

國際海洋資訊

International Ocean Information

11

April 2021

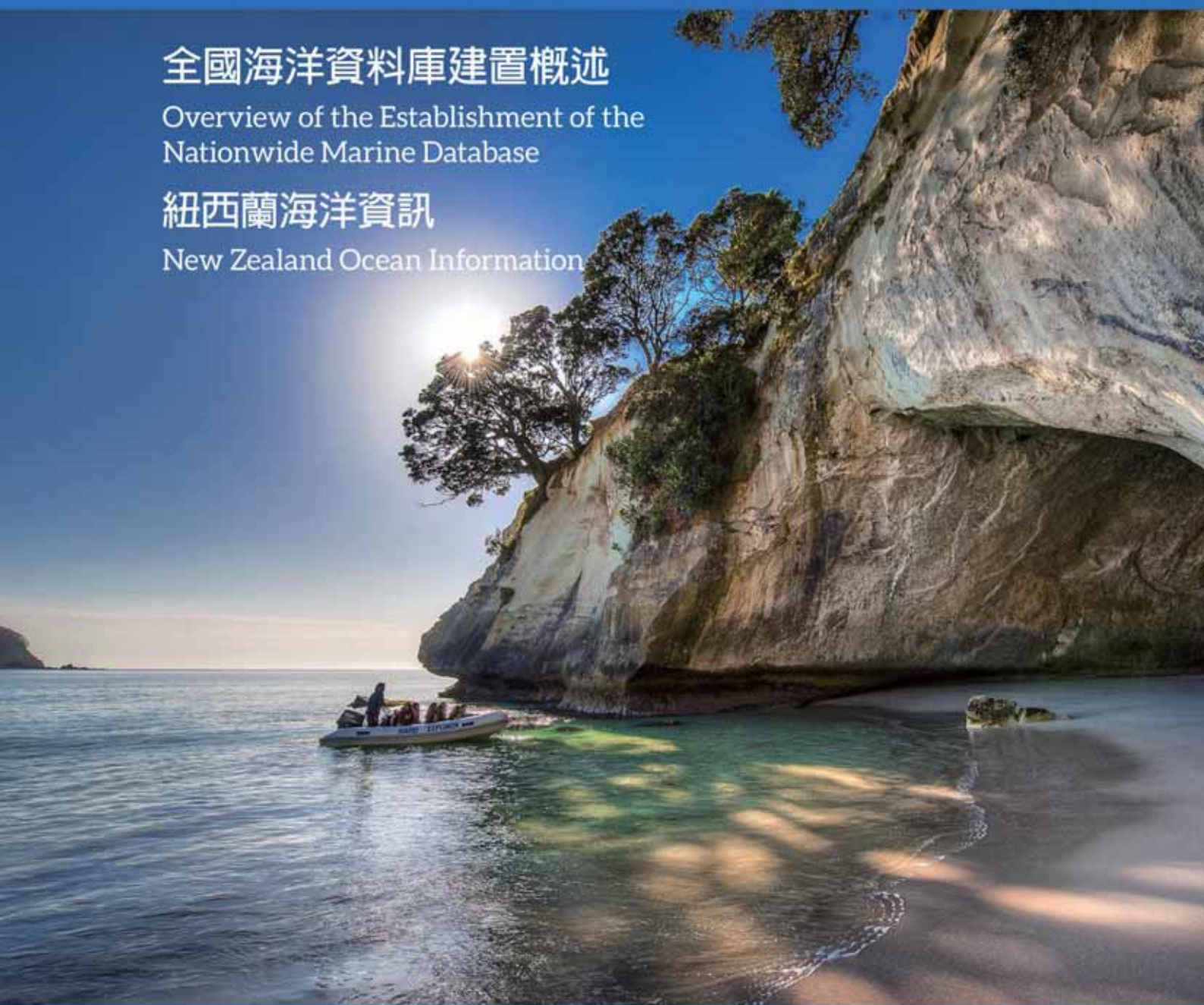
雙月刊 | Bimonthly

全國海洋資料庫建置概述

Overview of the Establishment of the
Nationwide Marine Database

紐西蘭海洋資訊

New Zealand Ocean Information



海洋委員會
Ocean Affairs Council

發行



目錄 Contents

發行人語	開發海洋資訊力 走向海洋科學新未來	01
專題報導	全國海洋資料庫建置概述	02
國際議題	2020年全球海洋科學報告：開拓研究能量 邁向海洋永續	07
產業動態	紐西蘭賞鯨業之制度規範	12
組織焦點	紐西蘭環境部及其國家海洋政策	17
資訊新知	窒息、纏困、溺水的海洋生物：美國非營利組織OCEANA發布之 塑膠危機報告	22
法規制度	紐西蘭毛利族之海洋文化與法律保障	27
Letter of Publisher	Developing Marine Information Power and Moving Towards a New Future Informed by Marine Science	31
Special Report	Overview of the Establishment of the Nationwide Marine Database	32
International Issues	Global Ocean Science Report 2020: Charting Capacity for Ocean Sustainability	37
Industry Dynamics	Systems and Regulations of New Zealand's Whale Watching Industry	42
Organization Focus	New Zealand's Ministry for the Environment and its National Ocean Policy	47
Latest News	Choking, Strangling, and Drowning Marine Creatures: The Plastic Crisis Report Issued by U.S. Non-Profit OCEANA	52
Regulatory Systems	Marine Culture and Legal Protection of New Zealand's Maori People	57



主任委員：李仲威

開發海洋資訊力 走向海洋科學新未來

位於水半球中心的紐西蘭，以初級產業為主要經濟來源，境內原住民毛利族以海洋為生活核心，其海洋政策與制度發展悠久，也是本期的主題國家。在「組織焦點」單元介紹紐西蘭環境部與保育部在海洋環境、自然資源方面的政策及法規；「產業動態」則介紹紐西蘭賞鯨業的發展背景與制度規範，包括賞鯨準則、船隻與鯨豚互動規範等制度，也建立更為永續的產業生態；「法規制度」說明紐西蘭毛利族之海洋文化與法律保障，對我國在原住民族的海洋文化保存與制度保障方面，亦可供參考。

另外，全球也逐漸重視海洋科學以及資訊彙整公開的議題。聯合國2020年發布《全球海洋科學報告》，在海洋科學人力、知識和應用、資料管理與公開取得、科學投資以及疫情影響等方面提供最新資訊；海洋保護組織Oceana則公布「窒息、纏困與溺水」的海洋塑膠垃圾報告，彙整2009年至2020年的政府及民間組織資料，發現美國受塑膠垃圾危害的海洋動物有近9成為受到威脅或瀕危之物種，也提醒政府及企業應正視塑膠垃圾危機；而我國在《國家海洋政策白皮書》中提及海洋資訊面臨缺乏整體規劃、資料品管與協調統合等機制之問題，國家海洋研究院參考國內外海洋資料庫，跨出建置「全國海洋資料庫」的一步，目前已介接97個資料庫。國內外在海洋科學與資訊方面，皆已朝向整體性、長期性發展，更重視資訊之公開，也更有益於海洋的永續發展！



圖說／紐西蘭礦山灣（Mine Bay）的毛利族岩雕

圖片來源／holgerheinze0 from Pixabay

<https://pixabay.com/photos/new-zealand-mural-maori-rock-water-583177/>

全國海洋資料庫建置概述

撰文／楊文昌（國家海洋研究院海洋科學及資訊研究中心研究員）

關鍵字／資料庫、資料標準化、海洋資訊網

無論是從生態、環境、資源、能源或災防的角度，都顯示出海洋對於臺灣永續發展的重要性。為了能持續享有海洋所提供的各種豐厚資源，在努力開發及運用海洋資源的同時，必須考量到應盡可能的維護海洋環境，使其保有健全的生態系。有鑑於此，從科學的觀點獲得並且活用海洋相關知識，瞭解海洋的綜合性和複雜性，從更高的觀點重新思考海洋的利用，進而能獲致環境保護與調和，即是目前建置全國海洋資料庫所期望達到的效益。

在海洋委員會所提出的2020《國家海洋政策白皮書》（National Ocean Policy White Paper）[1]中，有關「海洋科研與技術發展」的課題中，已提到海洋資訊的發展面臨的議題可歸納包括：

一、海氣象觀測缺乏整體性規劃

國內諸多海洋相關資料分別建置不同單位自有資料庫中，使得觀測資料散落及缺乏整體性規劃，造成無法將海氣象及近海觀測相關資料詳實整合並進行分析與應用。

二、缺乏科研資料品質管與跨域人才參與

海洋觀測資料之品質保證與管制，須仰賴不同海洋科學與工程領域人才之投入。透過專家協助長期維護國家海洋資訊系統，可達到共享平臺與資訊服務的目標。

三、資料庫分散缺乏協調統合機制

目前部分資料庫因計畫結束，無經費持續支持，以致後續發展中斷，加上缺乏協調統合機制，使得各類資料缺乏加值應用成果，無法展現多元資料監測價值。因此各界期待建立國家海洋資訊系統及共享平臺，管理海洋觀測基本資料與科技研發成果，避免經費中斷或資源重複投入之問題。

四、缺乏長期性觀測機制

長期觀測海洋資料，始能確實掌握過去、現在、未來有關海洋環境狀況的數據，將海洋環境數據發展演繹成為業務化的產品網路，以提供大眾對我們所共同居住的地球海洋環境有所瞭解，同時提供各產業進行海洋資源開發及環境影響評估使用。

據此論點分析，《國家海洋政策白皮書》中亦提出4項的具體措施：1.有效規劃資料庫，促進海洋資訊之整合與交流；2.建置國家海洋資訊系統；3.加深國際合作與資訊交流；4.建立人員培訓制度，普及海洋科研運用。

綜整前述，不論是議題論述與具體措施均與海洋資料庫的建置息息相關；反觀我國目前對於海洋觀測及海洋研究相關資料的確分散於政府部門、學術機構與研究單位等地，以致相關資料無法整體性地有效利用。國家海洋研究院（以下簡稱國海院）為海洋委員會之智囊機構，具有執行海洋政策的能

量，為整合各機關（構）之海洋資料，建構完整的海洋大數據資料收集與整合，以充分發揮科研資源整合效益，故而建置「全國海洋資料庫」。藉此進而可應用於海洋發展規劃、海洋政策、海洋空間規劃、環境生態維護、海域安全救難、防災及救災、建立環境保育機制等各層面的功效。

國內外海洋資料庫概述

為了營建國內海洋資訊整合供應環境，有必要對國內相關的海洋資料庫進行盤點，同時，為了建置具前瞻與完整的海洋資訊，參考國外海洋資料庫亦有其必要。基此，在建置全國海洋資料庫之當時，參考並瞭解許多國內外相關的海洋資料庫，如表1所示陳列其中數個國內外的海洋資料庫[2-11]，稍加描述其資料特性與資訊平臺。

表1／國內外數個海洋相關資料庫之概略描述

資料庫	資料特性	資訊平臺
中央氣象局	全國海氣象觀測、衛星遙感測報、數值模擬預報、和長期統計等各種與民生、災變、氣候變遷等密切相關的巨量資料。	1.氣象資料開放平臺 2.觀測資料查詢（CODIS） 3.天氣數值預報平臺
水利署	水利署以水資源管理、防災、防汛為目的建置一系列水文觀測站網，例如雨量、河川水位流量，其中與海洋較為相關的部分為氣象潮位站及浮標站。	1.水利資料整合雲平臺 2.水利地理資訊服務平臺 3.水文資訊網
科技部海洋學門資料庫（Ocean Data Bank, ODB）	彙整國內各研究船（海研一、二、三號以及水試一號）之探測資料，並將歷年的海洋研究成果系統性地分析、整理與展示，支援全國各界海洋研究所需之資料查詢與資料提供，資料項目包括有水文、海流、水深、震測等。	1.互動式「海的」資料展示平臺（ODB Hidy Viewer） 2.生物海洋資料庫（ODB BioQuery）
台灣海洋科技研究中心（TORI）的海洋環境資料庫（MED）	資料包括：船測水文、生地化資料、地質地形資料、CTD溫度與鹽度；衛星遙測影像、水溫、水色、表面鹽度與風場等；表面海流、氣壓、氣溫資料；浮標資料、數值模擬資料。	1.船測資料平臺 2.TOROS資料平臺 3.遙測資料平臺 4.錨碇觀測網
美國國家海洋暨大氣總署（NOAA）	提供天氣、氣候、海岸與海洋、漁業、衛星、航空氣象（颶風）、保育與教育普羅資訊，資料包括：衛星影像、大氣資料（氣溫、氣壓、風速等）、海洋資料（如CTD溫度與鹽度、地形等）、浮標資料、其他專案資料。	1.美國國家海洋資料中心（NCDC） 2.美國國家環境資訊中心（NCEI）
泛歐聯盟組織的海洋數據網（SeaDataNet）	涵蓋的資料項目除了一般的海洋生地化與水文參數外，還包括如水下影像、聲學、光學特性、地熱、冰圖、浮游生物或細菌等生物相關資料。	1.海洋數據雲端服務（SeaDataCloud） 2.詮釋資料服務（Metadata Services）
澳大利亞的海洋資訊網（AODN, Australian Ocean Data Network）	資料分4大類：生物環境：葉綠素、營養鹽、色素、生物相等；海洋化學：酸鹼度、二氧化碳、溶氧資料；海洋物理：聲學、聲納回波、光學特性、海氣交換通量、溫度、鹽度、密度、海表高、濁度、水壓、海流、波浪、地形等資料；大氣物理：包含氣溫、氣壓、濕度、蒸氣壓、紫外線、風速等資料。	1.整合海洋觀測平臺（IMOS） 2.詮釋資料平臺 3.資料工具與服務平臺 4.資料集交換平臺

資料出處／本文作者整理[2-11]

海洋資料庫規劃建置

海洋資料庫的建置除了有條理的結構化倉儲設計外，需搭配軟硬體的環境來支撐其營運與維護，使得資料的流通平臺於資料取得、儲存、與供應上能有完備且有效的機制。資料的標準化與詮釋對於資料的流通性與大數據的應用上，在資料蒐整的過程中是不可或缺的功課。海洋資訊網站的建置，係將資料活化成資訊，以利對資料的解讀與應用。資料開放係現今的趨勢，也才能顯現資料的價值，但在資料使用上必須遵循一定的規則，故而資料庫系統的資安防護有其必要性。綜整而言，一個完備的海洋資料庫的建置，必須配套的工作事項包括資料標準化、海洋資訊網站、資安防護，以及營運維護及擴充等，如圖1所示。

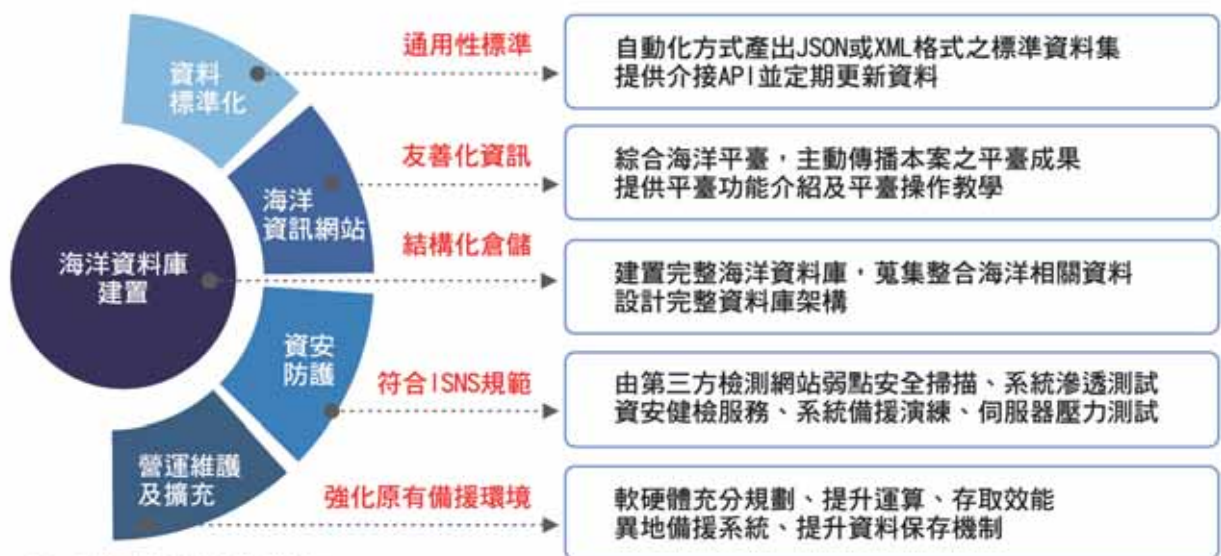


圖1/海洋資料庫系統建置概念圖

資料來源/國家海洋研究院(2020)[12]

全國海洋資料庫簡介

2020年國海院開始執行全國海洋資料庫建置計畫[12]，計畫的工作事項主要包括：資料庫營運環境的建置、資料庫倉儲架構的規劃、海洋資料的蒐整與標準化、詮釋資料的制定、資料庫的資安防護，以及海洋資訊網的建置等。歷經1年的期程已初步完成資料庫系統的型態，並已逐步收納散布於各部會、學研單位與民間機構的相關海洋資料。接續，分別述明過程中完成的事項。

全國海洋資料庫的營運環境區分成正式環境與備援環境，正式環境除了應用系統伺服器、圖資服務伺服器、資料庫伺服器外，在正式環境的前端設置有一臺反向代理伺服器作為資料使用者與其他應用系統實際與海洋資料庫連線的主機，並且負責前述伺服器連線的重新導向。備援環境的布設與正式環境類似，最主要的差異在於儲存裝置採用大容量的網路儲存裝置(NAS)儲存空間，而非正式環境的雲端儲存空間。

海洋資料種類繁多，依學術上來說可分成海洋物理、海洋化學、海洋生地化、海洋生物生態、地球物理等類別；另依觀測或探測的不同又可分為船測、錨定量測、陸基遙測、衛星遙測、測站取樣量測、浮標觀測、聲納系統探測等等。故而，在建置海洋資料庫時，以倉儲的概念，將資料分門別類，

架構結構化的倉儲來收納，使得資料的存取能夠依條理路徑迅速有效的運作。全國海洋資料庫的倉儲架構如圖2所示，依前置作業盤點國內的海洋資料庫的資料屬性，將資料庫區分成水文、生態與國土變遷3大主題倉儲，接續各主題倉儲再依資料的參數特性進行細分。水文分成海洋物理、海洋化學、環境與海氣象，生態分成生態調查記錄、物種解說、海洋保育及漁業，而國土變遷則分為地形、海洋地球物理及海洋地質鑽探；而在海洋資訊網中再以資料來源（如中央氣象局），加上測量儀器（如浮標）來執行圖層切換。過程中，經討論仍缺乏非生物資源的歸屬，故而亦預留該項主題倉儲的可能性。

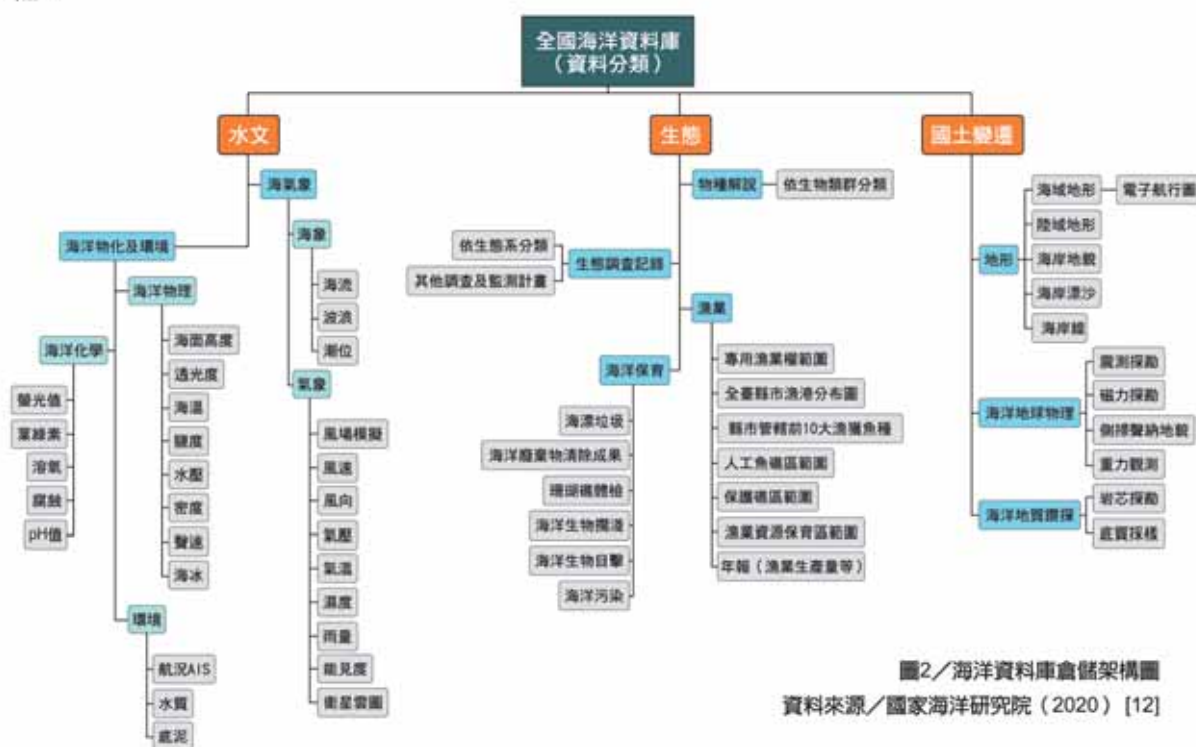
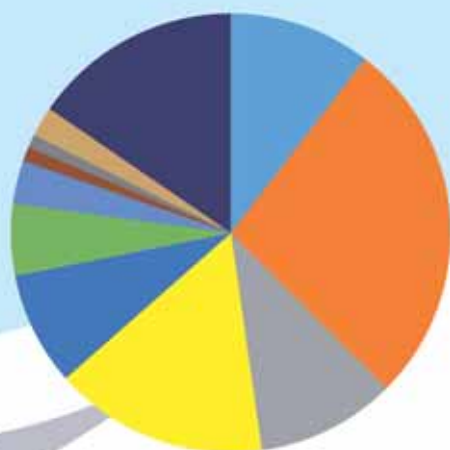


圖2/海洋資料庫倉儲架構圖

資料來源/國家海洋研究院 (2020) [12]

全國海洋資料庫目前已完成介接97個資料集，介接的單位主要來自政府單位、學研單位以及民間機構等。如圖3所示，係統計與各單位機構的介接情況，包括：海委會海保署與國海院、交通部中央氣象局與運研所港研中心、科技部海洋學門資料庫、農委會漁業署與水試所、經濟部水利署、地調所與能源局、內政部營建署與地政司、中央研究院、工業技術研究院、台灣海洋科技研究中心等。



