

國際海洋資訊

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國艦國造最後一哩路——
國家船模實驗室興建與
船模試驗國家隊籌組

The Last Mile in National Shipbuilding -
Establishment of a National Model Test
Laboratory and Formation of a
National Team for Model Testing

立陶宛海洋資訊

Lithuania Ocean Information



海洋委員會
Ocean Affairs Council

發行



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「立」維山海 「法」護文資 「臺」產更升級！

代理主任委員：周美伍

海洋空間規劃和海洋環境保護一向是各國重要的海洋政策規劃。本期介紹波羅的海東岸國家立陶宛，如何在平均寬度遠小於400哩的半封閉海域中，與其他周邊國家如俄羅斯、拉脫維亞及瑞典議定海域劃界，並在跨界協商後，於2014年完成海洋空間規劃法制化，2015年通過海洋空間計畫；而立陶宛的海洋環境事務由環境部（Ministry of Environment）主責，其主要策略將海洋環境和陸域環境視為一體，在「自然資源永續使用和廢棄物管理」、「環境品質改善」、「維持生態系穩定」以及「氣候變遷減緩和調適」4大優先領域中分別處理漁業、海水品質、生物多樣性等議題，亦遵循歐盟海洋法規規範，以及《國際船舶壓艙水和沉積物控制與管理公約》、《波羅的海地區海洋環境公約》，以有效管理壓艙水，防止或減緩因船舶壓艙水而引入之外來種入侵的問題。海洋環境保護不是一國一地之事，2022年第5屆聯合國環境大會通過「終結塑膠污染：制定具法律拘束力的國際文件」決議，並預計於2040年訂定終結塑膠污染的國際條約，這不僅是減塑運動的一大步，也是全球在永續目標實踐的新里程碑。

而邁向永續不僅要關注自然資源的維護，文化資產也十分重要，本期「國際議題」分享水下遺址的考古與維護，水下文化資產為文化觀光產業的重要資源，法國在1950年代即開始研究水下文物或沉船，我國也曾與法方在2007年合作培育水下考古人才，並成立第一支水下考古團隊；另外「專題報導」則介紹我國「國艦國造」的最後一哩路，從日治時期迄今，臺灣除了各式船艇的建造與維修外，亦有船模相關試驗水槽供造船產業進行設計、研發與教學，而為了帶動造船產業技術的升級，整合國內現有船模實驗室之試驗能量，目前亦已開始建置國家船模實驗室並籌組船模試驗國家隊，領航我國船舶產業邁向新高峰！



圖說／克萊佩達海岸峭壁鳥瞰圖

圖片來源／Pride Advertising Agency Ltd.

國艦國造最後一哩路——國家船模實驗室 興建與船模試驗國家隊籌組

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關鍵字／耐海性能與操縱性能水槽、迴旋臂水槽、船模試驗

「船模試驗」係指依據水槽試驗結果來進行設計、驗證與改進船舶的過程。該試驗受船隻型態或性能的不同其所需執行的試驗項目亦不同。為有效提升水面與水下各式船艦之性能，須於設計階段透過船模試驗進行各項性能的驗證。雖然「船模試驗」僅是船舶設計過程的一個環節，卻是船舶設計、規劃、建造等整個過程中不可或缺的基石。為帶動我國造船產業技術的升級、整合國內現有船模實驗室之試驗能量，提供國防船艦、海事海難現場重建、海洋結構設計等相關工程技術之諮詢與驗證服務，建置國家船模實驗室及整合國內能量來籌組國家隊乃為當前重要課題。



圖1／國家船模實驗室建築概念設計圖，將坐落於高雄市茄定區興達港[1]
圖片提供／台灣世曦工程顧問股份有限公司

我國船模試驗能量概況

臺灣船舶產業發展至今已逾百年的歷史，從日治時期僅建造與維修船舶和小汽艇，到現在的商船、貨櫃船、公務船、研究船、油輪、運搬船、冷凍船、軍艦等各式船（艇）。臺灣亦有船模相關試驗水槽，盤點臺灣現有4座船模相關試驗水槽，分別為國立臺灣大學拖航水槽、國立成功大學拖航水槽、國立臺灣海洋大學空蝕水槽與國防大學環流水槽，說明如下：

臺灣大學拖航水槽為1992年興建，大小為長130公尺×寬8公尺×深4公尺，並於2010年進行「拖車設備汰舊換新計畫」，可進行阻力、自推、流場、單獨螺槳性能及水下噪音量測等試驗（圖2左上）。

成功大學拖航水槽於1982年建置，長165公尺×寬8公尺×深4公尺，並於2022年開工擴建為長285公尺×寬8公尺×深5.5公尺，該水槽可進行阻力、自推、流場、艤跡流、單獨螺槳性能等試驗（圖2左下[2]）。

臺灣海洋大學空蝕水槽於1996年先建置中型空蝕水槽（長2.2公尺×寬0.5公尺×深0.5公尺），並於2002年再興建長10公尺×寬2.6公尺×深1.5公尺之大型空蝕水槽，目前可進行單獨螺槳性能、船殼激振力量測、空蝕觀測、水下噪音量測、反潛速度等測試（圖2右上[3]）。

國防大學環流水槽於1981年設置，大小為長14公尺×寬5.3公尺×深2.2公尺之環形水槽，可進行阻力、自推、流場、艤跡流等小型試驗（圖2右下）。

綜合上述，當前仍欠缺耐海性能、操縱性能與迴旋臂等船模試驗（圖2中），導致國內研發新式船艦之際，仍需向國外租借試驗水槽進行實驗，因而可能產生國防安全、資訊洩洩等疑慮。

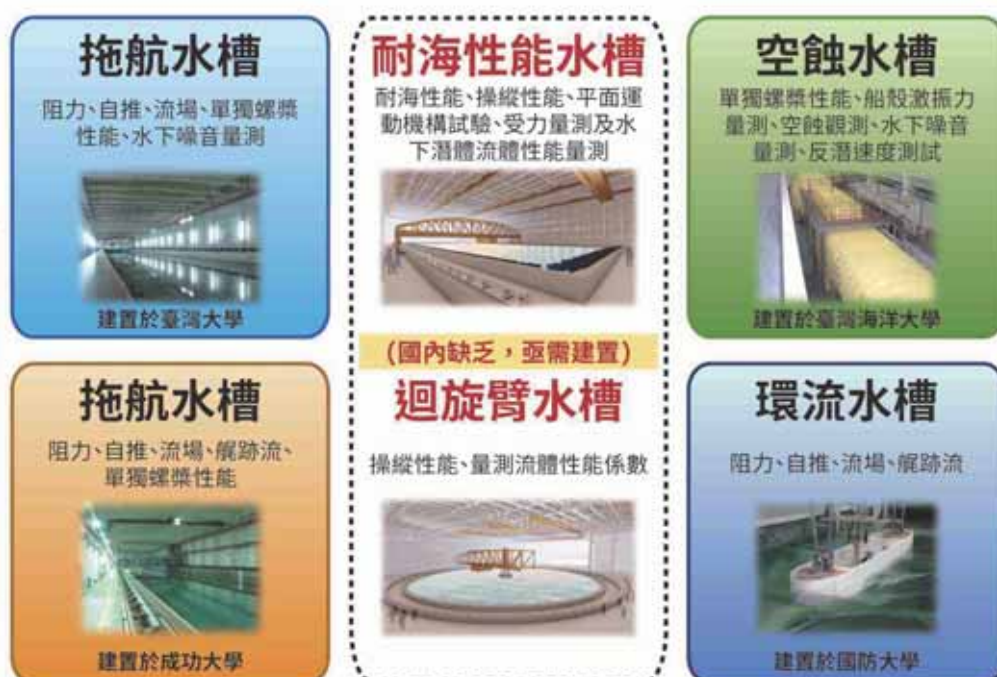


圖2/現有船模實驗室功能與國家船模實驗室需求示意圖
資料來源/本文作者整理

國家船模實驗室之規劃

為興建耐海性能水槽，參照國外現有水槽設計（表1），若要決定耐海性能水槽長度（X方向）與寬度（Y方向）之影響因子，則需考慮船模與實船長度之比例、船模最大速度、拖車加速度及減速度、所需測量時間之長短等。經國家海洋研究院（以下簡稱國海院）調查盤點國內造船業者、海軍、海巡署與海軍造船發展中心等未來5至10年的造艦計畫，並經綜合分析後提出可滿足造船產業、公務、國防船艦等各界需求之「國家船模實驗室多功能水槽建置計畫」。初步規劃內含耐海性能水槽與迴旋臂水槽（規劃概念圖參見圖3）。耐海性能水槽規劃之尺寸為長80公尺×寬40公尺×深6.5公尺（水深5.5公尺），該水槽基本設備包含造波機、吸波機、拖車與天車等。

表1／國際著名耐海性能水槽規格尺寸表

國家	單位	尺寸規格		
		長 (m)	寬 (m)	深 (m)
韓國	KRISO	56	30	4.5
日本	Japan Marine United Corporation	70	30	3
日本	Mitsubishi Heavy Industries	160	30	3.3
日本	National Maritime Research Institute	80	40	4.5
日本	IHI	70	30	3
日本	九州大學	38.8	24.4	2
中國	上海交通大學	50	30	6
中國	China Ship Scientific Research Center	69	46	4
中國	Shanghai Ship and Shipping Research Institute	90	30	3
印度	Naval Science and Technology Lab	135	37	5
美國	DTMB	110	73	6.1
加拿大	IOT-NRC	75	32	3.2
荷蘭	MARIN	170	40	5
瑞典	SSPA	88	39	3.5
英國	QinetiQ	122	61	5.5
挪威	MARINTEK	80	50	10
西班牙	CEHIPAR	152	30	5
芬蘭	VTT	40	40	2.8
俄羅斯	Krylov State Research Centre	162	37	5
保加利亞	Bulgarian Ship Hydrodynamics Centre	60	40	2.5

資料來源／<https://itc.info/facilities/> [4]

而「耐海性能水槽」與「迴旋臂水槽」將可執行的試驗項目包含：

- 一、耐海性能試驗：研究作用於船體之作用力與船體本身運動之關係，此作用力主要是指外在的力量諸如風、浪等之干擾；此項試驗視需要及探討之目的，而有規則波試驗、不規則波試驗之分，同時船速、船前進之方向與波浪之方向亦為試驗時所考慮的主要因素。

二、操縱性能試驗：操縱性能試驗主要在分析作用力與船體移動之關係，例如舵角的改變如何影響船的航向，多少時間船向開始改變等，視需要及探討之目的，而有迴轉試驗、旋臂試驗、Zig-Zag試驗等。

三、平面運動機構試驗（PMM）：船艦的運動方程式是由大量的流體動力係數所組成，為研究船艦的操縱性能，需求得作用在船艦運動方程式上之流體動力係數，本試驗主要在執行特定船舶運動時，以計算運動方程式之各項係數。

四、水下潛體運動性能量測：本試驗可以研究各類水下潛體在水下或是上浮及下潛時之流體性能。

因我國未有建置如此大型且專業船模實驗室之經驗，且船模試驗水槽之工程、儀器與設備具專業性，並且要求精密度高，爰此，為整合土木建築及相關設備儀器，國海院偕同船模試驗經驗豐富之財團法人船舶暨海洋產業研發中心（簡稱船舶中心），共同合作規劃有關國家船模實驗室之整體建置、專案管理及船模試驗所需之人才培育與維運管理等，另邀集台灣世曦工程股份有限公司進行規劃、設計以及後續監造等工作，以順利完成國家船模實驗室之興建工程。



圖3/國家船模實驗室規劃概念圖[1]
圖片提供/台灣世曦工程顧問股份有限公司

船模試驗國家隊的籌組

完整船模試驗需於不同型態水槽進行，為強化臺灣船模試驗能量，國海院於2022年6月21日舉辦船模實驗國家隊成立大會，承蒙蔡英文總統親臨主持並於會中指示將全力支持該計畫。藉由國內擁有船模試驗水槽及水下載具技術之大學（具大型空蝕水槽之臺灣海洋大學、具拖曳水槽之臺灣大學與成功大學、以及具水下載具技術之中山大學）共同簽署合作備忘錄，透過資訊共享、資源共享及技術交流等方式，逐步整合國內各船模試驗水槽的試驗能量與人力資源，以提升國家整體船模試驗技術水準，提供完整高品質的船模試驗能量、船舶性能推估、驗證與諮詢等服務。後續亦將共同進行船模實驗所需人才之國內外培訓計畫，供未來國家船模實驗室建置完成後之營運與維護管理所需，完成我國國艦國造與自主應用之目標。



圖4/船模試驗國家隊成立大會啓動儀式現場（左起國立臺灣大學張上淳副校長、國立臺灣海洋大學許泰文校長、國家海洋研究院邱永芳前院長、海洋委員會李仲威前主任委員、蔡英文總統、行政院張景森政務委員、湯文萬國策顧問、國立中山大學鄭英耀校長、國立成功大學蘇芳園副校長）

圖片提供/財團法人船舶暨海洋產業研發中心

結論

俟國家船模實驗室（耐海性能水槽與迴旋臂水槽）建置完工後，我國將擁有完整的船模試驗能力。不僅可供造船相關產業之設計、研發，也將有利於研究單位進行研究與教學使用。滿足國內船艦試驗需求，填補「國防船艦」規劃、設計、建造等過程之技術空缺。未來更將以船模試驗國家隊為核心，以「國際船模試驗機構」為發展目標，整合營運管理模式，串聯產、官、學、研之能量，以達有效分配國內水槽試驗能量之效益。強化國內船模試驗研究能力，培育造船產業人才，並建立國內船模試驗資料庫，逐步提升我國造船、造艦產業的國際競爭力，領航船舶產業邁向新的高峰。

參考資料

- [1] 台灣世暹工程顧問股份有限公司（2022）。國家船模實驗室新建工程規劃設計暨監造委託技術服務案規劃方案（初稿）。
- [2] NCKU TOWING TANK IN TAIWAN (n.d.).
<https://ncku-towing-tank.weebly.com/> (Aug. 15, 2022)
- [3] 國立臺灣海洋大學延平水下科技中心 (n.d.)。研究設備。
<https://se.ntou.edu.tw/p/412-1058-8037.php?Lang=zh-tw> (Aug. 15, 2022)
- [4] International Towing Tank Conference (ITTC)(n.d.). Facilities.
<https://itc.info/facilities/> (Aug. 15, 2022)

