential overlap area between the maritime zones of the two Parties (Figure 1). But the Maldives refused to negotiate the issue with Mauritius. Consequently, Mauritius, confronted with two disputes, chose to institute arbitral proceedings against the United Kingdom on 20 December 2010 and against the Maldives on 18 June 2019, respectively.

On 15 March 2015, the Arbitral Tribunal rendered its award, in the Arbitration Regarding the Chagos Marine Protected Area between Mauritius and the United Kingdom of Great Britain and Northern Ireland, that the United Kingdom's purported "MPA" was incompatible with article 2(3), article 56(2) and article 194(4) of UNCLOS [4]. As to the disputed sovereignty over the Archipelago, the United Nations General Assembly (hereinafter "the UNGA"), on 22 June 2017, requested the ICJ to give an advisory opinion. On 25 February 2019, the ICJ delivered its advisory opinion on the Legal Consequences of the Separation of the Chagos Archipelago from Mauritius in 1965 as follows [5]:

I. The process of decolonization of Mauritius was not lawfully completed when that country acceded to independence, following the separation of the Archipelago;

II. The Archipelago is an integral part of Mauritius. The United Kingdom's continued administration is an unlawful act of a continuing character, and must be brought to an end as rapidly as possible;

III. All Member States are under an obligation to cooperate with the United Nations (hereinafter "UN") to complete the decolonization of Mauritius.

In resolution 73/295 adopted on 22 May 2019, the UNGA demanded that the United Kingdom withdraw its colonial administration from the Archipelago and complete the decolonization of Mauritius within a period of no more than six months from the adoption of the present resolution, and called upon all Member States to cooperate with the UN to ensure the completion of decolonization of Mauritius as rapidly as possible. But the Maldives and the United Kingdom voted against it [6].

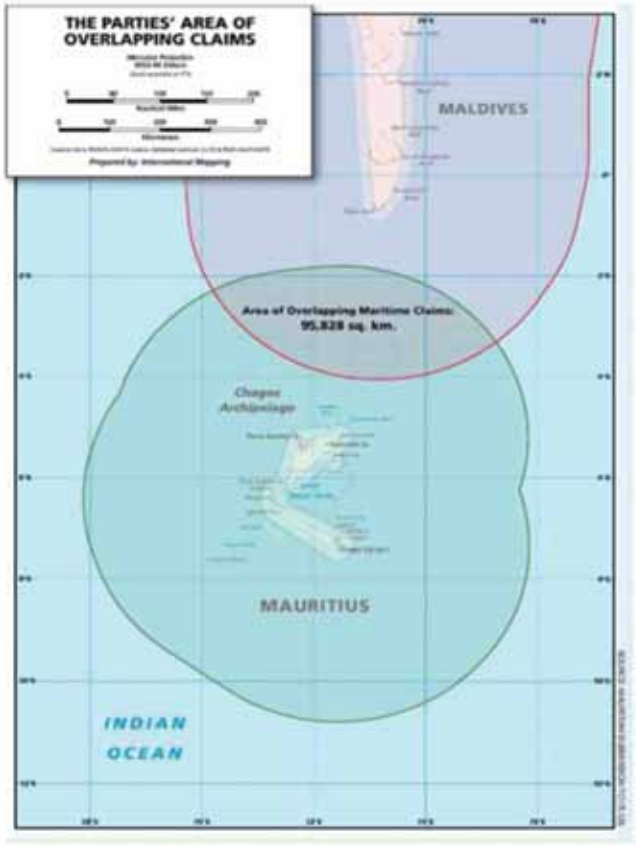

Figure 1/ International institute for Law of the Sea Studies (Dec. 7, 2019), Dispute concerning delimitation of the maritime boundary between Mauritius and Maldives in the Indian Ocean (Mauritius / Maldives)
Source/ [7]

Exchange of Views between the Two Parties

Before submitting the notification of instituting arbitral proceedings against the Maldives, Mauritius has tried to negotiate with the Maldives, but the Maldives was volatile. In respect to the Maldives' submission to the CLCS, Mauritius attended their first meeting in Malé, the capital of the Maldives. The Maldives agreed that the exclusive economic zone coordinates of Mauritius in the Chagos region were not taken into consideration and that this would be recitified by an addendum to the submission in question [8]. During a State visit to Mauritius, in a Joint Communiqué was issued on 12 March 2011, the Maldives agreed to make bilateral arrangements on the overlapping area of extended continental shelf around the Archipelago. However, no addendum had been filed to the submission. In a diplomatic dated 24 March 2011, addressed to the Secretary-General of the United Nations, Mauritius protested against that the extended continental shelf being claimed by the Maldives encroached on the Exclusive Economic Zone of Mauritius.

Following the ICJ's advisory opinion in 2019, in a diplomatic note dated 7 March, Mauritius invited the Maldives to a second round of discussion in April, but the latter did not respond to the former. Consequently, Mauritius informed the Maldives of instituting arbitral proceedings on 18 June. Nonetheless, the Parties, pursuant to article 15(2) of Annex VI to UNCLOS, reached an agreement on the transfer of the dispute concerning the delimitation of their maritime boundary in the Indian Ocean to a Special Chamber of the ITLOS (hereinafter "the Chamber"). The President of the ITLOS invited the Parties to consult on matters relating to proceedings, including the Maldives's right to submit its preliminary objections.

The Maldives' Preliminary Objections

On 18 December 2019, the Maldives raised five preliminary objections to the jurisdiction of the Chamber and the admissibility of Mauritius' claims as follows:

Table 1/ The Maldives' Five Preliminary Objections and the Special Chamber's Decisions

Objections	Contents	Decisions
First	The United Kingdom is an indispensable third party to the present proceedings.	Unanimously Rejects
Second	The Chamber has no jurisdiction to determine the disputed issue of sovereignty over the Archipelago.	Rejects By 8 votes to 1
Third	As the Parties have not engaged in the negotiations required by articles 74 and 83 of UNCLOS, the Chamber lacks jurisdiction.	Rejects By 8 votes to 1
Fourth	As there is no maritime boundary dispute between the Parties, the Chamber has no jurisdiction.	Unanimously Rejects
Fifth	Mauritius' claims constitute an abuse of process.	Unanimously Rejects

Source/ [9]

The Maldives contends in its first preliminary objection that, until the resolution of the sovereignty dispute, the United Kingdom is entitled to exercise the rights of a coastal State under UNCLOS. As the United Kingdom is absent in these proceedings and does not consent to be a party to them, under the Monetary Gold principle, the Chamber has no jurisdiction.

In its second preliminary objection, the Maldives contends that, if the Chamber were to determine Mauritius' claims, it would necessarily determine the disputed issue of sovereignty over the Archipelago. But the Chamber has no such jurisdiction over sovereignty disputes, but over disputes concerning the interpretation or application of UNCLOS, pursuant to article 288(1) of UNCLOS. Even if the ICJ determines the United Kingdom bears an obligation to complete the process of decolonization, such an obligation is not necessarily accompanied by an instant loss of sovereignty.

In its third preliminary objection, the Maldives argues that, pursuant to Article 74 and 83 of UNCLOS, only such negotiation between the Parties has been engaged in and the attempt to reach an agreement has been failed that either State can resort to the procedures provided for in Part XV of UNCLOS. However, as this precondition has not been fulfilled in the present case, the Chamber has no jurisdiction.

In its fourth objection, the Maldives states that Mauritius has not pointed to any dispute or positive opposition between the Parties regarding their respective maritime boundary claims and the agreement on the transfer of the dispute to the Chamber does not establish the existence of a dispute.

Based on these four objections, Mauritius' claims constitute an abuse of process.

Mauritius' Contentions

Mauritius requests the Chamber to rule and adjudicate as follows:

I. The Preliminary Objections raised by Maldives are rejected;

II. The Chamber has jurisdiction to entertain the Application filed by Mauritius;

III. There is no bar to the Chamber's exercise of that jurisdiction;

IV. The Chamber shall proceed to delimit the maritime boundary between Mauritius and the Maldives.

Mauritius contends that the issue of whether the Archipelago forms an integral part of Mauritius was inseparable from the issue of the lawfulness of Mauritius' decolonization. Once the ICJ decides whether the decolonization of Mauritius had been lawfully completed, it also inevitably determines which State was the lawful sovereign over the Archipelago. As the wrongful detachment from Mauritius would transgress the general principle of international law of ex injuria non oritur jus, the United Kingdom has no lawful basis to claim sovereignty over the Archipelagos. Under UNCLOS, Mauritius is the coastal State to the Maldives in respect of the Archipelago for the purpose of the delimitation of a maritime boundary.