資料庫介接清單與數量 (97個資料庫)

- 海委會 (10)
- 交通部 (26)
- 科技部 (10)
- 農委會 (15)
- 經濟部 (8)
- 內政部 (5)
- 中央研究院 (4)
- 工業技術研究院 (1)
- 臺灣海洋科技研究中心 (1)
- 中央大學太空及遙測研究中心 (2)
- 其他來源 (15)

圖3/全國海洋資料庫已收納海洋資料之統計圖

資料來源/國家海洋研究院 (2020) [12]

海洋資訊網建置的重要目的之一，便是完善未來海洋資料倉儲角色的資料流通機制，完成網站系統之實作上線，除了倉儲角色外，為了易於呈現收納之海洋資料與後續可能之運用成果，其展示方式係鏈結前述3大倉儲主題資料庫來進行呈現，並針對系統中重點之流通供應機制與後臺管理機制作詳細規劃建置。海洋資訊網規劃之系統整體架構概分成4層，包含來源端、儲存端、應用端及使用端。第1層來源端係整合及收納各機關之海洋資料；第2層儲存端係考量地理資訊系統（GIS）圖臺資料量龐大及來源眾多，故規劃介接資料存取於非結構化查詢語言（NoSQL），以提升巨量資料索引效能，並將較久遠（超過3年）的歷史資料定期匯入檔案伺服器（File Server），以檔案下載方式提供查詢，確保前端效能不會被大量資料而延遲，另外系統帳號、對外供應資料等關聯式資料則存取微軟結構化查詢語言（MSSQL）；第3層應用端，將介接資料呈現於GIS圖臺，以及存取系統資料應用於資料供應及後臺管理等；第4層使用端，提供政府機關、科研單位之整合性海洋資料平臺。

結論

資料庫的建置係屬長期性的工作，一般來說皆以四年期來規劃，亦即資料的豐富度與資訊平臺的穩定度才足以達到一定的水準。本資料庫於一年期中已完成介接97個資料集，完成收納的資料總量約達22TB，呈現於資訊平臺計有51筆資料集。資料標準化工項中，完成資料標準化欄位建置包含生態資料標準化、水文（測站）資料標準化、水文（測站）正規化表格、水文（海下）資料標準化、水文（海上）資料標準化，並完成水文（海上）資料標準化圖臺介接與資料應用程式介面（API）開發，同時建置詮釋資料欄位供予後臺管理者修改建置。海洋資訊網站中已完成網站系統建置，前臺包含首頁關於我們、會員登入系統、3大主題資料展示、資料供應系統、圖臺功能建置及網站人次統計。後臺則完成帳號管理、資料權限及編輯管理與資料供應申請單簽核管理。資安及系統維護方面，完成兩次網頁弱點掃描、滲透測試、資安健診、備援演練、壓力測試及相關所有弱點之修正。

參考資料

- [1] 海洋委員會（2020年6月），《國家海洋政策白皮書》。
- [2] 中央氣象局，氣象資料開放平臺
<https://opendata.cwb.gov.tw/index>
- [3] 中央氣象局，觀測資料查詢
<https://e-service.cwb.gov.tw/HistoryDataQuery/index.jsp>
- [4] 水利署，水利地理資訊服務平臺
<https://gic.wra.gov.tw/Gis/>
- [5] 水利署，水利資料整合雲平臺
<http://wise.wra.gov.tw/>
- [6] 科技部海洋學門，資料庫-互動式「海的」資料展示平臺（ODB Hidy Viewer）
<https://odbgo.oc.ntu.edu.tw/odbargo/>
- [7] 台灣海洋科技研究中心，海洋環境資料庫
<http://med.tori.narlabs.org.tw/>
- [8] 美國國家海洋暨大氣總署（NOAA），美國國家海洋資料中心（NODC）
<https://www.nodc.noaa.gov/>
- [9] 美國國家海洋暨大氣總署（NOAA），美國國家環境資訊中心（NCEI）
<https://www.ncei.noaa.gov/>
- [10] 泛歐聯盟組織，海洋數據網（SeaDataNet）
<https://www.seadatanet.org>
- [11] 澳大利亞的海洋資訊網（Australian Ocean Data Network, AODN）整合海洋觀測平臺
<http://imos.org.au/>
- [12] 國家海洋研究院（2020年10月），「109年度全國海洋資料庫」期末報告。

2020年全球海洋科學報告： 開拓研究能量 邁向海洋永續

撰文／陳璋玲（國立成功大學海洋科技與事務研究所教授）
劉健合（國立成功大學海洋科技與事務研究所博士生）

關鍵字／海洋科學報告、海洋永續、聯合國教科文組織

全球海洋科學報告（Global Ocean Science Report, GOSR）對於想要瞭解海洋科學和運用海洋科學來解決全球挑戰的人而言，是重要的資源。它提供的資訊有助於海洋科學資金相關的策略決定，且透露海洋科學合作研究的機會，以及促進夥伴關係，以進一步建立海洋科學研究能力。海洋科學研究運用於8大整合、跨領域及策略的主題，包括藍色經濟、人類健康和福祉、海洋生態系功能和運作過程、海洋地殼和地質危險、海洋和氣候、海洋健康、海洋觀測和海洋資訊、海洋科技。第一版全球海洋科學報告於2017年發表，第二版於2020年發表。2020年報告的資料來自於45個國家回報的問卷調查。該等國家的海洋科學研究發表占2010～2018年發表總量的82%，此使得報告得以從全球、區域和國家的尺度進行分析。（本文內容主要摘錄自IOC-UNESCO (2020). Global Ocean Science Report 2020—Charting Capacity for Ocean Sustainability. K. Isensee (ed.), Paris, UNESCO Publishing）



圖說／2020年全球海洋科學報告問卷調查回報的國家（藍色標示）（淡藍色國家表示其2017年的資料用於2020年報告）
資料來源／IOC-UNESCO (2020) [1]

前言

2020年全球海洋科學報告指出8大項發現如下：

- 一、海洋科學研究結果對於永續發展政策有直接意涵，其已運用於不同社會部門的管理策略和行動計畫中。研究結果已轉化成對社會助益的各項應用，例如新型藥物。

- 二、海洋科學研究資金不足，此有損海洋科學能力，尤其在探討如何永續提供海洋生態系服務價值予人類的議題上。
- 三、海洋科學領域人才，女性仍是代表不足，尤其是在高科技類別上。
- 四、不同國家對於年輕海洋科學家的認可和支持差異很大。大致上，早期生涯階段的海洋科學家和專業人士通常不被認為是未來可面對海洋永續挑戰的知識分子。
- 五、海洋科學的技術能力仍然在不同國家和區域之間呈現不平等狀態。
- 六、全球的海洋科學研究發表數目持續成長，尤其是在東亞和東南亞國家。
- 七、國家普遍沒有足夠能力管理海洋資料和資訊，此有礙資料公開和分享。
- 八、大部分地區缺乏系統性架構和策略，來量測聯合國2030年議程（UN 2030 Agenda）永續指標（Sustainable Development Goals, SDGs）的進展，尤其是永續發展指標14。該指標為增加科學知識、發展研究能力和轉移海洋科技。



圖說／海洋在永續發展目標的達成上扮演重要的角色
圖片提供／陳瑋玲

海洋科學人力

人力資源在海洋科學、科學到管理、以及科學到創新價值鏈中扮演重要的角色。資料顯示，國家別的海洋科學研究人員數目介於每百萬人口小於1到大於300人之間。這些數字和國家生產總額（Gross Domestic Product, GDP）沒有直接相關。就總人口數的比例而言，歐洲國家有最高比例的研究人員。例如，挪威和葡萄牙每百萬人都有超過300名研究人員。

在海洋科學領域，性別平衡仍未達成。女性占所有海洋科學人力（包括研究人員及技術支援人力）的7%（剛果民主共和國）到72%（愛爾蘭）。全球平均比例為37%。女性比例等於或大於50%的國家例如安哥拉、保加利亞、克羅埃西亞、薩爾瓦多、愛爾蘭、波蘭和土耳其。然而，有愈多女性參與國際會議，此可作為評估女性參與海洋科學的指標。在不同的海洋科學類別和區域，女性參與國際會議的比例約29%到53%，此數據高於2017年報告的數據。

海洋科學知識、應用和永續發展

過去18年來，全球海洋科學發表持續成長，最明顯的成長達10%，主要來自東亞和東南亞地區，中國是主要的貢獻者，其後是日本和韓國。此外，國際合作研究亦愈見成長，2012~2017年間，61%的期刊發表至少有一位共同作者是來自外國國家，高於2006~2011年的56%，2000~2005年的52%。此顯示跨國合作研究增加是個持續的趨勢，應視為是非常有價值且正向的發展。

多項科學研究成果已轉換成社會應用。此可由合作專利分類（Cooperative Patent Classification, CPC），最常使用的海洋相關科技（如「科技」、「減緩應用」、「氣候變遷調適」）中可看出端倪。此顯示海洋在調節氣候和人類對海洋健康產生負面的影響上，扮演重要的角色。

此外，海洋科學支持海洋資源永續發展和管理。易言之，海洋永續發展不能沒有海洋科學。然而目前許多國家仍缺乏一套特定策略，用以量測永續發展指標14的進展。填答此相關題項的37個國家中，70%表示已研擬達成2030年議程目標的策略和路徑圖，但其中只有21%表示研擬和海洋和永續發展指標14相關的特定策略。

海洋資料和資訊管理

不是每個國家都有海洋資料和資訊管理的能力和基礎建設。全球只有57個國家有指定的國家海洋資料中心，其主要提供的4項服務為：1.後製資料和資料保存；2.方法、標準和綱要的取得；3.資料視覺化；4.網頁服務。接受該等服務的顧客和末端使用者涵蓋社會各不同領域者，反映出海洋資料和資訊與經濟、研究、公共行政，以及商業等各領域的廣度關聯性。

資料分享和開放可確保不同的社會族群取得資料、資料產品和服務。雖然海洋資料被視為是公共財，然而公開取得資料離此仍是非常遙遠。舉例來說，僅管在歐洲和北美洲，超過90%的資料中心建立和其他資訊系統交換資料的關係，然而在拉丁美洲和加勒比海地區，卻少於50%的資料中心建立此關係。此外，雖然58%的海洋資料中心聲稱遵守FAIR原則（可發現性Findability、可取得性Accessibility、可互通性Interoperability、可再使用性Reusability），但其中仍有60%限制特定類型資料的取得。

海洋科學投資

42個國家回報有關用於海洋科學研究技術設備的相關資訊，但只有5個位於北半球國家回報可充分使用各式樣的技術基礎設施，包括美國、德國、挪威、日本和加拿大。全球有1,081艘船舶提供海洋科學服務，其中924艘大部分專用於海洋科學研究，而其餘157艘則有時用於海洋科學研究。超過全球研究船隊的三分之二是由美國維護。依據927艘研究船回報資料，24%研究船從事沿岸研究，8%從事區域研究，5%從事國際研究，11%從事全球尺度的研究。

整體而言，國家總支出用於海洋科學研發的比例明顯低於其他研究和創新的領域，比例介於0.03~11.8%，平均只有1.7%。相較於2010年海洋貢獻於全球經濟約有1.5兆美元，這個比例是非常低的。

海洋科學預算在不同國家及不同時間差異很大。依據蒐集的資料顯示，14個國家增加預算，9個國家減少預算。俄羅斯預算年成長率最高，約10.4%，之後是英國和保加利亞。預算減少幅度大者如日本、厄瓜多爾、土耳其、巴西和義大利。

近年來海洋科學研究的資金來源愈益多元化，包括國家行政單位、國際計畫、私人部門、基金會和慈善機構等。雖然資金主要來自政府機構，但私人基金和捐贈者在未來10年內，可在小型和大型計畫中扮演更重要的資金贊助角色。如同其他科學領域，海洋科學也開始受益於創新的資金贊助機制，包括跨領域研究基金、群眾募資、彩券和稅捐等。

跨國和跨領域的合作研究被認為是更有效使用資源和提升科學研究參與的關鍵策略。許多方法已運用於鼓勵國際合作和交換，例如提供財務贊助國際委員會會員、交換計畫、國家或區域組織諮詢工作，以及在學術部門客座研究員工作。



圖說／海洋研究船是海洋科學重要的技術設備
圖片提供／國家實驗研究院台灣海洋科技研究中心

COVID-19 對海洋科學的可能影響

2020年前半年，COVID-19對海洋觀測產生立即性的負面影響。幾乎所有研究船駛回母港，因此監測洋流和海氣交換定錨配置的維護工作大部分停擺。這種情況影響大約30~50%的定錨配置（全球有300多個系統），有些因電力耗盡而中斷傳送訊息。然而，幸好全球海洋觀測系統（Global Ocean Observing System）因使用自動觀測平臺，尚可發揮正常功能。但此狀態不能無限期維持，如果疫情仍持續，2020年下半年及2021年上半年的資料評估將受到影響。COVID-19對於海洋科學的確實影響仍尚待評估。2020年全球海洋科學報告是取自疫情發生前的資料，下一版本報告將全面評估疫情對海洋科學的基礎設施、人力和技術能力、資金、私部門投資、研究產出、研發趨勢和就業等的影響。

海洋科學行動

為實踐聯合國海洋科學十年（UN Decade of Ocean Science for Sustainable Development）的願景：「我們想要的海洋所需要的科學」（the science we need for the ocean we want），2020年全球海洋科學報告呼籲政府、科學家、慈善事業、私部門和社會團體，採取下列行動：

- 一、增加目前的海洋科學研究資金。
- 二、持續蒐集投資於科學研究的資料，以確認該等投資在國家、區域及全球尺度上所帶來的社會和經濟回饋。
- 三、促進海洋科學資訊生產者和使用者共同參與海洋科學的協同設計。
- 四、加強不同利益關係人夥伴關係建立和海洋科技移轉。
- 五、鼓勵所有國家、性別和年齡層都能平等參與海洋科學能量的建置。
- 六、研擬策略和執行計畫，支持女性和年輕科學家的職涯需求。
- 七、尋找方法消除海洋資料取得的障礙。
- 八、促進海洋科學專業領域的教育和訓練。
- 九、評估COVID-19對海洋科學人才和技術能力的影響。

結論

海洋在永續發展目標的達成上扮演重要的角色。對於未來我們想要的海洋已有共識，亦即必須根據最佳的海洋科學，永續管理海洋，而海洋科學報告即在於量測此能力。2020年全球海洋科學報告提出海洋科學人力、海洋科學知識和應用、海洋資料管理與公開取得、海洋科學投資，以及COVID-19對海洋科學影響等最新資訊，同時點出我們未來應加強的行動。下一版將於2025年出版，持續改進的資料蒐集和最新資訊將使未來分析更健全，且更正確衡量海洋科學研究的能量。

參考資料

- [1] IOC-UNESCO (2020). Global Ocean Science Report 2020—Charting Capacity for Ocean Sustainability. K. Isensee (ed.), Paris, UNESCO Publishing.

紐西蘭賞鯨業之制度規範

撰文／曾鈺琮（中華鯨豚協會秘書長）

關鍵字／紐西蘭、賞鯨、永續旅遊

2020年受到COVID-19的影響，為了阻止病原的移動與擴散，世界各國分別採取國境封鎖或飛航限制等相關措施，限制旅客的往來，出境與入境旅客大減，全球的觀光旅遊業面臨著嚴重的衰退[1]。我國因疫情穩定，國內短距離旅遊人數在6月後快速成長，戶外景點湧入大量民衆。根據本會長期在烏石港的賞鯨監測結果顯示，因暑期遊客量大增，2020年7至9月龜山島周圍海域的賞鯨船航行里程數明顯較前兩年來得高且密集，此外船隻包圍、追擊鯨豚群的情況也日益嚴重，甚至有遊艇業者惡意衝撞鯨豚群，製造無謂的干擾，此報復性旅遊的影響也使原先龜山島目擊鯨豚的熱點在2020年的夏季消失或是更往外海移動[2]。會產生以上現象的主因是我國未有明確的賞鯨規範與制度，船隻接觸鯨豚的方式、停留時間與距離等規定，皆由各地區業者間自治約束，沒有任何罰則和有效的監督機制[3]。然而每年有超過55萬人次參與賞鯨活動的紐西蘭，其產業發展的歷史、法規規範與產業研究皆較臺灣來得完整，本文將介紹紐西蘭賞鯨業之發展背景與相關制度規範，或許可讓更多民衆、業者與主管單位認識不同的賞鯨模式，進而調整臺灣賞鯨產業的發展路線，讓旅遊更永續。



圖1／賞鯨旅遊為臺灣近代新興的旅遊產業，宜蘭的飛旋海豚更是當地最重要的賞鯨物種
圖片提供／中華鯨豚協會

紐西蘭的賞鯨發展

約莫1769年，歐洲的捕鯨船就開始在紐西蘭海域活動並捕鯨，到19世紀中期，捕鯨產業已為紐西蘭重要的經濟產業之一，但過度捕撈的情況下捕獲量漸減，1920年起捕鯨產業開始逐漸虧損並邁入衰退，並在1960年代前後關閉最後一座捕鯨站，隨著產業沒落，以捕鯨為主要收入的凱庫拉（Kaikoura）小鎮居民面臨著艱困的經濟問題。由於凱庫拉周圍的鯨豚與海獅等海洋生態資源豐富，1980年代初期當地居民開始嘗試引入生態旅遊的觀光行程來改善收入，1987年在政府授權與協助下當地數個毛利人（Maori）家族共同成立紐西蘭第一家的賞鯨公司，推出以觀察抹香鯨（sperm whales）為主體的遊程，並在1989年7月開始營運。而在毛利人的傳統文化中，「kaitiakitanga」一詞代表人類需作為環境的守護者和保護者，因此在傳統文化的影響下，不論是經營或管理，紐西蘭當地的賞鯨活動更具備許多環境永續的概念。

除了傳統文化的影響外，紐西蘭政府也早在1978年頒布《海洋哺乳類動物保育法》（Marine Mammals Protection Act, MMPA），並在1988年制定《海洋哺乳動物保護條例》（Marine Mammals Protection Regulations, MMPR），相關的賞鯨準則、船隻與鯨豚的互動規範等，都在賞鯨業成立前已有規範，因此可即時運用在此新興的生態旅遊產業。1989年紐西蘭賞鯨旅遊推出後大受市場歡迎，並以每年14%的遊客量逐年成長，在2006年更有1百萬人次造訪凱庫拉，並為當地帶來約新臺幣6億元（2,000萬美元）的觀光產值及許多工作機會。然而隨著產業的發展，商業活動與鯨豚的衝突也逐漸增加，為了永續的經營與管理，除了賞鯨活動之潛在影響研究的執行外，相關法規也需適時修正，例如1989年至2000年間，研究顯示暗色斑紋海豚（dusky dolphins）常在中午休息，然而卻有72%的休息時間賞鯨船會出現在動物周圍，此外過多的賞鯨船包圍動物以及與動物距離過近等違反《海洋哺乳動物保護條例》的情況也時常出現。為此，紐西蘭的保育部（Department of Conservation, DoC）決議延緩新申請的賞鯨活動許可並為期10年，而賞鯨業者也共同簽署自治公約，避免在海豚休息的時段（上午11:30到下午1:30）接近海豚，減緩對鯨豚的干擾。

紐西蘭的賞鯨資訊

現今研究中，紐西蘭海域所記錄到的海洋哺乳動物約有51種，而全世界的鯨豚物種中（約90種），有半數種類可在此海域發現。

目前紐西蘭共有8處賞鯨地點，也有數個陸上鯨豚觀察景點，賞鯨型態部分像是常見的搭乘賞鯨船觀察動物之外，特定的地區或物種也有提供直升機導覽或是與動物共遊的行程，如表1所示[4]。凱庫拉為紐西蘭最熱門的賞鯨景點，幾乎紐西蘭40%的賞鯨行程都由這裡出發，由於凱庫拉周圍海域存在許多水下峽谷（underwater canyons），縱深的海域吸引最大的齒鯨（odontocetes）－抹香鯨（sperm whales）棲息於此且終年可見，因此觀賞抹香鯨也為凱庫拉最受歡迎的賞鯨行程之一。



圖2／舉尾下潛為抹香鯨深潛前的招牌動作，不只是紐西蘭的凱庫拉，臺灣的花蓮也有機會可巧遇
圖片提供／中華鯨豚協會

表1／紐西蘭各物種的賞鯨模式與區域

物種	城市或港口	賞鯨型態	最適觀察期
抹香鯨 Sperm whale (<i>Physeter microcephalus</i>)	凱庫拉 (Kaikoura)	乘船觀察、空中觀察	全年
布氏鯨 Bryde's whale (<i>Balaenoptera edeni</i>)	奧克蘭 (Auckland)	乘船觀察	全年
大翅鯨 Humpback whale (<i>Megaptera novaeangliae</i>)	凱庫拉 (Kaikoura)	乘船觀察、空中觀察	6-7月
南方露脊鯨 Southern right whale (<i>Eubalaena australis</i>)	凱庫拉 (Kaikoura) 但尼丁 (Dunedin)	乘船觀察	6-8月
虎鯨 Killer whale (<i>Orcinus Orca</i>)	凱庫拉 (Kaikoura) 馬爾堡峽灣 (Marlborough Sounds) 陶朗加 (Tauranga) 奧克蘭 (Auckland) 島灣 (Bay of Islands)	乘船觀察	全年
瓶鼻海豚 Bottlenose dolphin (<i>Tursiops truncatus</i>)	菲奧德蘭 (Fiordland) 島灣 (Bay of Islands) 奧克蘭 (Auckland) 陶朗加 (Tauranga) 馬爾堡峽灣 (Marlborough Sounds)	乘船觀察	全年
暗色斑紋海豚 Dusky dolphin (<i>Lagenorhynchus obscurus</i>)	凱庫拉 (Kaikoura) 馬爾堡峽灣 (Marlborough Sounds)	乘船觀察、乘船共游	全年
真海豚 Short-beaked common dolphin (<i>Delphinus delphis</i>)	島灣 (Bay of Islands) 奧克蘭 (Auckland) 陶朗加 (Tauranga) 馬爾堡峽灣 (Marlborough Sounds)	乘船觀察	6-8月
賀氏矮海豚 Hector's dolphin (<i>Cephalorhynchus hectori</i>)	阿卡羅阿 (Akaroa) 凱庫拉 (Kaikoura) 馬爾堡峽灣 (Marlborough Sounds)	乘船觀察、空中觀察	全年