水下文化資產保存與教育推廣： 以法國為例

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關鍵字／水下文化資產、水下考古

西元前的古希臘哲學家柏拉圖，曾在《對話集》中寫到沉沒的亞特蘭提斯，有人認為這是個虛構的故事，也有人認為這座島嶼遭逢地震、海嘯而沉沒的災難事件。兩千年來，尋找亞特蘭提斯，人們對於古文明的好奇心，從陸地延伸到水下。直到1943年的夏天，由法國海軍軍官庫斯托（Jacques-Yves Cousteau）和工程師迦南（Émile Gagnan）改良了俗稱水肺的水中呼吸器，這一套更輕便、便宜的潛水設備，讓潛水活動得以普及，提供水下考古工作發展的基礎[1]。自此，也展開了商業打撈與保護水下文化資產兩方的時間爭奪戰。

法國國家級水下考古研究中心與文化資產保存

法國本土與海外領地超過1萬公里的海岸線，蘊含豐富的水下文化資產。1950年代法國已開始強調以考古學的方法研究水下遺址。在1966年法國成立第1個保護水下文化資產的組織，後來在官方長期的支持下，於1991年成立國家海洋考古研究部門，5年後進一步整合內陸水域，合併為「國家水下考古研究中心」（Le Département des recherches archéologiques subaquatiques et sous-marines, DRASSM）。

其總部設立於法國最大的港口城市——馬賽，研究中心的工作範圍包含法國1,100萬平方公里經濟海域內的水下文化資產的調查、清點、研究、保護、執行「海洋遺產法」（Les Biens Culturels Maritimes）、授權進行工程前的預防性考古（L'archéologie préventive）、教育推廣等工作[2]。從早年以潛水員目視、搭配海洋科學探測技術的搜尋，到近年研發水下人形機器人「海洋一號」（Ocean One），讓考古學家能在船上，操控在高壓深海中的機器人工作，輕輕拾起脆弱的文物。直至今日，據水下考古研究中心估計，在法國領海至少有2到3萬艘的沉船[3]。

而在法國境內，有各類層級與水下文化資產有關的博物館，包含北方的布雷斯特城的國家級海軍博物館（Musée National de la Marine, Brest），展示內容以海軍歷史與船舶為主題；西南方的艾費布海洋考古博物館（Musée de l'Ephébe et d'archéologie sous-marine, Le Cap d'Agde）是少數非公立的水下考古博物館，它的建立起因於附近水域發現的亞歷山大青銅像，在送去羅浮宮修復時，由於文物的珍貴性，中央要求地方需有一定水準的博物館方能將文物送回，為了在當地保存它，居民積極爭取成立這間精緻的社區博物館；南方的阿爾勒及普羅旺斯古代博物館（Musée de l'Arles et de la Provence antiques）展示古羅馬時期的隆河沉船，這艘船體完整，長達30公尺的沉船，保

存了貨物與船上生活用具，反映當時的河運生活。2022年6月有一座整修後的帕拉杜湖考古博物館（Musée archéologique du Lac de Paladru）重新開放，展示在高山湖泊內發掘自史前至中世紀水下遺址的調查成果。



圖1/潛水員利用白色浮力袋將文物出水
圖片提供/攝影師Lionel Roux (CNRS-CCJ)

水下文化資產與文化旅遊

水下文化資產源於水下考古的調查成果，水下考古學則是考古學門的分支，保護這些考古遺址則有益於發展文化旅遊。在歐洲，一項針對歐盟公民進行「對考古學與文化遺產認識」的調查計畫（NEARCH）顯示，超過半數的受訪者認為考古學能觸動人心，它讓大眾能和過去的歷史、古文明與人類的起源進行對話。在調查結果中，雖然僅10%的歐盟公民認為考古學對地方和國家整體的經濟發展有幫助，但卻有86%的比例同意自己居住的城市如有考古遺址將是一大優勢，而且83%的人認為支持考古學發展，對國家十分重要[4]。

例如希臘提洛斯島（Délos），法國雅典學院（École Française d'Athènes）的考古團隊發掘島上的考古遺址，這座島嶼曾作為古希臘城邦「提洛同盟」（Delian League）的開會與金庫基地[5]。兩千年來由於海水上升與地震，部分港口、住房沒入水中，因此提洛斯島在島上與水下均有豐富的考古遺址。當海面清澈時，從空拍照得以清楚地見到水下建築殘跡。島上的重要的考古遺址是世界級的文化遺產，也在許多文化之旅愛好者的必訪清單上。

在法國，為兼顧文化資產保存與經濟發展，有法國國家預防性考古研究中心（Institut

national de recherches archéologiques préventives, INRAP) 負責陸地或水下工程前的考古評估，包含史前的舊石器時代遺址到二戰留下的沉船戰艦，這些都是屬於全民的歷史發展記憶。

今日，旅行不單只是到異地休閒放鬆，有更多人選擇以深度體驗的方式認識當地文化，從數據來看，有將近4成的歐洲旅客之行程設計取決於當地的文化資產[6]。保護文化資產能成為文化旅遊的重要養分。

從潛水紀念品到社區保護遺址的共識

留學期間，筆者曾參與水下考古的田野實習，且研讀各考古遺址的研究報告，認識法國60年來保護考古遺址的演變，從考古遺址遭受工程破壞，到今日的「預防性考古」。

在2019年的田野實習，屬於「Fossae Marianaе：福斯灣與馬略運河的古老港口」研究計畫的一部分，發掘地點「福斯濱海」(Fos-sur-Mer) 位於隆河(Rhône) 出海口旁。每日工作結束，傍晚的天空飄著來自對面垃圾焚化爐的五彩烏雲，那片工業區根據文獻推論是古羅馬奧古斯都時期(27 BC - AD 14) 的馬略運河(Le Canal de Marius) 出海位置。早在1963年考古學家便記錄部分遺址位置，然而由於興建工業區，且過去並無法律要求進行工程前的考古調查，學者推測遺址的主結構，已因此拆毀，兩千年的遺址便無聲地消失在經濟發展的洪流中。1970年代開始，國家研究單位展開長期的調查，尋找其餘運河與周圍的港口市鎮遺跡。他們曾在水下3至4公尺水深，發現35座可上溯至西元1、2世紀的墓碑與祭壇，並在1980年採集相關文物出水後確認定年[7]。

除了工程建設可能會影響遺址保存，福斯濱海自70年代以來便是夏季戲水的觀光勝地，早期許多水肺潛水員會在潛水結束時帶走「潛水紀念品」，小至陶片、錢幣，大至完整的雙耳陶罐(L'amphore)，此種行為同樣也會對遺址現況造成破壞。古運河帶來了人潮，無數人群生活留下來的物品，還有失事船舶的遺址。在田野工作期間曾有一位民衆拿了一袋自己在海灘拾獲的陶片，交給計畫主持人楓丹(Souen Fontaine) 老師，這些陶片由於沒有進行完整的脫鹽程序，狀況不佳，但她還是收下這些陶片，進行數量與類型的簡單記錄：她說，過去曾有潛水員在晚年時致電給法國水下考古中心，希望能將他的「紀念品」捐給國家，避免文物被不識貨的子孫給任意丟棄，然而這些文物多半沒即時進行處理和保護加固，而且失去出土的脈絡，成為單一、扁平的物件。這不僅是研究者的損失，也是集體歷史記憶的流失。



圖2/福斯濱海的考古遺址調查與對岸工業區
圖片提供/攝影師Lionel Roux (CNRS-CCJ)

改變對於保護水下文化資產的觀念需要時間，以福斯濱海的考古遺址為例，半世紀過去後，大眾對地方史與考古工作依舊充滿好奇，這股熱情也逐漸形成保護遺址的共識。在2019年發掘季的最後的週三晚上，舉行考古成果分享會，活動僅靠社區內張貼公告欄與口耳相傳，便座無虛席，民衆並在會後提出各式的問題。因為當地經常舉辦類似的活動，因此只要有團隊進行考古發掘，民衆便能透過講座瞭解該年度最新的研究進度。

結語：法國與臺灣

法國作為最早保護水下文化資產的國家，在這60年的期間修正出一套盡可能兼顧開發、考古調查與文化資產保存的作法，同時整合國內各個單位，包含國家級的水下考古研究中心、預防性考古研究中心等政府部門與各地商業考古公司、潛水團體、文史團隊等進行合作調查。以近年在諾曼第海域發展的離岸風場為例，由國家水下考古研究中心進行事前水下文化資產評估，並授權給國家預防性考古研究中心負責實際探測與發掘工作，也和學校合作進行系統性的人才培育，以及透過公眾考古學的推廣，降低民衆想接觸考古學知識的門檻，讓民衆對於考古學、古文明的好奇，轉為主動學習與開啓對話的契機。

法國水下考古中心也進行國際合作，例如，臺灣曾因澎湖馬公商港的疏浚工程，發現陶瓷破片等疑似沉船遺物，因此臺灣曾在2007年和法方簽訂合作行政協議書，整合國內、外專家在港內進行調查，也開展第1屆臺灣水下考古種子人才培育課程，並催生後來由中研院史語所的臧振華院士帶領的第1支水下考古團隊，歷年來在文化部文化資產局委託下於臺灣附近海域進行水下文化資產的普查計畫，臺灣的地理位置為航運必經之處，特別是西側的臺灣海峽，澎湖附近的海域更是凶險，具有極高的水下文化資產潛力[8]。迄今在臺灣附近海域已驗證近一百處目標物，且辨識20處為水下遺址點，其中有6艘列為重要的列冊水下文化資產，出水近1,600餘件文物[9]。

其它潛在的水下文化資產，包含在臺灣海峽自冰河時期留下的舊石器時代遺址：新石器時代海陸交通網跨區域貿易的物質遺留；歷史時期，南來北往不幸失事的沉船，以及傳統漁業的潮間帶石灘群等。凌純聲先生曾以「亞洲的地中海」來形容中國東南部、東南亞、南洋群島之間的古代航海傳統，其重要性正如歐洲地中海孕育了西方古文明[10]。考古遺址留下文明發展的痕跡，生活在海洋環繞的島嶼，從古至今海洋是島與島的橋樑，連結著人類的過去與展望未來，做好文化資產保存，也同時是在累積文化旅遊及文化創意產業的能量。

借鑑國外，因地制宜，臺灣在推行保護水下文化資產的這15年來，不斷修正與改進，以便在經濟發展和文化資產保存之間取得平衡。在2015年通過的《水下文化資產保存法》中以「現地保存」(In-situ Preservation)為原則；在2020年修訂《水域開發利用前水下文化資產調查及處理辦法》近似於「預防性考古」的精神，規定如工程可能直接或間接影響海床，則需進行事前的調查工作。文化資產局也透過舉辦人才培育課程、博物館展覽、工作坊、出版品及走入校園的講座等教育推廣活動，讓更多人能認識這些沉沒的文明瑰寶，增進全民守護水下文化資產的意識。



圖3／文化部文化資產局舉辦潛水教練的工作坊（2020年），水下考古隊的黃漢彰隊長正在示範現地保存的施作方式
圖片提供／攝影師高璽堯（淡江大學海洋及水下科技研究中心）

參考資料

- [1] Grands Sites Archéologiques (Jan. 26, 2018), Il était une fois-Les Pionniers.
<https://archeologie.culture.fr/archeo-sous-marine/fr/pionniers-0> (Mar. 10, 2022)
- [2] Ministère de la Culture (Apr. 27, 2017), Le Département des recherches subaquatiques et sous-marines.
<https://www.culture.gouv.fr/Thematiques/Archeologie/Acteurs-metiers-formations/L-archeologie-au-ministere-de-la-Culture/Le-Departement-des-recherches-subaquatiques-et-sous-marines> (Mar. 10, 2022)
- [3] franceinfo:culture (Jun. 27, 2021), À bord de l'Alfred Merlin, nouveau bijou technologique de l'exploration archéologique sous-marine : "On a le service de recherches le plus compétent au monde!"
https://www.francetvinfo.fr/culture/patrimoine/archeologie/abord-de-l-alfred-merlin-nouveau-bijou-technologique-de-l-exploration-archeologique-sous-marine-on-a-le-service-de-recherches-le-plus-competent-au-monde_4679123.html (Mar. 10, 2022)
- [4] NEARCH (Sep. 9, 2014), NEARCH-Involving, Imagining, Sharing, Innovating, Connecting.
<http://www.nearch.eu/connecting/> (Mar. 22, 2022)
- [5] 徐跃勤 (2013) 。《雅典海上帝国研究》（北京：中国书籍出版社）·43-46。
- [6] European Commission website (Jul. 11, 2016), Cultural Tourism.
https://ec.europa.eu/growth/sectors/tourism/offer/cultural_en (Mar. 22, 2022)
- [7] Hypotheses (Mar. 23, 2021), À la recherche de Fos sur Mer antique.
<https://amidex.hypotheses.org/10498> (Mar. 22, 2022)
- [8] 戴振華、劉金源、梁華綺、李麗芳 (2016) 。《臺灣附近海域水下文化資產普查計畫報告輯：第一階段報告》（臺中：文化部文化資產局）·18-21。
- [9] 董盈穎 (2020) 。〈探討我國水下文化資產教育推廣現況與未來展望〉，《文化資產保存學刊》(53)：7-26。
- [10] 凌純聲 (1979) 。《中國邊疆民族與環太平洋文化》（臺北：聯經出版事業公司）·335-344。

終結塑膠污染：國際塑膠條約的未來？

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關鍵字／塑膠污染、國際塑膠條約、循環經濟

2022年3月2日在聯合國環境規劃署成立50週年之際，175個會員國在第5屆聯合國環境大會第2階段會議中，通過名為「終結塑膠污染：制定具法律拘束力的國際文件」的決議（以下簡稱決議），並預計於2040年訂定終結塑膠污染的國際條約。這項歷史性的決議，意味著全球減塑運動又向前推進一大步，自然環境保護也邁向新的里程碑[1]。

無所不在的塑膠污染是當前的3大地球危機之一。由於塑膠的延展性、便利性及價格低廉，因此自1950年代以來，塑膠製品便開始大量出現在日常生活之中，人類對塑膠的依賴也日益增加。根據聯合國報告指出，在1950年至2017年間，全球大約製造了9.2億公噸的塑膠。其中，僅有三分之一尚在使用中，其餘三分之二成了塑膠廢棄物，被棄置在垃圾掩埋場或自然環境中，部分則流入河川或海洋，進一步透過空氣或洋流的傳播，遍布世界各地。不能在自然環境中分解的塑膠垃圾成為地球最大的危機之一，其中又以海洋所受到的影響最為嚴重。研究指出，目前海洋垃圾中，近95%是塑膠，若未積極處理，水生生態環境中塑膠排放量，預估在2040年將增加3倍[2]。