During the eight years from 2011 to 2019, the Maldives has failed to abide by the promises and has violated its obligation as provided in Article 74 and 83 of UNCLOS. It also failed to abide by the UNGA resolution 73/295, where all Member States have an obligation to cooperate with the UN to ensure the completion of decolonization of Mauritius. The Maldives cannot refuse to negotiate with Mauritius only by invoking the United Kingdom's unlawful claims over the Archipelago. Furthermore, a dispute has existed between the Parties before instituting the arbitral proceedings, and the meeting was convened expressly to discuss a potential overlap of the extended continent shelf and to exchange views on maritime boundary delimitation between the Parties.

The Decisions of the Special Chamber

The Chamber rejected all of the five preliminary objections presented by the Maldives (Table 1). First, the Chamber notes that Mauritius' claims are based on the premise that it is the coastal State of the Archipelago, but as to which the Maldives hold a markedly different view.

Accordingly, the Chamber should entertain the first and second preliminary objection together: once the question of the legal status of the Archipelago is resolved, so is the question of whether the United Kingdom is an indispensable third part. The Chamber agrees that UNGA has not sought the ICJ's opinion to resolve a territorial dispute over the Archipelago, but it cannot be referred that there is no relevance or implication for the issue of sovereignty [10]. The Chamber considers that the Archipelago's wrongful detachment by the United Kingdom constitutes its unlawful administration of the Archipelago. The United Kingdom cannot have any legal interests in disposing of maritime zones around the Archipelago [11]. Mauritius can be regarded as the coastal State in respect of the Archipelago even before the process of the decolonization is completed [12].

The Chamber rejected the third and the fourth objections because Mauritius has attempted to engage the Maldives in negotiation while the Maldives at times had shown interest in meeting and had met

with Mauritius to exchange views on maritime boundary delimitation between the two Parties. However, the Maldives insists that the jurisdiction over the Archipelago is not exercised by the Mauritius and refuses to engage any negotiation. The Chamber considers that the obligation under article 74 and article 83 of UNCLOS, if no agreement can be reached within a reasonable period of time, the States concerned shall resort to the procedures provided for in Part XV, has been fulfilled. Accordingly, the Chamber rejects all the preliminary objections by the Maldives.

Conclusion

As the ICJ states, respect for the right to self-determination is an obligation erga omnes, all States have a legal interest in protecting that right [13]. The present case shows decolonization and territorial sovereignty are closely interrelated. It was not possible to talk of an international agreement on territory cessation when the United Kingdom was the authority of the Mauritius, which means no inter-state relations existed then. The detachment was not based on the free and genuine expression of the will of the people on the non-self-governance territory. Such a wrongful detachment of the Archipelago, which results into the incomplete decolonization of Mauritius, constitutes the United Kingdom's continued administration an unlawful act of a continuing character. Transgressing the general principle of international law of ex injuria non oritur jus, the United Kingdom' continued claim over the Archipelago still cannot constitute a lawful claim.

ICJ's advisory opinion is not binding but has legal effect [14]. The United Kingdom's refusal to comply with the UNGA resolution to withdraw the colonial administration shows that the international community does not possess any power to take enforcement measures or sanctions against the Strong Power refusing to comply with the international law.

The present case also shows the arbitral proceedings as a default forum is increasingly important in the future. Once any party to the dispute submits the dispute to the arbitral proceedings, the other party is recommended to exchange views regarding their choice of procedure and to submit the preliminary objections to defense itself.

Note: Besides the present case, there are five more cases: the M/V "SAIGA" Case, Case Concerning the Conservation and Sustainable Exploitation of Swordfish Stocks in the South-Eastern Pacific Ocean, Dispute concerning delimitation of the maritime boundary between Bangladesh and Myanmar in the Bay of Bengal, The M/V "Virginia G" Case, and Dispute concerning delimitation of the maritime boundary between Ghana and Côte d'Ivoire in the Atlantic Ocean.

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[10] Ibid., 51, para. 168. About the definition of 'legally binding' and 'legal effect', see丘宏達著，陳純一修訂（2012），《現代國際法》[修訂三版]：104。
[11] Ibid., 52, para. 172 and 73, para. 247.
[12] Ibid., 74, para. 250.
[13] Ibid., 52, para. 172
[14] Ibid., 62, para. 205.

Strategic Planning for the Long-Term Offshore Wind Power Industry in the UK

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Keywords: Offshore wind power, net zero emissions

Offshore wind power has long since become a key energy source for the UK to achieve its 2050 net zero emissions goal. This article discusses the long-term planning for offshore wind power in the UK, which may serve as a reference for the promotion of the offshore wind power policy in Taiwan. This article mainly refers to the offshore wind power planning report made in cooperation from the Offshore Wind Industry Council (OWIC), which was formed by the UK government and the wind power industry, and ORE Catapult [1] .

The International Energy Agency's latest report - World Energy Outlook 2021 [2] pointed out that although new energy economies, such as solar and wind energy and electric vehicles, have flourished in certain countries, their progress is still far from sufficient to reduce global carbon emissions to the net zero emissions target by 2050. In the past two years, global economic development has been profoundly affected by the COVID-19 pandemic. However, renewable energy such as wind power and solar power have benefited from the loosening of economic policies and innovation in technology, and have grown rapidly in many countries.

In 2020, the installed capacity of world wind power reached a record high of 93GW. However, on the road to net zero emissions, the current growth rate still lags far behind. By 2050, wind power will account for about 43% of global energy mix. If net zero emissions is to be achieved, the annual growth rate of global wind power generation equipment would need to be fourfold over the next decade. Only then would the world be able to deploy scales of 380GW of offshore wind power by 2030 and 2,000GW by 2050.

The United Kingdom is one of the few countries that have included the pledge for net zero GHG emissions by 2050 into its Climate Change Act. Data show that since 1990, the UK's GHG emissions have dropped by 43.5%, mainly due to the extensive use of renewable energy sources such as wind and solar energy to replace coal-fired power generation. Compared to solar power, wind power is more susceptible to the impact of the terrain. However, due to the continuous improvements made in technology, offshore wind power has become the focus of global renewable energy development. The installed capacity of renewable energies in the UK surpassed that generated by fossil fuels for the first time in 2019, and of those renewables, the contribution of wind power is indisputable. In particular, there are many large offshore wind farms in the north that have been connected to the grid.

About 44% of the UK's electricity came from renewable energy sources in 2020. It is estimated that it will have 40GW (40 gigawatts) of wind power capacity by 2030. Offshore wind power has long since become a key energy source for the UK to achieve its 2050 net zero emissions goal. This article discusses different offshore wind power planning reports from the long-term offshore wind power plan made in cooperation from the OWIC and ORE Catapult, which looks to achieve the net zero

emissions target by 2050. The following summarizes the key points of the plan, which may serve as a reference for the promotion of the offshore wind power policy in Taiwan.

Planning model and scenario design

The offshore wind power potential of British waters is between 600GW and 1,000GW. Therefore, the report plans an offshore wind power installation by 2050 of between 50GW and 70GW. There are two main plan models. One of the models is ESME (Energy System Modelling Environment), which is used to evaluate the political and economic impact of offshore wind power and the optimal configuration of energy costs. The other model is SFM (Storage and Flexibility Model), which simulates uncertain risk factors for long- and short-term energy system operation. Under the influence of the 2050 net zero emissions target, there are two scenarios for this study: One is Further Ambition (FA), and the other is Alternative Net Zero (ANZ). ANZ contains 'speculative' non-energy related measures, such as changes in eating habits or reduction in carbon emissions from aviation. This scenario will achieve zero carbon emissions in 2050, while also putting relatively little pressure on the energy system. In contrast, FA puts greater pressure on the energy system. The core of the scenario is to increase offshore wind power, but there is no need to adopt additional carbon reduction measures. Therefore, under this scenario, carbon emissions will still be 4% in 2050 (Figure 1).