資料來源／<https://www.handbook.iwc.int/en/country-profiles/new-zealand>

紐西蘭的賞鯨規範

所有的鯨豚皆受《海洋哺乳類動物保育法》保護，而所有的賞鯨活動與商業行為許可皆由《海洋哺乳動物保護條例》所管理，除一般常見的嚴禁干擾與騷擾鯨豚等規定之外，法規中還針對海域與空域的商業賞鯨活動進行定義與規範說明，也特別保護育幼中的鯨豚並管控賞鯨活動的噪音，例如禁止製造噪音與減速措施等，以下為賞鯨活動規範之摘要整理[4]。

一、一般規範

- 禁止干擾、騷擾與在鯨豚周圍製造噪音。
- 當海洋哺乳動物表現出任何受到干擾或驚嚇的反應，則應停止接觸。
- 不要在海洋哺乳動物附近餵食或丟棄任何垃圾。
- 避免任何船隻或飛機在海洋哺乳動物周圍突然地或反覆地加速或變換方向。
- 在任何海洋哺乳動物的範圍 300 公尺內，船隻與飛機的總數不得超過3艘。

二、海域規範

- 距離任何海洋哺乳動物 300 公尺內以怠速或不產生伴流（no wake）的速度行駛。
- 從鯨豚群的背側或側面接近。
- 勿包圍鯨豚，阻礙鯨豚行進路線或穿越鯨豚群。
- 距離鯨魚至少50公尺（遇鯨魚的母子對至少維持距離200公尺）。
- 禁止與鯨魚共游。
- 可以與海豚共游，但禁止與海豚的母子對共游。
- 離開海豚群時可緩慢地加速遠離，但在與海豚 300 公尺範圍內之航行速度不得超過 10節。

三、空域規範

- 當飛行接近任何海洋哺乳動物時，飛機應與動物保持大於150公尺的水平距離。
- 避免直接飛行在海洋哺乳動物上方或用陰影遮擋動物。

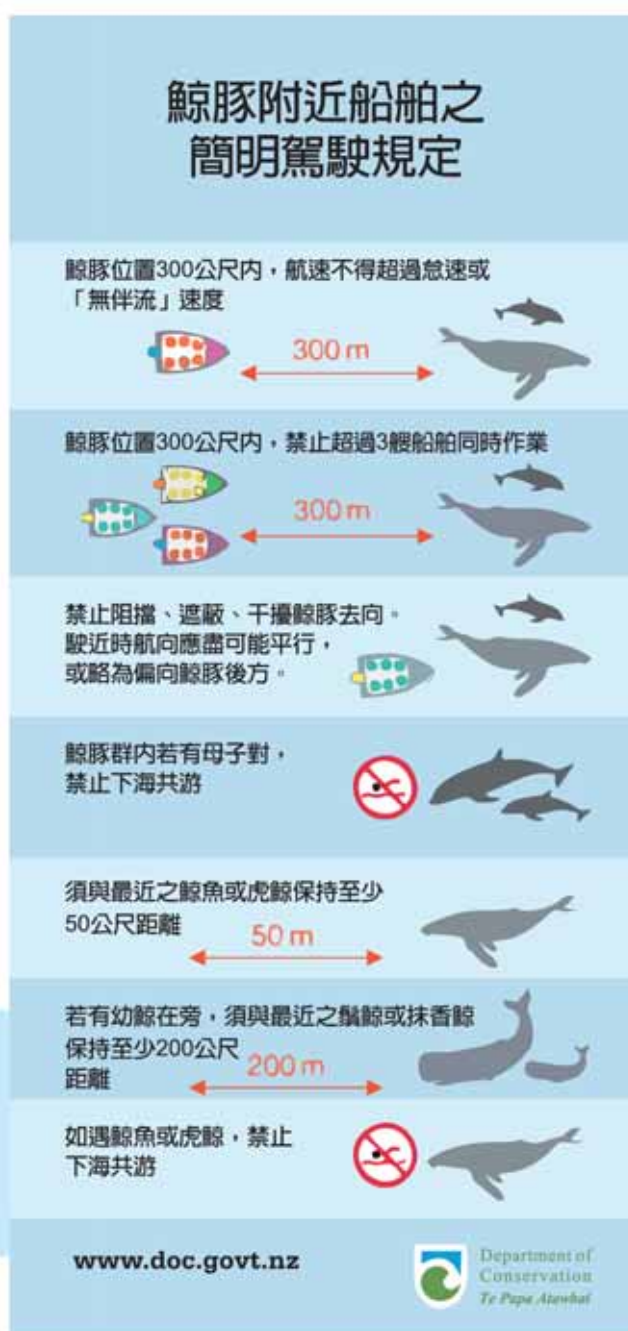


圖3／簡易紐西蘭賞鯨規範

圖片來源／<https://s3-eu-west-1.amazonaws.com/wwhandbook/guideline-documents/New-Zealand-marine-mammal-rules-for-social-media.pdf>

回顧紐西蘭的賞鯨產業發展歷史與制度，不論是法規與規範都在產業成立與執行之前就緒，業者也高度配合，結合研究數據評估賞鯨活動造成的潛在風險，以利政府制定相關規範或彈性調整產業發展的快慢，以維護環境生態穩定，再加上人類為環境守護者的傳統文化思維影響與社區共同的參與發展，讓紐西蘭海域的鯨豚資源得以永續利用，如同全球永續旅遊委員會（Global Sustainable Tourism Council）所倡議的永續旅遊目的準則：讓旅遊產業透過永續的管理策略（Sustainable Management），同時整合環境永續（Environmental sustainability）、文化永續（Cultural sustainability）與社會與經濟利益（Social and Economic Benefits），以達到旅遊地區生活環境的永續發展，讓賞鯨旅遊更具有永續性[5][6]。

結語

臺灣賞鯨首航於1997年，距今已超過20年，但在這20年間相關的法規與規範並未跟上，各地區業者間的自治公約，也未見有效的監督機制，船隻干擾鯨豚的事件持續發生中，就如同2012年的研究[7]發現賞鯨衝擊造成海上目擊鯨豚位置的離岸距離有增加的趨勢，而龜山島常見的飛旋海豚，發現的群次數與隻數有逐年下降趨勢，且多艘賞鯨船觀賞時，群體狀態也多半出現下潛的閃避行為。

回顧這20年，臺灣的賞鯨制度的確有須增進之處，特別是：

- 賞鯨活動專責規範的建立與執法。
- 國家或公正第三方永續賞鯨旅遊審查制度的建立。
- 賞鯨船與鯨豚互動之長期監測的進行。
- 賞鯨旅程中海洋環境教育的執行。

在海洋委員會成立後，這些對鯨豚干擾的狀態或許能慢慢改善，《海洋保育法》的草案內容中針對海洋遊憩、休閒活動與船舶海上航行、活動、作業等事項即將提出相關管理規範，海洋委員會海洋保育署也在2019年發布「臺灣海域賞鯨指南」，內文的友善賞鯨守則雖不具法律效應，但指南中《野生動物保育法》的置入也足見政府想要保護臺灣海域鯨豚的想法。但僅有規範是不夠的，社區的共同參與、自然地景與在地文化的導入、業者的自我管理與海域生態資源的維護等，才能讓賞鯨旅遊更多元化，也才能讓臺灣賞鯨產業更永續發展。

參考資料

- [1] 財團法人臺灣觀光協會（2021年1月6日），2020 1-10月全球觀光整體概況
http://www.tva.org.tw/Trends_detail/9cc2fd7f80bd4ae2ad5e21d7f41564eb (Jan. 15, 2021)
- [2] 陳冠宇、曾鈺琮、郭曉瑛（2021），報復性旅遊與龜山島周邊鯨豚族群生態互動之研究，口頭發表，2021 動物行為、生態暨環境教育研討會。
- [3] 財團法人黑潮海洋文教基金會（2018），臺灣海域賞鯨規範可行性評估暨推廣計畫（案號：108-C-27）成果報告書，海洋委員會海洋保育署委辦計畫，5-68。
- [4] International Whaling Commission (2021). Whale watching handbook
<https://www.handbook.iwc.int/en/country-profiles/new-zealand> (Jan. 15, 2021)
- [5] 台灣永續旅行協會（2021），GSTC永續旅遊準則 & 認證
<https://sustainabletravel.org.tw/step%E5%9C%8B%E9%9A%9B%E8%AA%8D%E8%AD%89/> (Jan. 15, 2021)
- [6] Global Sustainable Tourism Council (GSTC) (2021). The GSTC Criteria for Destinations
<https://www.gstcouncil.org/gstc-criteria/gstc-destination-criteria/> (Jan. 15, 2021)
- [7] 謝嘉煌（2012），宜蘭海域的鯨豚生態監測與賞鯨船對鯨豚之影響，碩士論文，國立宜蘭大學，18-44。

紐西蘭環境部及其國家海洋政策

撰文／鍾蕙先（國立臺灣海洋大學海洋法政學士學位學程助理教授）

關鍵字／紐西蘭、海洋政策、環境部

紐西蘭是一個位在水域半球（watery hemisphere），擁有全球第4大範圍的專屬經濟海域。紐西蘭作為一個以初級產業為主要經濟來源的島國，加上境內的原住民族毛利人是以海洋為生活核心，使得紐西蘭現代社會將海洋視為社會的核心價值，與海洋的連結甚強。



圖說／紐西蘭奧克蘭（Auckland）保育區的物種：左上寬吻海豚（Bottlenose Dolphins）、左下鱒魚（snapper）、右上褐鴨（Brown Teal）、右下鱷蜥（tuatara）

圖片來源／Department of Conservation from Flickr (CC BY 2.0)

<https://www.flickr.com/photos/docnz/albums/72157665069302220>

紐西蘭的環境法案和環境議題自1970年代開始發展，在海洋事務分工方面，紐西蘭政府採聯邦制，領海範圍內的海洋活動由地方的區域委員會（Regional Council）管理，專屬經濟海域到領海外界範圍的海洋活動以及紐西蘭全水域的漁業、海洋保育、海事交通、海上安全等事務由聯邦政府相關機關管轄，如表1。

表1／紐西蘭政府機關海洋事務分工表

主責機關	管轄
環境部 (Ministry for the Environment)	管理與專屬經濟海域有關的法規與範圍
環保署 (Environmental Protection Authority)	同意、監督與執行與專屬經濟海域有關的法律
初級產業部 (Ministry for Primary Industries)	漁業管理
保育部 (Department of Conservation)	海洋保育區與瀕危物種
交通部 (Ministry of Transport)	海事交通法 (Maritime Transport Act 1994)
海事紐西蘭 (Maritime New Zealand)	海事交通管理
區域委員會 (Regional Council)	管理領海事務
商業、投資與就業部 (Ministry of Business, Innovation and Employment)	海洋管理有關的健康與安全事務
紐西蘭石油與礦物 (NZ Petroleum & Minerals)	管理石油、天然氣與礦物使用許可
外交事務與貿易部 (Ministry of Foreign Affairs & Trade)	海洋相關國際公約

資料來源／Ministry for the Environment of New Zealand Government (2019) [1]

本文簡介紐西蘭環境部的組織發展、環境部與保育部的合作關係，以及紐西蘭海洋政策的發展現況。詳述如下：

紐西蘭環境部組織發展

紐西蘭的環境部，在1986年的《環境法》(The Environment Act 1986)通過後成立，環境部成立的主要目的在使紐西蘭成為全球最適合居住的地方，為了達成此目的，必須讓環境得以繁榮。依據1986年《環境法》，環境部主要功能有：

- 一、建議政府及相關部門所有與環境行政有關的事務，包含管理自然與物理資源與生態系統有關的政策以符合《環境法》的目標，管理對環境有重大影響的公部門或私部門提案，確認法規可有效地使公民參與區域與地方級別的環境規劃與政策形成。
- 二、獲取、處理、監督與環境政策有關的研究與建議。
- 三、提供政府及相關公部門與環境有關的建議，包含《環境法》應用、操作與有效執行、評估與監控環境影響、污染控制與污染物質管理、辨識自然有害物質與減少其影響。
- 四、處理可能會與環境保護有衝突之政策與提案。
- 五、提供與傳遞促進環境政策之資訊與服務，包含環境教育與公民參與[2]。

紐西蘭環境部自許作為環境的組織、改變的中介，環境部推動與環境相關政策時，重視與相關利益方與其他組織建立夥伴關係，利用「由下而上」、「由外而內」的政策制訂與決策模式，逐步形成共識，以確保環境保護及經濟發展平衡，並在此一基礎之上促進經濟成長，邁向低碳且具恢復力的社會。

紐西蘭環境部主責的作用法相當多，其中以1991年的《資源管理法》（Resource Management Act 1991，簡稱RMA）與2012年的《專屬經濟區與大陸礁層環境影響法》（Exclusive Economic Zone and Continental Shelf [Environmental Effects] Act 2012）與海洋關係密切。

RMA是管理自然資源的主要法律，規範紐西蘭人對自然資源與環境的行為，確立處理自然資源分配與利用時，須遵守永續原則，且RMA第12條明示，沒有任何人可宣稱對海灘及海床有所有權，因此，紐西蘭的海灘與海床皆為國家所有，有關其使用或處理必須依國家環境標準並獲得國家同意[3]。

《專屬經濟區與大陸礁層環境影響法》目的在促進永續管理專屬經濟海域與大陸礁層的自然資源永續使用，環境部有權據此法規範允許與禁止的活動類型，以避免有害物質或船舶對此區域產生的污染。因此，該法內容包含了此區域之開發活動、海底電纜鋪設、科學研究等活動之相關規範[4]。

環境部與保育部的分工

環境部是紐西蘭處理環境議題的主管機關，隨著永續發展議題催化，僅以環境保護為主要目標已不足以提升生活品質，明智利用自然資源發展社會與經濟也是另一重要的管理項目。為此，紐西蘭在1987年設立保育部（Department of Conservation, DoC），其任務為管理自然資源使用，包括原始森林、野生動物、水資源、海岸環境等，致力於推動自然資源保存與永續利用等工作[5]。《海洋保存法案》（Marine Reserve Act）是保育部轄下與海洋相關之作用法，是紐西蘭劃設海洋保護區的主要依據[6]。為保育野生動植物包括海洋生物，紐西蘭1978年通過《海洋哺乳類動物保育法》（Marine Mammals Protection Act），保育部依據國際自然保育聯盟（International Union for Conservation of Nature, IUCN）建立的紅名單（Red List），設計紐西蘭威脅物種分類系統（New Zealand Threat Classification System），有系統的保育海洋生物[7]。

環境部與保育部在管理海洋使用方面有相當多的合作關係，譬如：依據環境部2020年發布的「年度報告」顯示，在環境部、保育部與其他部門的合作下，紐西蘭0.4%的海洋與沿岸地區已劃設為最嚴格的禁止進入與使用的海洋保留區（no-take marine reserves），並在地方政府的區域發展計畫中，納入海洋與沿岸地區，用整合的方式管理海洋與陸地[8]。兩個部門相較之下，環境部聚焦在管理人類活動對海洋環境的影響，保育部則聚焦在海洋資源利用與保存議題。譬如進行海底地震調查活動時，除了要遵守環境部《專屬經濟區與大陸礁層環境影響法》管理關於此活動可能對海洋環境產生的影響，同時需要遵照保育部《最小化海洋調查活動產生之海洋噪音對海洋哺乳類動物影響指南》（Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations）進行海底活動[9]。

紐西蘭的海洋政策

紐西蘭目前有海岸政策，但尚未有海洋政策（Oceans policy）。然而，紐西蘭自1990年代起，體認到法規未能提供整合的或全面的途徑治理海洋，1999年，時任紐西蘭執政黨的工黨政府較早開始

支持發展措施管理紐西蘭的海域，國會環境監察員（The Parliamentary Commissioner for the Environment）發布一份環境報告，建議透過整合途徑形塑紐西蘭海洋政策，該份報告揭示永續漁業、物種與生態系統衰退問題、非目標魚種的混獲問題、缺乏全面的生物安全、休閒漁業規範、海洋資源與生態系統的科學數據、深海保育、陸域管理對海洋環境之影響等，都亟待被處理[10]。

2001年紐西蘭內閣成立海洋政策部長級顧問委員會（Ministerial Advisory Committee on Oceans Policy）負責起草紐西蘭的海洋政策，海洋政策起草過程分為3階段，第1階段——「定義願景」（defining the vision），該委員於2001年辦辦公聽會與公民參與，將討論結果彙整成一份報告書，該份報告書指出，紐西蘭社會高度依賴海洋，因此，安全的海洋基礎建設與健康的海洋生態系統服務，應是國家重點發展方向。該份報告同時指出，儘管紐西蘭已有相當多的法規處理海洋事務，但卻缺乏共同的海洋政策願景與目標、缺乏公民參與管理之機會、且須建立以生態為基礎的海域空間規劃與整合管理[11]。國家的海洋政策將有助於處理不同管理機制間的衝突、確保當代使用海洋時不會危害到海洋生態系統，使海洋能作為紐西蘭世世代代的發展基礎以處理未來挑戰。最後，委員會同意將海洋政策的願景聲明，定義在發展健康的海洋（Healthy Ocean），確認健康的海洋生態系統可貢獻紐西蘭世世代代的社會、文化、環境與經濟福祉[12]。

然而，紐西蘭海洋政策發展到第2階段——「設計工具以邁向願景」（designing the tools to achieve the vision）出現停滯，原定目標在2003年產生海洋政策草案並提交給內閣，但毛利族與王室之間對於海邊高潮線和低潮線之間的前灘地區（foreshore）與海床使用與管理意見歧異，包含海洋牧場污染毛利族的傳統使用海域、科技發展增加海洋空間與資源使用的壓力、非法漁捕的執法成效等議題皆討論未果[13]。毛利族是紐西蘭主要的原住民族也是主要的文化起源之一，紐西蘭是大英國



圖片來源／Pride Advertising Agency Ltd.

協一部分，雙方在1840年簽訂《懷唐伊條約》（Treaty of Waitangi），確立雙方權利義務關係，毛利族可保有既有土地的傳統使用權，該條約被認為是紐西蘭建立西方現代化國家的重要文獻。在海洋政策起草過程中，確保毛利文化價值與西方現代化皆納入海洋管理與決策程序有其必要[14]。儘管第2階段的討論曾經在2005年再次重啟，但2008年政府輪替後，發展國家海洋政策之議題已被擱置至今[15]。

結論

儘管紐西蘭已有相當多的法律處理海洋事務，但尚未有總體的海洋事務目標，使得涉海機關較難共同產生以生態為基礎且具意義、整合性的管理方式。有鑑於越來越多海洋國家發展國家海洋政策，如澳洲、加拿大，加上人類活動對海洋系統的壓力持續增加，紐西蘭國內有專家學者持續呼籲政府應繼續完成海洋政策草案，並將發展過程推向第3階段，也就是「傳達願景」（delivering the vision）。這階段預期將發展相關政策工具、通過必要的法律與組織調整，以實踐健康海洋的願景[16]。由此可見，國家的海洋政策，可說是國家發展海洋事務的總體方向與目標。

參考資料

- [1] Ministry for the Environment of New Zealand Government (2019), The Sasakawa Peace Foundation, Managing our marine environment, Ministry for the Environment of New Zealand Government
<https://www.mfe.govt.nz/marine/we-all-have-role-play/managing-our-marine-environment> (Jan. 18, 2021)
- [2] Ministry for the Environment of New Zealand Government (2019), Why our marine environment matters, Ministry for the Environment of New Zealand Government
<https://www.mfe.govt.nz/marine/why-our-marine-environment-matters> (Jan. 20, 2021)
- [3] New Zealand Legislation, Resource Management Act 1991, art. 12
<https://www.legislation.govt.nz/act/public/1991/0069/latest/DLM231949.html> (Jan. 20, 2021)
- [4] New Zealand Legislation, Exclusive Economic Zone and Continental Shelf (Environmental Effect) Act 2012
<https://www.legislation.govt.nz/act/public/2012/0072/latest/DLM3955428.html> (Jan. 20, 2021)
- [5] Department of Conservation of New Zealand Government, Our purpose and outcomes, Department of Conservation of New Zealand Government
<https://www.doc.govt.nz/about-us/our-role/our-purpose-and-outcomes/> (Jan. 20, 2021)
- [6] Geange, Shane W. et al. (2017), "Integrating conservation and economic objectives in MPA network planning: A case study from New Zealand", *Biological Conservation* 210: 136-144.
- [7] Townsend, Andrew J. et al. (2007), New Zealand Threat Classification System manual, New Zealand: Department of Conservation
<https://www.doc.govt.nz/documents/science-and-technical/sap244.pdf> (Jan. 20, 2021).
- [8] Ministry for the Environment of New Zealand (2020), Ministry for the Environment annual report 2020, NZ Ministry for the Environment, 42-43
<https://www.mfe.govt.nz/sites/default/files/media/About/Ministry-for-the-Environment-Annual-Report-2019-2020.pdf> (Jan. 20, 2021).
- [9] Environment Guide, Exclusive Economic Zone Act
[http://www.environmentguide.org.nz/activities/minerals/decision-making-framework/exclusive-economic-zone-act/#:~:text=The%20Exclusive%20Economic%20Zone%20and,activities\)%20beyond%20the%20territorial%20sea](http://www.environmentguide.org.nz/activities/minerals/decision-making-framework/exclusive-economic-zone-act/#:~:text=The%20Exclusive%20Economic%20Zone%20and,activities)%20beyond%20the%20territorial%20sea) (Jan. 20, 2021).
- [10] The Parliamentary Commissioner for the Environment (1999), Setting Course for a Sustainable Future: The Management of New Zealand's Marine Environment, The Parliamentary Commissioner for the Environment, 2.
- [11] NZ Ministerial Advisory Committee on Oceans Policy (2001), Healthy Sea: Healthy Society Toward an Oceans Policy for New Zealand, NZ Ministerial Advisory Committee on Oceans Policy, 6-7.
- [12] NZ Ministerial Advisory Committee on Oceans Policy (2001), Healthy Sea: Healthy Society Toward an Oceans Policy for New Zealand, NZ Ministerial Advisory Committee on Oceans Policy, 10.
- [13] Pete Hodgson (2003), Oceans Policy: Maori engagement, New Zealand Government
<https://www.beehive.govt.nz/speech/oceans-policy-maori-engagement> (Jan. 20, 2021).
- [14] Foster, Angela (2003), "New Zealand's Oceans Policy", *Victoria U. Wellington L. Rev.* 34: 469-496, 469.
- [15] Scott, Karen N (2021), "Does Aotearoa New Zealand Need an Oceans Policy for Modern Oceans Governance?", *Ocean Yearbook* 35: 1-44, 1.
- [16] Scott, Karen N (2021), "Does Aotearoa New Zealand Need an Oceans Policy for Modern Oceans Governance?", *Ocean Yearbook* 35: 1-44, 44.