聯合國環境大會決議的通過，意味著世界各國已體認塑膠污染的災難性及嚴重性，並願意共同攜手解決當前危機。同時也認定徹底解決塑膠污染，不能單靠個別國家的政策，而需結合全世界所有成員的合作與努力，並藉由具有法律拘束力的國際條約才能成功。

重點解析[3]

本次決議有下列幾項重點：重申永續發展目標、承認塑膠污染的嚴重性及範圍、強調塑膠整體生命週期及循環經濟，以及設立政府間談判委員會啟動全球塑膠條約之談判。

一、重申永續發展目標

決議中重申2030年永續發展議程及《里約宣言》原則。保護自然環境為永續發展的核心，為落實永續發展目標，各國須藉由回收、再使用以減少塑膠廢棄物，實現塑膠的永續生產與消費。決議中也呼應過去聯合國環境大會相關決議，認為永續目標的實踐有賴全球視野及長期的集體合作與治理，並認可各國政府、相關國際組織、非國際組織及私部門的努力，以及相關國際公約協調的重要性。

二、塑膠污染的定義與範圍

決議首先確認塑膠污染應包含微塑膠，並特別關注塑膠污染對海洋環境造成的衝擊。同時也承認當前大規模且快速增加的塑膠污染已經無所不在，形成全球性的危機，不僅侵害自然環境，衝擊永續發展，對社會及經濟層面的影響亦不容小覷。

微塑膠又稱塑膠微粒（Microplastics），美國國家海洋暨大氣總署（NOAA）將細小、不規則狀，且長度或直徑在5毫米以下的塑膠碎片定義為塑膠微粒。微塑膠不僅嚴重影響地球環境，同時也影響威脅海洋作為碳匯的能力，因而可能惡化氣候危機。此外，微塑膠藉由海洋、空氣及食物鏈的傳播，不僅危害生物生存，危及生態環境，亦會在人體累積，嚴重威脅人類健康與福祉。塑膠污染不僅對人類健康帶來不利影響，更使得塑膠廢棄物的管理及清理費用大幅增加。而海洋塑膠污染亦造成觀光業、漁業、養殖業及其他產業等巨大的經濟損失。

其次，決議中亦主張有效解決塑膠污染的問題，應聚焦在塑膠整體生命週期及跨境特性。根據聯合國報告指出，約有90%的塑膠廢棄物為消費後產品（post-consumer product），其中又以塑膠包裝居多；其餘10%為消費性前產品，如提煉或製造塑膠的產品。自1950年到2017年，全球塑膠回收率還不及10%。塑膠整體生命週期中，每年將製造18億噸溫室氣體，不僅惡化氣候變遷所帶來的負面效應，也威脅到全球所致力之碳排目標。但是，如果能藉由循環經濟資源再利用的方式，則全球可望在2024年減少55%的原生塑膠生產及80%的海洋的塑膠排放量[4]。

最後，決議強調海洋及其他環境中的塑膠污染具有跨境的特性，不僅影響全球生態環境，同時也危害全體人類健康。因此強調會員國應透過合作的方式，採取各種可能的方式應對塑膠整體生命週期。換言之，未來，從塑膠原料生產、製造、設計、丟棄到回收再使用將可望納入國際條約，建立完整的規範機制。

三、全面性的方法

決議第3點擬定未來國際塑膠條約的規範原則與內涵。為應對塑膠完整生命週期，國際公約應採納全面性的方法，得以兼採強制性及自願性方式，並考量《里約宣言》的原則及國家情況與能力。因此，未來國際塑膠條約中應包括下列重點規定：

（一）強化循環經濟以達永續消費與生產

條文中應強調資源有效性及循環經濟方式，從產品設計到符合環境的廢棄物管理，以促進塑膠的永續生產與消費。並應敦促各國制定並執行國家行動計畫，力求預防、降低及消除塑膠污染，以支持區域及國際合作。

（二）全面性措施

條約中應促進國家及國際合作，並與其他相關區域及國際公約協調，以解決現存塑膠污染及海洋環境中的塑膠污染。也應廣納公眾參與，鼓勵包含私部門在內的所有利害關係人參與行動，以利地方、國家、區域及全球各層級的合作。

另外，藉由意識提升、資訊交換及教育來增加知識，並鼓勵研究的投入，進一步發展永續的、革新的、可負擔的以及有效益的方式。最後，條文中應建立以科學及社會經濟為基準的評估機制，並定期評估協議落實的進展及相關措施的有效性。



圖1 / 無所不在的塑膠污染已構成地球危機
圖片來源 / Pride Advertising Agency Ltd.

四、設立政府間談判委員會

為能儘速於2024年具體擬定具有法律拘束力之國際條約，決議第1點要求成立政府間談判委員會（International Negotiation Committee）商議條約細節，並於2022年下半年度開始行動。再者，為使發展中國家和經濟轉型國家能有效履行未來國際條約所加諸的國際義務，決議第2點認定應優先提供發展中國家和經濟轉型國家必要的的能力與建設、技術及財政支持，使其能有效參與特設工作小組和政府間談判委員會的工作。

此外，依決議第4點，談判委員會協商時應考量以下要素。首先，部分條文應保有彈性，允許國家考量其國情並得以裁量決定如何履行其承諾。次者，應結合最佳科學、傳統、原住民及地方知識系統，參酌過去經驗或最佳實踐，包括各種非正式或合作式作法。最後，考量建立機制的可能性，以提供塑膠污染相關政策的科學與社會經濟資訊及評估。

挑戰與展望

無所不在的塑膠及其廢棄物是當前全球最為迫切且待解決的重大議題。各國雖然已積極採取各種限塑政策或措施，但是多數措施僅針對特定項目，欠缺系統性政策及標準，既無法解決環境污染問題，亦無法有效地降低塑膠的經濟及社會成本。本次決議的通過為地球危機帶來一線治癒的希望，為塑膠污染治理建立全球性規模及系統性的框架，但同時也為全體人類社會帶來新的挑戰與衝擊。

首先，本次決議代表全體國際社會體認到塑膠污染應從過去著重於將塑膠廢棄物集中處理的線性模式，又稱末端處理或管末處理（end-of-pipe treatment）轉換到針對塑膠整體生命週期的循環模式。從源頭減塑，透過重複使用及回收延長塑膠產品經濟使用價值，建立清楚完整的塑膠規範管制架

構。決議中要求未來全球塑膠協議將採取全面性措施，包括強制及非強制措施，以全面解決塑膠污染。各會員國並得視情況採取符合國家需求的措施，此種彈性、動態結構的設計讓各國可以依循國家經濟、科技、政治及社會條件等變化而調整因應之道，也更願意給予或強化其承諾。

另外，循環塑膠經濟的建立及塑膠污染的減少，需要不同利益關係者的行動，包括政府、消費者、塑膠產業相關製造商、廢棄物管理等公私部門。決議中強調公眾與多元利益關係者參與的重要性，認定國際組織及非政府組織參與的必要性，以強化塑膠污染治理的正當性及決策基礎，並有助於未來全球塑膠條約之推動與實踐。

2022年6月WTO第12屆部長會議中，由73個WTO會員國所參與的塑膠污染及環境永續塑膠貿易的非正式對話公開聲明支持決議的通過，並主張貿易及貿易政策為解決塑膠污染的手段之一。WTO會員國將持續致力於透過貿易相關的手段共同參與全球減塑行動。此外，為落實巴塞爾公約塑膠修正案，世界關務組織已修正塑膠廢棄物定義。未來，塑膠製品的國際貿易勢必受到重大影響，而貿易與減塑措施應如何調和，以避免構成新型態的貿易障礙，亦成為各國即將面臨的挑戰[5]。

再者，會員國雖於決議中承諾於2024年制定並通過全球塑膠協議，但是，條約談判不僅攸關各國權利義務及能力，同時也涉及國內政治協商。一般條約的協商平均需要5到10年的時間才能完成[6]。參與談判國家越多，完成條約談判所需時間就越長。因此，會員國將如何在兩年內完成全球塑膠協議談判仍有待觀察。另外，決議以抽象價值、目的及規範方向闡述為主，至於具體目標、措施及監督機制尚有賴會員國進一步協商。因此，全球塑膠協議能否如期完成並落實，皆有待觀察。



圖2 / 未臻完善的塑膠廢棄物管理已造成整體海洋環境的污染
圖片來源 / Pride Advertising Agency Ltd.



圖3 / 全球塑膠條約將為地球危機帶來一線治癒的希望
圖片來源 / Pride Advertising Agency Ltd.

雖然大眾對塑膠污染的危機意識逐漸抬頭，但近年來全球塑膠需求卻不斷增加。COVID-19疫情爆發之後，全球原生塑膠（virgin plastic）的需求更是大量增加，全球石化及塑膠產業也持續挹注高額投資，可預期塑膠產量將持續成長。未來國際條約通過後，也將改變塑膠生產與管理的模式，對於塑膠相關產業亦會造成重大衝擊。因此，各國應如何在落實減塑義務與產業轉型發展間取得平衡，亦將會是一大考驗。

最後，我國近年來也展現決心逐步實施限塑政策。自2002年起禁止免費購物用塑膠袋，2018年公布海洋廢棄物清理行動計畫，針對4大類一次性塑膠製品訂出2020年內用不提供免洗餐具及一次性塑膠吸管、2025年以價制量限用、2030年全面禁用的政策時程表。政府決心雖值得讚許，但現行政策及資源多聚焦在塑膠廢棄物的末端處理，無法有效解決塑膠污染。為因應未來新型態之國際塑膠規範機制，建議我國政府應及早通盤檢視當前塑膠治理政策，規劃國家減塑藍圖及相關配套措施，為地球永續發展盡一份心力。

參考資料

- [1] United Nations Environment Program (2021). "From Pollution to Solution: a Global Assessment of Marine Litter and Plastic Pollution." <https://www.unep.org/resources/pollution-solution-global-assessment-marine-litter-and-plastic-pollution> (Sep. 2, 2022)
- [2] One Ocean Hub (May 4, 2022). REFLECTIONS ON THE NEW UN PROCESS TO DEVELOP A TREATY ON PLASTICS. <https://oneoceanhub.org/reflections-on-the-new-un-process-to-develop-a-treaty-on-plastics/> (Sep. 2, 2022)
- [3] UNEP/EA.5/Res.14 (Mar. 7, 2022). "End Plastic Pollution: Towards an International Legally Binding Instrument."
- [4] United Nations Environment Program (2021). "Drowning in Plastics: Marine Litter and Plastic Waste Vital Graphics." <https://www.unep.org/resources/report/drowning-plastics-marine-litter-and-plastic-waste-vital-graphics> (Sep. 2, 2022)
- [5] Informal Dialogue on Plastic Pollution and Environmentally Sustainable Plastics Trade (IDP), WT/MIN (22)/12 (Jun. 13, 2002). "Ministerial Statement on Plastic Pollution and Environmentally Sustainable Plastic Trade." <https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/MIN22/12.pdf&Open=True> (Sep. 2, 2022)
- [6] The SDG Knowledge Hub (Mar. 10, 2022). UNEA Launches Negotiation of Plastic Pollution Treaty. Science Body on Chemicals. <https://sdg.iisd.org/news/unea-launches-negotiation-of-plastic-pollution-treaty-science-body-on-chemicals/> (Sep. 2, 2022)

立陶宛環境部： 致力環境保護和引領海洋空間規劃

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關鍵字／立陶宛、環境部、國家環境保護策略、海洋空間規劃

立陶宛共和國（Republic of Lithuania，簡稱立陶宛）是歐盟會員國，也是《聯合國海洋法公約》的締約國。該國沒有專責的海洋事務機構，而海洋環境相關事務係由環境部主責。環境部擬訂的「國家環境保護策略」，是環境治理的主要政策文件。該文件明訂的環境保護政策原則，代表立陶宛政府對環境保護所持的核心和價值，包括生態效率、污染預防、污染者付費、預警原則等，該等原則當然亦適用於海洋環境保護。此外，環境部於2014年完成海洋空間規劃的法制化，將海洋空間計畫納入國土計畫的一環，於2015年獲國會通過。此顯示立陶宛積極投入海洋空間規劃的政治意志力，視海洋空間為國土重要資源，以促進國家藍色經濟發展和海洋環境保護。

立陶宛簡介

立陶宛地處波羅的海（Baltic Sea）東岸，北接拉脫維亞、東南接白俄羅斯、南接波蘭、西南接俄羅斯的加里寧格勒州，緯度介於北緯 53° 至 57° 之間，經度大致介於東經 21° 至 27° 之間。全國人口約280萬，面積約65,300平方公里，海岸線長度約90.66公里，領海1,810平方公里，專屬經濟海域面積約4,560平方公里[2]。海岸線北段面對波羅的海，其餘則緊鄰庫爾斯潟湖（Curonian Lagoon）。庫爾斯沙嘴上的沙丘，為歐洲最大的流動沙丘，被劃為國家公園，同時也是聯合國教科文組織世界遺產。



圖1／波羅的海各國的專屬經濟海域界線（紅線）及立陶宛海洋空間（橙色斜線的區域）

資料來源／[1]



圖2/立陶宛庫爾斯湖沙丘——聯合國教科文組織世界文化遺產
(註：樹叢外側是湖湖水體)
圖片提供/陳璋玲

立陶宛政府體制為半總統制，總統為國家元首，由全民直選產生，任期5年，最多可任兩屆，負責外交與國安事務。總統提名總理，經國會同意。總理為政府首長，提名內閣各部會首長，經總統同意。立陶宛有14個部會，分別是環境部 (Ministry of Environment)、能源部 (Ministry of Energy)、經濟和創新部 (Ministry of Economy and Innovation)、財政部 (Ministry of Finance)、國防部 (Ministry of National Defence)、文化部 (Ministry of Culture)、社會安全和勞工部 (Ministry of Social Security and Labour)、交通和通訊部 (Ministry of Transportation and Communication)、衛生部 (Ministry of Health)、教育科學和運動部 (Ministry of Education, Science and Sport)、司法部 (Ministry of Justice)、外交部 (Ministry of Foreign Affairs)、內政部 (Ministry of the Interior)、以及農業部 (Ministry of Agriculture) [3]。