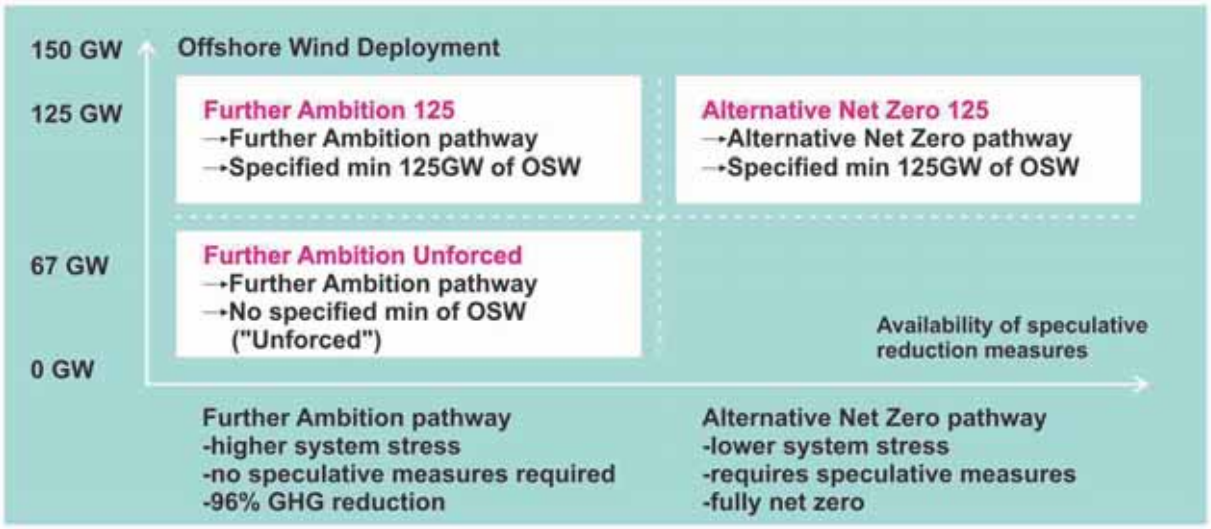

Figure 1/ Planned amounts of offshore wind power by 2050 under each scenario
Source/ [1]

Energy structure in the UK by 2050

Compared with the current 10GW of installed capacity of offshore wind power, the growth by 2050 to an installed capacity of 50-70GW will be stunning. Of course, in this scenario, the cost of the total energy system is relatively high, but it can achieve the policy goal of energy transition in the UK. From Figure 2, it can be seen in the 125GW (ANZ) scenario, the demand for offshore wind power is as high as 93GW during winter nights, when the wind is sufficient. But when the wind is relatively insufficient, the peak power demand is still as high as 91GW. During times of insufficiency, the gap needs to be filled by combined-cycle gas turbine and carbon capture and storage (CCGT+CCS) with 99% carbon capture capacity and hydrogen generators. To arrive at a low-carbon era and achieve an economically efficient energy structure, the following important factors should be paid attention to:

I. Energy diversification: The combination of other renewable energies (solar) and nuclear power generation should be considered as a response to the low air volume characteristics of wind power during specific periods.

II. Clean thermal power plants: CCGT+CCS and hydrogen generators are indispensable energy sources for power dispatch.

III. Nuclear energy: The deployment of nuclear energy also plays an important role in long-term plans, mainly due to nuclear energy's characteristics of low carbon emissions and low power generation costs. However, after the large-scale installation of offshore wind power, the demand for nuclear energy has dropped significantly (from 37GW to 8GW), which may impair the optimal scale (cost) of the nuclear power that was originally planned.

IV. Hydrogen energy is everywhere: In the future, CCGT+CCS will be mainly used to support peak electricity demand, and hydrogen energy will be used for immediate energy demand, including industrial, transportation, and heating. It is estimated that the demand for hydrogen energy will be as high as 200TWh by 2050.

V. Transportation and heating: The demand for transportation and heating does not change much between different scenarios.

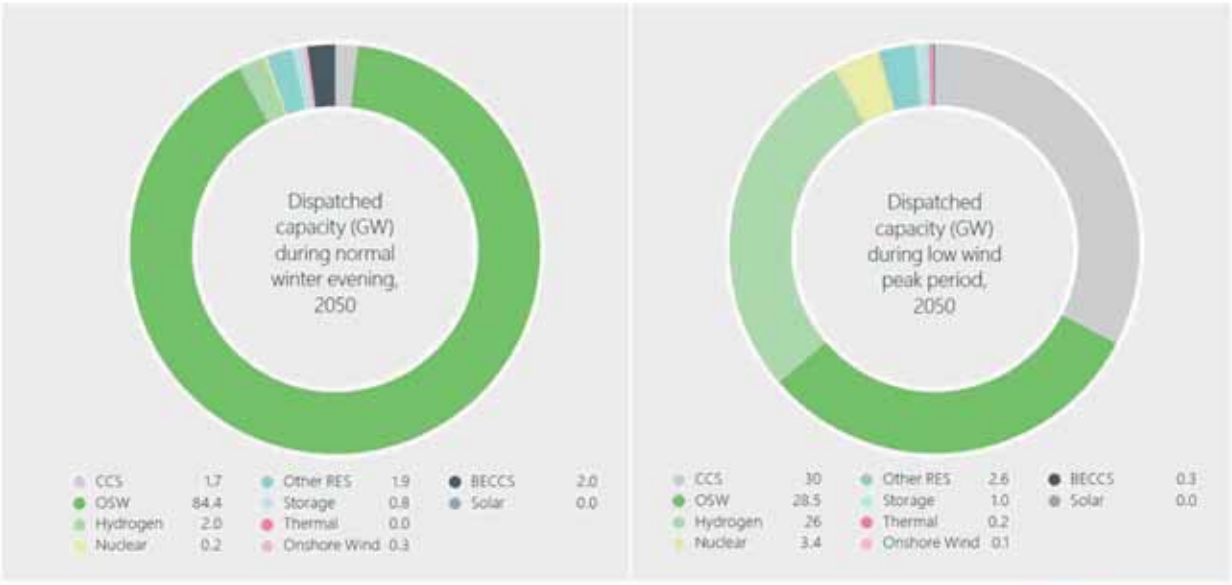

Figure 2/ OSW is typically the largest source of electricity generation in the UK (ANZ 125 scenario), with back up plant supporting in rare periods of low wind availability

Source/ [1]

Energy storage and power supply flexibility

How will the future energy system provide energy that is both cost-effective and reliable? The key lies in energy storage technology. Reserve energy capacity is made in response to the intermittent power generation characteristics of renewable energy. Affected by the significant increase in offshore wind power and the decline in nuclear power, the main energy sources for reserve capacity by 2050 will be hydrogen generators and CCGT+CCS. For example, in the 125GW (FA) scenario, 100GW of thermal power plants and 18GW of energy storage equipment are required to support a small number of specific energy demand peak times. When a large number of offshore wind power systems are used, demand-side management can also be used to reduce demand for standby power plants and thereby reduce

power generation costs. For example, heating storage technology for buildings (regional) and electric vehicle charging management are also possible methods (not charging during peak time of power demand). If the technologies or policy measures discussed above are implement appropriately, 30% of offshore wind power generation (100–190TWh) can be reduced, with a reduction in the corresponding investment costs for standby power plants.

Energy technology system considerations

Power system operations, related services, and power transmission infrastructure will also influence the installed scale of offshore wind power, and power systems will require combinations of multiple technologies. The impact of offshore wind power on the power system is mainly focused on two aspects: One problem is grid congestion. Transmitting a large amount of electricity from ocean to shore requires large-scale investment in grid facilities. The second problem is lack of traditional power backup. Power systems with excessive proportions of renewable energy (wind) power generation are prone to instability. These two problems can be solved by the smart grid, which is shown in Table 1.

Table 1/ Power transmission issues and solutions related to offshore wind power

Offshore transmission	→ East coast bootstraps will be effective. → Interconnection has a lot to offer - operability and synergies with markets with different characteristics. → Offshore grid could be even more effective - directly selling wind to where it's valued highest.
Smart grid solutions	→ A range of technologies already exists - the obstacle is finding the right governance arrangements to apply them, and comparing them fairly against conventional system services. → Operational paradigms - a grid made of many cells that self control, for example, may provide more reliability but less economy of scale.
Wind farms and ancillary services	→ With innovative control applications, wind farms could potentially contribute - but may not always be most economic solution. → OSW industry can support the System Operator in design of products and services.