窒息、纏困、溺水的海洋生物：美國非營利組織OCEANA發布之塑膠危機報告

撰文／陳德豪（國立海洋生物博物館副館長、國立東華大學海洋生物研究所教授）

關鍵字／塑膠、海洋生物、美國

本篇介紹非營利性海洋保護組織Oceana於2020年11月發布的「窒息、纏困與溺水：攤開我們海洋中的塑膠危機」（Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans）報告[1]（圖1），這是首份關於在美國水域塑膠垃圾對海龜或海洋哺乳類動物吞食塑膠或是被塑膠纏繞的全面性報告。



圖1／美國非營利性海洋保護組織Oceana所發布的報告「窒息、纏困與溺水：攤開我們海洋中的塑膠危機」（Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans）

圖片來源／<https://usa.oceana.org/publications/reports/choked-strangled-drowned-plastics-crisis-unfolding-our-oceans>

從上個世紀的1950年代開始，塑膠製造商們為了能夠持續製造商品以獲得利潤，大力推廣鼓吹可拋式的生活型態（throwaway lifestyle），並將這樣的生活型態塑造成是一個方便與進步的象徵。因此，二次大戰之後的美國開始大量出現一次性使用的可拋棄式商品，而這樣的風潮逐漸擴展到世界上其他的國家，成為全球性的問題。其實，最早在1968年時，美國政府就已將塑膠列為海洋污染物之一。在1970年代，科學家就已在調查中發現海水及魚體中有小型的塑膠碎片，而近年的大量研究更顯示，從海面到水下至海底到處都有塑膠污染，這所反映出來的就是從1950年代開始塑膠大量被製造、使用與丟棄所累積的後果。一次性使用的塑膠包裝材料（例如塑膠瓶、塑膠袋、食物包裝盒等）是最大宗的塑膠產品，這些塑膠產品其實非常持久耐用，但因為質輕又便宜，反而大部分這些產品僅被使用一次就被丟棄。回收體系的處理能量根本無法追上塑膠產品的生產速度，因此許多塑膠便成為各式

各樣的廢棄物污染著我們的陸地、河川、終至海洋。科學家估計，每年全球的塑膠產量是4億公噸[2]，而每年進入海洋中的塑膠廢棄物可達1,500萬公噸，這相當於每分鐘有兩部垃圾車的塑膠倒入海中[3]。

2020年11月，總部位於美國華盛頓特區的非營利性海洋保護組織Oceana「大洋洲」發布了一份「窒息、纏困與溺水：攤開我們海洋中的塑膠危機」（Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans）的報告[1]，這是首份關於在美國水域塑膠垃圾對海龜或海洋哺乳類動物（包括海牛、鯨豚、海豹、海獅等）吞食塑膠或是被塑膠纏繞的全面性報告。在過去，美國境內的海龜以及海洋哺乳類動物受到塑膠垃圾危害的證據從未被整理在一份報告裡完整呈現。Oceana從數十個政府單位或民間組織整理了2009～2020年的相關資料，發現有1,800個海龜及海洋哺乳類動物吞食塑膠或是被塑膠纏繞的案例，涵蓋40種不同的物種，其中有88%的物種是列在美國《瀕危物種法》（Endanger Species Act）中的受到威脅（threatened）或是瀕危（endangered）的物種。這份報告所反映出來的案例其實是遠遠少於野外實際發生的數字的，因為當這些海洋生物吞食塑膠或是被塑膠纏繞時，大多是發生在大洋區或水面下，這些受傷或者死亡的個體多數都很難被觀察到。

海龜與海洋哺乳類動物具有顯著的生態重要性，但他們目前正面臨多樣的生存威脅，包括污染、棲地破壞、商業漁具傷害、船舶撞擊、非法獵捕、有毒藻華，以及全球氣候變遷所導致的環境改變（例如海平面上升及海水溫度改變），這些都可能影響他們的覓食及生存棲地。塑膠污染對這些海洋生物來說又會增加額外的生存壓力，特別是對於那些已受威脅或是瀕危的物種而言，更是雪上加霜。塑膠對海洋生物的影響主要包括吞食和纏繞。海洋動物可能將塑膠誤為食物吞食下去，或者在覓食或游泳時不小心吞食塑膠。被動物吞食的塑膠可能會阻塞或割傷動物的胃腸，進而影響動物覓食和吸收營養的能力，導致營養不良甚至死亡。當動物被魚網或塑膠袋等塑膠製品纏繞時，可能會導致溺水、窒息而死，也可能造成身體傷害，例如斷肢或是感染。如果塑膠纏繞影響動物正常的覓食能力，也可能導致營養不良。

這份報告的作者之一、也是Oceana的資深科學家Kimberly Warner博士表示，雖然或許永遠都不可能有一份報告可以完整呈現海洋動物受到塑膠危害的情形，但這份報告至少呈現出部分驚人的事實，讓世人可以省思。她認為這個世界已經被塑膠所綁架了，因為企業持續地將塑膠這個持久性的污染物強迫滲入我們生活的各個面向中。當這些塑膠變成廢棄物進入海洋中，就會讓海洋動物因吞食或纏繞而造成傷害甚至死亡。這份報告明白顯示各式各樣的一次性塑膠產品正在危害海洋動物。這些塑膠不只是我們常見的塑膠袋、氣球或瓶蓋，也包括其他產品例如塑膠束帶、牙線或洋蔥網袋等。如果企業持續將一次性塑膠塞入消費者的手中，可預期這樣的悲劇只會越來越多。這份報告也發現塑膠垃圾影響著各個生活史階段的動物，從還在乳養幼仔的母海豹到剛孵化的海龜（圖2）。吞食塑膠是最常見的問題，占總案例數的90%，然而塑膠纏繞所影響的動物數量也相當可觀，而且那些纏繞所造成的傷害常常是令人心碎甚至不忍卒睹的。報告中所整理的結果還包括：

- 大部分吞食或纏繞塑膠的物種是瀕危或是受威脅的物種，包括夏威夷僧海豹、海牛、海獅以及所有分布於美國的海龜（一共6種）。
- 在那些可能因為吞食塑膠所造成的死亡案例裡面，有7個例子裡的動物只吞食一件塑膠。
- 在被動物吞食的塑膠廢棄物裡，最常見的是塑膠袋、氣球、釣魚線、塑膠布或包裝膜。
- 在纏繞動物的塑膠廢棄物裡，最常見的是膠帶、塑膠袋、連著繩子的氣球、塑膠布。
- 綠蠵龜和赤蠵龜吞食塑膠的案例比其他種類海龜高出許多。
- 有些海洋哺乳類動物例如北方海狗（northern fur seal），吞食塑膠的機率是所有海獅種類平均的50倍。
- 其他被吞食或纏繞的塑膠物品包括瓶蓋、塑膠瓶、吸管、塑膠椅、塑膠叉、牙刷、兒童玩具、塑膠籃、塑膠氣泡布、塑膠海綿、泳鏡、塑膠草皮、三明治袋、保麗龍餐具。



圖2／被塑膠環套住的剛孵化的海龜
圖片來源／Oceana（2020）[1]

本報告作者之一、也是Oceana塑膠議題活動主任的Christy Leavitt說，這篇報告僅僅呈現了在美國水域的海洋動物受到塑膠威脅實況的一小部分，但還有多少受害的動物是沒有被觀察到或是記錄到的？在未來的十幾二十年之後，全世界的塑膠產量將會是現今的4倍。如果我們不做出任何改變，到2040年時，流入海洋中的塑膠廢棄物將會是現在的3倍[4]。塑膠污染已經出現在世界的每個角落，研究顯示微塑膠（microplastic）也已經在海鮮、飲用水、啤酒、食鹽、蜂蜜等食品中被發現。隨著塑膠製造高速成長，可預期塑膠廢棄物也會快速淹沒我們的藍色星球，並且造成毀滅性的後果。要關掉這個塑膠水流的水龍頭以保護海洋，最有效的方法就是要讓企業停止生產非必要的一次性產品。而要達到這個目標，需要聯邦、州及地方政府透過各項政策及法案來確保企業們會照做。在報告的最後，Oceana提出以下建議：

- 企業必須減少製造塑膠產品，特別是那些非必要的一次性產品。
- 企業必須提供消費者無塑的選擇。
- 國家、州及地方政府必須透過政策以減少一次性塑膠產品的製造與使用。
- 企業及政府應該積極推廣可重複使用或裝填的包裝及容器。
- 負責保護受威脅或瀕危海洋生物的聯邦機構，例如美國國家海洋暨大氣總署（National Oceanic and Atmospheric Administration）及美國魚類暨野生動物署（U.S. Fish and Wildlife Service），必須持續收集塑膠危害海洋生物的案例，並改善及標準化資料收集的方法。
- 國會必須在政策上及經費上全力支持那些對於監測、保護及重建脆弱海洋生物族群的法案，例如《瀕危物種法》和《海洋哺乳類動物保育法》（Marine Mammal Protection Act）。

這份報告的內容雖然主要是從美國的角度來論述，但臺灣也正面對一樣的挑戰，臺灣海域的海洋生物一樣飽受塑膠污染之苦。以國立海洋生物博物館2017年10月至2019年11月收容救傷的海龜為例，共計39隻海龜中（包含30隻綠蠵龜、3隻玳瑁、6隻玳瑁），100%的收容個體都曾排出塑膠垃圾，每隻海龜平均總排出廢棄物重 $2.43 \pm 0.62\text{g}$ （範圍0.02~21.16g），數量平均 13.92 ± 2.12 個（範圍1~43個），包括硬塑膠碎片、塑膠袋碎片、橡皮筋、釣魚線、糖果包裝、泡棉、保麗龍等人類生活中常見的塑膠用品[5]（圖3）。2019年3月在花蓮立霧溪出海口北端沙灘擱淺死亡的一隻柯氏喙鯨，解剖發現肚子裡有6個塑膠袋、4個麻布袋，還有許多塑膠碎片和魚線[6]。此外，我們也不時會看到海龜或鯨豚類被廢棄魚網纏繞受傷甚至死亡的例子[7]。誠如這份Oceana的報告所建議的，要解決海洋塑膠污染的問題光靠回收、淨灘、淨海是遠遠不夠的。真正的解決之道，除了從消費者端在生活中落實各樣減塑措施之外，最有效的手段還是從政策面著手，限制一次性塑膠產品的製造與使用，進而達到限塑、減塑、終至無塑的目標。

我國環保署在2018年針對吸管、飲料杯、購物袋、免洗餐具等4種一次性塑膠提出「2020內用禁用、2025以價制量限用、2030全面禁用」的減用時程表，期能從源頭來減少這些常見的海洋塑膠垃圾[8]，然而在現實上依然充滿了挑戰，例如就有環團指出2009年至2019年間臺灣的塑膠使用量依然持續成長，顯示政府的限塑政策趕不上塑膠產品增加的速度[9]。減塑限塑的政策確實會影響人民生活便利性以及相關產業經濟，因此從來就不是容易的事情。但若能夠健全相關的配套措施、持續培養民衆改變生活習慣，政策依然是改善海洋塑膠污染最有力的工具之一。



圖3／海生館收容海龜某次排便所排出的塑膠垃圾
圖片提供／陳德豪

參考資料

- [1] Oceana (2020), Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans
<https://usa.oceana.org/publications/reports/choked-strangled-drowned-plastics-crisis-unfolding-our-oceans#> (Feb. 17, 2021)
- [2] Geyer R, Jambeck JR and Law KL (2017) Production, use, and fate of all plastics ever made. *Science Advances* 3: e1700782. doi: 10.1126/sciadv.1700782
- [3] Forrest A, Giacomazzi L, Dunlop S, et al. (2019) Eliminating Plastic Pollution: How a Voluntary Contribution From Industry Will Drive the Circular Plastics Economy. *Frontiers in Marine Science* 6: 627. doi: 10.3389/fmars.2019.00627
- [4] Lau WWY, Shiran Y, Bailey RM, et al. (2020) Evaluating scenarios toward zero plastic pollution. *Science*: eaba9475. doi: 10.1126/science.aba9475
- [5] 曾文卜 (2020) 。〈海生館救援海龜排遺中海洋廢棄物分析及可能之健康影響〉。國立東華大學海洋生物研究所碩士論文。
- [6] 公視新聞網 (2019年3月) 。〈柯氏鰐鰩1屍2命 肚內竟有大量塑膠垃圾〉
<https://news.pts.org.tw/article/426234> (Feb. 17, 2021)
- [7] 自由時報 (2020年11月) 。〈漁網纏繞 澎湖又發現3隻海龜2死1傷〉
<https://news.ltn.com.tw/news/life/breakingnews/3339316> (Feb. 17, 2021)
- [8] 環境資訊中心 (2018年2月) 。〈民間參與限塑政策 2030全面禁用吸管等四種一次性塑膠〉
<https://e-info.org.tw/node/209976> (Feb. 17, 2021)
- [9] 環境資訊中心 (2020年11月) 。〈限塑10年政策失靈？一次性塑膠用量增22.8%〉
<https://e-info.org.tw/node/227866> (Feb. 17, 2021)

紐西蘭毛利族之海洋文化與法律保障

撰文／王毓正（國立成功大學法律學系副教授、前國家海洋研究院研究員）

關鍵字／紐西蘭、毛利族、海洋文化

近年研究推論指出，紐西蘭境內的毛利族人（the Māori），同屬南島語族（Austronesian peoples）的臺灣原住民具有血緣及歷史的連結，甚至臺灣為包含毛利族的南島語族之發源地[1]；惟依據目前較有力的推論，作為遠洋民族（ocean-going people）的毛利族人大約在1320年至1350年之間從玻里尼西亞區域的東部，藉由其傳統獨木舟（waka），透過其掌有的傳統星象知識之應用，在星象之指引下穿越廣闊的海洋，以幾波的族群遷徙先後來到了他們的新家園「長白雲之鄉」（aotearoa），亦即今日的紐西蘭北島。

作為典型海洋民族的毛利族，不僅在歷史、日常生活、文化與精神各方面，同時也在信仰與生態哲學層次發展出與海洋緊密的關係，進而也促成政府形成許多與海洋文化相關的政策與法律制度，其目的不只在於保障毛利族人的海洋文化；更進一步地，透過毛利族海洋文化的實踐與法律制度的結合，可強化海洋資源保育、促進海洋文化創意產業，更藉由海洋文化的推廣成為國際外交的軟實力，而值得作為我國研擬國家總體海洋政策及制度上之參考。

毛利族語言（te Reo Māori）與海洋文化

毛利族人的民族語言原本沒有文字，因受到歐洲殖民文化的影響於1840年開始以拉丁字母作為民族語言之文字；然而即如其他南島語族一樣，係以口傳歷史以及歌謠記述著族群的歷史，當中最典型的即是傳統歌謠（waiata），其內容多數訴說著先祖們以waka乘風破浪的渡海旅程，也包括對部落（iwi）重要的地標命名的由來[2]。這對於已定居不復從事遠洋遷徙的族群而言，如何回溯考證先祖為了遠渡重洋所製造與利用之獨木舟與今日之差異，係屬重要的無形文資線索。除此之外，今日的毛利族部落多數仍座落於海岸地區，大海長期以來不只是食物與生活資源的來源，對其精神層面以及與先祖間之連結都具有重要意義，因此部落週邊重要地標之命名由來，亦屬深具意涵的文資線索。由此可見，毛利族語的復振不只對於毛利族主體性及文化延續具有核心的地位，同時對於海洋文化的研究與推廣亦屬不可或缺。

毛利族代表於1972年9月14日將3萬多人的請願書遞交給紐西蘭國會，並訴求毛利族語應該成為官方認定的語言，此一運動被譽為是毛利族語復振的重要起點[3]。1975年為了紀念1972年時的請願運動，政府將9月14日的當週定為毛利族語言週（Te Wiki o te Reo Māori）。3年後，紐西蘭一所官辦的雙語學校正式設立，第1個毛利語廣播電臺（TeReo-o-Pōneke）則於1983年開播。直至1987年毛利族語方正式成為紐西蘭的國家語言[4]。隨著毛利語教育逐漸從小學正式課程開始推廣，2018年時，紐西蘭政府正式宣示將在2025年前使毛利族語教育成為全國小學的核心課程[5]。

毛利族生態知識與海洋資源共管

在毛利族和波利尼西亞神話中，坦加羅亞（Tangaroa）是守護海洋之神，同時也是天空（Ranginui）與大地（Papatūānuku）為父母共同孕育之子。毛利族的傳統信仰中，坦加羅亞創造了海洋中的動物，並負責潮汐和水流的律動。透過水流可以賦予生命和平靜，也可以具有破壞性和強大功能，並且也發展出這樣的諺語：「如果您照顧我，那麼我會照顧您（Tiaki mai I ahau, maku ano koe e tiaki）的法律……」，其寓意著毛利人的宇宙觀（te ao Māori）承認所有生物之間的相互聯繫，由於相互依存，因此健康的生態系統成為人類生命與福祉之間支持的基礎[6]。

對於毛利人而言，人與自然世界之間的深厚血緣關係使他們有義務保護環境並為子孫後代維護環境。這項義務被表示「kaitiakitanga」——一種基於mātauranga Māori信仰的監護和環境管理的文化習俗，保護海洋意味著保護毛利族的環境，同時更使得毛利族與海洋生命力量的文化和精神聯繫得以持續。在此信仰基礎之上，毛利族發展出許多資源管理傳統，而自然資源使用週期基本上即是根據季節和陰曆而定的，同時也發展出禁漁獵週期的傳統，在毛利族語稱為「rāhui」。所謂rāhui，係指各部落形成一種對於特定期間內與區域內採集或利用自然資源的限制，或是對於特定海洋物種的禁止或限制，並且成為生活上的規範。就目前生態保育的角度來看，即是一種自然資源保育或資源管理的模式，同時也可減緩生物繁衍上的壓力。也因此，當政府機關在思尋如何透過永續的方式來守護海洋資源的同時，也發現其實與海洋民族的傳統文化實踐與復振是不謀而合，因此促成了地方政府或國家保育部（The Department of Conservation, DoC）與毛利族的海岸部落之間的合作，建立海岸生態資源共管的機制。

紐西蘭政府機關近年來即在毛利族的傳統生態知識（Traditional ecological knowledge, TEK）的基礎上，發展出若干海洋資源共管機制，該類機制之建立具有雙重目的，以及一方面保障毛利族的海洋文化，一方面也善用其傳統生態知識。在此擬介紹的是「海洋文化健康指標」（Marine Cultural Health Indicators, MCHI），此一計畫是由威靈頓大區議會（Greater Wellington Regional Council）、保育部（DoC）以及位於威靈頓北部的毛利族Ngāti Toa部落於2017年共同啟動的一項計畫。

海洋文化健康指標，簡言之是一種監測機制（toolkit，或可翻譯成「工具包」），可提供Ngāti Toa部落能夠在其部落鄰近的海岸和其他沿海保護區範圍內，建立海洋生態回復目標以及永續採集策略。該環境指標的建立主要係結合了在地傳統知識，亦即政府透過研究團隊採取訪談的方式，搜集了來自100位部落代表的在地和傳統知識。該團隊根據社區訪談選擇了前30個指標，來提供部落作為監測的評估和記錄依據。記錄主要項目例如：1. Ngāti Toa部落採集範圍內海岸生態區之生態現狀；2. 海洋生態系統健康狀況長期間的變化；3. 在地漁獵規則與復育的成效。

透過此一海洋文化健康指標的實施，Ngāti Toa部落能參與對於Porirua港口（毛利族語：Te Awarua-o-Porirua）的文化健康進行有效地監測。Porirua港口對於形塑Ngāti Toa部落本身的自我認同至關重要，此外族人對於該海灘的退縮也越來越關注，透過該計畫的推動不僅有助於Ngāti Toa部落履行其對Te Awarua-o-Porirua的責任，並同時重新接起當地毛利族人與海洋（Moana）的聯繫。該

計畫的主要目標有三：1. 架構一個內含Ngāti Toa部落傳統知識的海洋文化健康指標框架；2. 於建構海洋文化健康文化指標框架期間與部落成員的互動，能確保各方之間的知識有效地移轉；3. 建立與強化部落對於環境監測的能力（賦權）[7]。

我國海洋文化政策之借鏡

臺灣2017年時隨著《原住民族語言發展法》第1條明定「原住民族語言為國家語言」，目前官方正式承認的26個原住民族群的語言也隨之成為國家語言，然而後續如何在學校教育、社會教育乃至官方訊息層面落實國家語言的宏願，可謂是不小的挑戰。無論如何，思考從日常生活層面以及基礎教育等面向著力，實有其必要。同時縱使是全民推廣，也必須深刻地認識到原住民族語的推廣對於族人與非族人的意義是完全不同的，對於非族人而言是一種多元文化的認識，但對於族人而言卻是嚴肅的文化延續問題。

即以個人於2020年服務於國家海洋研究院（以下簡稱「國海院」）期間多次前往蘭嶼進行田野調查的經驗為例，達悟海洋文化與歷史，除了一般所知之口傳歷史之外，古謠更是一種可以追溯到更古老、更完整的敘事載體，可說是一種對於達悟古代海洋文化歷史研究上非常重要的資料庫與工具。例如在古謠的內容即提到前往巴丹島的拼板舟為20人大船，且船中央尚可放置火爐，而且是有船帆的拼板舟，以及蘭嶼與巴丹島之間的交易物品項目等。達悟古謠的內容甚至也可以連結到南島文化圈的一些描述，因此亦屬南島文化研究的重要瑰寶。然而，現存在的達悟族人當中能夠聽得懂古謠以及收藏有古謠的人越來越少，而達悟族人郭建平先生（Shaman Fengayan）即是目前碩果僅存的研究者，至於年輕一輩族人幾乎已經無人能辨識古謠的內容與意涵。

此外，國海院於2019年度起陸續於東海岸進行阿美族傳統海洋文化及知識相關研究。經人類學田野調查後得知，即類似於毛利族人一般，阿美族人使用的族語地名實富含海岸地形、近岸海域、海洋生態、歷史記憶等呈現出人與海洋長期互動關係的要素，甚至也蘊含許多與海域風險相關的內容。這些描述海岸或海域的傳統地名在訴說著身為海洋民族的阿美族人經年積累且傳承至今的海洋知識，以及與自然環境和諧共生的用海智慧[8]。然而目前此些海岸地區傳統地名在政權更迭的過程中，卻已被許多外來文化、政治意涵或不當類比之影響的新地名所取代。當中所流失的不只是傳統地名的稱呼而已，更甚至是背後所隱含的海洋文化與智慧的消散。例如現稱為「石雨傘」的地方，阿美族語為Penpen，意指海浪拍打產生回音。又例如「美麗灣」，阿美族語為Fudafudak，意指海面上如星星閃亮之地方。近年觀光熱門景點「天空之鏡」，原為Pacefongan，意思是竹筏下海的地方，正好是描述海岸具有淺灘的地形，方便於竹筏下海的意涵。