立陶宛沒有專責的海洋事務機構，其海洋環境相關事務歸屬於環境部權責。該部的「國家環境保護策略」(National Environmental Protection Strategy)，是環境治理的主要政策文件。此外，該部亦負責國家海洋空間規劃 (Marine Spatial Planning, MSP)。另注意的一點是立陶宛為歐盟會員國，歐盟通過有關海洋法規，對立陶宛有約束效果，這些法規如歐盟海洋策略架構指引 (EU Marine Strategy Framework Directive)、歐盟海洋空間規劃指引 (EU Directive on Marine Spatial Planning)、歐盟整合海洋政策 (Integrated Maritime Policy of the EU)。本文目的即介紹環境部及二個政策文件——國家環境保護策略和海洋空間規劃，以瞭解立陶宛海洋治理的內容。

環境部和國家環境保護策略

環境部掌管氣候變遷、空氣、水、化學物質、環境影響評估、廢棄物處理、污染防治、自然保育、森林、保護區和地景、國土規劃、永續發展等事務[4]。該國國會2016年9月25日通過「國家環境保護策略」，為立陶宛治理環境的主要政策文件。此文件內容主要包括環境保護政策的原則、環境保護政策的優先領域，以及重要政策執行方針等[5]。

環境保護政策的原則代表立陶宛政府致力環境保護所持的核心與價值，共計11項，包括生態效率、污染預防、負責任（即污染者付費原則）、源頭矯正、環境保護政策整合、使用最佳可得科技、預警原則、替代、輔助、夥伴關係和責任共擔、公共參與及資訊。其中，生態效率（eco-efficiency）係指使用更少的資源並減少浪費和污染，同時創造更多商品和服務。替代（substitution）係指無害物質取代對人類和環境的有害物質、乾淨或少污染的再生資源取代不永續的資源，同時對生產過程中所產生的廢棄物予以再利用、回收或作其他使用（如產生能源）。而輔助（subsidiarity）係指在決策和執行的過程中，加強民主和夥伴參與，包括協助地方社區關切他們自己生活的環境，並增加他們參與解決環境問題的機會。

環境保護政策的優先領域有4大領域，分別是「自然資源永續使用和廢棄物管理」、「環境品質改善」、「維持生態系穩定」，以及「氣候變遷減緩和調適」。由此4大領域可以顯示立陶宛在環境議題上列為優先治理的議題。值得一提的是，「國家環境保護策略」並未以單章或單節處理海洋環境相關議題，而是將海洋環境和環境視為一體，並在上述各個優先領域中來處理。例如，在「自然資源永續使用和廢棄物管理」領域，有處理漁業資源問題；在「環境品質改善」領域，有提及確保庫爾斯潟湖和波羅的海的水質品質等；在「維持生態系穩定」領域，提及生物多樣性和生態系統服務等。

有關漁業資源的部分，特別提及波羅的海及潟湖的沿岸水域，商業捕撈強度大，以及非法捕撈和意外捕獲海鳥、海洋哺乳類生物等問題。此外，亦提出重要的政策執行方針，包括確保漁業資源永續利用、保護魚群（鮭魚和鱒魚）洄游路徑和產卵地，以及建立從波羅的海到河川上游的洄游路徑、訂定合宜的捕撈規定等。

海洋空間規劃

歐洲共同體（European Council）於2014年通過「歐盟海洋空間規劃指南」（Directive 2014/89/EU），目的在促進海洋經濟活動永續成長、海洋地區發展和海洋資源永續利用。22個沿岸的歐盟會員國最晚須於2021年3月21日前完成國家海洋空間計畫，且最少每隔10年需檢討一次[6]。為追蹤各會員國進行海洋空間的進度，歐盟設定一個平臺網站（The European Maritime Spatial Planning Platform），網站包括各國海洋空間規劃相關內容[2]。此外，赫爾辛基委員會（HELCOM, Baltic Marine Environment Protection Commission）為波羅的海的區域性組織，致力於建立一個健康的波羅的海環境。海洋空間規劃為工具之一，該組織亦在其網站設立MSP專頁，提供組織各會員國的MSP相關資訊，包括立陶宛[7]。本節有關立陶宛MSP資訊主要摘錄自上述二個網站。

立陶宛是歐盟會員國中，海岸線最短的國家之一，其所轄海洋空間的北邊和拉脫維亞相接，南邊和俄羅斯相接，西側和瑞典相鄰。為因應「歐盟海洋空間規劃指南」及加強海洋空間治理，立陶宛早於2013年開始修正《國土規劃法》（Law on Territorial Planning），將海洋空間規劃納為國土規劃的一部分，法規修正案於2014年1月1日生效。海洋空間規劃法制化完成後，立陶宛即著手海洋空間規劃，並於2015年6月11日通過海洋空間計畫（Comprehensive Marine Territorial Plan），成為國

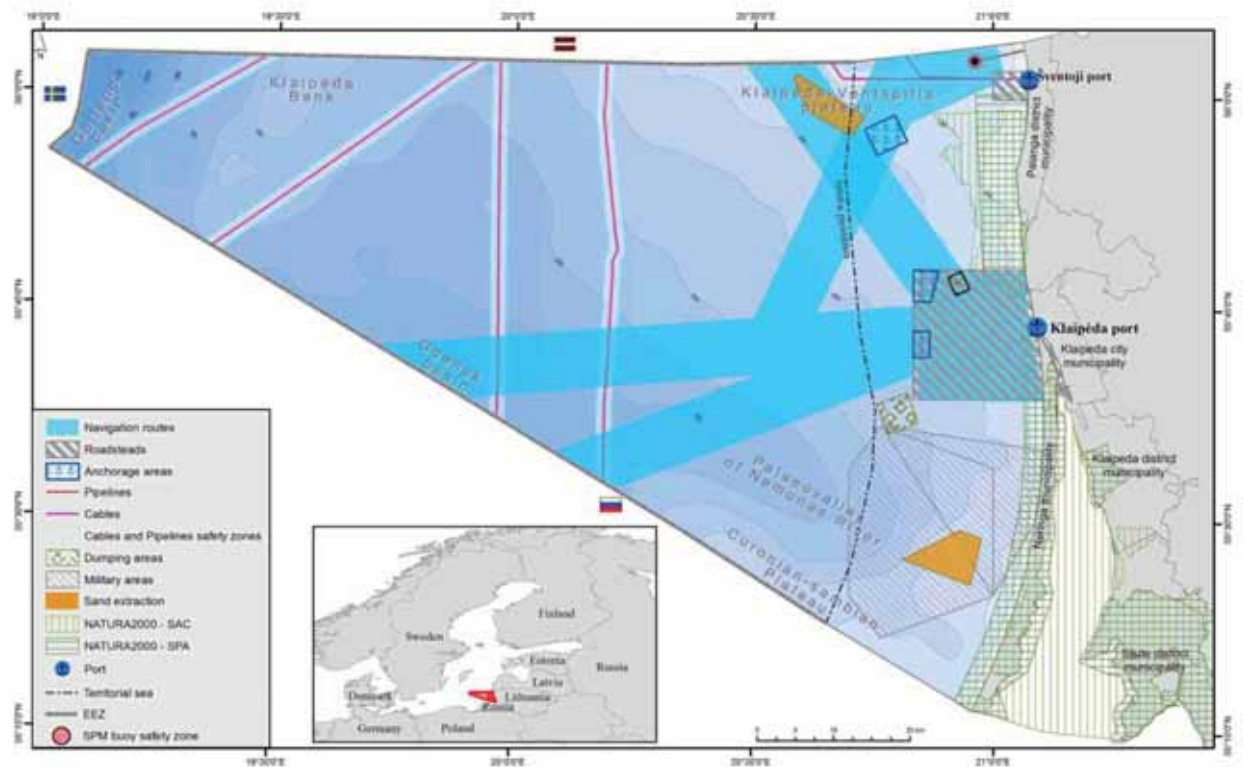


圖3/立陶宛海洋空間規劃，標誌海洋空間的各不同使用，包括航道、管線、纜線、港口、海拋區、採砂區、保護區等
圖片來源/[8]

土整體計畫（Comprehensive Plan of the Territorial of the Republic of Lithuania）的一部分。最新的國土整體計畫第2版（包括海洋空間計畫）於2021年9月29日業經國會通過。

海洋空間包括內水（不含潟湖水域）、領海、專屬經濟海域、以及該海域的海底床和底土。該計畫明訂應遵循的法規，包括「歐盟海洋空間規劃指引」、《立陶宛克萊佩達州港埠法》（Law on Klaipėda State Seaport of the Republic of Lithuania），以及歐盟有關建立安全渡輪和港埠基礎設施的規定等。

海洋空間規劃明訂目的為：

- 維持經濟發展及生態之間的平衡。
- 打造一個健康及和諧的環境，以創造國家更好的生活條件。
- 建立一個容納各不同活動領域發展的整合政策。
- 保護、復育和合理使用自然和遊憩資源，以及文化資產價值。
- 保留基礎設施和其他各不同活動發展需求的海域空間。
- 促進經濟發展的投資，同時保護和復育自然、人文和遊憩資源。
- 協調自然人和法人、市政府和州政府的利益，以及國際法的個體在立陶宛海域空間使用的權利。

海洋空間規劃考量目前使用、未來使用、議題和空間衝突等。特定功能的區位和其相關圖資包括空間發展概念和國土功能優先區位、經濟活動發展區位、確保生態平衡和保存文化資產的區位、技術

基礎設施發展區位、國家需要保留區位等。雖然區位有特定功能，但大部分區位是多元混合使用，但原則是該等使用不能干擾該特定區位的優先使用和功能，例如在非特定和自由海域區域（the non-specific and free marine region），提供漁業、養殖和海上通行等多元的使用。而為促進再生能源的發展，部分海域空間分配予再生能源基礎設施，如風機、波浪能和其他創新技術方法。另特定區域供高速渡輪航行使用，以及海岸地區優先作生態保護。圖3顯示不同使用的海洋空間配置，包括航道、管線和纜線、港口、海拋區、採砂區、軍事區、特別保育區（Special Area Conservation）、特別保護區（Special Protection Area）等。

空間規劃的過程必須確保公眾參與，作法包括規劃過程的各階段資訊公開、計畫相關文件在環境部網站可公開取得、於國家和國際會議中報告海洋空間計畫，以及召開公聽會等。此外，規劃過程亦包括跨界協商（transboundary consultation），協商的國家是和其海域空間相鄰的歐盟會員國——拉脫維亞和瑞典。

結論

立陶宛沒有專責的海洋事務機構，海洋環境相關事務歸屬於環境部權責。環境部負責擬定與執行的「國家環境保護策略」和海洋空間規劃，是海洋治理的重要政策文件。尤其，立陶宛早於2014年完成海洋空間規劃法制化，將海域空間納為國土的一部分，並於2015年通過海洋空間計畫，是歐盟會員國之中，率先完成國家海洋空間規劃計畫的國家，可見該國非常重視其管轄海域空間的經濟活動發展和環境保護。

雖然立陶宛海岸線短，只約90.66公里，管轄海域面積亦只有6,370平方公里，遠小於我國海岸線長度（約1,900公里）和領海及鄰接區的總面積（約83,700平方公里）[1]，但該國將海洋空間視為國家重要的資產，積極投入海洋空間規劃，以滿足國家經濟活動發展的需求，同時確保環境保護，這種作法值得我國參考借鏡。

參考資料

- [1] The European MSP Platform (Feb. 22, 2022). Baltic Sea.
<https://maritime-spatial-planning.ec.europa.eu/sea-basins/baltic-sea-0> (Sep. 7, 2022)
- [2] The European MSP Platform (Jul. 07, 2022). Lithuania.
<https://maritime-spatial-planning.ec.europa.eu/countries/lithuania> (Aug. 11, 2022)
- [3] Government of the Republic of Lithuania (n.d.). My Government.
<https://lr.lt/en/> (Aug. 11, 2022)
- [4] Government of the Republic of Lithuania (n.d.). Ministry of Environment of the Republic of Lithuania.
<https://am.lrv.lt/en/> (Aug. 11, 2022)
- [5] Ministry of Environmental of the Republic of Lithuania (2016). National environmental protection strategy.
<https://am.lrv.lt/uploads/am/documents/files/National%20Environmental%20Protection%20Strategy.pdf> (Aug. 11, 2022)
- [6] The European MSP Platform (n.d.). Introduction to MSP.
<https://maritime-spatial-planning.ec.europa.eu/msp-eu/introduction-msp> (Aug. 11, 2022)
- [7] HELCOM (n.d.). HELCOM-VASAB cooperation.
<https://helcom.fi/action-areas/maritime-spatial-planning/msp-roadmap/> (Aug. 11, 2022)
- [8] The European MSP Platform (n.d.). Lithuanian Model Case.
<https://maritime-spatial-planning.ec.europa.eu/practices/lithuanian-model-case> (Sep. 7, 2022)

立陶宛外來種入侵與壓艙水管理

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關鍵字／波羅的海、水生入侵種、赫爾辛基委員會、壓艙水交換

2005年千禧年生態系統評估指出，在未來的幾十年，外來入侵物種的影響將越來越大。外來入侵物種被認為是生物多樣性喪失、生態系統改變的主要原因之一。隨著貿易全球化程度的提高，海上運輸的貨物數量不斷增加，亦間接導致船舶壓艙水的大量使用。而外來物種透過壓艙水被引入至新的海洋環境，已被認為是世界海洋和全球生物多樣性的重要威脅。國際海事組織於2004年制定《國際船舶壓艙水和沉積物控制與管理公約》（簡稱《壓艙水管理公約》），以確保有效的壓艙水管理，防止或減緩因船舶壓艙水而引入之外來種入侵的問題。立陶宛位於波羅的海的東南部，為波羅的海地區海洋環境公約（簡稱《赫爾辛基公約》）之締約國。《赫爾辛基公約》促使波羅的海地區的國家合作，共同採取壓艙水管理措施以保護波羅的海之海洋環境及生態系統。



圖1／立陶宛克萊佩達海港（Port of Klaipėda）

圖片來源／<https://portofklaipeda.lt/en/naujienos/eu-funds-to-dredge-the-navigation-channel-up-to-15-meters-in-klaipeda-port/>

外來入侵種與壓艙水

外來種是指經由人為無意或有意引進的物種。人類的活動導致全球各地頻繁地交流，並使得一些物種得以突破地理限制而拓展其分布至他處。部分外來物種可能會在沒有捕食者、寄生蟲或疾病等自然因素的影響下，嚴重地改變當地的生態系統，而此等物種即被稱之為外來入侵種[1]。