Source/ [1]

Offshore wind power industry issues

Offshore wind power in the UK is estimated to have an installed capacity exceeding 40GW by 2030. Planning corresponding industry policies and management regulations will be the cornerstone of improving the offshore wind power industry. However, in the current market environment, large-scale offshore wind power generation will cause the wholesale electricity price to fall during periods of low power demand and reduce the revenue of the industry as a consequence. This issue will have a greater impact when the long-term plan gradually increases installed offshore wind power. On the road to net zero emissions, it is necessary to properly plan for the offshore wind power market to rectify the imbalance between power supply and demand. Important measures include grid-associated ancillary equipment and power market operation models. In order to achieve net zero emissions under the planned future energy market structure, a review of electricity market reform is necessary. It is necessary, especially in the short term, to thoroughly investigate the current power market model, including the electricity auction system, increasing the demand response to the power system, flexibility of power storage, establishing exit mechanisms for poorly operated power plants, innovative policy planning, reviewing non-regulatory government intervention measures, establishment of a carbon trading market, and establishment of a grid charging system that is fair and reflective of costs.

The need for innovation

Offshore wind power plays an important role in the UK's policy for net zero emissions by 2050. Therefore, it is necessary to formulate innovative policies, regardless of whether it is the energy industry or other areas. Integrating a large amount of offshore wind power is a very important part of innovation in technology, organization, market, policy, and regulations (Table 2). For example, the offshore wind power supply can be stabilized through policies for effective management of smart grids. At the same time, adopting a comprehensive minimum-cost optimal management policy (demand-side management) can effectively reduce offshore wind power generation (by 30%) and mitigate the impact from reduced revenue (electricity prices) resulting from a large number of units installed. Net zero emissions policy is an important vision and motivation for full offshore wind power generation. Improving the wholesale price of electricity is also an indispensable economic instrument.

Table 2/ The key to success and innovative approaches to offshore wind power

Electricity system operability support	→ Novel implementation of existing solutions (e.g. new ways of operating the power system, synchronous compensators, storage operating as part of local smart grids) → Grid-supporting capabilities of wind farms and their connecting networks (e.g. inertia, fast response, voltage support, fault current, black start, etc).
Power generation	→ Hydrogen turbines' flexible capabilities for evolving duty cycles (e.g. operability support, fast start). → Carbon capture and storage improvements to capture rates under all operating conditions (e.g. with low carbon content and whilst ramping). → Nuclear designs with greater load-following flexibility and/or ability to produce hydrogen.
Electrical and heat demand	→ Electrolysis cost reductions, improvement of operability characteristics and ability to site in difficult offshore environments. → Unit cost reductions of electrical storage (batteries and thermo-mechanical). → Increased energy density of domestic thermal storage, and cost-effective ability to interact with heat networks. → Interoperability of electric vehicle smart charging systems, and offerings to support uptake.
New hydrogen systems	→ Rules and standards for safe devices. → Incentivisation of hydrogen appliance uptake.
Power and gas interconnection	→ Hydrogen transmission and distribution network designs (e.g. potential for cost-effective hydrogen network to displace need for OSW farm power grid connection). → Cost reductions in design, infrastructure, and operational costs of offshore power networks.
Market innovation	→ CfD design to gradually incentivise OSW to deliver a wider range of capabilities in support of grid operation → Innovative market designs to create the impetus for demand flexibility to be fully realised. → Future energy market framework that unleashes innovation and provides a highly competitive environment, with clearly defined market outcomes for participants.
Policy innovation	→ Diversity in private financing of OSW and flexibility solutions through innovative policies, tools and instruments to reduce risks, remove barriers and mobilise finance. → Government-facilitated planning of strategic siting of OSW farms. → Design of the OFTO regime that includes consideration of energy system planning and opportunities for shifting between energy vectors.

Source/ [1]

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Introduction to Agencies of Marine Management in the UK

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Translated by Linguitronics
Keyword: Marine and Coastal Access Act, Marine Management Organization, Department of Energy & Climate Change, Maritime and Coastguard Agency

As the exploration and understanding of the ocean have continued to expand, the government management of maritime affairs has increased for the United Kingdom, an island maritime country. Prior to 1999, the UK lacked a unified and comprehensive maritime and coastal area management policy framework. Rather, local governments would establish management measures specifically for their own localities. As a result, maritime and coastal area management plans and legal systems were complex and fragmentary, with a lack of coordination among regional management, marine management, and cross-regional management. The UK had up until that point been unable to form an overall maritime and coastal area management policy [1]. In 2002, the British government promulgated the Marine Stewardship Report, under the theme of realizing their vision for the marine environment. The Report clearly stated that the United Kingdom needed a new method for managing the entirety of marine activities; it also needed to pass legislation to ensure that the method could be implemented correctly. In 2009, in order to achieve the sustainable development of the marine environment and ocean economy, the UK reiterated its vision for the marine environment as "clean, healthy, safe, productive and biologically diverse oceans and seas." In the same year, the Marine and Coastal Access Act 2009 was approved and brought into effect. The Act covers all aspects of marine management development and protection, and establishes a comprehensive marine management structure so as to better respond to the challenges of marine governance in the future. In the following, this article will introduce the major agencies of marine management in the UK as well as their main functions, including Marine Management Organization, Department of Energy & Climate Change, and Maritime and Coastguard Agency.

The Marine Management Organization (MMO)

The UK Marine and Coastal Access Act contains 11 sections (Figure 1): The Marine Management Organization (MMO); Exclusive Economic Zone, UK Marine Area and Welsh Zone; Marine Planning; Marine Licensing; Nature Conservation; Management of Inshore Fisheries; Fisheries; Enforcement; Coastal Access; Miscellaneous; Supplementary Provisions [2]. In terms of marine management, the Act introduces a new system of marine management, including an overall marine planning system for achieving the British government's marine environment strategic goals as well as specific marine development plans to be adopted for the governance of various sea areas [3]. Looking to solve issues of decentralized marine management, the British government established an independent marine

management agency under its Department for Environment, Food and Rural Affairs (DEFRA) in accordance with the UK Marine and Coastal Access Act in 2010. That agency is the MMO. It also provided that the MMO is a specialized unit under the British government that performs a number of marine protection functions, with the goal of achieving the sustainable development of British oceans.

Before the establishment of the MMO, the various responsibilities of marine management and marine development planning in the UK were taken up or supported by separate units, such as the Department of Energy; Department of Trade and Industry; Ministry of Defense; DEFRA; Ministry of Agriculture, Fisheries and Food; Department of Science and Education; Engineering and Physical Sciences Research Council (EPSRC); and Natural Capital Committee. There was no coordinating agency or organization expressly responsible for marine management and development. The establishment of the MMO could effectively solve diverse problems stemming from: unclear division of management responsibilities among various agencies which were scattered across various management systems; decentralized systems of law enforcement; and lack of effective organization in marine development andutilization. More importantly, after the establishment of the MMO, the departments or organizations which had previously taken responsibility for marine management and development in the UK were not made completely defunct, but rather comprehensively managed by the MMO, which maintains close cooperation and contact with previous agencies and promotes coordination and cooperation among various ministries, thus avoiding the emergence of management with "too many managers" [4][5].