因此目前權責機關應積極思考如何與現存的族人研究者建立合作研究互惠之關係，否則如果連避免原住民海洋文化（當然也包括高山族群文化）的流失都做不到了，就更談不上保存與推廣了。

其次，在有關傳統生態知識方面，即如生態學家Johan Colding和Carl Folke指出，原住民族漁獵行為上之自律與限制不只是為了統合人類的社會生活，同時也影響或是能夠直接管理在地的自然環境。無論這些限制背後的原因為何，禁忌在地方上所扮演著的主要角色很可能是保護自然資源、物種以及生態系統[9]。類似於毛利族的「rāhui」，在印尼西巴布亞省拉賈安帕特群島（Kabupaten Raja Ampat）的原住民族稱為「Sasi」，亦即自然資源在特定的時間或空間內禁止利用的慣習，其包

括農田、森林、珊瑚礁或是捕魚地點，也包括特定海洋生物及捕魚方式。而在2003年時Raja Ampat地方政府亦將當地的Sasi納入依法設置之保育管理制度。依據調查研究發現，相關區域的海洋生態資源皆已出現顯著的回復，足見承認傳統海域並保護傳統生態知識之實踐，對於海洋生態資源保育有其重要性，並可彌補國家法律之不足（Hedley S. Grantham該文對於相關區域的海洋生態資源回復情形有詳細調查數據分析說明，本篇礙於篇幅不在文章內介紹）[10]。

生活於臺灣蘭嶼上的達悟族，其飛魚文化背後所蘊含的民族生態學的延續，不僅是族群生存的延續、傳統文化的延續，同時也是生態永續的延續，3個面向具有相伴相生與相互依存的緊密關係[11]。保障達悟族人能在其傳統海域從事其傳統生態知識之實踐，且不受外縣市漁船之侵入干擾，不僅同時具有避免飛魚被過度捕撈，且於飛魚汛期亦可確保礁岩及底棲生物得以休養生息。因此如何保障並善用達悟族與海洋相關之傳統生態知識，使其也能內化到我國海洋保護相關法制當中，實具有相當的啓示作用。

結語

《生物多樣性公約》（Convention on Biological Diversity, CBD）第10（C）條規定「對於按照傳統文化實踐且符合保育或永續利用之要求的生態資源慣習利用，應給予保護並鼓勵」，從條文內容可以得知，其所追求的不只是對於傳統生態知識的保護而已，同時應該予以鼓勵發展以資作為維護生物多樣性目標的措施之一。事實上，原住民語言教學與其文化，乃至其傳統生態知識的傳遞皆有高度密切關係，唯有透過語言的脈絡才能深入瞭解其文化，始能理解其背後的生態知識或信念之意涵。

此外，透過毛利族傳統生態知識與政府機關合作管理模式可以發現，生態保護區的No-take Zone概念並非是一種絕對性的要求，而且生態保護區容許傳統採集或捕獵並非僅能例外容忍，相反地，更可結合傳統生態知識的實踐，成為一種共管機制的模式，換言之，保障海洋相關之傳統生態知識，不僅是海洋文化之保護，期同時更可強化透過國家法律所劃設之生態保護區的功能。

參考資料

- [1] Kao (Mar. 6, 2014), AMS, Early Austronesians: Into and Out Of Taiwan, AJHG 94(3): 426-436.
- [2] Clements, Ann C. (2015), Maori Waiata (Music): Re-Writing and Re-Righting the Indigenous Experience, IK: Other Ways of Knowing 1(2): 134.
- [3] The encyclopedia of New Zealand
<https://teara.govt.nz/en/photograph/35951/maori-language-petition> (Feb. 20, 2021)
- [4] 有關毛利族與歷史發展之介紹
<https://nzhistory.govt.nz/culture/maori-language-week/history-of-the-maori-language> (Feb. 20, 2021)
- [5] SBS News (Oct. 9, 2018), NZ government pushes for Maori language in all schools by 2025
<https://www.sbs.com.au/news/nz-government-pushes-for-maori-language-in-all-schools-by-2025> (Feb. 20, 2021)
- [6] Harmsworth GR (2013), Awatere S, Indigenous Māori knowledge and perspectives of ecosystems. In Dymond JR ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand, 274.
- [7] Ngāti Toa Rangitira – Marine Cultural Health Indicator Report (2017)（有關紐西蘭海洋文化健康指標計畫的詳細介紹）
<http://www.ngatitoa.iwi.nz/sitecontent/images/Folders/Blog/Ngati-Toa-MCHI-report-final-2017.pdf> (Feb. 20, 2020)
- [8] 蔡政良（2020），〈阿美族傳統海洋知識與文化研究暨活用推廣委託專業服務採購案，國家海洋研究院委託研究報告，第10頁以下〉。
- [9] Colding, J. & Folke, C. (1997). The relations among threatened species, their protection, and taboos. Conservation Ecology 1(1): 6. Retrieved May 28, 2013
<http://www.consecol.org/vol1/iss1/art6/> (Dec. 5, 2020)
- [10] Hedley S. Grantham et al. (2013). A comparison of zoning analyses to inform the planning of a marine protected area network in Raja Ampat, Indonesia, Marine Policy, 38, 184-194; Paulus Boli et al., 2014. Benefits of Sasi for Conservation of Marine Resources in Raja Ampat, Papua, JMHT XX, (2): 131-139.
- [11] 王毓正（2021），〈達悟族傳統海域自治管理與海域法規之衝突與調和〉，《原住民法學》7，40-53。



Developing Marine Information Power and Moving Towards a New Future Informed by Marine Science

Translated by Lingultronics

Minister of the Ocean Affairs Council: Chung-Wei Lee

New Zealand, located in the centre of the water hemisphere, relies on primary industries as its main source of income while the indigenous Maori people residing in with its territory have built their lives around the ocean. As such, we have decided to make New Zealand the focal point of this issue due the long history of development of its ocean policies and systems. In the section entitled "Organization Focus," we introduce the policies and regulations of New Zealand's Ministry for the Environment and Department of Conservation that pertain to the marine environment and natural resources, while "Industry Dynamics" summarizes the development background and institutional norms of New Zealand's whale watching industry, including whale watching guidelines and systems including regulations governing the interaction between vessels and cetaceans that help to establish a more sustainable industrial ecology. Apart from the above two sections, "Regulatory Systems" explicates the marine culture of the Maori people in New Zealand and the legal protection to which they are entitled, providing valuable reference information for the preservation and institutional protection of the marine culture of Taiwan's indigenous peoples.

Meanwhile, issues regarding marine science and information compilation and disclosure have been garnering increasing attention across the globe. For instance, the United Nations released the "Global Ocean Science Report" in 2020, providing the latest information on marine science manpower, knowledge and applications, data management and public access, scientific investment, and the impact of the epidemic, while Oceana, a marine conservation organization, published a report on marine plastic waste entitled "Choked, Strangled, Drowned," compiling data from government and non-governmental organizations from 2009 to 2020 and revealing that nearly 90% of the marine animals endangered by plastic waste in the United States are species already listed as threatened or endangered, thus calling on government agencies and private enterprises to respond to the plastic waste crisis. Taiwan has also mentioned in its "National Ocean Policy White Paper" that the challenges of managing and utilizing ocean information include lack of overall planning, data quality control, and coordination and integration, issues in response to which the National Academy of Marine Research has established a "Nationwide Marine Database" that has so far been connected to 97 databases. As marine science and information both in Taiwan and abroad move towards integrated, long-term development and greater emphasis is being placed on information disclosure, we hope these advancements will serve to facilitate the sustainable development of the ocean!



Rock carvings by the Maori people of New Zealand Mine Bay
Image by holgerheinze0 from Pixabay
<https://pixabay.com/photos/new-zealand-mural-maori-rock-water-583177/>

Overview of the Establishment of the Nationwide Marine Database

Wen-Chang Yang (Research Fellow, Marine Science and Information Research Center, National Academy of Marine Research)

Translated by Linguistronics

Keywords: Database, data standardization, marine information network

Whether from the perspective of ecology, environment, resources, energy, or disaster prevention, it is clear that the ocean is vital to Taiwan's sustainable development. To continue enjoying the various types of abundant resources provided by the ocean as we seek to further develop and utilize marine resources, we must, to the greatest extent possible, give due consideration to conserving the marine environment, thus maintaining a sound ecosystem. As such, the establishment of the Nationwide Marine Database will enable us to achieve the following benefits, including obtaining and applying marine-related knowledge from a scientific point of view, understanding the comprehensiveness and complexity of the ocean, and rethinking use of the ocean from a higher point of view, thereby achieving environmental protection and harmonization.

In the 2020 National Ocean Policy White Paper [1] proposed by the Ocean Affairs Council (OAC), the section titled "Scientific Marine Research and Technical Development" already summarizes issues deterring the development of ocean information as follows:

I. Lack in overall planning of marine meteorological observation

Taiwan's marine-related data is scattered among databases built and maintained by different agencies, resulting in dispersed observational data and lack of overall planning, making it impossible to comprehensively integrate, analyze and apply marine meteorological and offshore observation-related data.

II. Lack of scientific research data quality control and cross-domain talent participation

The quality assurance and control of ocean observation data depends on the expertise of talents specializing in a wide variety of ocean science and engineering fields. Through the help of experts who engage in long-term maintenance of the national marine information system, the goal of platform and information service-sharing can be achieved.

III. Databases are scattered and lacking in a coordination and integration mechanism

At present, due to project closure, database integration is no longer funded, which has resulted in the suspension of subsequent development, while the lack of a coordination and integration mechanism has led to the insufficiency of value-added application results for various types of data, taking away from the value of diverse data monitoring. From this perspective, it is imperative that related government agencies accelerate the establishment of a national marine information system and shared platform for managing fundamental ocean observation data and scientific research outcomes, thus avoiding funding gaps and overlapping resources.

IV. Lack of a long-term observation mechanism

Long-term observation of marine data allows us to truly grasp the data on the past, present, and future conditions of the marine environment, and develop and interpret marine environmental data into a commercially viable product network that provides the public with an understanding of the global marine environment in which we live and at the same time enables various industries to engage in marine resource development and environmental impact assessment.

Based on the analysis of this argument, four specific measures are also proposed in the White Paper: 1. Effectively plan a database to promote the integration and exchange of marine information; 2. Build a national marine information system; 3. Enhance international cooperation and information exchange; 4. Establish a personnel training system to popularize the use of marine scientific research.

To sum up the foregoing, the importance of establishing a marine database is highlighted in both the issues summarized and specific measures. However, as Taiwan's ocean observation and marine research-related data is scattered across different government agencies, academic institutions, and research institutions, we have been unable to comprehensively and effectively make use of this abundance of information. The National Academy of Marine Research (NAMR) is a think tank operating under the OAC and empowered to implement ocean policies. To integrate marine data scattered across various agencies (institutions) and formulate a comprehensive marine big data collection and integration system to bring into full play the benefits of integrating scientific research resources, the NAMR has established Taiwan's first ever "Nationwide Marine Database" which can in turn be applied to a multitude of dimensions including marine development planning, marine policies, marine spatial planning, environmental and ecological maintenance, maritime safety and rescue, disaster prevention and relief, and the establishment of environmental conservation mechanisms.

Overview of domestic and foreign marine databases

To build an environment for integrating and supplying domestic marine information, it is necessary to inventory relevant domestic marine databases. At the same time, to build a database of forward-looking and complete marine information, it is also necessary to refer to the contents of foreign marine databases. As such, many domestic and foreign marine databases were researched at the time of the establishment of Taiwan's national marine database. Table 1 lists a few of such domestic and foreign marine databases and gives a brief description of their data characteristics and information platforms [2-11].

Marine database planning and establishment

In addition to a highly-organized structured warehousing design, adequate software and hardware environments must be utilized to support the operation and maintenance of the marine database, so that there is a complete and effective mechanism for the acquisition, storage, and supply of data on the data circulation platform. The standardization and interpretation of data is an indispensable task in the process of data collection and sorting for the circulation of data and the application of big data. The establishment of the Marine Information Network converts raw data into information, thus facilitating the interpretation and application of the data. Open data is not just a current trend, but a means through which the value of data is revealed. However, certain rules must be followed in the use of data, making information security protection of the database an indispensable part of the system. In summary, the construction of a comprehensive marine database requires a variety of supporting mechanisms including data standardization, marine information networks, information security protection, and expansion of operation and maintenance.

Table 1/ A brief description of several domestic and foreign marine-related databases

Database	Data characteristics	Information platform
Central Weather Bureau	Nationwide marine meteorological observation, satellite remote sensing forecasts, numerical simulation forecasts, long-term statistics and other big data closely related to civilian needs, catastrophes, and climate change.	<ol style="list-style-type: none"> 1. Open Weather Data 2. CWB Observation Data Inquire System (CODiS) 3. Numerical Weather Prediction Products Display
Water Resources Agency	The Water Resources Agency has established a series of hydrological observation station networks for the purpose of water resources management, disaster prevention, and flood prevention, such as stations monitoring rainfall, river water level and discharge, among which meteorological tide gauge stations and buoy stations are more closely associated with the observation of marine data.	<ol style="list-style-type: none"> 1. Water Resources Data Integration Cloud Platform 2. Water Resources Geographic Information Service Platform 3. Hydrological Information Network
Ocean Data Bank (ODB), Ministry of Science and Technology	Survey data collected by various domestic research vessels (Ocean Researcher 1, No. 2, No. 3 and Fishery Researcher 1) is compiled, and marine research outcomes over the years are systematically analyzed, sorted and displayed, offering marine research units across the country access to data including hydrology, ocean currents, water depth, and seismic surveys, etc.	<ol style="list-style-type: none"> 1. ODB Hidy Viewer 2. ODB BioQuery
Marine Environment Database (MED), Taiwan Ocean Research Institute (TORI)	Data includes: Ship hydrology, biogeochemical data, geological topography data, CTD temperature and salinity; satellite telemetry images, water temperature, water color, surface salinity and wind field, etc.; surface ocean current, air pressure, temperature data; buoy data, numerical simulation data.	<ol style="list-style-type: none"> 1. Ship Survey Data Platform 2. TOROS Data Platform 3. Telemetry Data Platform 4. Anchor Observation Network
National Oceanic and Atmospheric Administration (NOAA)	Provides general information on weather, climate, coast and ocean, fishery, satellites, aviation meteorology (hurricane), conservation and education, including: Satellite images, atmospheric data (temperature, pressure, wind speed, etc.), ocean data (such as CTD temperature, salinity, topography, etc.), buoy data, and other project data.	<ol style="list-style-type: none"> 1. National Climatic Data Center (NCDC) 2. National Center for Environmental Information (NCEI)
SeaDataNet	In addition to the general marine biogeochemical and hydrological parameters, types of data covered also include underwater images, acoustics, optical properties, geothermal energy, ice circles, and biological data such as plankton or bacteria.	<ol style="list-style-type: none"> 1. SeaDataCloud 2. MetaData Services
Australian Ocean Data Network (AODN)	The data is divided into 4 categories: Biological environment: chlorophyll, nutrients, pigments, biota; marine chemistry: PH, carbon dioxide, dissolved oxygen data; ocean physics: acoustics, sonar echo, optical characteristics, sea-air exchange flux, temperature, salinity, density, sea surface height, turbidity, water pressure, ocean currents, waves, topography and other data; atmospheric physics: including temperature, air pressure, humidity, vapor pressure, ultraviolet light, wind speed, etc.	<ol style="list-style-type: none"> 1. Integrated Marine Observing System (IMOS) 2. Data Interpretation Platform 3. Data Tools and Services Platform 4. Dataset Exchange Platform

Consolidated by the author [2-11]

Introduction to the Nationwide Marine Database

In 2020, the NAMR began carrying out the Nationwide Marine Database Establishment Project [12], the main tasks of which include: establishment of the database operating environment, planning of the database warehousing structure, collection and standardization of marine data, the formulation of data interpretation rules, information security protection of the database, and the establishment of the marine information network. After a one-year period, the database system has been preliminarily completed, and relevant marine data scattered across various government agencies, academic and research units and private organizations have been gradually included. In the following paragraphs, tasks completed in the process will be individually described.

The operating environment of the Nationwide Marine Database is divided into a formal environment and a backup environment. In the formal environment, in addition to the application system server, mapping service server, and database server, a reverse proxy server is installed at the front end of the formal environment as the host through which data users and other application systems actually connect with the ocean database, and which is also responsible for the redirection of the aforementioned server connections. The layout of the backup environment is similar to the formal environment, with the primary difference being that storage devices comprise large-capacity NAS storage space, while the informal environment utilizes cloud storage space.

Among the many types of marine data, categories can include marine physics, marine chemistry, marine biogeochemistry, marine biological ecology, and geophysics, etc. academically. Data can also be categorized into marine surveys, anchored quantitative surveys, land-based telemetry, satellite telemetry, station sampling measurement, buoy observation, and sonar system detection, etc., depending on the means of observation or detection. Therefore, when building a marine database, data is classified based on the concept of warehousing, and structured storage is built to store data, so that data can be quickly and efficiently accessed according to an orderly path. According to the data attributes of domestic marine databases, the database is divided into three themed warehouses for hydrology, ecology and territorial evolution, while the structure within each warehouse is subdivided according to the specific parameters of individual data. Hydrology is divided into marine physics, marine chemistry, environment and marine meteorology, ecology is divided into ecological survey records, species explanations, marine conservation, and fishery, while territorial evolution is divided into topography, marine geophysics and marine geological drilling. Layer switching can be performed on the Marine Information Network based on data source (such as the Central Weather Bureau) and measuring instrument (such as buoys). In the process of the establishing the database, data on non-biological resources was found to be lacking, therefore a themed warehouse for this category has been established pending future use.

The Nationwide Marine Database has now completed the interface of 97 data sets from units primarily including government agencies, academic and research units, and private organizations. Units and organizations connected to the system include: The Ocean Conservation Administration and National Academy of Marine Research of the OAC, the Central Weather Bureau and Harbor and Marine Technology Center, Institute of Transportation of the Ministry of Transportation and Communications, the Ocean Data Bank of the Ministry of Science and Technology, the Fisheries Agency and Fisheries Research Institute of the Council of Agriculture, the Water Resources Agency, Central Geological Survey and Bureau of Energy of the Ministry of Economic Affairs, the Construction and Planning Agency and Department of Land Administration of the Ministry of the Interior, Academia Sinica, Industrial Technology Research Institute, and Taiwan Ocean Research Institute, etc.

One of the most important purposes for establishing the marine information network is to improve the data circulation mechanism for facilitating marine data storage in the future. The website system, completed and launched, offers not only data storage but also convenient access to the stored marine data, enabling subsequent applications and outcomes. Data is presented according to the aforementioned three major warehousing themes, and detailed planning and construction have been undertaken regarding the key circulation supply mechanism and back-end management mechanism in the system. The overall system architecture planned for the Marine Information Network is roughly divided into 4 layers, including source, storage, application, and use. The first layer, source, entails integrating and storing marine data from various agencies; the second layer, storage, in consideration of the huge amount of data in the system's GIS platform and the multitude of sources, is designed to interface data access to NoSQL to improve big data index efficiency. Historical data of earlier dates (more than 3 years) is regularly imported into the File Server, and can be queried via file download to ensure that front-end performance is not hindered by access to a large amount of data. In addition, relational data such as system accounts and externally available data is converted to MSSQL. The third layer, application, displays the interfaced data on the GIS platform, and accesses system data for data supply and backend management while the fourth layer, use, provides an integrated marine data platform for government agencies and scientific research institutions.

Conclusion

The establishment of a database is a task that continues over the long-term. Generally speaking, plans are made for the process to take over a four-year period for data richness and information platform stability to reach satisfactory levels. Interfaces to 97 data sets have been completed for this database in a one-year period, and the total amount of data that has been added is approximately 22TB with a total of 51 data sets displayed on the information platform. Regarding data standardization, standardized fields for data that have been completed include ecological data standardization, hydrology (station) data standardization, hydrology (station) standardized forms, hydrology (undersea) data standardization, and hydrology (offshore) data standardization. Interfacing to the hydrological (offshore) data standardized platform and data API development have also been completed, while data interpretation fields have been added, allowing back-end administrators to modify and build data. Establishment of the website system has been completed for the Marine Information Network. The front-end includes the Home Page, About Us, the member login system, displays of the 3 major data themes, the data supply system, the establishment of platform functions, and traffic statistics. In the back-end, functions including account management, data permissions, editing and management, and approval management for data supply application forms have been completed. In terms of information security and system maintenance, two web page vulnerability scans, penetration tests, information security diagnostics, backup drills, stress tests and corrections for all related weaknesses have been completed.

References

- [1] 海洋委員會 (2020年6月) , 《國家海洋政策白皮書》。
- [2] 中央氣象局 , 氣象資料開放平臺
<https://opendata.cwb.gov.tw/index>
- [3] 中央氣象局 , 觀測資料查詢
<https://e-service.cwb.gov.tw/HistoryDataQuery/index.jsp>
- [4] 水利署 , 水利地理資訊服務平臺
<https://gic.wra.gov.tw/Gis/>
- [5] 水利署 , 水利資料整合雲平臺
<http://wise.wra.gov.tw/>
- [6] 科技部海洋學門 , 資料庫-互動式「海的」資料展示平臺 (ODB Hidy Viewer)
<https://odbgo.oc.ntu.edu.tw/odbargo/>
- [7] 台灣海洋科技研究中心 , 海洋環境資料庫
<http://med.tori.narlabs.org.tw/>
- [8] 美國國家海洋暨大氣總署 (NOAA) , 美國國家海洋資料中心 (NODC)
<https://www.nodc.noaa.gov/>
- [9] 美國國家海洋暨大氣總署 (NOAA) , 美國國家環境資訊中心 (NCEI)
<https://www.ncei.noaa.gov/>
- [10] 泛歐聯盟組織 , 海洋數據網 (SeaDataNet)
<https://www.seadatanet.org>
- [11] 澳大利亞的海洋資訊網 (Australian Ocean Data Network, AODN) 整合海洋觀測平臺
<http://imos.org.au/>
- [12] 國家海洋研究院 (2020年10月) , 「109年度全國海洋資料庫」期末報告。

Global Ocean Science Report 2020: Charting Capacity for Ocean Sustainability

Chung-Ling Chen (Professor, Institute of Ocean Technology and Marine Affairs, National Cheng Kung University)

Chien-Ho Liu (PhD student, Institute of Ocean Technology and Marine Affairs, National Cheng Kung University)

Keywords: Ocean science report, ocean sustainability, UNESCO

The Global Ocean Science Report (GOSR) is an important resource for the people who seek to understand and harness the potential of ocean science for addressing global challenges. It can help inform strategic decisions on funding for ocean science, reveal opportunities for scientific collaborations and foster partnerships for further developing capacity in ocean science. The capacity for ocean science is employed in eight integrative, disciplinary and strategic themes: blue growth, human health and well-being, marine ecosystems functions and processes, ocean crust and marine geohazards, ocean and climate, ocean health, ocean observation and marine data, and ocean technology. The first GOSR was published in 2017 and the second edition in 2020. The data in the GOSR 2020 was from the survey reported by 45 countries, which are responsible for 82% of ocean science publications over the time period 2010-2018. This allowed analyses to be conducted at the global, regional and national scales. (The content of this paper is mainly excerpted from IOC-UNESCO. 2020. Global Ocean Science Report 2020—Charting Capacity for Ocean Sustainability. K. Isensee (ed.), Paris, UNESCO Publishing.)