隨著國際貿易的發達，航運對全球經濟至關重要，其為遠距離運輸貨物最具成本效益的方式，目前80%的貨物由船舶運輸。而船舶航行需要汲取或排放海水作為壓艙水以確保船舶的適航性，壓艙水的主要作用包括[2]：

- 調整船舶載重和吃水深度。
- 載運物的重量分布不均時，維持船身的平衡。
- 在不同的海洋氣象狀況，控制船舶的穩定度。
- 提高船舶燃料使用效率。

在自然狀態下，海洋水生物種大多會有遷移或擴散現象，但由於地理屏障生物較難以擴散或傳輸到較遠的海域。然而當船舶汲取壓艙水時，大量水生物種也會進入船舶之中，這些物種隨著壓艙水在目的港排放，而被遷移到另一個地區的海域。壓艙水被認為是潛在外來種入侵傳播的主要媒介之一，據估計，全球每天有高達140億公噸的壓艙水被運輸到世界各地，而這些壓艙水中可能含有7,000至10,000種不同的海洋微生物、植物和動物[3]。表1列舉出船舶壓艙水所轉移之最具入侵性的物種。目前大多數國家都受到壓艙水排放的影響，也意識到船舶壓艙水的無控制排放會導致外來種入侵和病原體的轉移，對生態環境、經濟及人類健康造成損害。

國際海事組織（International Maritime Organization, IMO）海洋環境保護委員會（Marine Environment Protection Committee, MEPC）亦關注壓艙水與水生外來種入侵的問題。在2004年，國際海事組織大會於英國倫敦通過《國際船舶壓艙水和沉積物控制與管理公約》（International Convention for the Control and Management of Ships' Ballast Water and Sediments, BWMC），以確保有效的壓艙水管理，並藉此公約來防止或減緩因船舶壓艙水而引入之外來入侵種。BWMC於2017年9月生效。截至2022年4月，已有89個國家批准BWMC，約占全球商船隊總噸位的91.20%[4]。

表1/ 透過船舶壓艙水轉移的10種最具入侵性的物種

物種俗名	物種學名
霍亂弧菌 Cholera	<i>Vibrio cholera</i>
魚鈎水蚤 Cladoceran water flea	<i>Cercopagis pengoi</i>
中華絨螯蟹 Mitten crab	<i>Eriocheir sinensis</i>
毒藻 Toxic algae	various species
黑口新鰕虎 Round goby	<i>Neogobius melanostomus</i>
斑馬貽貝 Zebra mussel	<i>Dreissena polymorpha</i>
淡海椰水母 Comb jellyfish	<i>Mnemiopsis leidyi</i>
多棘海盤車 North Pacific seastar	<i>Asterias amurensis</i>
歐洲濱蟹 European green crab	<i>Carcinus maenas</i>
裙帶菜 Asian kelp	<i>Undaria pinnatifida</i>

資料來源/https://wwwcdn.imo.org/ocalresources/en/OurWork/PartnershipsProjects/Documents/Mono25_English.pdf

波羅的海和立陶宛的水生外來入侵種

波羅的海為一個半封閉的水體，且上下水層鹽度具有明顯差異，水體具有明顯分層。波羅的海的外來入侵種在過去50年中已有所增加，相較於之前的年代，目前相對活躍的海上運輸活動，造成船舶能在更短的時間內從更多地區運來大量的壓艙水，而使得壓艙水中的外來物種更容易被引入不同的海域[5]。

為了保護波羅的海的海洋環境，波羅的海沿岸國家（丹麥、愛沙尼亞、芬蘭、德國、拉脫維亞、立陶宛、波蘭、俄羅斯、瑞典）及歐盟共同簽署《赫爾辛基公約》（Convention on the Protection of the Marine Environment of the Baltic Sea Area, Helsinki Convention），避免波羅的海受到陸地、空氣和海洋污染源的影響，以維持生物多樣性及棲息地。波羅的海海洋環境保護委員會（The Baltic Marine Environment Protection Commission, HELCOM）亦稱為赫爾辛基委員會，是一個政府間的組織。該組織之目的為管理《赫爾辛基公約》，並作為區域性海洋環境政策制定的平臺。赫爾辛基委員會自2008年以來即開始編制並更新波羅的海外來物種引入的綜合清單。根據該清單歷年資料可以發現波羅的海之外來物種引入的情況隨年代而呈上升趨勢[6]。據估計，在波羅的海中已記錄到約120種的水生入侵種，其中近80個物種已在波羅的海建立繁殖種群。這些入侵種大部分是在過去100年中被引入，而航運則是最重要的引入媒介[7]。

立陶宛位於波羅的海的東南部，海岸線長度為90.66公里。據記載，立陶宛海岸地區的水域已觀察到17種透過船體或壓艙水而被引入的底棲生物。這些生物包含1種水螅類（hydroids）、1種多毛蟲類（multi-bristle worms）、11種甲殼類（crustacean）和4種帽貝類（limpets）[8]。著名的入侵外來種黑口新鰕虎於1990年首次出現在波蘭格但斯克灣（Gulf of Gdansk），並於2002年出現在立陶宛沿海。研究顯示，這些地區所出現的黑口新鰕虎可能是來自黑海、亞速海和裏海地區的壓艙水[5]。目前在立陶宛沿海的庫爾斯潟湖（Curonian Lagoon），黑口新鰕虎正在進一步的擴張。已有證據顯示黑口新鰕虎在潟湖北部的種群密度穩定，並可能影響本地底棲魚類梅花鱸（*Gymnocephalus cernua*）的棲息地和食物資源[9]。

立陶宛的壓艙水管理

克萊佩達港（Port of Klaipeda）是立陶宛唯一的商業海港，年貨物吞吐量（annual cargo turnover）約為2,000萬噸。每年約有7,000艘船舶會進入該港，並排放約200到400萬噸的壓艙水。立陶宛沿海地區壓艙水的另一個來源為布廷格油庫港（Port of Butinge Oil Terminal），該港口於1999年開始營運，供油輪在此裝載。布廷格港能夠容納載重高達150,000噸的油輪。這些油輪在裝載石油產品之前會釋放壓艙水[5]。克萊佩達國家港務局（Klaipeda State Seaport Authority）和布廷格港務局（Butinge Port Authority）為壓艙水管理的主管機關。赫爾辛基委員會與奧斯陸—巴黎公約委員會（OSPAR Commission）共同採取壓艙水管理措施以保護波羅的海和東北大西洋。因此，立陶宛的壓艙水管理也需遵照前述區域管理組織所制定的規範。

根據BWMC規範及國際海事組織2017年壓艙水指定區域交換指南（G14），船舶應於距離最近陸地至少200浬、且水深至少200公尺的水域中排放壓艙水。如果無法滿足前述條件，則需於距離最近陸地至少50浬且水深至少200公尺的水域中排放，然而波羅的海的海域無法滿足前項深度和離岸距離的要求。因此根據BWMC及G14指南，同時赫爾辛基委員會認為波羅的海大多數外來物種對鹽度的耐受性很廣，故波羅的海內不適合進行壓艙水交換[10]。

赫爾辛基委員會、奧斯陸—巴黎公約委員會與《巴塞隆納公約》（Barcelona Convention）已合作制定一套3項聯合IMO自願性臨時指南。該指南係根據船舶的航線，指定壓艙水交換的地點。需注意的是，當船舶採用BWMC的D-2標準（表2）時，則不適用這些臨時指南[6][10]。船舶航行於波羅的海、東北大西洋和地中海地區，其壓艙水交換之相關規範如下：

- 自2008年4月起，通過大西洋或從途經西非海岸的航線進入東北大西洋的船舶，應在抵達或通過OSPAR地區之前，需在距離最近陸地至少200浬且水中至少200公尺處，進行符合D-1標準（表2之D-1）的壓艙水交換（圖2之Guidance G1）。
- 自2010年1月起，離開波羅的海並通過OSPAR地區前往其他目的地的船舶，應在距離西北歐海岸至少200浬且水深至少200公尺處，進行符合D-1標準的壓艙水交換（圖2之Guidance G2）。
- 自2012年10月起，在地中海和東北大西洋和／或波羅的海之間航行的船舶，一旦進入或離開東北大西洋，應在地中海之外的地區距離最近陸地至少200浬且水中至少200公尺處，進行符合D-1標準的壓艙水交換（圖2之Guidance G3）。

除此之外，赫爾辛基委員會與奧斯陸—巴黎公約委員會於2013年到2020年間，通過並修正壓艙水豁免聯合統一程序（The Joint Harmonized Procedure for the Contracting Parties of OSPAR and HELCOM on the granting of exemptions under the BWM Convention, Regulation A-4，以下簡稱JHP）。依據BWMC規範，在符合有害水生生物和病原體（harmful aquatic organisms and pathogens, HAOP）風險較低的區域，JHP允許行經波羅的海和東北大西洋的船舶，可向指定港口提出壓艙水管理的豁免申請。然而，根據BWMC及國際海事組織規範，在2024年9月之前，所有船舶都必須使用經過核准的船上壓艙水處理系統（Ballast Water Management System）處理壓艙水以符合D-2標準。因此JHP僅為過渡期間（2017年到2024年）的暫時方案，過渡期將於2024年結束，屆時將全面適用壓艙水管理的D-2標準[11]。

表2/BWMC中壓艙水排放的標準

控制標準	說明
D-1壓艙水交換標準	船舶如使用連續交換法應達到所載壓艙水量95%交換率；如使用稀釋交換法應達到注入及排出壓艙水至少3倍容積的水量。
D-2壓艙水性能標準	經由壓艙水處理系統（Ballast Water Management System）處置過之壓艙水，必須符合最大允許活生物體限制標準，才能排放入海。 1. 每立方公尺<10個活生物體，尺寸≥50μm。 2. 以及指標微生物在每毫升水中<10個活生物體，尺寸<50μm和≥10μm。

資料來源/ <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Implementing-the-BWM-Convention.aspx>

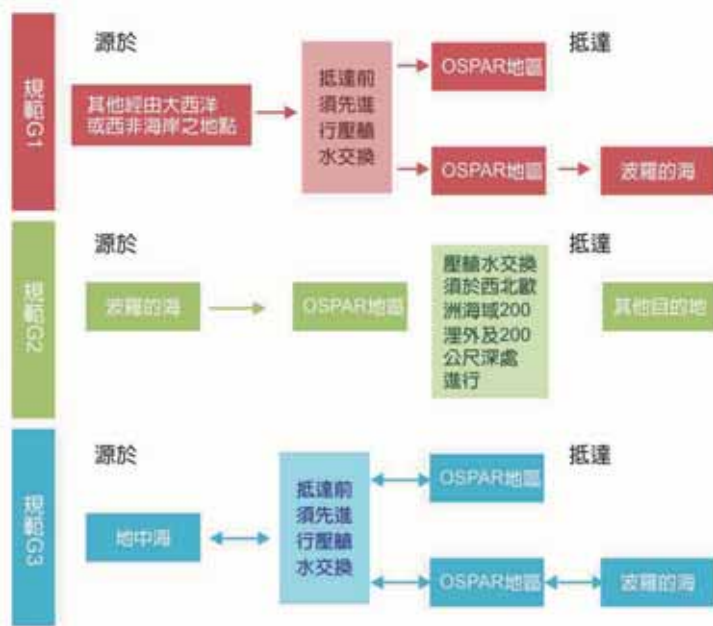


圖2/波羅的海地區之壓艙水交換規範

圖片來源/https://helcom.fi/post_type_publ/helcom-guide-to-alien-species-and-ballast-water-management-in-the-baltic-sea

結論

船舶壓艙水的不當排放所引入之外來種入侵，對於目的地海域之生態環境、經濟損失和人類健康造成重大的威脅。為此，國際海事組織已於2004年通過《壓艙水管理公約》，並於2017年9月生效。立陶宛屬波羅的海沿岸國家，為《壓艙水管理公約》的締約國，亦是《赫爾辛基公約》的締約國。因此立陶宛依循赫爾辛基委員會之規範，共同採取壓艙水管理的措施，執行《壓艙水管理公約》。赫爾辛基委員會與其他區域組織已合作制定3項自願性臨時指南，該指南係根據船舶的航線來指定壓艙水交換的地點以符合D-1標準。此外，赫爾辛基委員會與奧斯陸—巴黎公約委員會業已通過並修正壓艙水豁免聯合統一程序（JHP），作為直到2024年全面適用D-2標準前的暫時方案。

參考資料

- [1] Tamelander J., Riddering L., Haag F. & Matheickal J. (2010). Guidelines for Development of National Ballast Water Management Strategies. GEF-UNDP-IMO GloBallast, London, UK and IUCN, Gland, Switzerland. GloBallast Monographs No. 18.
- [2] David, M. (2015). Vessels and Ballast Water. In: David, M., Gollasch, S. (eds) Global Maritime Transport and Ballast Water Management. Invading Nature - Springer Series in Invasion Ecology, vol 8. Springer, Dordrecht.
- [3] Lakshmi, E., Priya, M., & Achari, V. S. (2021). An overview on the treatment of ballast water in ships. Ocean & Coastal Management, 199, 105296.
- [4] International Maritime Organization (2022). Status of Conventions - Ratification by Treaty. <https://www.imo.org/en/About/Conventions/Pages/StatusOfConventions.aspx> (Apr. 30, 2022).
- [5] Olenin, S. (2005). Invasive aquatic species in the Baltic states. Klaipėda University Press, Klaipėda, Lithuania.
- [6] HELCOM (2014). HELCOM Guide to Alien Species and Ballast Water Management in the Baltic Sea. https://helcom.fi/post_type_publ/helcom-guide-to-alien-species-and-ballast-water-management-in-the-baltic-sea (Jun. 10, 2022).
- [7] Gollasch, S., & Leppäkoski, E. (2007). Risk assessment and management scenarios for ballast water mediated species introductions into the Baltic Sea. Aquatic Invasions, 2(4), 313-340.
- [8] Ignatavičius, G., & Vilutienė, V. (2007). Impact of Lithuanian Sea Harbors on Environmental Stability and Local Ecosystems. In Environmental Security in Harbors and Coastal Areas (pp. 395-407). Springer, Dordrecht.
- [9] Rakauskas, V., Pūrys, Ž., Dainys, J., Lesutienė, J., LOŽYS, L., & ARBAČIAUSKAS, K. (2013). Increasing population of the invader round goby, *Neogobius melanostomus* (Actinopterygii: Perciformes: Gobiidae), and its trophic role in the Curonian Lagoon, SE Baltic Sea. Acta Ichthyologica et Piscatoria, 43(2).
- [10] HELCOM (2017). Baltic Sea clean Shipping guide. <https://helcom.fi/wp-content/uploads/2019/08/Baltic-Sea-Clean-Shipping-Guide-2017.pdf> (Jun. 15, 2022).
- [11] Outinen, O., Bailey, S. A., Broeg, K., Chasse, J., Clarke, S., Daigle, R. M., Gollasch, S., Kakkonen, J. E., Lehtiniemi, M., Normant-Saremba, M., Ogilvie, D. & Viard, F. (2021). Exceptions and exemptions under the ballast water management convention—Sustainable alternatives for ballast water management?. Journal of Environmental Management, 293, 112823.