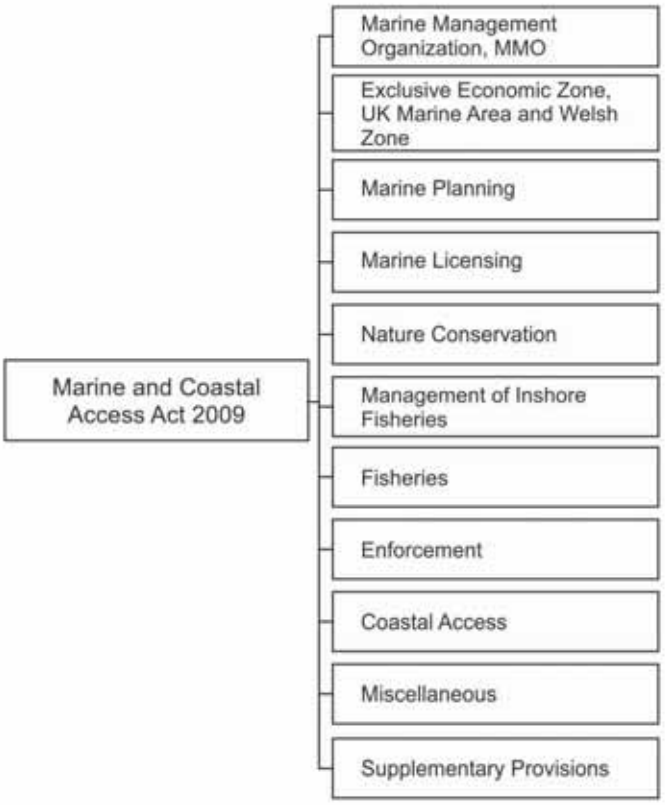

Figure 1/ The structure of the UK Marine and Coastal Access Act
Source/ [2]

According to the Marine and Coastal Access Act, the MMO is responsible for reforming marine and coastal zone management, including the establishment of planning policies, marine fishery management and resource conservation, nature conservation, marine planning, and the production and installation of renewable energy. The responsibilities of the MMO also include the management of the European Maritime and Fisheries Fund, port control, marine fisheries, maritime permits, oil spills, wildlife and habitat conservation, fishing vessel permits, and many other matters related to marine utilization. Among which, marine planning is of highest importance. The Marine and Coastal Access Act introduces the concept of marine planning for sea area management, which the British government uses to guide or influence decision-making on the utilization of sea areas. Therefore, the many activities already carried out at sea as well as new types of maritime activities all require authorization or permits. For example, this includes: Coastal and marine development, offshore wind farm installation, wave and tidal energy development, and marine dredging [6].

When the MMO began to develop marine planning, it would use data on the sea area space, its use, and other data, and constantly review such use. Facilitated by this process, a marine planning database was established. The database contains: Results of the evaluation of characteristics of each sea area, available and required data, interactions among various maritime activities, current use of each sea area as well as the emerging and future use, and future plans for sea area development. Spatial analysis and planning for sea areas can identify known and common conflicts in use among various marine activities, which then allow the MMO to use marine planning to design and provide the most suitable management plan [7]. When the plan is subsequently adopted, the MMO continues to monitor its implementation results. It reviews the implementation of various plans every 3 years and modifies or replaces certain plans when necessary. When modification or replacement is warranted, the MMO also follows a standard procedure—scoping, planning, preparation and evaluation, consultation, modification and execution (Figure 2). Over the past 10 years, the MMO has developed a reliant framework for marine planning, permits, and regulation, one that can maintain the sustainable development of the British marine environment and ocean economy. After re-examining its management responsibilities, the MMO now hopes to achieve the following goals by 2030 [8]:

- Realize sustainable ocean development
- Provide opportunities for sustainable fishing
- Conserve marine habitats and wildlife
- Manage maritime funding
- Provide regulatory support and assurance
- Support global ocean protection

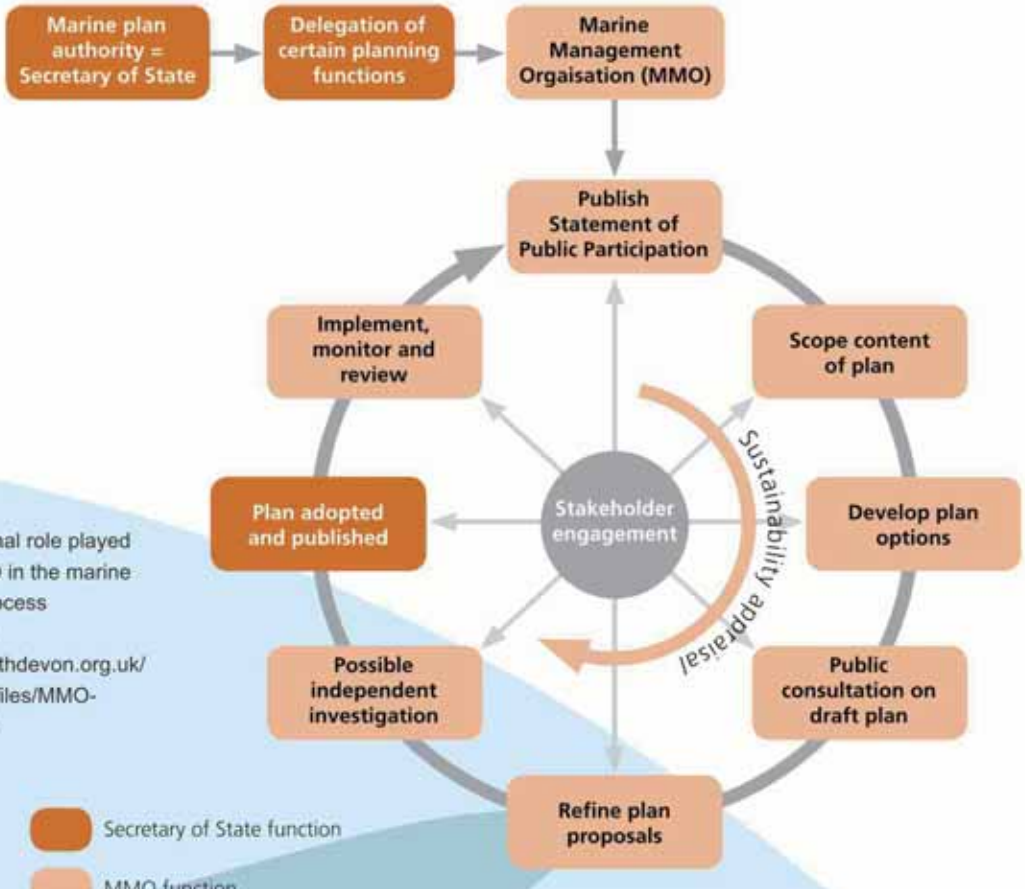

Figure 2/ The functional role played by the MMO in the marine planning process
Source/ https://www.coastwisenorthdevon.org.uk/sites/default/files/MMO-brochure.pdf

Department of Energy & Climate Change (DECC)

In order to adapt to climate change, the British Parliament passed the Climate Change Act in November 2008, the first such act in the world, thereby setting a legally binding target for reducing greenhouse gas emissions. For the reduction of GHG emissions - taking 1990-level emissions as its baseline, the UK will reduce GHG emissions to a level 80% lower than that of 1990 by 2050. The passing of the Climate Change Act was regarded as a historic step, and has received widespread support from politicians and leaders, media, environmentalists, trade unions, and businesses. The Climate Change Act has since taken its place in the core leadership role for climate change [9].

The Climate Change Act provides two innovations on the institutional level: The establishment of the Committee on Climate Change and the Department of Energy & Climate Change (DECC). The Committee on Climate Change is an independent, non-governmental organization composed of experts. Its main function is to provide professional advice addressing climate change issues to the British government and Parliament. The Committee makes recommendations on the UK's Carbon Budget and regularly reports to Parliament on progress in reducing GHG emissions [9]. The DECC was founded in 2008 "to make sure the UK has secure, clean, affordable energy supplies and promote international action to mitigate climate change" [10]. To this end, the British government has combined the UK's energy policy (previously the responsibility of the Department for Business, Enterprise and Regulatory Reform, BERR) and climate change mitigation policy (previously the responsibility of the DEFRA) and handed it over to the DECC. First, the DECC proposes policies for climate change response based on two major goals, and makes legislation to regulate renewable and non-renewable energies in the UK (the Petroleum Act of 1998; Energy Act of 2008, 2010, and 2011; and the Climate Change Act of 2008). Its actual efforts reflect the fact that climate change and energy policy are inseparable. In addition, the DECC also retains its responsibility for permitting, exploration, and supervision of various oil and gas developments on the British continental shelf [4].