Countries (dark blue) responding to the GOSR 2020 questionnaire (countries where data from the GOSR 2017 are used in the GOSR 2020 assessments are shown in light blue)
Source/ IOC-UNESCO (2020) [1]

Introduction

The GOSR 2020 presents eight top findings:

- I. The findings of ocean science have direct implications for sustainable development policies and are applied in the management strategies and action plans of multiple societal sectors. They are converted into numerous applications (e.g., new pharmaceuticals) which are beneficial to the society.

- II. Funding for ocean science is inadequate. This lack undermines the ocean science ability particularly on how to support the sustainable provision of ocean ecosystem services to humanity.
- III. Women in ocean science continue to be underrepresented, particularly in the highly technical categories.
- IV. Recognition of young ocean scientists and the level of support offered for them differs widely among countries. In general, early career ocean scientists and professions are not yet recognized as intellectual source that will confront the challenge of ocean sustainability.
- V. The technical capacity of ocean science remains unequally distributed among countries and regions.
- VI. The number of ocean science publications worldwide continues, especially in countries of Eastern and South-Easter Asia.
- VII. Countries, in general, do not have adequate capacity to manage their ocean data and information, which hampers open access and data sharing.
- VIII. Many parts of the world do not have systematic frameworks and strategies in place to measure progress towards the achievement of the 2030 Agenda, and SDG 14 in particular. SDG 14 is specified as 'Increase scientific knowledge, develop research capacity and transfer marine technology'.



The ocean plays a key role in the achievement of Sustainable Development Goals
Image by Chung-Ling Chen

Ocean Science human capacity

Human capacity is a critical role in the ocean science enterprise and in the science-to-management and science-to-innovation value chains. Information shows that national numbers of ocean science researchers per million inhabitants vary between <1 to >300. These ratios do not directly relate to Gross Domestic Product (GDP). For example, Norway and Portugal have more than 300 employed researchers per million inhabitants.

Gender equality in ocean science is not yet achieved. Female ocean science personnel range from 7% (Democratic Republic of the Congo) to 72% (Ireland) of all ocean science personnel. The global average stands at 37%. The personage of female ocean science personnel is equal to or higher than 50 in countries such as Angola, Bulgaria, Croatia, El Salvador, Ireland, Poland and Turkey. However, there is increasing participation of female scientists in international conferences, serving as an indicator used to

assess the involvement of women in ocean science. Female participants account for 29% to 53% of total conference participants, depending on science category and region. This number is higher than that of GOSR 2017.

Ocean science knowledge, applications and sustainable development

Global ocean science publications continue to rise over the past 18 years, with the obvious rise of a 10% increase from the Eastern and South-Eastern Asia region. This is largely driven by China, and followed by Japan and Republic of Korea. In addition, papers generated from international partnerships are increasing as well. In the period 2012-2017, 61% of the papers published ocean scientists had at least one co-author from a foreign country, higher than approximately 56% from 2006 to 2011 and 52% from 2000 to 2005. This indicates that collaboration among scientists from different countries is a sustained trend and should be regarded as a very valuable and positive development.

It is noted that many ocean science findings are converted into applications for society. This is reflected in the most frequent ocean science-related technologies (e.g., 'Technologies', 'Applications for mitigation', or 'Adaption to climate change') in the Cooperative Patent Classification (CPC). This also indicates that ocean's role is important in regulation the climate change and the negative impact of anthropogenic change on ocean health.

Furthermore, ocean science supports sustainable development and management of ocean resources. Namely, sustainable development is not possible without ocean science. However, currently many countries lack a specific strategy to measure progress towards the achievement of SDG 14. Of the 37 countries that respond to the related question, only 70% have strategies and a roadmap to achieve the goals of the 2030 Agenda. However, only 21% reported that they have a specific strategy relevant to the ocean and SDG 14.

Ocean data and information management

Not every country has capacity and infrastructure supporting the management of ocean data and information. Globally, only 57 countries have a designated national oceanographic data center. The top four services the centers offer are: 1. metadata and data archival; 2. access to documented methods, standards and guidelines; 3. data visualization; 4. web services. The clients and end users of these services cover many sectors of society, reflecting the broad relevance of oceanographic data and information to the economy, research, public administration and business.

Data sharing and open access ensure that a variety of societal groups have access to data, data products and services. However, while ocean data is regarded as a common good, open access to ocean data is still from this norm. As an illustration, while in Europe and Northern America, more than 90% of data centers have established relationships to exchange their data with other data systems, in Latin America and the Caribbean, fewer than 50% of data centers have established such relationships. In addition, though 58% of ocean data centers claim to comply with the FAIR principles (Findability, Accessibility, Interoperability and Reusability), 60% of them still restrict access to certain data types.

Investments in ocean science

42 countries provided information about technical equipment used for ocean science. But only five countries from the Northern Hemisphere reported have full access to a wide range of technical infrastructure, including USA, Germany, Norway, Japan and Canada. A total number of 1,081 vessels serve ocean science. Among them, 924 vessels almost exclusively and 157 ship occasionally used for

ocean science, respectively. More than one third of the global research fleet is maintained by the USA. Based on the information gathered from 920 research vessels, 24% engage in coastal research, 8% at regional, 5% at international and 11% at global scale.

Overall, the portion of gross domestic expenditure on research and development devoted to ocean science is noticeably smaller than for major fields of research and innovation. The percentages range from 0.03% to 11.8%, with an average of 1.7%. This is a very small proportion compared to the estimated USD 1.5 trillion contribution of the ocean to the global economy. In addition, ocean science budgets vary significantly among countries and over time. Based on the information received, 14 countries increased their budgets and 9 reduced their budgets. Russia had the highest annual growth rate, peaking at 10.4% followed by the UK and Bulgaria. Japan, Ecuador, Turkey, Brazil and Italy markedly reduced their budgets.

The sources of funding for ocean science have diversified over the years, including national administration, international programmes, the private sector, foundations and philanthropic organizations. Although funding mainly comes from institutions, private foundations and donors could play a larger role in the funding of small- and large-scale projects during the next decade. As other scientific domains, ocean science is also starting to benefit from innovative funding mechanisms, including transdisciplinary research funds, crowdfunding, lotteries and levies.

Partnerships across countries and different sectors are recognized as a key strategy for more effective resource use and increased participation in ocean science. Multiple measures have been in place to encourage international cooperation and exchange, such as financial support to facilitate international board memberships, exchange programmes, advisory positions in national and regional bodies, as well as guest researcher positions in the academic sector.



Research vessel is an important technical equipment of ocean science
Image by Taiwan Ocean Research Institute

Potential impact of COVID-19 on ocean science

The immediate impact of COVID-19 on ocean observations during the first half of 2020 was observed. Almost all research vessels returned to their home ports. Consequently, almost all work to maintain mooring arrays that monitor ocean currents and air-sea exchange has been cancelled. This situation affected between 30–50% of the 300+ moorings, some of which ceased to transmit data as batteries ran out. However, it is lucky to see that the Global Ocean Observing System still functioned normally due to its use of autonomous observing platform. But this system will not stay this way indefinitely and if the COVID-19 continues, data assessment will be affected for the second half of 2020 and the first half of 2021. The impact of the COVID-19 pandemic on ocean science is yet to be assessed. The data contained in the GOSR 2020 are pre-COVID-19. The next edition of the report will evaluate the full impact of the pandemic on ocean science infrastructure, human and technical capabilities, funding, investment by the private sector, scientific output, trends in R & D, and employment.

Actions in ocean science

To turn the vision of the UN Decade of Ocean Science for Sustainable Development – 'The science we need for the ocean we want' – into reality, the GOSR calls for the following actions by governments, organizations, scientists, philanthropy, the private sector and civil society:

- I. Enhance the current level of funding for ocean science;
- II. Continue to collect data on investments in ocean science so as to identify their multiple socio-economic returns at the national, regional and global scale;
- III. Facilitate co-design of ocean science by involving ocean science information users and producers;
- IV. Promote multi-stakeholder partnerships in ocean science and transfer of marine technology;
- V. Foster equal participation of all countries, genders and ages in ocean science capacity development;
- VI. Develop strategies and implementation plans to support the career needs of women and young scientists;
- VII. Find solutions to remove barriers for open access to ocean data;
- VIII. Foster education and training in professions related to ocean science;
- IX. Assess the impact of the COVID-19 pandemic on human and technical capacity in ocean science.

Conclusion

The ocean plays a key role in the achievement of Sustainable Development Goals. A consensus is emerging that the future 'ocean that we want' should be one that is managed sustainably based on the best available science; and the GOSR measures such adequacy. GOSR 2020 offers updated information on ocean science human capacity, knowledge and application, ocean data management and open access, investments in ocean science, and the impact of COVID-19 on ocean science. It also points out the actions that we need to strengthen in the future. The next edition will be published in 2025. The continuously improved data collection and updated information will make future analysis more robust and the measurement of ocean science capacity more accurate.

References

- [1] IOC-UNESCO (2020). Global Ocean Science Report 2020—Charting Capacity for Ocean Sustainability. K. Isensee (ed.), Paris, UNESCO Publishing.

Systems and Regulations of New Zealand's Whale Watching Industry

Cheng-Tsung Tseng (Secretary-General, Taiwan Cetacean Society)

Translated by Linguistronics

Keywords: New Zealand, whale watching, sustainable tourism

Due to the impact of COVID-19 in 2020, to prevent the spreading and dissemination of pathogens, countries around the world have adopted relevant measures such as border blockades or flight restrictions and travel limits. The number of outbound and inbound passengers has therefore greatly reduced, resulting in a severe recession in the global tourism industry [1]. As the epidemic is largely under control in Taiwan, domestic short-distance travel has soared rapidly after June as large numbers of visitors flooded outdoor attractions. According to results from the Taiwan Cetacean Society's long-term whale watching monitoring efforts at Wushi Port, whale watching cruises in the waters around Guishan Island from July to September 2020 took place in greater numbers and at higher frequencies than the previous two years due to the surge in summer tourists. On top of that, the issue of vessels surrounding and chasing cetaceans and dolphins is also becoming increasingly serious with yacht operators even maliciously ramming into cetaceans and dolphins, creating unnecessary interference. The impact of this "travel spree" that has emerged as a result of the COVID pandemic has as a result caused previous whale watching hot spots on Guishan Island to completely disappear in the summer of 2020 or move to the open sea at distances further away from land and human activity [2]. The primary reason for the above issue is Taiwan's lack of clear whale watching policies and regulations. The methods, duration, and distance with which ships may approach whales and dolphins are subject to the autonomy of operators in various regions, without any penalties and effective mechanisms of supervision [3]. New Zealand, on the other hand, where more than 550,000 persons engage in whale watching activities every year, has a history of industry development, laws and regulations and industry research that are all more comprehensive than those of Taiwan. This article introduces the development background and relevant systems and regulations of New Zealand's whale watching industry so that more members of the public, businesses and government authorities can gain a deeper understanding of the different forms of whale watching that will in turn broaden the directions of development for Taiwan's whale watching industry and ensure that tourism is more sustainable.

The development of whale watching in New Zealand

European whaling ships began operating in New Zealand waters and hunting whales as early as 1769. By the middle of the 19th century, the whaling industry had become one of New Zealand's important economic industries, but the catch had gradually reduced due to overfishing, leading to commercial losses and gradual industry decline starting in 1920 with the last whaling station closing around the 1960s. As the industry waned, residents of the small town Kaikoura who relied



Figure 1/ Whale watching tourism is an industry that has emerged in Taiwan within the past few years, and the spinner dolphins in Yilan are the most important whalewatching species in the area
Image by Taiwan Cetacean Society

on whaling as their primary source of income began experiencing severe economic problems. As the region surrounding Kaikoura is abundant in marine ecological resources such as whales, dolphins and sea lions, local residents began trying to introduce ecotourism sightseeing itineraries to improve their income in the early 1980s. In 1987, several local Maori families, authorized and assisted by the government, co-founded New Zealand's first whale watching company, launched a tour featuring sperm whale watching, and started operations in July 1989. In traditional Maori culture, the term "kaitiakitanga" means that humans must be the guardians and protectors of the environment. Under the influence of this traditional culture, New Zealand's local whale watching activities are informed by concepts of environmental sustainability, whether in terms of business or management.

In addition to the influence of traditional culture, the New Zealand government also promulgated the Marine Mammals Protection Act (MMPA) as early as 1978 and formulated the Marine Mammals Protection Regulations (MMPR) in 1988. The relevant standards for whale watching, the rules for interactions between ships and cetaceans, etc. were all regulated before the establishment of the whale watching industry, and became immediately applicable upon the emergence of this new form of eco-tourism. After whale watching tours became available in New Zealand in 1989, they gained great market popularity with the number of tourists growing by 14% annually. In 2006, more than 1 million visitors traveled to Kaikoura, bringing to the region approximately US\$20 million in tourism output value and many job opportunities. However, with the development of the industry, conflicts between commercial activities and cetaceans have gradually increased. To ensure sustainable operation and management, in addition to the implementation of studies on the potential impact of whale watching activities, it is also necessary to revise relevant laws and regulations in a timely manner. From 1989 to 2000, for instance, studies have shown that dusky dolphins often rest at noon, while 72% of their rest time may be disturbed by whale watching vessels appearing in their vicinity. Other violations against MMPR such as extraneous numbers of vessels surrounding the animals and vessels approaching the animals too closely also occur frequently. In response, New Zealand's Department of Conservation (DoC) decided to postpone the issuance of new whale watching permits for a period of 10 years, and members of the whale watching industry also signed a self-governance agreement on refraining from approaching dolphins during their rest period (11:30 am to 1:30 pm) to lessen the disturbance caused to cetaceans.

Whale watching information in New Zealand

Current research shows that about 51 species of marine mammals have been recorded in New Zealand waters, and half of the world's cetacean species (about 90 species) can be found in this region. Since the introduction of whale watching tours in the 1980s, an average of more than 550,000 tourists visit New Zealand for whale watching each year.

There are currently 8 whale watching locations in New Zealand as well as several land-based whale watching hotspots. In terms of method of observation, apart from the more commonly known whale watching boats that visitors may board, helicopter guided tours or swimming alongside the animals is also available in certain areas or for certain species, as shown in Table 1 [4]. Kaikoura is the most popular whale watching spot in New Zealand and where almost 40% of New Zealand's whale watching trips depart. Due to the many underwater canyons around Kaikoura, the deep sea attracts sperm whales – the largest species of odontocetes – who reside in these waters and can be seen all year round, making them the most popular attraction on whale watching tours in Kaikoura.

Table 1/ Forms and regions of whale watching for New Zealand's cetacean species

Species	City or port	Form of whale watching	Optimal observation period
Sperm whale (<i>Physeter microcephalus</i>)	Kaikoura	Observation by boat, aerial observation	Year-round
Bryde's whale (<i>Balaenoptera edeni</i>)	Auckland	Observation by boat	Year-round
Humpback whale (<i>Megaptera novaeangliae</i>)	Kaikoura	Observation by boat, aerial observation	June to July
Southern right whale (<i>Eubalaena australis</i>)	Kaikoura Dunedin	Observation by boat	June to August
Killer whale (<i>Orcinus Orca</i>)	Kaikoura Marlborough Sounds Tauranga Auckland Bay of Islands	Observation by boat	Year-round
Bottlenose dolphin (<i>Tursiops truncatus</i>)	Fiordland Bay of Islands Auckland Tauranga Marlborough Sounds	Observation by boat	Year-round
Dusky dolphin (<i>Lagenorhynchus obscurus</i>)	Kaikoura Marlborough Sounds	Observation by boat, swimming with dolphins	Year-round
Short-beaked common dolphin (<i>Delphinus delphis</i>)	Bay of Islands Auckland Tauranga Marlborough Sounds	Observation by boat	June to August
Hector's dolphin (<i>Cephalorhynchus hectori</i>)	Akaroa Kaikoura Marlborough Sounds	Observation by boat, aerial observation	Year-round

Source/ <https://www.handbook.iwc.int/en/country-profiles/new-zealand>

Whale watching regulations in New Zealand

All cetaceans are protected by the Marine Mammals Protection Act, and all whale watching activities and commercial activities are governed by the Marine Mammals Protection Regulations. In addition to commonly known regulations that prohibit interference and harassment of cetaceans, these regulations additionally define and regulate commercial whale watching activities in the sea and airspace while also protecting mother-calf pairs and controlling the level of noise generated from whale watching activities, such as banning noise and requiring boats to decelerate. The following is a summary of regulations governing whale watching activities [4].

I. General regulations

- Interference, harassment and the generation of noise around cetaceans is prohibited.
- When marine mammals show any response to disturbance or fright, contact should be stopped.
- Do not feed or discard any garbage near marine mammals.
- Vessels or aircrafts should refrain from suddenly or repeatedly accelerating or changing directions around marine mammals.
- Within 300 meters of any marine mammal, the total number of vessels and aircrafts shall not exceed 3.

II. Sea regulations

- Travel at idle speed or with no wake within 300 meters of any marine mammal.
- Approach from the back or side of the cetacean group.
- Do not surround the cetaceans, obstruct the path of the cetaceans, or pass through the cetacean group.
- Remain at least 50 meters away from whales (at least 200 meters when a mother-calf whale pair is encountered).
- Swimming with whales is prohibited.
- Swim with dolphins is allowed, but swimming with mother-calf dolphin pairs is prohibited.
- When leaving a group of dolphins, you may slowly accelerate away, but sailing speed within 300 meters of the dolphins must not exceed 10 knots.

III. Air regulations

- When flying close to any marine mammal, the aircraft should maintain a horizontal distance greater than 150 meters from the animal.
- Avoid flying directly above marine mammals or covering animals with shadows.

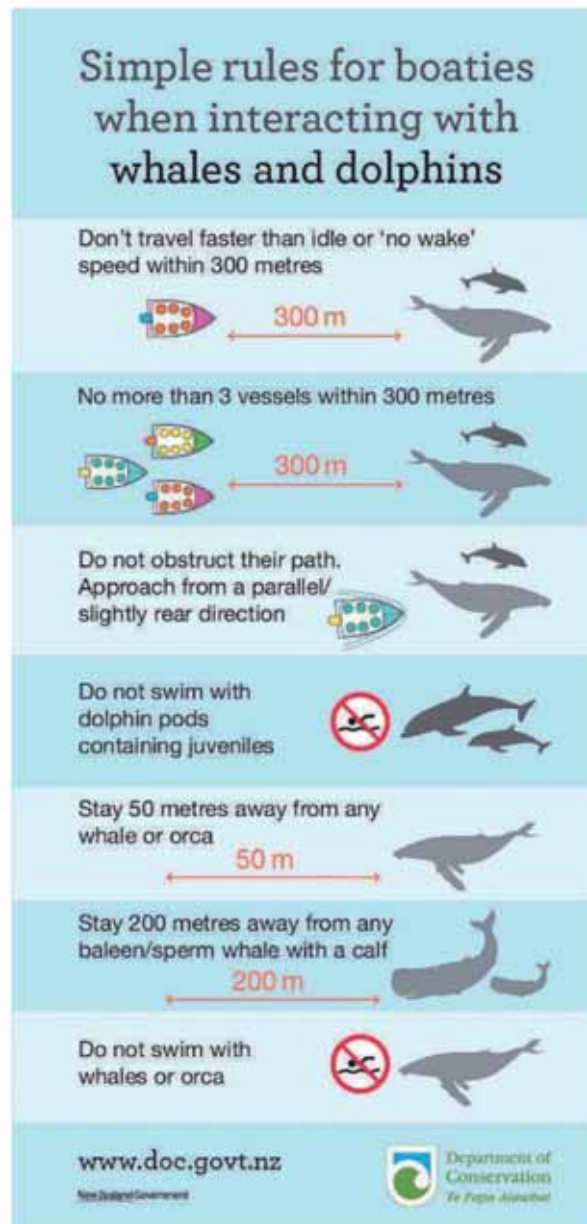


Figure 2/ Simplified New Zealand Whale Watching Regulations
Source/ <https://s3-eu-west-1.amazonaws.com/wwhandbook/guideline-documents/New-Zealand-marine-mammal-rules-for-social-media.pdf>

An overview of the development history and system of the whale watching industry in New Zealand reveals that both laws and regulations were in place before the establishment and implementation of the industry, and operators are also highly cooperative in assessing the potential risks caused by whale watching activities based on research data, enabling the government to formulate relevant regulations or make flexible adjustments to the speed of industrial development to maintain environmental and ecological stability. In conjunction with New Zealand's traditional culture of regarding human beings as guardians of the environment and the joint participation and development of the community, the cetacean resources found in New Zealand waters have remained sustainable. Just as the criteria for

sustainable tourism proposed by the Global Sustainable Tourism Council specify, the tourism industry should utilize sustainable management strategies, while integrating environmental sustainability and cultural sustainability with social and economic benefits to achieve the sustainable development of living environments in travel destinations, thus ensuring whale watching tourism becomes more sustainable [5][6].

Conclusion

It has been more than 20 years since Taiwan's maiden whale watching voyage took place in 1997. These two past decades however have seen no further updates to relevant laws and regulations, and there is as yet no effective supervision mechanism arising from the self-governance agreements signed by operators of various regions; as such, interference on cetaceans by ships continues to occur. As evidenced by research conducted in 2012 [7], the impact of whale-watching has caused an increase in the distance from the shore to the locations where whales and dolphins are spotted at sea, while the number of spinner dolphins that were originally commonly seen around Guishan Island have been decreasing year by year. When multiple whale watching boats approach, most dolphin pods also dive into the water, exhibiting dodging behavior.

Looking back on the past two decades, there are indeed certain aspects of Taiwan's whale-watching policies that exhibit room for improvement, particularly:

- The establishment and enforcement of regulations exclusively designed for whale watching activities.
- The formulation of a national or impartial third-party sustainable whale watching tourism review mechanism.
- Carrying out long-term monitoring of the interactions between whale-watching vessels and cetaceans.
- The implementation of marine environmental education during whale-watching tours.