立陶宛之海域劃界協定與相關實踐

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關鍵字／立陶宛、拉脫維亞、俄羅斯、海域劃界、瑞典

前蘇聯解體後，立陶宛分別與俄羅斯、拉脫維亞及瑞典締結海域劃界協定，過程中除出現海上經濟活動及資源分布的爭議外，另涉及波羅的海周邊情勢改變及領土主權紛爭，而此等協定之成敗不一，但透過各項協定經驗之介紹與分析將有助於瞭解劃界之爭議與可能之解決方案，並促成區域和平。

波羅的海海域劃界協定概述

波羅的海周邊國家均為《聯合國海洋法公約》（以下簡稱《公約》）之締約國[1]，而《公約》中除規範各海域之性質、範圍、國家權利義務外，亦有海岸相向或相鄰國家之間海域界限劃定的相關條文；雖然《公約》針對領海（第15條）與專屬經濟海域（第74條）及大陸礁層（第83條）設有不同劃界原則，然「協議」為共通之主要解決爭端方式，而國家間締結之劃界協定亦為處理海域界限問題的優先適用依據。

波羅的海屬半封閉海域，其平均寬度遠小於400浬，考慮到國家得依《公約》主張200浬專屬經濟海域，波羅的海周邊國家顯然有與他國進行劃界談判之必要性，而相關的談判與協議締結狀況亦隨著國家間關係的變化而受影響。學者Erik Franckx教授分4時期說明相關國家之協議成果[2]：

- 一、1945年-1972年：此時期涵蓋冷戰高峰期，第1項海域劃界協定為波蘭及前蘇聯於1958年締結之領海劃界協定，其後絕大多數之劃界協定均由東歐集團國家間締結，芬蘭為唯一非東歐集團之參與劃界協定國。
- 二、1973年-1985年：隨著東西德於1972年簽署《兩德基礎條約》，東歐及西方兩大集團國家之間的關係部分走向正常化，海域劃界協議的締結也出現跨集團之趨勢。
- 三、1985年-1990年：於前兩階段解決較單純之劃界爭議後，國家間於此階段處理較為複雜的問題（例如：島嶼對於劃界之效果）以及隨著《公約》制定所產生之新議題（例如：專屬經濟海域）。在此5年左右的時間內，締結之劃界協定數量多於過去的40年。
- 四、1990年至今：隨著前蘇聯解體，其過去簽訂之劃界協定的效力產生爭議，波羅的海3國的再度出現，也帶來新的劃界需求。

於前述第3階段末期，波羅的海劃界已有相當完整的成果，僅剩少部分水域尚未有劃界共識，然隨著前蘇聯解體，對此區域的海域劃界帶來相當大的影響。國際法下雖對於國際法人消滅、合併、分裂或移轉領土情況發展出國家繼承之理論，國際間並訂有1978年《維也納國家於條約方面之繼承公

約》(Vienna Convention on Succession of States in respect of Treaties) [3]，然許多規則並未獲得國際間的共識支持，且波羅的海3國，在態度上傾向不認定其為前蘇聯之繼承國[4]，故須重啓劃界談判，以下乃針對立陶宛與他國之間的劃界協定作一介紹。

立陶宛與他國締結之海域劃界協定

1992年《立陶宛共和國憲法》中雖有條文針對領空、波羅的海之大陸礁層及「經濟區」(economic zone)主張專屬權利[5]，但並未規範海域劃定相關事宜[6]。立陶宛於同年6月通過之《立陶宛共和國國界法》(Law on the State Border of the Republic of Lithuania)確立了12哩的領海主張，並透過其後的立法、決議等文件，公告其對鄰接區、專屬經濟海域及大陸礁層之主張[7]，其後立陶宛政府於2004年通過之決議中，附有與其鄰國之海域劃界示意圖(圖1)。

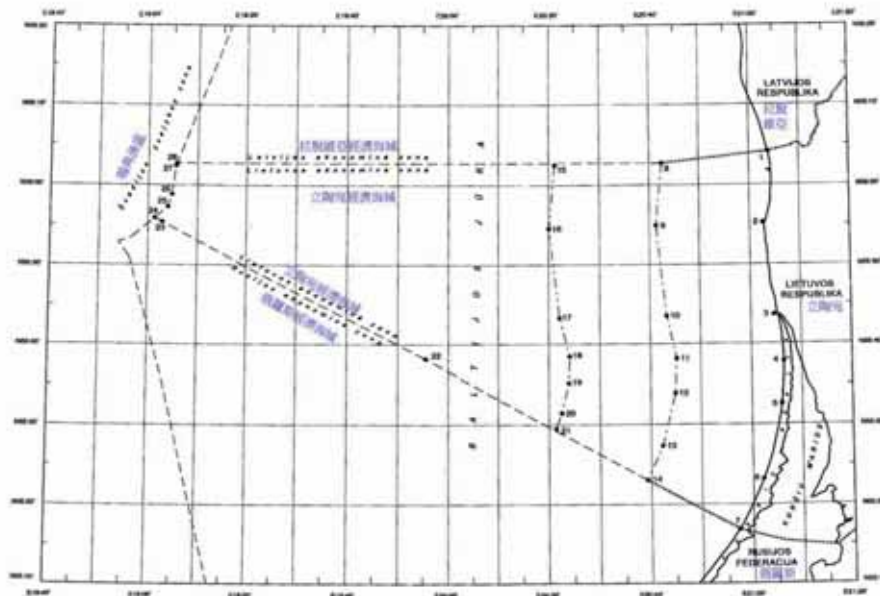


圖1/立陶宛與鄰國海域邊界示意圖
資料來源/立陶宛政府
(收錄於聯合國法律事務辦公室海洋事務與海洋法部門資料庫[8])

根據立陶宛提交給聯合國法律事務辦公室海洋事務與海洋法部門之資料，目前已締結且生效之海域劃界協定共有3項，均屬同時處理專屬經濟海域及大陸礁層劃界之協定，其中兩項為分別與俄羅斯和瑞典簽訂之雙邊協定，另一項則為與俄羅斯和瑞典共同簽訂之三邊協定。回顧波羅的海周邊國家之作法，可看出若3國海域有所重疊時，多會先分頭進行兩國間的劃界協定談判，各項雙邊協定完成後，始進行三邊交界(tripoint)協定的討論[9]，但立陶宛的作法則有些許的不同，說明如下。

立陶宛西南方與俄羅斯之卡列寧格勒(Kaliningrad)接壤，兩國並於1997年締結《波羅的海專屬經濟海域及大陸礁層劃界條約》(Treaty between the Republic of Lithuania and the Russian Federation on the Delimitation of the Exclusive Economic Zone and the Continental Shelf in the Baltic Sea)，並以等距離中線做為劃界基礎，但進一步調整時，由於俄羅斯較重視近海油田的開發，而立陶宛則是希望保有通往波羅的海中部的通道，故於近岸的第1段邊界採偏向俄羅斯主張之界線，而在第2段邊界的劃設則考量立陶宛之通道需求[10]。本項條約於簽署之初，由於兩國關係敏感，例如：俄羅斯對克萊佩達(Klaipeda)的主張和立陶宛欲加入北大西洋公約組織之計畫等，

使得俄羅斯國會的態度存有變數[11]。雖是如此，但此項協定最終仍於2003年獲得俄羅斯國會同意批准後生效[12]。

在立陶宛締結並已生效的劃界協定中，第2項為與俄羅斯和瑞典間的三邊交界協定（Agreement between the Government of the Republic of Lithuania, the Government of the Russian Federation and the Government of the Kingdom of Sweden on the Common Point of Boundaries of the Exclusive Economic Zones and Continental shelf in the Baltic Sea），3國於2005年11月30日締結此協定，並於2011年生效[13]。不同於前述波羅的海國家之作法，此項三邊協定締結時，僅有前蘇聯－瑞典間於1988年締結之劃界協定，及上述之立陶宛－俄羅斯協定，而立陶宛尚未與瑞典達成劃界共識。但立陶宛的國內法及上述2004年政府決議中，可看出其與瑞典間海洋邊界劃設的態度，雖然此等文件中並未直接引前述蘇聯－瑞典間1988年劃界協定，但實際上參考了該項協定中的邊界及座標點[14]。3國於2005年締結之三邊協定中，亦於第1條明確提及前蘇聯－瑞典間1988年劃界協定，這樣的作法呼應了俄羅斯及瑞典認為1988年協定持續有效的態度，但卻引發了立陶宛國內的爭議；立陶宛國會近6年後方批准此項協定，並於2011年6月17日生效[15]。

下一項劃界協定為立陶宛與瑞典締結之《波羅的海專屬經濟海域及大陸礁層劃界協定》（Agreement between the Government of the Republic of Lithuania and the Government of the Kingdom of Sweden on the Delimitation of the Exclusive Economic Zones and the Continental Shelf in the Baltic Sea），這項協定基本上承繼了前蘇聯－瑞典間1988年劃界協定及前述立陶宛－俄羅斯－瑞典間的三邊交界協定所形成之海洋邊界，但與1988年劃界協定不同的是，當時前蘇聯及瑞典間重大爭議問題涉及捕魚活動，故除締結劃界協定以解決海域爭議外，兩國間另訂有漁業協定，針對原爭議海域捕魚量等問題進行規範，而這樣的特殊安排並沒有持續適用於立陶宛及瑞典間，兩國於2014年締結劃界協定時，漁業問題亦非重要考量。

上述3項為立陶宛與他國締結並已生效之海洋劃界協定，其另與拉脫維亞於1999年簽署《波羅的海領海、專屬經濟海域及大陸礁層劃界協定》（Agreement between the Republic of Latvia and the Republic of Lithuania on the Delimitation of the Territorial Sea, Exclusive Economic Zone and the Continental Shelf in the Baltic Sea），此項條約除直接與前蘇聯解體有關之外，另涉及兩國爭議海域中可能蘊藏之非生物資源，包括石油及天然氣[17]；雖然兩國於1920年代劃有陸地及海洋邊界，當時國家的海洋主張與《公約》體系下得以主張之海域及範圍均有所不同，故仍有進行劃界談判之需要，最終兩國以等距離中線為基準，考量到漁業等經濟活動後進行調整，並於1999年7月9日締結協定，立陶宛國會已於同年10月批准此項協定，然拉脫維亞一方面面臨漁民抗議[18]，另一方面則希望先探勘石油資源，因此至今尚未批准此項劃界協定[19]。

結論

從本文中立陶宛與他國締結之劃界協定及相關發展可歸納出幾點觀察：第一，劃界談判的過程中，各方可能都有不同的關切重點，如何掌握本國追求的目標，並在他國關切之處適度地妥協均屬談判國須重視的課題；第二，海域劃界協定之談判和締結除涉及劃界方法、經濟活動、資源分布等傳統考量外，實際上談判的推動及協定締結後批准的進度，可能受到非傳統劃界因素的影響，欲成功解決劃界爭端，則有賴相關國家之間各類條件的配合；第三，國家締結劃界協定後，如何克服各方批准的障礙以成功推動協定生效，並確保生效後協定之履行，則有待相關國家之努力及國家間關係之維繫，始能避免爭端的持續或加劇，並和平使用海洋。

參考資料

- [1] United Nations Treaty Collection, United Nations Convention on the Law of the Sea. https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtmsg_no=XXI-6&chapter=21 (Aug. 10, 2022)
- [2] Franckx教授在多篇文章中使用此方式分析。See, e.g., Erik Franckx, *Maritime Boundaries in the Baltic Sea: Post 1991 Developments*, 28 GA. J. INT'L & COMP. L. 249, 254-5 (2000); Erik Franckx, *Gaps in Baltic Sea Maritime Boundaries*, in REGULATORY GAPS IN BALTIC SEA GOVERNANCE 7, 13-16 (Henrik Ringbom ed., 2018).
- [3] 國家繼承相關討論請見：丘宏達著、陳純一修訂，《現代國際法》，修訂四版，第七章，2021年10月，三民書局。
- [4] See, e.g., Erik Franckx, *Current Legal Developments: Baltic Sea*, 16 INT'L J. MARINE & COSTAL L. 645, 651 (2001).
- [5] The Constitution of the Republic of Lithuania, Article 47. <https://www.lrs.lt/home/Konstitucija/Constitution.htm> (Aug. 10, 2022)
- [6] Indrė Isokaitė-Valužė, *30 Years of Lithuania's Restored Independence: A Coastal State's Prescriptive Jurisdiction over Inland Waters*, 117 TEISĖ 64, 67 (2020).
- [7] For relevant legislation, see United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, Lithuania. <https://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/LTU.htm> (Aug. 10, 2022)
- [8] United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, Illustrative Map. https://www.un.org/depts/los/LEGISLATIONANDTREATIES/PDFFILES/MAPS/LTU_MZN57_2006_00il.jpg (Aug. 10, 2022)
- [9] Erik Franckx, *Maritime Delimitation in the Baltic Sea: An Update*, 15 INT'L J. MARINE NAVIGATION & SAFETY OF SEA TRANSP. 885, 887 (2021).
- [10] Erik Franckx, *Treaty between the Republic of Lithuania and the Russian Federation on the Delimitation of the Exclusive Economic Zone and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-18 (1) (Jonathan I. Charney & Robert W. Smith eds., 2002).
- [11] See, e.g., Erik Franckx, *Two More Maritime Boundary Agreements Concluded in the Eastern Baltic Sea in 1997*, 13 INT'L J. MARINE & COSTAL L. 274, 279 (1998).
- [12] *Treaty between the Republic of Lithuania and the Russian Federation on the Delimitation of the Exclusive Economic Zone and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-18 (1&2) (Add. 1) (David A. Colson & Robert W. Smith eds., 2005).
- [13] United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, *supra* note 7.
- [14] Erik Franckx, *Agreement between the Government of the Republic of Lithuania, the Government of the Russian Federation and the Government of the Kingdom of Sweden on the Common Point of Boundaries of the Exclusive Economic Zones and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-23 (Coalter Lathrop ed., 2019).
- [15] *Id.*
- [16] United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, *Agreement between the Government of the Republic of Lithuania and the Government of the Kingdom of Sweden on the Delimitation of the Exclusive Economic Zones and the Continental Shelf in the Baltic Sea*. <https://www.un.org/depts/los/LEGISLATIONANDTREATIES/PDFFILES/TREATIES/LithuaniaSwedenTreaty.pdf> (Aug. 10, 2022)
- [17] Erik Franckx, *Agreement between the Republic of Latvia and the Republic of Lithuania on the Delimitation of the Territorial Sea, Exclusive Economic Zone and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-20 (Jonathan I. Charney & Robert W. Smith eds., 2002).
- [18] *Id.*
- [19] Lithuania and Latvia Disagree over Maritime Boundary, LIETUVOS NACIONALINIS RADIJAS IR TELEVIZIJA, Apr. 15, 2019. <https://www.lrt.lt/en/news-in-english/19/1048887/lithuania-and-latvia-disagree-over-maritime-boundary>



Protecting Our Environment Legal Protections for Cultural Assets Upgrade Taiwan's Industries!