Maritime and Coastguard Agency (MCA)

The Maritime and Coastguard Agency (MCA) is an executive agency under the Department for Transport (DfT). Its vision is to become the world's preeminent maritime safety organization, to promote a safer life, safer ships, and cleaner oceans for the UK. The main role of the MCA is to prevent loss of life and property on the coast and at sea, to formulate regulations and guidelines for maritime affairs, and to provide various certifications for seafarers. The MCA plays an important role in the safety and maintenance of the marine environment throughout the United Kingdom; it is committed to achieving the DfT's goals, namely promoting opportunities for economic growth and development as well as improving the maritime navigation environment to provide a safe, reliable, and sustainable transportation process with higher efficiency. Its main work includes [11]:

- Formulating regulations and guidelines; providing certification for ships and seafarers. The MCA, using its investigation and inspection system, is able to realize ship safety, ensure safety, prevent pollution, and provide for the health, safety and welfare of mariners.
- MCA provides a national 24-hour maritime and coastal search and rescue (SAR) emergency response service for the entirety of the United Kingdom.
- Improve maritime safety, promote economic growth, and minimize the impact of the maritime sector on the environment by joint cooperation with strategic partners (the National Strategy for Maritime Security and the UK Ship Register).

In 2020, the MCA submitted an internal plan (The Big Three) that outlines the main goals to be achieved over the following three years. These three main goals cover three major themes [11]:

- **Safety and sustainability:** Work with partners to improve maritime safety, mitigate environmental impact, and reduce the number of deaths in coastal areas.
- **Maritime growth:** Provide higher quality services to enhance the reputation of British maritime services; attract more clients to the UK Ship Register and other maritime agencies.
- **Maritime innovation:** Enable the UK to take the lead in the field of maritime innovation through cooperation with industry, governmental departments, and academia, and development and utilization of new methods, opportunities and technologies.

Conclusions

Since 1999, the British government has developed its marine and coastal management policy into a nationally integrated management structure. The national level of maritime planning and formulation of marine protected areas showcases the successful transformation of British marine and coastal area management policy into a national-level framework that covers planning and overall marine management, and this is especially true after the promulgation of the Marine and Coastal Access Act. Similarly, the British government recognizes that stakeholders and organizations have their own important roles to play in the decision-making process of various marine affairs management policies. Legislation can provide solid and robust legal support to the overseeing authorities. The DECC established by the Climate Change Act is one clear example. The British government has handed over the energy policy and climate change mitigation policies, both of which inextricably linked to the issue of climate change, to the DECC, and has introduced a holistic climate change response strategy. A holistic and comprehensive marine management structure indicates the management of various maritime affairs issues. However, looking from the perspective of its marine management structure, it is impossible for a single agency to take responsibility for the overall management of maritime affairs, especially at the national level. Therefore, it is imperative that various maritime affairs issues and activities be supervised by respective governmental departments. Special laws and specialized agencies are required for overseeing the work toward certain goals as well as the coordination and cooperation among key agencies. In such a way, the management of Taiwan's marine environment and maritime affairs may be accomplished.

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Promotion of the Blue Belt Programme in UK Overseas Territories and Ocean Monitoring Technology

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Keywords: United Kingdom, Blue Belt Programme, Monitoring

In the 19th century, the UK government was known as the "the Empire on which the sun never sets". Today, it still possesses 14 territories outside of the UK, which are called UK Overseas Territories [1]. The geographic scope of these overseas territories spans across the Pacific, Atlantic, Antarctic, and Indian oceans, from the tropics to the Antarctic Circle. They are sparsely populated and are rich in marine resources. The total area of Marine Protected Areas (MPAs) of the UK Overseas Territories exceeds 4 million km^2, which is equivalent to 17 times the size of the United Kingdom or about 1% of the Earth's oceans. However, these overseas territories have very small populations, they are in Exclusive Economic Zones (EEZs) that are subject to Illegal, Unreported and Unregulated (IUU) fisheries, and face issues related to global climate change, so they are in urgently need of support in the form of external resources and human resources. Responding to such concerns, the UK government declared that it would provide long-term support, and planned to connect the sea areas scattered throughout its overseas territories into a blue belt MPA that spans four oceans.

Figure 1/ Coral reef survey at Pitcairn Islands
Source/ GOV.UK
https://marinescience.blog.gov.uk/tag/blue-belt-programme/

UK Blue Belt Programme

The UK government has invested more than 20 million pounds (approximately NT$790 million) in combining the scientific research capabilities of the Centre for Environment, Fisheries and Aquaculture Science (Cefas) with the surveillance and enforcement capacity of the Marine Management Organization (MMO). It also cooperates with external academic units, NGOs, and stakeholders in the 7 participating UK Overseas Territories (1 in the Pacific Ocean, 1 in the Indian Ocean, 4 in the Atlantic Ocean, and 1 in the Antarctic). The Blue Belt Programme was implemented for the first time over a period of 5 years (2016–2020), with the claim of being the world's largest marine conservation project.

Table 1/ The 7 UK Overseas Territories participating in the Blue Belt Programme

Name	Geographic location	Area of territory	Permanent inhabitants	Unique biological resources
Pitcairn Islands	South Pacific	47km^2	54	Pristine coral atolls, important breeding grounds for seabirds and humpback whales
British Antarctic Territory (Not internationally recognized)	Antarctic Circle	1.7 million km^2	0	Important habitat for penguins
South Georgia & the South Sandwich Islands (SGSSI)	South Atlantic	3,755km^2	0	Important habitat for penguins and migratory cetaceans
Tristan da Cunha	South Atlantic	98km^2	261	Important habitat for seabirds, endemic species, lobster export industry
St Helena	South Atlantic	122km^2	4,000	Oceanic migration routes for sea turtles and cetaceans, and endemic species of butterfly fish
Ascension Island	South Atlantic	90km^2	873	Important habitat for seabirds and sea turtles
British Indian Ocean Territory (BIOT)	Indian Ocean	60km^2	0	Marine biodiversity hotspot

Source/ GOV.UK [1][2]; organized for this paper

Figure 2/ The geographic scope of the UK Blue Belt Programme spans the Pacific, Atlantic, Antarctic, and Indian oceans
Source/ GOV.UK
https://www.gov.uk/guidance/the-blue-belt-programme

The Blue Belt Programme is promoted not only to assist UK Overseas Territories, but it is also a core leadership action of the UK government intended to address serious global ocean issues. They have demonstrated, using scientific investigations, the benefits of the Blue Belt Programme on such global ocean issues as over-fishing, species extinction, plastic pollution, and climate change. At the same time, the UK government has supported more than 4 million km^2 of MPAs in UK Overseas Territories, thereby demonstrating its commitment to protect at least 30% of the global ocean as MPAs by 2030.

Enhance management of MPAs in overseas territories

The goals of the Blue Belt Programme include improving scientific understanding of the marine environment; assisting in the development and implementation of evidence-based, tailored marine management strategies (including surveillance and enforcement); and providing support to ensure sustainable and long-term management. The following is a summary of the UK's strategy to strengthen MPAs in overseas territories:

I. Cooperating with scientific research institutes to conduct marine surveys of the South Atlantic

- In Tristan da Cunha and St Helena, two marine surveys were conducted, human resource training in UK Overseas Territories was completed during the 10,000 nautical voyage, and a 100,000 km^2 seabed map (including 12 seamounts) was drawn up.
- In SGSSI, two marine surveys were conducted, 4,000 photos and 30 hours of video were produced for research and analysis, 500 specimens were contributed to museum collections and used in the Darwin Tree of Life project.

II. Understanding and protecting biodiversity

- Participated in the organization and issuing of local Blue Belt Symposiums.
- Established models to predict where vulnerable habitats are located in MPAs.
- Applied the results of marine surveys, for instance: Seabed maps produced to improve MPA management plans.
- Provided a new vessel to Tristan da Cunha for inshore biodiversity monitoring, and their fisheries patrol vessel was refurbished.

III. Strengthening governance

- Supported local administrative departments in conducting the first 5-year retrospective review of the management of MPAs.
- Provided information on important habitats, important species, and their threats for the development of local marine protection strategies.
- To assist local council in the adoption of the most appropriate legislative model and implement policy analysis. Examples: Providing analysis, evidence, and advice to support the decision of the local council of Ascension Island to designate 100% of their EEZ as a MPA.
- Funded local counsel to help local authorities to produce the laws and regulations necessary for effectively manage and enforce laws in their waters.
- Supported the development of marine management and action plans to sustainably manage and monitor MPAs.