Following the establishment of the Ocean Affairs Council, the current status of cetacean interference is expected to gradually improve, particularly with the upcoming proposal of the Ocean Conservation Act that stipulates relevant management regulations targeting marine recreation, leisure activities, maritime navigation and activities, and vessel operation. In 2019, the Ocean Conservation Administration of the Ocean Affairs Council also issued the "Cetacean Watching Guide in Taiwan." Although the guide may simply be a code of conduct that calls on environmentally friendly whale watching behavior and has no legal effect, references to the Wildlife Conservation Act exhibit the government's intention to protect the cetaceans living in Taiwan waters. The formulation of regulations alone are however never enough. The collective participation of the community, the introduction of natural landscapes and local culture, the self-management of the industry and the maintenance of ecological resources in the sea area, etc., are all aspects that contribute to the diversification of whale watching tourism and the sustainability of Taiwan's whale watching industry.

References

- [1] 財團法人臺灣觀光協會 (2021年1月6日) 。2020 1-10月全球觀光整體概況
http://www.tva.org.tw/Trends_detail/9cc2fd7f80bd4ae2ad5e21d7f41564eb (Jan. 15, 2021)
- [2] 陳冠宇、曾廷球、郭毓璞 (2021) 。報復性旅遊與龜山島周邊鯨豚族群生態互動之研究。口頭發表，2021 動物行為、生態暨環境教育研討會。
- [3] 財團法人黑潮海洋文教基金會 (2018) 。臺灣海域賞鯨規範可行性評估暨推廣計畫 (案號：108-C-27) 成果報告書，海洋委員會海洋保育署委託計畫，5-68。
- [4] International Whaling Commission (2021). Whale watching handbook
<https://wwhandbook.iwc.int/en/country-profiles/new-zealand> (Jan. 15, 2021)
- [5] 台灣永續旅行協會 (2021) 。GSTC永續旅遊準則 & 認證
<https://sustainabletravel.org.tw/step%E5%9C%8B%E9%9A%9B%E8%AA%8D%E8%AD%89/> (Jan. 15, 2021)
- [6] Global Sustainable Tourism Council (GSTC). The GSTC Criteria for Destinations. 2021
<https://www.gstccouncil.org/gstc-criteria/gstc-destination-criteria/> (Jan. 15, 2021)
- [7] 謝嘉煌 (2012) 。宜蘭海域的鯨豚生態監測與賞鯨船對鯨豚之影響，碩士論文，國立宜蘭大學，18-44。

New Zealand's Ministry for the Environment and its National Ocean Policy

Huey-Shian Chung (Assistant Professor, Ocean Law and Policy Bachelor Degree Program, National Taiwan Ocean University)

Translated by Linguistronics

Keywords: New Zealand, ocean policy, Ministry for the Environment

New Zealand is located in a watery hemisphere and equipped with the world's fourth largest exclusive economic zone. As an island country with primary industries as its main source of income and the indigenous Maori people whose livelihoods depend on the ocean, New Zealand's society of today regards the ocean as the core value of society and remains strongly connected with the ocean.



The species of New Zealand Conservation in Auckland: Bottlenose Dolphins (upper left), snapper (lower left), Brown Teal (upper right), tuatara (lower right)
Image by Department of Conservation from Flickr (CC BY 2.0)
<https://www.flickr.com/photos/docnz/albums/72157665069302220>

New Zealand's environmental laws and environmental issues have been developing since the 1970s. In terms of the division of maritime affairs, the New Zealand government adopts a federal system: maritime activities in the nation's territorial waters are managed by local regional councils, while maritime activities within the exclusive economic zone and outside of territorial waters as well as fisheries, marine conservation, maritime traffic, maritime safety and other matters in the entire waters of New Zealand are under the jurisdiction of the relevant federal government agencies, as shown in Table 1.

Table 1/ Division of maritime affairs among New Zealand's government agencies

Responsible agency	Jurisdiction
Ministry for the Environment	Administration of laws related to the exclusive economic zone and its scope
Environmental Protection Authority	Approval, supervision and enforcement of laws related to the exclusive economic zone
Ministry for Primary Industries	Fisheries management
Department of Conservation	Marine conservation areas and endangered species
Ministry of Transport	Maritime Transport Act 1994
Maritime New Zealand	Maritime Traffic Management
Regional Council	Management of territorial waters
Ministry of Business, Innovation and Employment	Health and safety matters related to marine management
NZ Petroleum & Minerals	Management of oil, gas, and mineral licenses
Ministry of Foreign Affairs & Trade	Maritime related international conventions

Source/ Ministry for the Environment of New Zealand Government (2019) [1]

This article introduces the development of the New Zealand Ministry for the Environment (MfE), the cooperative relationship between the MfE and the Department of Conservation (DoC), and current developments in New Zealand's ocean policy. The details are as follows:

Organizational Development of New Zealand's Ministry for the Environment

The Ministry for the Environment (MfE) of New Zealand, established after The Environment Act was passed in 1986, was formulated for the primary reason of making New Zealand the most livable place in the world. To achieve this goal, the quality of the environment should be improved in order to toward prosperity. According to The 1986 Environmental Act, the main functions of the MfE are:

- I. Advising the government and related departments on all matters related to environmental administration, including policies related to the management of natural and physical resources and ecosystems to meet the objectives of the Environmental Act, management of public or private sector proposals that have a significant impact on the environment, and verifying that laws and regulations can effectively involve citizens in the formation of environmental planning and policies at the regional and local levels.
- II. Obtaining, processing, and supervising research and recommendations related to environmental policies.
- III. Providing government and relevant public agencies with environmental-related recommendations, including the application, operation and effective implementation of the Environment Act, assessing and monitoring environmental impact, pollution control and pollutant management, and identifying natural hazardous substances and reducing their impact.
- IV. Responding to policies and proposals that may be in conflict with environmental protection.
- V. Providing and transmitting information and services that promote environmental policies, including environmental education and citizen participation [2].

The purpose of New Zealand's MfE is to act as an intermediary for the organization and change of the environment. When promoting environmental-related policies, the MfE attaches great importance to the establishment of partnerships with relevant stakeholders and other organizations, utilizing a "bottom-up" and "outside-in oriented" policy formulation and decision-making model to gradually form a consensus, thus ensuring the balance between environmental protection and economic development is maintained. On this basis, the Ministry promote economic growth and build a low-carbon and resilient society.

The New Zealand MfE is responsible for a number of laws. Among these laws, the Resource Management Act 1991 (referred to as RMA) and the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 are closely related to ocean affairs.

RMA is the main law administrating natural resources. RMA regulates New Zealanders' activities on natural resources and their impacts to the environment. RMA also applies the principle of sustainability when addressing the allocation and use of natural resources. In ocean environment, Article 12 of the RMA also clearly states that no one can claim ownership of beaches and seabeds, therefore all beaches and seabeds in New Zealand are owned by the state, and their use or disposal must be in accordance with national environmental standards and approved by the state [3].

The "Exclusive Economic Zone and Continental Reef Environmental Impact Law" aims to promote the sustainable management of the sustainable use of natural resources in the exclusive economic zone and continental reefs, and the MfE is vested with rights to either permit or prohibit certain types of activities based on this Act to prevent harmful substance or pollution from ships from affecting this area. Therefore, the contents of the law include relevant regulations for development activities, submarine cable laying, scientific research and other activities in this area [4].

Division of labor between the Ministry for the Environment and the Department of Conservation

The Ministry for the Environment (MfE) is New Zealand's competent authority for dealing with environmental issues. As sustainable development issues become increasingly pressing, environmental protection alone has become less than sufficient for improving quality of life; the wise use of natural resources to drive social and economic advancement is also another important aspect of management. To this end, New Zealand established the Department of Conservation (DoC) in 1987, assigning it the



Image by Pride Advertising Agency Ltd.

mission to manage natural resources including virgin forests, wildlife, water resources, coastal environments, etc., and to remain committed to promoting the conservation and sustainable use of natural resources [5]. The Marine Reserve Act is a marine-related law under the jurisdiction of the DoC, and it is the main basis according to which New Zealand designates marine protected areas [6]. To conserve wildlife, including marine life, New Zealand passed the Marine Mammals Protection Act in 1978, following which the DoC designed the New Zealand Threat Classification System Red List based on the Red List established by the International Union for Conservation of Nature (IUCN) to provide marine life with systematic protection [7].

The MfE and the DoC have established many partnerships for the management of ocean utilization. For instance, according to the "Annual Report" issued by the MfE in 2020, under the cooperation of the MfE, DoC and other government agencies, 0.4% of New Zealand's oceans and coastal areas have been designated as no-take marine reserves that entail the strictest protection against entry and use. Ocean and coastal areas are moreover included in the regional development plans of local governments so ocean and land are managed in an integrated manner [8]. In terms of the respective responsibilities of these two agencies, the MfE focuses on managing the impact human activities have on the marine environment, while the DoC is committed to issues regarding the utilization and conservation of marine resources. For example, when conducting ocean bottom seismic surveys, the regulations of The Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act must be observed with regard to the impact that the process may have on the ocean environment, and all ocean bottom activities must be performed in accordance with the Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations [9].

New Zealand's Ocean Policy

New Zealand currently has a coastal policy, an ocean policy has not yet been formulated. However, New Zealand had already realized in the 1990s that laws and regulations fail to enable ocean governance in an integrated or comprehensive manner; in 1999, therefore, the Labour Government, which was the ruling party in New Zealand at the time, began to support development measures to manage New Zealand's waters. In conjunction, the Parliamentary Commissioner for the Environment issued an environmental report suggesting that New Zealand's ocean policy should be shaped through an integrated approach. The report also revealed that sustainable fisheries, the decline of species and ecosystems, mixed catch of non-target fish species, lack of comprehensive biosecurity, recreational fishery regulations, scientific data on marine resources and ecosystems, deep-sea conservation, and the impact of land management on the marine environment were all issues that needed to be addressed urgently [10].

In 2001, the Cabinet of New Zealand established the Ministerial Advisory Committee on Oceans Policy to draft New Zealand's ocean policy, the drafting process for which was divided into three stages. In the first stage - "defining the vision," the committee conducted a public hearing and citizen participation in 2001, and consolidated the results of the discussion into a report which pointed out that New Zealand society is highly dependent on the ocean and that safe ocean infrastructure and healthy marine ecosystem services should be the key development directions of the country. The report also pointed out that although New Zealand has already promulgated a considerable number of laws and regulations for dealing with marine affairs, it lacks an overall ocean policy vision and goals as well opportunities for citizens to participate in management. As such, it is imperative the country establishes an ecologically-based marine spatial planning and integrated management system [11]. A national-level ocean policy will facilitate the resolution of conflicts between different management mechanisms and ensure that contemporary use of the ocean will not cause harm to the marine ecosystem, so the ocean can serve as the foundation for the development of New Zealand as it continues to face a changing variety of future challenges. Finally, the committee agreed to define the vision statement of New Zealand's ocean policy as the development of a healthy ocean (Healthy Ocean), confirming that a healthy marine ecosystem can contribute to the social, cultural, environmental and economic well-being of New Zealand for generations [12].

However, the development of New Zealand's ocean policy came to a standstill in the second stage, which entailed "designing the tools to achieve the vision." The original goal was to produce a draft of the maritime policy in 2003 and submit it to the cabinet, but differences arose between the Maori people and the Royal on the use and management of the foreshore between the high tide line and low tide line of the sea and the seabed. Issues including marine ranches polluting the Maori's traditional use of sea areas, technological development increasing stress on marine space and resource use and the effectiveness of law enforcement on illegal fishing were all discussed, but negotiations were unsuccessful [13]. The Maori are the main aboriginal people of New Zealand and one of the primary cultural origins. New Zealand has maintained a steadfast relationship with the Great Britain. The two sides signed the Treaty of Waitangi in 1840, establishing the rights and obligations of both parties, including the Maori's retention of traditional rights to use their existing land. The treaty is considered an important document for the establishment of a modern Western country in New Zealand. In the process of drafting ocean policies, it is necessary to ensure that both the Maori cultural value and Western modernization are incorporated into the ocean management and decision-making procedures [14]. Although the second stage of the discussion was reinitiated in 2005, after the current administration took over in 2008, the issue of developing a national ocean policy has been put on hold until today [15].

Conclusion

Although New Zealand enforces a considerable number of laws regulating maritime affairs, there is no overall maritime affairs objective, making it difficult for related agencies to jointly formulate meaningful and integrated management methods that are ecologically-oriented. In view of the fact that an increasing number of maritime countries such as Australia and Canada are developing national ocean policies, and the pressure of human activities on the ocean system continues to increase, experts and scholars in New Zealand continue to call on the government to continue completing the draft maritime policy and push the development process forward onto the third stage which entails "delivering the vision". In this stage, it is expected that relevant policy tools will be developed, and necessary legal and organizational adjustments will be undertaken to realize the vision of a healthy ocean [16]. As such, it is evident that a nation's maritime policy can be said to be the overall direction and goal of the country's development of maritime affairs.

References

- [1] Ministry for the Environment of New Zealand Government (2019), The Sasakawa Peace Foundation, Managing our marine environment, Ministry for the Environment of New Zealand Government <https://www.mfe.govt.nz/marine/we-all-have-role-play/managing-our-marine-environment> (Jan. 18, 2021)
- [2] Ministry for the Environment of New Zealand Government (2019), Why our marine environment matters, Ministry for the Environment of New Zealand Government <https://www.mfe.govt.nz/marine/why-our-marine-environment-matters> (Jan. 20, 2021)
- [3] New Zealand Legislation, Resource Management Act 1991, art. 12 <https://www.legislation.govt.nz/act/public/1991/0069/latest/DLM231949.html> (Jan. 20, 2021)
- [4] New Zealand Legislation, Exclusive Economic Zone and Continental Shelf (Environmental Effect) Act 2012 <https://www.legislation.govt.nz/act/public/2012/0072/latest/DLM3955428.html> (Jan. 20, 2021)
- [5] Department of Conservation of New Zealand Government, Our purpose and outcomes, Department of Conservation of New Zealand Government <https://www.doc.govt.nz/about-us/our-role/our-purpose-and-outcomes/> (Jan. 20, 2021)
- [6] Geange, Shane W. et al. (2017), "Integrating conservation and economic objectives in MPA network planning: A case study from New Zealand", *Biological Conservation* 210: 136-144.
- [7] Townsend, Andrew J. et al. (2007), *New Zealand Threat Classification System manual*, New Zealand: Department of Conservation <https://www.doc.govt.nz/documents/science-and-technical/sap244.pdf> (Jan. 20, 2021).
- [8] Ministry for the Environment of New Zealand (2020), Ministry for the Environment annual report 2020, NZ Ministry for the Environment, 42-43 <https://www.mfe.govt.nz/sites/default/files/media/About/Ministry-for-the-Environment-Annual-Report-2019-2020.pdf> (Jan. 20, 2021).
- [9] Environment Guide, Exclusive Economic Zone Act <http://www.environmentguide.org.nz/activities/minerals/decision-making-framework/exclusive-economic-zone-act/#:-:text=The%20Exclusive%20Economic%20Zone%20and,activities%20beyond%20the%20territorial%20sea> (Jan. 20, 2021).
- [10] The Parliamentary Commissioner for the Environment (1999), *Setting Course for a Sustainable Future: The Management of New Zealand's Marine Environment*, The Parliamentary Commissioner for the Environment, 2.
- [11] NZ Ministerial Advisory Committee on Oceans Policy (2001), *Healthy Sea: Healthy Society Toward an Oceans Policy for New Zealand*, NZ Ministerial Advisory Committee on Oceans Policy, 6-7.
- [12] NZ Ministerial Advisory Committee on Oceans Policy (2001), *Healthy Sea: Healthy Society Toward an Oceans Policy for New Zealand*, NZ Ministerial Advisory Committee on Oceans Policy, 10.
- [13] Pete Hodgson (2003), *Oceans Policy: Maori engagement*, New Zealand Government <https://www.beehive.govt.nz/speech/oceans-policy-maori-engagement> (Jan. 20, 2021).
- [14] Foster, Angela (2003), "New Zealand's Oceans Policy", *Victoria U. Wellington L. Rev.* 34: 469-496, 469.
- [15] Scott, Karen N (2021), "Does Aotearoa New Zealand Need an Oceans Policy for Modern Oceans Governance?", *Ocean Yearbook* 35: 1-44, 1.
- [16] Scott, Karen N (2021), "Does Aotearoa New Zealand Need an Oceans Policy for Modern Oceans Governance?", *Ocean Yearbook* 35: 1-44, 44.

Choking, Strangling, and Drowning Marine Creatures: The Plastic Crisis Report Issued by U.S. Non-Profit OCEANA

Te-Hao Chen (Deputy Director General of the National Museum of Marine Biology & Aquarium and Professor of the Graduate Institute of Marine Biology, National Dong Hwa University)

Translated by Linguitronics

Keywords: Plastics, marine life, the United States

This article is an introduction to the report entitled "Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans" [1] (Figure 1) released in November 2020 by Oceana, a non-profit marine conservation organization, and the first comprehensive report on the ingestion or entanglement of plastic by sea turtles or marine mammals in the waters of the United States.



Figure 1/ Oceana, a non-profit marine conservation organization in the United States, released a report entitled "Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans"

Source/ <https://usa.oceana.org/publications/reports/choked-strangled-drowned-plastics-crisis-unfolding-our-oceans>

Since the last century around the 1950s, plastic manufacturers have been vigorously advocating the throwaway lifestyle so as to be able to continue manufacturing more products for profit, and have shaped this lifestyle into a symbol of progress and modern convenience. Therefore, a large number of disposable products began to appear in the United States following the end of WWII, a trend that has gradually spread to other countries across the globe and become a global problem. In fact, the US government listed plastic as a marine pollutant in as early as 1968. In the 1970s, scientists discovered small plastic fragments in sea water and the bodies of fish during investigations, while a large number of studies completed in recent years have even shown that plastic pollution can be found everywhere from the sea surface and underwater to the seabed, fully exhibiting the cumulative consequences of large quantities of plastic that have being manufactured, used and discarded since the 1950s. Disposable plastic packaging materials (such as plastic bottles, plastic bags, food packaging boxes, etc.) constitute the highest percentage of plastic products manufactured by man. These plastic products are in fact extremely durable, but because they are lightweight and cheap, most products are used only once before being discarded. The processing energy of the recycling system simply cannot catch up with the

production speed of plastic products, therefore plastics become various forms of waste that pollute our land, rivers, and eventually the ocean. Scientists estimate that annual global plastic production is 400 million metric tons [2], and that plastic waste entering the ocean can reach 15 million metric tons annually, which is equivalent to two garbage trucks dumping plastic into the sea every minute [3].

In November 2020, Oceana, a non-profit marine conservation organization headquartered in Washington, D.C., issued a report entitled "Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans" [3], the first comprehensive report on the plastic waste being swallowed by or entangling sea turtles or marine mammals (including manatees, whales, seals, sea lions, etc.) in the waters of the United States. In the past, evidence that sea turtles and marine mammals in the United States are being harmed by plastic waste has never been compiled and presented in a single report. Oceana compiled relevant data from dozens of government units or non-governmental organizations from 2009 to 2020, and found 1,800 cases of sea turtles and marine mammals swallowing plastic or being entangled by plastic, covering 40 different species, 88% of which are listed as threatened or endangered in the US Endanger Species Act. The number of cases reflected in this report is actually far fewer than the number actually occurring in the wild, because when these marine organisms swallow plastic or are entangled by plastic, such incidents occur in the ocean area or under water, and injured or killed individuals are difficult to observe.

Sea turtles and marine mammals are of significant ecological importance, but they are currently facing various survival threats, including pollution, habitat destruction, damage by commercial fishing gear, ship collisions, illegal hunting, toxic algal blooms, and environmental changes (such as sea level rise and sea temperature changes) resulting from global climate change, may also affect their foraging and living habitat. Plastic pollution will add additional pressure for survival to these marine organisms, especially for those already threatened or endangered. The impact of plastic on marine life constitutes primarily swallowing and entanglement. Marine animals may mistakenly swallow plastic as food, or accidentally swallow plastic while searching for food or swimming. Plastic swallowed by animals may block or cut the animal's gastrointestinal tract, thereby affecting the animal's ability to forage and absorb nutrients, leading to malnutrition and even death. When an animal is entangled with plastic products such as fishing nets or plastic bags, they may be prone to drowning, suffocation and death. Entanglement may also cause physical injury, such as severed limbs or infection. If plastic entanglement affects the animal's normal foraging ability, it may also lead to malnutrition.

Dr. Kimberly Warner, one of the authors of this report and a senior scientist at Oceana, said that although it may never be possible for a report to fully present the situation of marine animals being harmed by plastics, this report at least presents some surprising facts that help to raise public awareness. She believes that the world has been kidnapped by plastic, because companies continue to force plastic, a persistent pollutant, into all aspects of our lives. When these plastics become waste and enter the ocean, they are ingested or entangle marine animals, causing harm or even death. This report clearly demonstrates that all kinds of disposable plastic products are endangering marine animals. These plastics constitute not just the plastic bags, balloons, or bottle caps that we commonly use, but also other products such as plastic straps, dental floss, or mesh onion bags. If companies continue to stuff single-use plastic into the hands of consumers, such tragedies can only be expected to increase. The report also found that plastic waste affects animals at all stages of their life cycle, from female seals that are still nursing their cubs to newly hatched turtles (Figure 2). Swallowing plastic is the most common problem, accounting for 90% of the total number of cases. However, the number of animals affected by plastic entanglement is also considerable, and the injuries caused by entanglement are often heartbreaking or even unbearable. The collated results in the report also include the following:

- Most species that ingest or are entangled by plastic are endangered or threatened species, including Hawaiian monk seals, manatees, sea lions, and all species of sea turtles distributed in the United States (6 species in total).

- Among the death cases that may be caused by ingestion of plastic, there are 7 cases where the animal only swallowed one piece of plastic.
- Among the different types of plastic waste swallowed by animals, the most common are plastic bags, balloons, fishing lines, plastic fabric or packaging film.
- Among the types of plastic waste entangling animals, the most common are packaging tape, plastic bags, balloons with strings still attached, and plastic fabric.
- Cases of green turtles and loggerhead turtles swallowing plastic are much higher in number than other types of sea turtles.
- Some marine mammals such as the northern fur seal, are on average 50 times more likely to swallow plastic than other sea lion species.
- Other plastic items that have been swallowed or become entangled include bottle caps, plastic bottles, straws, plastic chairs, plastic forks, toothbrushes, children's toys, plastic baskets, plastic bubble wrap, plastic sponges, swimming goggles, artificial turf, sandwich bags, and polystyrene tableware.