Translated by Linguitronics

Acting Minister of the Ocean Affairs Council: Mei-Wu Chou

Marine Spatial Planning (MSP) and protecting marine environments have been the key aspects of planning marine policies for many countries. This issue introduces how Lithuania, a country east of the Baltic Sea, plans marine demarcations in a closed ocean territory of 400 nautical miles with nearby countries such as Russia, Latvia, and Sweden; after some planning, legalization of Marine Spatial Planning was completed in 2014 and a MSP project was passed in 2015. Lithuania's marine environment affairs was headed by the country's Ministry of Environment, who's primary strategy was combining marine and terrestrial environments into one to prioritize the 4 major areas of "sustainable use of natural resources and waste management", "improvement of the quality of the environment", "maintenance of ecosystem stability", and "climate change mitigation and adaption" when dealing with issues involving the fishing industry, seawater quality, and biodiversity. Additionally, compliance to the EU Marine Policy, "International Convention for the Control and Management of Ships' Ballast Water and Sediments", and "Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area" were implemented to effectively manage ballast water to prevent or mitigate the issue of invasion by alien species due to ballast water. The protection of marine environments cannot be the affairs of individual nations. During the 5th United Nations Environmental Assembly in 2022, the resolution "End Plastic Pollution: Towards a Legally Binding International Instrument" was passed. The international treaty to end plastic pollution is expected to complete in 2040 and become a massive step in the movement to reduce plastics as well as a new global milestone in the achievement of sustainability goals.

The path towards sustainability not only requires our focus on protecting natural resources, but cultural assets as well. The latest "International Issues" shares the archeology and preservation of underwater sites. Underwater cultural assets are a key resource for the cultural tourism industry. In the 1950's, France began to research underwater cultural artifacts or sunken ships; in 2007, Taiwan and France collaborated to nurture underwater archeologists and formed the first underwater archeology team. Additionally, "Special Report" introduces the final mile of Taiwan's "domestic shipbuilding"; since the period of Japanese rule, Taiwan has been involved in the construction, repair, and maintenance of various ships as well as providing the shipbuilding industry with experimental water tanks for the purposes of design, R&D, and education. These efforts have driven the technological improvements of the shipbuilding industry and integrated existing testing capabilities of ship model laboratories; currently, Taiwan has begun implementation of a ship model lab and the formation of a ship model testing national team to lead Taiwan's shipbuilding industry to new heights!



Figure/ Aerial view of rinsed land coastal cliff near Baltic Sea in Karkle, Klaipeda, Lithuania
Source/ Pride Advertising Agency Ltd.

The Last Mile in National Shipbuilding - Establishment of a National Model Test Laboratory and Formation of a National Team for Model Testing

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Translated by Linguitronics

Keywords: Seakeeping and maneuvering tank, rotating arm tank, model test

"Model testing" refers to the design, verification, and improvement of ships based on the results of tank tests. The required tests depend on the type or performance of the ship. In order to improve the performance of various vessels on the water surface and underwater, various performance verifications must be carried out through model testing at the design stage. While "model testing" is only a small part of the ship design process, it is an indispensable foundation stone of the whole process, from design and planning to construction. To be able to drive technological upgrading of Taiwan's shipbuilding industry and integrate the testing capabilities of existing domestic ship model laboratories, the pivotal issues at present are to provide consulting and verification services for engineering technologies applied to naval defense ships, marine disaster site reconstruction, and marine structural design, to establish a national model test laboratory, and domestically integrate and form a national team with capabilities in relevant areas.



Figure 1/ Conceptual design blueprint of the National Model Test Laboratory, which will be located in Xingda Port, Qiding District, Kaohsiung City [1]

Image by CECI Engineering Consultants, Inc., Taiwan

Overall Situation of Model Test Capability in Taiwan

The shipbuilding industry in Taiwan has a history of more than a century, from the construction and maintenance of ships and small motor boats during the Japanese occupation, to merchant ships, container ships, official vessels, research vessels, oil tankers, transport ships, reefer vessels, warships, and other types of ships (boats, ships) in the present. Taiwan also has model test tanks. There are currently 4 model test tanks in Taiwan: the National Taiwan University (NTU) towing tank, the National Cheng Kung University (NCKU) towing tank, the National Taiwan Ocean University (NTOU) cavitation tunnel, and the National Defense University (NDU) circulating tank. Descriptions as follows:

NTU's towing tank was built in 1992 with dimensions of 130 meters long x 8 meters wide x 4 meters deep. It has been renewed in 2010 with the "Tow Equipment Replacement Project". The tank can be used for resistance tests, flow field measurement, propeller open water test and underwater noise measurement (upper left of Figure 2).

The NCKU towing tank was built in 1982 with dimensions of 165 meters long x 8 meters wide x 4 meters deep; in 2022, it was expanded to 285 meters long x 8 meters wide x 5.5 meters deep. The tank can be used for resistance test, self-propulsion test, flow field measurement, stern wake measurement, propeller open water test (bottom left of Figure 2 [2]).

In 1996, a medium-sized cross section was built for the NTOU cavitation tunnel (2.2 meters long x 0.5 meters wide x 0.5 meters deep); in 2002, it was rebuilt as a large section sealed water tank with dimensions of 10 meters long x 2.6 meters wide x 1.5 meters deep. It can currently be used for propeller open water test, hull exciting force measurement, cavitation measurement, underwater noise measurement and anti-submarine speed test (upper right in Figure 2 [3]).

The NDU circulating tank was set up in 1981 with dimensions of 14 meters long x 5.3 meters wide x 2.2 meters deep. The tank can be used for resistance test, self-propulsion test, flow field measurement, stern wake measurement (bottom right of Figure 2).

It is obvious from the preceding that there is still a lack of model tests, such as seakeeping test, maneuverability test, and rotating arm test (middle of Figure 2). Therefore, when developing new ships in Taiwan, test tanks must be leased from abroad, which entails concerns about national security and data leaks.



Figure 2/ Design blueprints of the existing ship model laboratory and the National Model Test Laboratory
Image by the author

Planning of the National Model Test Laboratory

In order to build a seakeeping tank, reference is made to existing foreign designs of water tanks (Table 1). To determine the impact factors of length (X axis) and width (Y axis) of the seakeeping tank, several factors must be considered, for example, the ratio of the ship model to the actual ship length, the maximum speed of the ship model, the acceleration and deceleration of the towing carriage, the length of the required measurement time, etc. The National Academy of Marine Research (hereinafter referred to as the NAMR) surveyed and inventoried the shipbuilding plans of domestic shipbuilders, the Navy, the Coast Guard Administration, and the Shipbuilding Development Center for the next 5 to 10 years. After comprehensive analysis, the NAMR proposed the "National Model Test Laboratory Construction Project" to meet the needs of the shipbuilding industry, official ships, and naval defense ships. The preliminary plan includes a seakeeping tank and a rotating arm tank (see Figure 3 for the planning concept schematic). The dimensions of the seakeeping tank are 80 meters long x 40 meters wide x 6.5 meters deep (water depth 5.5 meters). Basic equipment in the water tank includes wave generators, wave absorbers, towing carriages and overhead cranes.

Table 1/ Specifications and Dimensions of Internationally Noteworthy Seakeeping Tanks

Nation	Unit	Dimensions		
		Length (m)	Width (m)	Depth (m)
Korea	KRISO	56	30	4.5
Japan	Japan Marine United Corporation	70	30	3
Japan	Mitsubishi Heavy Industries	160	30	3.3
Japan	National Maritime Research Institute	80	40	4.5
Japan	IHI	70	30	3
Japan	Kyushu University	38.8	24.4	2
China	Shanghai Jiao Tong University	50	30	6
China	China Ship Scientific Research Center	69	46	4
China	Shanghai Ship and Shipping Research Institute	90	30	3
India	Naval Science and Technology Lab	135	37	5
USA	DTMB	110	73	6.1
Canada	IOT-NRC	75	32	3.2
Netherlands	MARIN	170	40	5
Sweden	SSPA	88	39	3.5
England	QinetiQ	122	61	5.5
Norway	MARINTEK	80	50	10
Spain	CEHIPAR	152	30	5
Finland	VTT	40	40	2.8
Russia	Krylov State Research Centre	162	37	5
Bulgaria	Bulgarian Ship Hydrodynamics Centre	60	40	2.5

Source/ <https://itc.info/facilities/> [4]

The "seakeeping tanks" and "rotating arm tank" can perform below test items:

- I. **Seakeeping test:** To study the relationship between the force acting on the hull and the movement of the ship. This force mainly means the interference of external forces such as wind and waves. It can be divided into a regular wave test and irregular wave test, depending on the needs and the purpose of test. Meanwhile, the ship speed, heading, and the direction of the waves are the main factors to be considered for the test.
- II. **Maneuverability test:** The maneuverability test mainly analyzes the relationship between the force and the movement of the hull, for example, the influence of the rudder angle affects on the ship heading, and the time needed to change ship's heading. Depending on the purpose of test, it includes the rotating test, arm test, Zig-Zag test, and other tests.
- III. **Planar Motion Mechanism (PMM) Test:** The equation for the motion of a ship contains of a large number of hydrodynamic coefficients. In order to study the maneuverability of a ship, it is necessary to act on the relevant hydrodynamic coefficients of the ship. The PMM test mainly performs as particular ship motions to calculate the coefficients of equation.
- IV. **Underwater Vehicle Performance Test:** This test is to study the fluid dynamics of various underwater vehicles when the studied vehicle is underwater, surfacing or diving.

We have has no experience in building such a large and professional model test laboratory in Taiwan. Besides, the engineering, instrumentation, and equipment used with model test tanks are professional and require high precision. For these reasons, the NAMR, together with the Ship and Ocean Industries R&D Center (hereinafter referred to as the SOIC), which has extensive experience in model testing, are cooperating on the overall establishment, project management, personnel training, and maintenance management planning for model testing. In addition, CECI Engineering Consultants, Inc., Taiwan was invited to carry out planning, design, and subsequent supervision to successfully complete the construction of the National Model Test Laboratory.



Figure 3/ Planning Concept Schematic of the National Model Test Laboratory [1]
Image by CECI Engineering Consultants, Inc., Taiwan

Formation of the National Team for Model Testing

Comprehensive model testing must be carried out in different types of water tanks. In order to enhance the capability of model testing in Taiwan, the NAMR held the inaugural meeting of the national team for model testing on June 21, 2022. President Ing-Wen Tsai personally presided over and attended the meeting and voiced her full support for the project. A memorandum of cooperation was signed by universities in Taiwan that were in possession of model test tanks and underwater equipment and

technology (NTOU's cavitation tunnel, NTU's towing tank, NCKU's towing tank, and National Sun Yat-sen University [NSYSU]'s underwater equipment and technology). Through information sharing, resource sharing and technical exchange, the cooperation will gradually integrate the test capacity and human resources of various model test tanks in Taiwan to improve the overall level of national model testing technology in Taiwan and provide comprehensive, high-quality ship model test capacity, ship performance estimation, verification, and consulting services. In the future, domestic and foreign training programs will be jointly conducted for talent required for model testing, which will be used for operation and maintenance management after the completion of the construction of the National Model Test Laboratory, thus achieving our goal for national shipbuilding and autonomous applications.



Figure 4/ The launching ceremony of the inaugural meeting of the national team for model testing (From left, NTU Executive Vice President Shan-Chwen Chang, NTOU President Tai-Wen Hsu, NAMR former President Yong-Fang Qiu, Ocean Affairs Council former Minister Chung-Wei Lee, President Ing-wen Tsai, Executive Yuan Minister without Portfolio Jing-Sen Chang, National Policy Advisor to the President Wen-Wan Tang, NSYSU President Ying-Yao Cheng, NCKU Executive Vice President Fong-Chin Su)

Image by SOIC

Conclusions

After the construction of the National Model Test Laboratory (seakeeping tank and rotating arm tank) is completed, Taiwan will have complete model test capabilities. It will be used for not only design and R&D of shipbuilding-related industries, but also for research units conducting research and teaching. It can meet the testing needs of domestic ships, and fill technical gaps in the planning, design, and construction of "naval defense ships". The National Team for Model Testing will be the core of future development. Its goal is to be an "international model testing institution"; to integrate operation and management and link up the capacities of industry, government, academia, and research institutions; to benefit from effectively distributing capacity of domestic tank tests; to strengthen domestic model test research capabilities, cultivate talents in the shipbuilding industry, and establish a domestic model test database, gradually improve the international competitiveness of our shipbuilding industries in Taiwan, and lead the ship industry to a new peak.