IV. Managing human impacts

- Supported the Maritime and Coastguard Agency (MCA) and the GB Non-Native Species Secretariat in cooperation with the overseas territories to understand the territories' capacity to respond to marine pollution emergencies and invasive species.
- Supported the St Helena government's development of strategies to manage human activities including marine tourism, water quality and sand extraction.
- Supported Pitcairn Islands development of a code of conduct for whale watching. Provided assistance to create a booklet and a leaflet to communicate the code of conduct to the local community and visitors and supported practical training for the community.
- Conducted water quality surveys around the BIOT, the results of which will help the BIOT manage human activities.

V. Supporting sustainable fisheries management

- Undertook the review of all aspects of local fishery development.
- Cooperate with scientists to develop satellite surveillance to support enforcement and explore alternative surveillance tools in the region.
- Procured and deployed camera systems on research and commercial fishing vessels to empirically manage the effectiveness of suggestions.

- Provided capacity building to staff from local fisheries departments, including vessel maintenance, sea survival techniques, compliance and enforcement, and data management.
- Supported the UK Overseas Territories to improve compliance with International Commission for the Conservation of Atlantic Tunas (ICCAT) measures, contributing valuable scientific evidence for the regional management of migratory species.
- Over 1,500 fish have been tagged and local staff have been trained in electronic tagging techniques to support ongoing monitoring.

VI. Supporting compliance and enforcement

- Dispatched maritime patrol officers to join patrols that span UK Overseas Territories.
- Developed a formal procedure for gathering and recording information on fishing vessel activities supporting compliance and enforcement.
- Provided on-island and online training to staff, such as: Providing training in compliance and enforcement for fisheries department staff and supporting the training of additional scientific observers to monitor fishing operations.
- Built St Helena's capacity by funding an on-island coordinator, a marine enforcement officer, a fisheries officer and a new laboratory which, once complete, can enable marine science studies and monitoring.
- Developed a Blue Belt surveillance and intelligence hub providing on going intelligence and live operational support during a multiagency operation which resulted in the interception, detention, and prosecution of vessels fishing illegally in the local area.
- Researched current and future technologies the territories may adopt or invest in to help identify illegal activities, such as: Applying satellite imagery over an area of more than 142 million km^2 to conduct risk management for target surveillance activities; conducted unmanned aerial vehicle (UAVs) tests to improve effectiveness in supporting on-site patrols and identifying illegal fishing vessels.

Ocean monitoring technology applications

The UK Overseas Territories are both extremely remote and vast in their extent. In order to achieve monitoring and management, MMO and Cefas along with consultants published a review of the technology application review in 2019 [3]. That review includes existing technologies as well as emerging technologies that have been funded by the UK government and the European Union since 2005; it comprehensively applies multiple technologies to the territories in the Blue Belt Programme in accordance with the requirements of each territory. The ultimate goal of these technologies is to establish a maritime safety technology streaming system which can provide information for fishery management while also combating IUU fisheries and other illegal activities.

Existing technologies include aerial drones; passive acoustic monitoring; Unmanned Surface Vessels (USVs); biological genetic analysis; microchemical analysis using otolith or scales; morphometric analysis; stable isotope analysis; satellite telemetry; Automatic Identification System (AIS) analysis; ground/buoy based radar; Argo floats; and Modular Electronic Warfare System (MEWS) used to detect ship radar and high-frequency emissions.

In another aspect, the Blue Belt Programme cooperated with Blue Abacus in the use of Baited Remote Underwater Video Systems (BRUVS) [4]. Since it uses bait to attract migratory fish of epipelagic zone, it is similar in effect to a Fish Aggregation Device (FAD). Target species include shark, tuna, mahi mahi, and other fish. Most of these species belong to the top consumer food webs, and their global numbers are in decline. One advantage of the BRUVS is that it can collect data such as stock abundance without harming the fish. It also helps to improve the long-term lack of offshore fishery data in the EEZs of UK Overseas Territories.

The next phase of the UK Blue Belt Programme

The benefits of the UK Blue Belt Programme from 2016 to 2020 are still in effect in overseas territories. With the assistance of this programme, Tristan da Cunha officially released a five-year marine management plan in September 2021 [5] and signed an agreement for the establishment of the largest MPA in the Atlantic Ocean, thus setting a milestone for local marine environmental management. Under the group initiative, the UK government is calling on new UK Overseas Territories to join. It will continue to cooperate with UK Overseas Territories, external academic institutions, NGOs, and stakeholders to support the implementation of current management plans, surveillance, as well as regulations and law enforcement. In addition, by supporting infrastructure and human resource training and building capabilities and technologies in UK Overseas Territories to enable long-term implementation of the Programme, it can ensure that the highly biodiverse and unique, pristine marine environments can be maintained and protected. At the same time, it showcases the effectiveness of the integrated management system in existing MPAs.

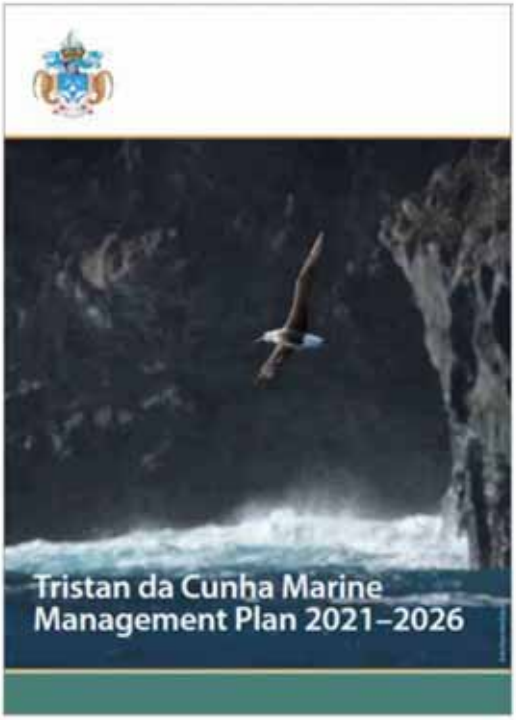

Figure 3/ Tristan da Cunha announces its 5-year ocean management plan
Source/ Tristan da Cunha Government & Tristan da Cunha Association
https://www.tristandc.com/wildlife/news-2021-09-21-mmp.php

Conclusions

According to statistics up to May 2021 from the Ocean Conservation Administration, there are 46 MPAs in Taiwan covering a total area of about 5,264 km^2, of which 8.17% are in Taiwanese territorial waters [6]. Among them, one protected area distant from the main island of Taiwan and which is not easily accessible is part of the Dongsha Marine National Park. As for Nansha Taiping Island, located south of Taiwan, the National Academy of Marine Research (NAMR) cooperated with the Biodiversity Research Center of the Academia Sinica this year to survey coral reefs and sea turtles; it also plans to build a marine research station on Nansha Taiping Island in the future. By learning from the experience of the UK Blue Belt Programme, NAMR will strengthen the surveying and research of marine biodiversity to provide a scientific basis for the support of management practices and enhancement of enforcement, thereby ensuring the sustainability of the pristine, unique, and diverse marine environment of the Taiwanese territorial waters in the South China Sea.

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Introduction to the Management of Marine Activities—Management of Marine Non-licensable Activities in England

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Translated by Linguitronics
Keyword: Marine non-licensable activities, maritime permit exemption system, marine management organizations

The Marine Management Organization (MMO) is a non-governmental public executive body responsible for the protection and management of waters in England. It is invested with the power to formulate regulations and marine planning policies. In England, Marine Protected Area (MPA), Marine Conservation Zones (MCZ), Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPA), and Special Areas of Conservation (SAC) that do not require maritime licenses for beach recreational and water activities are directly or indirectly regulated and managed to achieve the protection of MPAs. This article mainly introduces the Management of Marine Non-licensable Activities in England, and content of which includes management of water sports activities, for instance on-shore beach recreation and bait collection for recreational sea fishing, as well as activities involving sailing and motorboats. (The content of this article is mainly derived from the Management of Marine Non-Licensable Activities in England [1].)