Figure 2/ A newly hatched turtle trapped in a plastic ring
Source/ Oceana (2020) [1]

Christy Leavitt, one of the authors of this report and the director of Oceana's plastic issues activities, said that this report only presents a small part of the actual situation in which marine animals in U.S. waters are threatened by plastics, but how many other instances of harm have not been observed or recorded? In the next ten to twenty years, the world's plastic production will be four times that of today. If we do not take the initiative to make change, by 2040, the amount of plastic waste flowing into the ocean will be three times as large as it is now [4]. Plastic pollution has appeared in every corner of the world with studies showing that microplastics have also been found in foods such as seafood, drinking water, beer, salt, honey and other places. As plastic continues to be manufactured at accelerated speeds, it can be expected that plastic waste will quickly flood our blue planet and cause devastating consequences. The most effective way to turn off this incessant flow of plastic into our system and protect the ocean is to stop companies from producing non-essential disposable products. To achieve this goal, federal, state, and local governments need to adopt various policies and laws to ensure that companies will follow suit. At the end of the report, Oceana made the following recommendations:

- Companies must reduce the manufacture of plastic products, especially non-essential disposable products.
- Companies must provide consumers with plastic-free choices.
- National, state, and local governments must adopt policies to reduce the manufacturing and use of disposable plastic products.
- Companies and governments should actively promote reusable or refillable packaging and containers.
- Federal agencies responsible for protecting threatened or endangered marine life, such as the National Oceanic and Atmospheric Administration and the United States Fish and Wildlife Service, must continue to collect cases of plastic causing harm to marine life and improve and standardize the methods of data collection.
- Congress must fully support bills that monitor, protect, and rebuild vulnerable marine life populations such as the Endangered Species Act and the Marine Mammal Protection Act in terms of policy-making and funding.

Although the contents of this report are presented primarily from the perspective of the United States, Taiwan faces the same challenges with marine life in Taiwan's waters also suffering from plastic pollution. With the sea turtles rescued and taken in by the National Museum of Marine Biology and Aquarium from October 2017 to November 2019 as example, among 39 sea turtles (including 30 green loggerhead turtles, 3 olive ridley turtles, and 6 hawksbill turtles), 100% of animals taken into shelter have discharged plastic waste. The average total waste discharged by each turtle weighs 2.43 ± 0.62 g (range: 0.02-21.16 g), and the average number of pieces of waste is 13.92 ± 2.12 (range: 1-43 pieces), including hard plastic fragments and plastic bag fragments, rubber bands, fishing lines, candy packaging, foam, styrofoam and other plastic products commonly used in our everyday activities [5] (Figure 3). In March 2019, a Keleti beaked whale that died stranded on the beach at the northern end of the Liwu River estuary, Hualien, was dissected, and 6 plastic bags, 4 linen bags, many plastic fragments and fishing lines were discovered in its belly [6]. In addition, from time to time, we see examples of sea turtles or cetaceans becoming entangled in discarded fishing nets, leading to injury or even death [7]. As suggested in this Oceana report, recycling, beach cleaning, and ocean cleanups are under no circumstances sufficient for solving the problem of ocean plastic pollution. Apart from the practice of plastic reduction by consumers in every aspect of their lives, the real solution and the most effective means is to utilize government policy to restrict the manufacture and use of disposable plastic products, thereby achieving plastic limit and reduction as well as the ultimate goal of becoming plastic-free.



Figure 3/ Plastic garbage discharged by a sea turtle sheltered at the NMMBA
Image by Te-Hao Chen

In 2018, Taiwan's Environmental Protection Administration proposed a plastic reduction timetable for 4 types of single-use plastic utensils including straws, beverage cups, shopping bags and disposable tableware that entails "prohibiting dine-in use by 2020, establishing a price system by 2025, and imposing a complete ban by 2030" to reduce these commonly found forms of ocean plastic waste from the source [8]. In reality, however, the policy has met with many challenges. For instance, environmental NGOs pointed out that plastics use still exhibited continuous growth between 2009 and 2019, demonstrating that the government's plastic ban is ineffective against the production of plastic products [9]. As plastic reduction and plastic ban policies do indeed affect everyday convenience and certain industries, such initiatives are inherently difficult to enforce. Nevertheless, with the help of adequate supporting measures and continuous public education advocating lifestyle changes, policies are still the most effective tools for minimizing ocean plastic pollution.

References

- [1] Oceana (2020). Choked, Strangled, Drowned: The Plastics Crisis Unfolding In Our Oceans
<https://usa.oceana.org/publications/reports/choked-strangled-drowned-plastics-crisis-unfolding-our-oceans#> (Feb. 17, 2021)
- [2] Geyer R, Jambeck JR and Law KL (2017) Production, use, and fate of all plastics ever made. *Science Advances* 3: e1700782. doi: 10.1126/sciadv.1700782
- [3] Forrest A, Giacomazzi L, Dunlop S, et al. (2019) Eliminating Plastic Pollution: How a Voluntary Contribution From Industry Will Drive the Circular Plastics Economy. *Frontiers in Marine Science* 6: 627. doi: 10.3389/fmars.2019.00627
- [4] Lau WWY, Shiran Y, Bailey RM, et al. (2020) Evaluating scenarios toward zero plastic pollution. *Science*: eaba9475. doi: 10.1126/science.aba9475
- [5] 曾文卜 (2020) 。〈海生館救援海龜排遺中海洋廢棄物分析及可能之健康影響〉。國立東華大學海洋生物研究所碩士論文。
- [6] 公視新聞網 (2019年3月) 。〈柯氏鰐鯨1屍2命 肚內竟有大量塑膠垃圾〉
<https://news.pts.org.tw/article/426234> (Feb. 17, 2021)
- [7] 自由時報 (2020年11月) 。〈漁網纏繞澎湖又發現3隻海龜2死1傷〉
<https://news.ltn.com.tw/news/life/breakingnews/3339316> (Feb. 17, 2021)
- [8] 環境資訊中心 (2018年2月) 。〈民間參與限塑政策 2030全面禁用吸管等四種一次性塑膠〉
<https://e-info.org.tw/node/209976> (Feb. 17, 2021)
- [9] 環境資訊中心 (2020年11月) 。〈限塑10年政策失靈？一次性塑膠用量增22.8%〉
<https://e-info.org.tw/node/227866> (Feb. 17, 2021)

Marine Culture and Legal Protection of New Zealand's Maori People

Yu-Cheng Wang (Associate Professor of the Department of Law, National Cheng Kung University; former researcher fellow at the National Academy of Marine Research)

Translated by Linguitronics

Keywords: New Zealand, Maori, marine culture

Research in recent years has concluded that the Māori people of New Zealand and the aborigines of Taiwan who belong to the Austronesian peoples share common ancestry and history, and that Taiwan may be the place of origin of Austronesian peoples including the Māori [1]. However, according to theories that are currently considered more grounded, the Maori, an ocean-going people, would have had between approximately 1320 and 1350 traveled from the western parts of the Polynesian region on "waka" (their traditional canoes) across vast expanses of ocean water under the guidance of their traditional astrological knowledge, ultimately arriving at and settling in their new home (the "aotearoa") otherwise known as the North Island of New Zealand today, via several waves of ethnic emigration.

As a typical marine ethnic group, the Maori not only developed a tightly woven relationship with the ocean in terms of history, daily life, culture, and spirituality, but also at the level of belief and eco-philosophy. This has in turn led the New Zealand government to form many policies and laws related to marine culture that not only serve to protect the marine culture of the Maori people but also, through combining the practice of Maori marine culture and enforcement of the legal system, strengthen the conservation of marine resources and drive the development of the marine cultural and creative industries. The promotion of marine culture has furthermore enabled New Zealand to gain the soft power of diplomacy on the international stage, a tactic that is worthy of emulation by Taiwan as we draw the blueprints for our overall national maritime policy and system.

Maori language (te Reo Māori) and marine culture

The Maori national language originally had no written text. Due to the influence of European colonial culture, however, the Latin alphabet began to be used for writing the Maori language in 1840. As with other Austronesian groups, nevertheless, the history of the ethnic group continues to be passed down through oral history and song, the most typical of which is the traditional song "waiata" that primarily tells of the Maori ancestors' journey across the seas, riding the wind and waves on waka, while also including the origins of the tribe's (iwi) important landmarks [2]. For the Maori who have settled in a new land and no longer engage in ocean migration, such instances of oral history are intangible yet important cultural assets that enable them to study the difference between the canoes made and used by ancestors to travel across the oceans and those still used by the Maori people of today. In addition, as most of today's Maori communities are still located along the coast, the sea has over time become more than just a source of food and living resources, but is moreover vital in terms of spiritual sustenance and as a link to the Maori ancestry and heritage. Therefore, the origins of names designated for important landmarks within the Maori communities are also cultural assets of vast significance. Based on the above, it is clear that the revitalization of the Maori language is not only vital to the establishment of the Maori subjectivity and cultural continuity, but also indispensable for the research and promotion of marine culture.

Maori representatives submitted a petition signed more than 30,000 people to the New Zealand Parliament on September 14, 1972, and demanded that the Maori language should be recognized as an official language of New Zealand. This movement has been hailed as an important starting point for the revival of the Maori language [3]. In 1975, to commemorate the petition made in 1972, the government designated the week of September 14 as Maori Language Week (Te Wiki o te Reo Māori). Three years later, a government-run bilingual school in New Zealand was officially established, and the first Maori radio station (TeReo-o-Pōneke) was launched in 1983. It was not until 1987, however, that the Maori language officially became an official language of New Zealand [4]. With Maori language education gradually becoming an integral part of the formal curriculum at primary schools, in 2018, the New Zealand government officially announced that Maori language education will become the core curriculum of primary schools nationwide by 2025 [5].

Maori ecological knowledge and the co-management of marine resources

In Maori and Polynesian mythology, Tangaroa is the god who guards the ocean and also the son of Ranginui (the sky) and Papatūānuku (the earth). In the traditional beliefs of the Maori people, Tangaroa created marine creatures and was responsible for the rhythm of tides and currents. The flow of water can give life and calm, but it can also be powerful and destructive, a contradiction that engendered the following proverb: "the law of 'Tiaki mai i ahau, maku ano koe e tiaki' (if you care for me, I shall care for you) ...", which means that the Maori cosmology (te ao Māori) recognizes the interconnection between all living things, and that interdependence is the basis of a healthy ecosystem that supports and facilitates human life and well-being [6].

For the Maori, the deep blood relationship between humans and the natural world obliges them to protect the environment and conserve it for future generations. This obligation is expressed as "kaitiakitanga" - a cultural custom based on the belief of mātauranga -- guardianship and environmental management -- held by the Maori. Protecting the ocean means protecting the environment of the Maori people, and at the same time, maintaining the cultural and spiritual connection between the Maori people and the marine life force. On the basis of this belief, the Maori people have developed many resource management traditions, and the use cycle of natural resources is basically determined by season and the lunar calendar. At the same time, the Maori also developed a tradition of prohibiting hunting and fishing at certain times of the year, referred to as "rāhui." The so-called rāhui means that the tribes form a restriction on the collection or use of natural resources during a specific period or in a specific area, or prohibit or restrict the catching of specific marine species, and that these restrictions become the norm in life. From the current perspective of ecological conservation, rāhui constitutes a mode of natural resource conservation or resource management that can also alleviate the pressure on biological reproduction. Therefore, while government agencies seek ways to protect marine resources in a sustainable way, they may also find that such policies actually coincide with the traditional cultural practices and revitalization of marine peoples. This was precisely what motivated the local governments and Department of Conservation (DoC) of New Zealand to cooperate with the coastal tribes of the Maori tribe in establishing a mechanism for the co-management of coastal ecological resources.

In recent years, New Zealand government agencies have developed a number of ocean resource co-management mechanisms based on the traditional ecological knowledge (TEK) of the Maori people, on the one hand protecting the Maori marine culture and on the other tapping into and utilizing their traditional ecological knowledge. What's worthy of mentioning in this article is the idea of using "Marine Cultural Health Indicators" (MCHI) to measure the conservation of marine culture. This project was developed by the Greater Wellington Regional Council, the Department of Conservation (DoC) and the Maori Ngāti Toa tribe residing in northern Wellington in 2017.

Marine cultural health indicators, in short, are a monitoring mechanism (or "toolkit") that can provide the Ngāti Toa tribe with the means to establish marine ecological restoration targets and sustainable collection strategies within the boundaries of its neighboring coasts and other coastal protected areas. The establishment of this environmental indicator primarily entails the integration of local traditional knowledge consisting of local and traditional wisdoms that the government has collected from 100 tribal representatives through interviews conducted by a research team. The team selected the top 30 indicators based on community interviews to provide tribes as a basis for monitoring evaluation and recording of items mainly including: 1. The ecological status of the coastal ecological zone within the

Ngāti Toa tribe's collection area; 2. The long-term changes in the health of the marine ecosystem; 3. Local fishing and hunting practices and the effectiveness of rehabilitation.

Through the use of marine cultural health indicators, the Ngāti Toa tribe can participate in the effective monitoring of the cultural health of Porirua Harbour (Maori: Te Awarua-o-Porirua). The harbour of Porirua is crucial to shaping the self-identity of the Ngāti Toa tribe itself, therefore the tribespeople are increasingly concerned regarding the shrinking coastline. The promotion of this project not only helped the Ngāti Toa fulfill their responsibilities toward Te Awarua-o-Porirua, but also reconnected the local Maori people with the ocean (Moana). The project has three main objectives: 1. Construct a marine cultural health indicator framework that includes the traditional knowledge of the Ngāti Toa tribe. 2. Interactions with tribal members during the construction of the marine cultural health cultural indicator framework can ensure the effective transfer of knowledge between all parties. 3. Establish and strengthen the tribe's ability to monitor the environment (empowerment) [7].

Examples Taiwan can consider in the development of our marine cultural policies

In Taiwan, with the promulgation in 2017 of the "Indigenous Languages Development Act" which clearly defines in Article 1 that "indigenous languages are national languages," the 26 officially recognized languages of indigenous peoples have also become national languages. However, realizing the vision of normalizing indigenous languages in schools, society, and even official documents and information will be no easy feat. In any case, it is indeed necessary to focus on the aspects of daily life and fundamental education. At the same time, even if indigenous languages become prevalent among the general public, we must recognize the fact that indigenous languages have entirely different meanings for ethnic and non-ethnic groups. For non-ethnic communities, the understanding of indigenous languages signify multiculturalism; for ethnic communities, however, this entails a serious matter of cultural continuity.

Taking as an example the author's personal experience of traveling several times to Lanyu while serving at the National Academy of Marine Research (NAMR) in 2020 for fieldwork, Tao marine culture and history consists of much more than the oral history that is commonly known. Indeed, their ballads are carriers of narrative that can be traced back to older and more complete historical records, and are thus very important databases and tools for the study of ancient Tao marine culture and history. For example, in the contents of ancient ballads, legend has it that the tatala via which people traveled to Batan Island is a large boat able to carry 20 people and has a fire pit in the center of the vessel. The boat is also equipped with sails and loaded with goods traded between the peoples of Lanyu and Batan Island. The contents of Tao ancient ballads can even be linked to certain descriptions of the Austronesian cultural sphere and are regarded as important assets enabling Austronesian cultural studies. However, within currently existing Tao communities, fewer and fewer people collect and are able to understand ancient ballads. In fact, Tao tribesman Mr. Shaman Fengayan is the only remaining scholar with rich research experience and outcomes; as for the younger generation, almost no one can identify the content and meaning of the ancient ballads.

In view of this predicament, NAMR began conducting research on the traditional marine culture and knowledge of the Amis people on the east coast in 2019. Following a series of anthropological field research, it was found that similar to the Maori, the meanings of ethnic place names used by the Amis are actually closely linked with coastal topography, coastal waters, marine ecology, historical memory and other elements such as those that point to dangers at sea that show the long-term interaction between man and the ocean. These traditional place names describing the coast or sea area reveal the ocean knowledge accumulated and passed down by the Amis people as a marine tribe over the years, and the wisdom of living in harmony with the sea and the natural environment [8]. However, in the process of regime change, the traditional names of these coastal areas have been replaced by many new names influenced by foreign cultures, political connotations, or inappropriate analogies. For example, what is now known as the "Stone Umbrella" is "Penpen" in the Ami language, meaning the echoes produced by waves beating upon the shore, while "Beautiful Bay," which is spoken of as "Fudafudak" in the Ami language, means a place on the sea that shines like the twinkling stars. Another example is the "Mirror of the Sky," a popular tourist attraction in recent years, that was originally called Pacefongan, which means the place where bamboo rafts are launched into the sea, describing the shallow topography of the coast and the ease of launching bamboo rafts into the water.

Therefore, it is the responsibility of current government authorities to actively think about how to establish a cooperative and mutually beneficial relationship with ethnic scholars who still engage in academic research. If the loss of indigenous marine culture (including mountain indigenous culture, of course) cannot be stopped and reversed, there will no longer be cultural assets that we can preserve and promote.

Furthermore, in terms of traditional ecological knowledge, the self-discipline and restrictions exhibited in indigenous fishing and hunting behaviors as identified by ecologists Johan Colding and Carl Folke show that such practices not only serve to unify human social life, but also influence or directly enable management of the local natural environment. Regardless of the reasons behind these restrictions, their primary purposes at the local level are most probably to protect natural resources, species, and ecosystems [9]. Similar to the "rāhui" of the Maori tribe, the indigenous peoples of the Kabupaten Raja Ampat in Indonesia's West Papua Province (Kabupaten Raja Ampat) practice "Sasi," which means the habit of prohibiting the use of natural resources during a specific period or in particular spaces including farmland, forests, coral reefs or fishing locations, as well as restrictions on the catching of specific marine species and use of specific fishing methods. In 2003, the Raja Ampat local government also incorporated the local Sasi into the conservation management system established by law. According to survey and research, the marine ecological resources in the relevant areas have already all shown significant revitalization, which shows that the practice of acknowledging traditional sea areas and protecting traditional ecological knowledge is important to the conservation of marine ecological resources and can remedy the insufficiencies of national laws and policies (Hedley S. Granthem's paper gives an in-depth analysis and discussion of the detailed survey data obtained on the revitalization of marine ecological resources in the relevant areas which are not included in this article due to limited space) [10].

For the Tao people living on Lanyu in Taiwan, the perpetuation of the ethnic ecology behind their flying fish culture not only entails the survival of the ethnic group and traditional culture, but also the continuation of ecological sustainability as these three aspects are closely linked, inter-related, and interdependent [11]. Ensuring that the Tao people can practice their traditional ecological knowledge in their traditional waters without being interfered by the intrusion of fishing boats from other counties and cities can not only prevent flying fish from being overfished, but also ensures reefs and benthic organisms can recuperate during periods in which the catching of flying fish is prohibited. As evidenced above, the protection and utilization of the Tao people's traditional ecological knowledge (TEK) of the ocean, and furthermore the integration of such policies and practices into the laws associated with marine protection and conservation of Taiwan is a direction of development well worthy of consideration.

Conclusion

Article 10(C) of the Convention on Biological Diversity (CBD) stipulates that contracting parties shall "Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements." From the contents of the article, it can be seen that what the convention pursues is not just the protection of traditional ecological knowledge but moreover the encouragement of measures that contribute towards the ultimate goal of maintaining biodiversity. As a matter of fact, the teaching of indigenous languages is closely related with the continuation of their cultures and the propagation of their traditional ecological knowledge as in-depth understanding of the context of their languages is what enables us to appreciate their cultures and acknowledge the ecological knowledge or beliefs that shape and feed into these cultures.

The co-management mechanism formulated by integrating Maori traditional ecological knowledge and government policy also shows us that the concept of setting up no-take zones in ecological reserves is not an absolute requirement, and allowing traditional collection or hunting in ecological reserves does not constitute exceptions that must be tolerated. On the contrary, practices informed by traditional ecological knowledge can be incorporated into the co-management mechanism so that the traditional ecological knowledge contributing to marine protection and conservation safeguards not just marine culture, but enhances the functions of ecological reserves established according to national law. (References: see P.30)

國際海洋資訊

11
April 2021
雙月刊 | Bimonthly



International Ocean Information

發行：海洋委員會

地址：806610高雄市前鎮區成功二路25號4樓

電話：(07)3381810

E-mail：master@oac.gov.tw

網址：https://www.oac.gov.tw/

執行：財團法人台灣經濟研究院

地址：104222臺北市中山區德惠街16-8號7樓

電話：(02)2586-5000分機888

傳真：(02)2595-7131

網址：http://www.tier.org.tw/

發行人：李仲威

副發行人：蔡清標、周美伍

總編輯：劉國列

編輯委員：黃向文、邱永芳、謝亞杰、
沈建中、許啓業、王茂城、
黃世偉、陳裕興、林麗英、
陳致延、紀琇雯

編輯顧問：李忠潘、宋克義

執行主編：鍾嘉雯、陳璋玲

執行編輯：黃釋緯、洪承豐、李茗家、謝惠子

美編設計：不賴的廣告

電話：(02)2783-0978

傳真：(02)2783-3033

Published by Ocean Affairs Council

Address：4F., No. 25, Chenggong 2nd Road,
Qianzhen District, Kaohsiung City 806610,
Taiwan

Telephone：(07)3381810

E-mail：master@oac.gov.tw

Website：https://www.oac.gov.tw/

Executive：Taiwan Institute of Economic Research

Address：7F., No. 16-8, Dehuei St., Zhongshan District,
Taipei City 104222, Taiwan

Telephone：(02)2586-5000 Ext.888

Fax：(02)2595-7131

Website：http://www.tier.org.tw/

Publisher：Chung-Wei Lee

Associate Publisher：Ching-Piao Tsai, Mei-Wu Chou

Editor-in-Chief：Kuo-Lieh Liu

Editorial Board：Hsiang-Wen Huang, Yung-Fang Chiu,
Ya-Chieh Hsieh, Chien-Chung Shen,
Chad C.Y. Hsu, Mao-Chen Wang,
Shin-Wei Huang, Yu-Hsing Chen,
Li-Ying Lin, Chih-Yen Chen, Siou-Wun Ji

Reviewer：Chung-Pan Lee, Keryea Soong

Managing Editor：Chia-Wen Chung, Chung-Ling Chen

Executive Editor：Shi-Wei Huang, Cheng-Li Hung,
Ming-Chia Lee, Hui-Tzu Hsieh

Designed by Pride Advertising Agency Ltd.

Telephone：(02)2783-0978

Fax：(02)2783-3033

讀者意見回饋，請來電(02)2586-5000分機888或E-mail至d11743@tier.org.tw

國際海洋資訊

11
April 2021
雙月刊 | Bimonthly



International Ocean Information



封面：紐西蘭教堂灣；封底：紐西蘭奧克蘭保育區的寬吻海豚

中華民國110年4月出版（每雙月出版）

中華民國108年8月創刊

ISSN 2706-638X（紙本）

ISSN 2706-6398（電子）

中華郵政高雄雜字第236號執照登記為雜誌交寄

高雄郵局許可證 高雄字第2084號

著作權所有未經同意不得轉載



海洋委員會

Ocean Affairs Council

發行



臺灣經濟研究院

Taiwan Economic Research Institute

編印

贈閱