Legal Development

In 2009, the British Parliament formulated the Marine and Coastal Access Act, 2009, and established the Marine Management Organization (MMO). To conduct maritime activities in sea areas and rivers below the high tide line and within areas affected by the tides, the person in question needs to apply for a marine license from the MMO. However, maritime activities that have little impact on the environment or are temporary can be exempted on the basis of Marine Licensing Exempted Activities [2]; such activities can be exempted by filing in advance provided that they meet the relevant qualification standards.

Regarding the overlapping of powers between the MMO and other management departments in regulating and managing marine non-licensable activities, the formulation of the Management of Marine Non-licensable Activities in England provides an explanation on the scope of powers of the MMO. Better control principles are used to manage the coast and activities to reduce the burden of regulations, especially to avoid unnecessary overlapping of management rules.

Introduction to the Key Agencies that Manage Beach Recreation and Water Activities in England

I. Inshore Fisheries and Conservation Authorities (IFCA)
Article 155 of the Marine and Coastal Access Act empowers the IFCA to formulate territorial marine regulations on the development of fishery resources, including recreational fishing activities such as sea angling and digging for bait.

II. Harbour Authorities
Most harbour authorities only formulate regulations for ship navigation; however, based on the powers and objectives of conservation management, the harbour authority can delimit the harbour's restricted navigational area in accordance with a Harbour Revision Order or Harbour Empowerment Order.

III. Local Authorities
On the basis of local methods—Alternative Procedure (England) 2016, local authorities such as the local councils and the London City Council have the right to formulate and modify "seashore" laws and regulations, including those regulating seashore activities and dog walking on beaches. Unless otherwise specified, local competent authorities are required to make decisions on whether to authorize or enforce decisions on land-based activities above the low-tide line in accordance with appropriate ocean policies, such as the Marine Planning or the Marine Policy Statement.

IV. Marine Management Organization (MMO)
The MMO formulates marine conservation management regulations in accordance with the law to promote the conservation goals of MCZ in England. Including "prohibition or restriction of personnel entry to a site," "movement or other activity," "prohibition or restriction of any ship's mooring or anchoring" within MCZs; and when the site is in urgent need of protection, formulate emergency and temporary management regulations. In order to protect European Marine Sites (EMS) as sites containing animals, plants and habitats that are considered rare, special or threatened, the MMO has established SAC and SPA to protect important bird species.

V. Statutory Nature Conservation Bodies
Natural England is an adviser for the natural environment established by the British government. It has the power to formulate regulations for the intertidal zones of SSSIs and National Nature Reserves (NNRs). In addition, a Special Nature Conservation Order (SNCO) to protect the natural environment can be requested from the British Home Secretary. After the order takes effect, legally effective "stop notices" are issued on behalf of the government declaring that certain activities are not allowed.

British Beach Recreational and Water Activities Management Strategy

The following three management strategies are summarized from the Managing Marine Recreational Activities: a Review of Evidence (NECR242):

I. On-site access management
- designate areas for particular (fixed) activities.
- provision of designated access points and locations.

II. Education and communication with the public and site users
- using signs, interpretation and leaflets (guides) to convey management strategies and legal norms.
- implement and practice voluntary codes of conduct.
- managing (wardening).
- provide off-site education/information to local clubs/training centres and/or residents.

III. Legal enforcement
- byelaws which can be created by a range of bodies including regulators, local authorities and landowners.
- permitting or licence conditions.

MMO Exclusive Management of Marine Non-licensable Activities

MMO Exclusive Jurisdiction of Marine Non-licensable Activities include: "Walking and dog walking," "motorised and non-motorised vehicles for land-based activities," "general beach leisure and recreational activities," "observing wildlife from shore," "coasteering," and "bait collection." However, many seaside activities are currently managed by their respective competent authorities. The MMO suggests that activities be managed in a way that does not add to the number of management levels, so as to reduce the overlapping of management between ocean management organizations and other competent authorities.

I. Walking and dog walking
Public Spaces Protection Orders (PSPOs) give local authorities and land owners the power to manage walking and dog-walking activities in coastal or intertidal zones under their jurisdiction; the authorities and owners have the obligation to inform the public of the content of such protection orders and the penalties for violation.

II. Motorised and non-motorised vehicles for land-based activities
Land vehicles used for beach activities, include: motorised four-wheeled all-terrain vehicles (ATV), light utility vehicles (LUV), off-road modified two-wheeled street vehicles or four-wheeled motorhomes, and non-motorised, land-based, off-road vehicles powered by sails or kites and kite skateboards.

According to the Road Traffic Act (1988), motorised vehicles are not allowed to drive in coastal areas; and land-based vehicles powered by sails must drive on wide sandy beaches with flat, planned routes. The national management organization KiteSports manages all kite-powered sports in England; and the private organization British Landsailing (BFSLYC) is an advisory body for onshore sailing activities. Both of these organizations formulate safety codes of conduct and operating specifications for land-based vehicles powered by sails. They include restrictions on the scope of activity and time and season of activity. Club members must comply with ecological protection measures and conduct non-motorised land-sailing and kite off-roading activities under the supervision and management of their respective clubs.

III. General beach leisure and recreational activities
General beach leisure and recreational activities as defined in this article refer to beach games, walking, sunbathing, tide pool exploration, and swimming at the seashore, most of which are managed by local competent authorities and environmental non-governmental bodies by the use of notice boards and signs to prevent stepping on sand dunes or marking of ecologically sensitive areas. Publicity publications (publicity leaflets) are used to publicize and encourage administrators and volunteers to abide by codes of conduct, so as to reduce the impact of activities on marine and coastal environment and wildlife.

IV. Observation of wildlife from shore
This refers to observing a series of marine species such as marine mammals, basking sharks, and birds from the land. There is currently no government agency in England regulating commercial wildlife observation activities. Examples of management cases: Although Winterton-Horsey Dunes SSSI is not designated for the protection of seals, it is a model case of wildlife observation from shore. The "Seal Keeper Project" initiated by the cooperation of several public and private organizations encourages tourists to respect the voluntary closure of beaches from November to January each year and to protect the gray seal population from public interference. A warden team composed of 100 volunteers provides

guidance on seal observation on site and on the Internet, and promotes the Countryside Code and Photographers' Code of Practice. It teaches on-site visitors how to carry out seal counting and additional monitoring and investigation work, thus enhancing visitors' ability to understand and observe gray seals. It also implements beach cleaning activities after the tourist season in preparation for the seal breeding season.

V. Coasteering

Coasteering is an adventure exploration activity that traverses the intertidal zone, sub-tidal zone, and the coastal area. The activity culminates in climbing, walking, swimming, or diving, and is done without the aid of boats, surfboards, or other large buoys. There is currently no government agency managing coasteering activities in England. The National Coasteering Charter (NCC) is a coasteering consulting organization that provides experience and activity guides for coasteering. A voluntary agreement has been signed with the British Mountaineering Council to manage coasteering activities to prevent coasteering activities from disturbing seabirds and seals during sensitive periods.

VI. Bait collection

In England, bait collection activities are classified as marine fishery resources and fall under the jurisdiction of the Inshore Fisheries and Conservation Authority. Natural England is responsible for the management of bait collection activities in SSSIs and NNRs. Digging for bait is defined as "fishing", and fishing activities require a license issued by the competent authority. Although England has listed this activity as a beach recreational and water activity that does not require a license, the management and legal restrictions on bait digging may still differ with each local authority.

Bait collection activities are managed in the following four primary directions:

- Prohibition of all bait collection activities.
- Authorization and assessment: Prohibition of bait collection activities that have not been authorized or pre-assessed.
- Restrictions on the total amount: the total amount of marine segmented worms (Annelida) collected is restricted to 1 kg/day.
- Set up special collection areas: anglers can collect bait for their own use, but are prohibited from reselling collected bait.

Conclusions

Driven by the British government's goals for "clean," "healthy," "safe," "productive," and "biodiverse" oceans, the Management of Marine Non-licensable Activities in England is used to reduce the overlapping of ocean management among the MMO and other competent authorities. It aims to achieve the protection and improvement of the marine environment without adding to the number of management levels. And through the management mechanisms and strategies of "on-site access management," "education and communication with the public and site users," and "legal enforcement," it endeavors to achieve sustainable marine activities and development, and to protect the fragile habitats and species in British waters.

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