References

- [1] 台灣世暉工程顧問股份有限公司 (2022) · 國家船模實驗室新建工程規劃設計暨監造委託技術服務案規劃方案 (初稿) ·
- [2] NCKU TOWING TANK IN TAIWAN (n.d.).
<https://ncku-towing-tank.weebly.com/> (Aug. 15, 2022)
- [3] 國立臺灣海洋大學延平水下科技中心 (n.d.) · 研究設備 ·
<https://se.ntou.edu.tw/p/412-1058-8037.php?Lang=zh-tw> (Aug. 15, 2022)
- [4] International Towing Tank Conference (ITTC)(n.d.). Facilities.
<https://itc.info/facilities/> (Aug. 15, 2022)

Preservation and Educational Promotion of Underwater Cultural Heritage in France

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Keywords: Underwater Cultural Heritage, Underwater Archaeology

The ancient Greek philosopher Plato wrote about the sunken kingdom of Atlantis in his dialogue, *Timaeus-Critias*. Some people think it is a fable, while others believe it was a disaster event resulting from earthquakes and tsunamis. For over two thousand years, curiosity about ancient civilisations has extended from under the land to under the water. Then, in the summer of 1943, the French Naval lieutenant Jacques-Yves Cousteau and the engineer Émile Gagnan improved the underwater breathing apparatus, commonly known as the "aqualung". The new invention was lighter and cheaper. Since then, it has promoted scuba diving activities and established underwater archaeology development [1]. At the same time, it also launched a time-war between commercial salvage and the protection of the underwater cultural heritage.

The French National Department of Underwater Archaeological Research and Cultural Heritage Preservation

France's coastline is more than 10,000 kilometres, including mainland France and overseas. There are plentiful sources of underwater cultural heritage. In the 1950s, France began emphasising the archaeological methodology of studying underwater sites. In 1966, France became the first country to organise the protection of underwater cultural heritage. With long-term official support, the Marine Archaeology Research Department was established in 1991. Five years later, inland waters such as lakes, streams and rivers were also integrated into the Marine Archaeology Research Department. The name was changed to the Underwater Archaeology Research Department (Le Département des recherches archéologiques subaquatiques et sous-marines, DRASSM).

With DRASSM's headquarters in Marseille, the largest port city in France, the DRASSM's scope of work includes investigation, inventory, research, protection, and implementation of the *Les Biens Culturels Maritimes* (Maritime cultural property), authorisation to conduct preventive archaeology (L'archéologie préventive), and educational promotion [2] within the 11 million square kilometres of French economic waters. In the early period, divers would search only with their eyes while using marine scientific exploration technology; now, with the recent development of the underwater humanoid robot "Ocean One", archaeologists can operate the robot to work in high-pressure deep-sea areas to recover fragile artefacts. To this day, the DRASSM estimates that there are at least 20,000 to 30,000 shipwrecks in the French territorial waters [3].

In France, there are various levels of museums related to underwater cultural heritage, including the Musée National de la Marine in the northern city of Brest, which has displays on the theme of naval history and ships; the Musée de l'Ephèbe et d'archéologie sous-marine, in the southern town of Le Cap d'Agde, one of the few non-public underwater archaeological museums and one that was founded on the discovery of Alexandrian bronzes in nearby waters—when these were sent to the Louvre for restoration, due to their preciousness, the central government required a certain level of museum for the return of the cultural relics, and to preserve them locally, the residents actively contended for the

establishment of this exquisite community museum; the Musée de l'Arles et de la Provence antiques displays a wreck in the Rhone from ancient Roman times that has a complete hull and a length of 30 meters, with the goods and living utensils on board well preserved, reflecting river life at the time. In June 2022, the newly renovated Musée archéologique du Lac de Paladru reopens and presents surveys of alpine lake underwater sites from prehistoric to medieval times.



Figure 1/ Divers use the white lifting bag to lift artefacts out of water
Image by Photographer *Lionel Roux (CNRS-CCJ)*

Underwater cultural heritage and cultural tourism

Underwater cultural heritage is derived from underwater archaeology research, a branch of archaeology. Protecting these archaeological results could benefit cultural tourism. In Europe, the NEARCH survey project for "Awareness of Archaeology and Cultural Heritage" among EU citizens shows that more than half of the survey respondents believe that archaeology can touch people's hearts, allow the public to engage in a dialogue with history, ancient civilisation, and humankind's origins. Survey results show that although only 10% of EU citizens believe that archaeology is helpful for local and national economic development, 86% agree that having archaeological sites in the city where they live is a considerable advantage. In comparison, 83% believe that supporting the development of archaeology is very important to the country [4].

Such as the island of Délos, where the French School, École Française d'Athènes, initially excavated those archaeological sites. This island served as the official meeting place and treasury of the "Delian League" [5], an association of Greek city-states. Over the past two thousand years, due to the rising sea levels and earthquakes, Délos has rich archaeological sites on land and underwater, such as some submerged ports and houses. When the sea is not murky, one can even take clear pictures of the remnants of underwater buildings from the air. This island with significant archaeological sites is a World Heritage Site and is often on the "must-visit list" for many cultural travellers.

In France, The French National Institute for Preventive Archaeological Research (Institut national de recherches archéologiques préventives, INRAP) is responsible for archaeological assessments before land and underwater construction projects to take into account the preservation of cultural heritage and economic development; from prehistoric sites to World War II wrecks, these all belong to the collective historical memory of humankind.

Today, travel is not just about relaxing in exotic places, but more and more about learning about local cultures through an immersive experience. According to data, nearly 40% of European tourists' itineraries are based on local cultural heritage [6]. Protecting cultural heritage can become an essential benefit to cultural tourism.

From diving memorabilia to community-protected sites

While studying abroad, I used to participate in fieldwork of underwater excavation and reviewed the reports of different archaeological sites over the years. I also learned about the evolution of protecting the archaeological sites from construction damage to the present "preventive archaeology" development over the past 60 years in France.

Fieldwork in 2019 was under the research project "*Fossae Marianaë: The Ancient Port of Fos-sur-Mer and the Le Canal de Marius*"; the excavation sites in "Fos-sur-Mer" are next to the mouth of the Rhône river. At the end of the daily work, the evening sky was filled with colourful clouds from the garbage incinerator at the opposite end. According to the literature review, researchers believed that the industrial area was where *Le Canal de Marius* emptied into the sea during the reign of Caesar Augustus (27 BC-AD 14). As early as 1963, archaeologists recorded the location of some of the ruins. However, scholars speculated that the main archaeological site had already been demolished due to the construction of the industrial zones. The two thousand-year-old ruins disappeared silently in the torrent of economic development. In the 1970s, national research institutes launched a long-term investigation to find the remains of the remaining canal and surrounding port towns. They found 35 tombstones and altars dating back to the 1st and 2nd centuries AD at water depths of 3 to 4 meters and confirmed the dating in 1980 after collecting relevant artefacts [7].

In addition to the fact that construction may affect the site's preservation, Fos-sur-Mer has been a tourist destination for summer swimming since the 1970s. In its early days, many scuba divers would take away "diving souvenirs" at the end of their dives, ranging from small pieces of pottery and coins to large complete amphora, which was also detrimental to the current state of the site. The ancient canal brought crowds, items left behind by countless people and shipwrecks. During fieldwork, a citizen handed a bag of pottery shards he had picked up on the beach to the project investigator Souen Fontaine. These pottery shards were in poor condition because they had not undergone a complete desalination process.



Figure 2/ Archaeological survey on Fos-sur-Mer and the industrial area across the shore
Image by Photographer Lionel Roux (CNRS-CCJ)

Nevertheless, Fontaine still accepted the pottery pieces and made a simple record of their quantity and type. She said there used to be an old diver called the DRASSM, hoping to donate his "souvenirs" to the country to prevent them from being discarded by his children, who did not know their value. However, most of these artefacts weren't immediately protected and desalinated, and they have lost their context from the site, becoming a single, flat object. The artefacts without their context are not only losses to the researchers but also the collective memory of all people.

Awareness of protecting the underwater cultural heritage takes time to change. The enthusiasm of the archaeological sites in Fos-sur-Mer has gradually led to a consensus on the protection of the site. Half a century later, the public is still curious about local history and archaeological work. On the last Wednesday night of the excavation season in 2019, there was a public day to share the archaeological results. It relied solely on bulletin board posts and word of mouth in the community, but still, the activity centre was packed, and people raised various questions after the meeting. Similar activities are familiar to the locals, so as long as there is a team in the community to conduct archaeological excavations, there will be lectures to let the public know about the latest excavation progress of the year.

Conclusion: France and Taiwan

France has revised a set of practices earliest country to protect underwater cultural heritage. Over the past sixty years, the French government has adopted a way to continue the economic construction and preserve the cultural heritage and archaeological sites. At the same time, the French government integrates various domestic units, including government departments such as the DRASSM and INRAP, which conducts cooperative surveys on local archaeological companies, diving groups, and cultural and historical societies. Looking to the recent offshore wind farm developed in the waters off of Normandy as an example, the DRASSM has conducted a pre-assessment of its underwater cultural heritage and authorised the INRAP to be responsible for the detection and excavation work. It has also allowed the school to cooperate in systematic talent cultivation. The educational promotion of public archaeology has lowered the threshold for the public to access archaeological knowledge. By holding these events, the public will have a better understanding, and their curiosity will turn into the action of practising our past.

The DRASSM also provides international cooperation. For example, Taiwan once discovered suspect shipwrecks while dredging the Magong Harbor in Penghu. As a result, Taiwan signed an administrative agreement with France in 2007. Taiwan government invited domestic and foreign experts to investigate the port and conducted the first Training Workshop on Underwater Cultural Heritage Preservation. Then, the first underwater archaeology team was led by Academician Cheng-Hwa Tsang of the Institute of History and Philology, Academia Sinica. Over the years, entrusted by the Bureau of Cultural Heritage (BOCH) of the Ministry of Culture, Tseng has conducted general surveys of underwater cultural heritage in the waters near Taiwan. Taiwan's geographical location is important for shipping, especially on the Taiwan Strait. The seas near Penghu are dangerous and have a high potential for underwater cultural heritage [8]. So far, the underwater archaeology team has verified near hundred objects in the waters near Taiwan and identified 20 as underwater sites. The government listed six shipwrecks as significant shipwrecks, with nearly 1,600 artefacts extracted from water [9].

There is a variety of underwater cultural heritage around Taiwan seas, including Paleolithic sites in the Taiwan Strait, shipwrecks during the historical period, and the stone weir group still in use for traditional fishing. Anthropologist Chun-Sheng Ling once described the ancient maritime tradition among Southeast China, Southeast Asia, and the South Seas islands as "the Asian Mediterranean" and argued that it is as essential as the Mediterranean is to the birth of ancient Western civilisation [10].

Archaeological sites leave traces of the development of culture. From ancient times to the present, oceans have been bridges between islands and linked the past and future of humankind. To preserve the cultural heritage is to build up cultural tourism and enhance the capacity of cultural and creative industries.

Learning from foreign countries and adapting measures to the local conditions, Taiwan has continuously revised and improved a set of appropriate strategies over the past 15 years to promote the protection of underwater cultural heritage and has, as a result, achieved a balance between economic development and preservation of cultural heritage. In the *Underwater Cultural Heritage Preservation Act* passed in 2015, the principle of "in-situ preservation" was adopted; the revised *Regulations Relating to Underwater Cultural Heritage Surveying and Processing Prior to Water Area Exploitation and Utilisation* from 2020 is similar in spirit to "preventive archaeology" in that if a project can directly or indirectly affect the seabed, it is necessary to carry out a pre-development investigation. The BOCH also organises education and promotion activities such as talent training courses, museum exhibitions, workshops, publications, and school lectures. By holding these events, BOCH hopes to increase people's awareness of protecting underwater cultural heritage and also the sunken treasure of our maritime past.



Figure 3/ The BOCH of the Ministry of Culture held a workshop for diving instructors (2020). Captain Han-Zhang Huang of the underwater archaeology team demonstrated the operation method of in-situ preservation
Image by Photographer Xi-Yao Gao (Center for Ocean and Underwater Technology Research, Tamkang University)

References

- [1] Grands Sites Archéologiques (Jan. 26, 2018), Il était une fois-Les Pionniers.
<https://archeologie.culture.fr/archeo-sous-marine/fr/pionniers-0> (Mar. 10, 2022)
- [2] Ministère de la Culture (Apr. 27, 2017), Le Département des recherches subaquatiques et sous-marines.
<https://www.culture.gouv.fr/Thematiques/Archeologie/Acteurs-metiers-formations/L-archeologie-au-ministere-de-la-Culture/Le-Departement-des-recherches-subaquatiques-et-sous-marines> (Mar. 10, 2022)
- [3] franceinfo:culture (Jun. 27, 2021), À bord de l'Alfred Merlin", nouveau bijou technologique de l'exploration archéologique sous-marine : "On a le service de recherches le plus compétent au monde!"
https://www.francetvinfo.fr/culture/patrimoine/archeologie/abord-de-l-alfred-merlin-nouveau-bijou-technologique-de-l-exploration-archeologique-sous-marine-on-a-le-service-de-recherches-le-plus-competent-au-monde_4679123.html (Mar. 10, 2022)
- [4] NEARCH (Sep. 9, 2014), NEARCH-Involving, Imagining, Sharing, Innovating, Connecting.
<http://www.nearch.eu/connecting/> (Mar. 22, 2022)
- [5] European Commission website (Jul. 11, 2016), Cultural Tourism.
https://ec.europa.eu/growth/sectors/tourism/offer/cultural_en (Mar. 22, 2022)
- [6] 徐跃勤 (2013) .《雅典海上帝国研究》(北京:中国书籍出版社) .43-46 .
- [7] Hypotheses (Mar. 23, 2021), À la recherche de Fos sur Mer antique.
<https://amidex.hypotheses.org/10498> (Mar. 22, 2022)
- [8] 戴振華、劉金源、梁華綺、李麗芳 (2016) .《臺灣附近海域水下文化資產普查計畫報告輯：第一階段報告》(臺中:文化部文化資產局) .18-21 .
- [9] 董盈穎 (2020) .〈探討我國水下文化資產教育推廣現況與未來展望〉.《文化資產保存學刊》(53) : 7-26 .
- [10] 凌純聲 (1979) .《中國邊疆民族與環太平洋文化》(臺北:聯經出版事業公司) .335-344 .

End Plastic Pollution: The Future of a Global Plastics Treaty?

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Keywords: Plastic Pollution, International Plastics Treaty, Circular Economy

On the 50th anniversary of the establishment of the United Nations Environment Programme, 175 Member States adopted a resolution "Ending Plastic Pollution: Towards a Legally Binding International Instrument" on March 2, 2022 at the resumed fifth session of the United Nations Environment Assembly. The resolution aims to complete an international treaty to end plastic pollution by 2040. This resolution marks a historic moment that the fight against plastic waste has taken a big step forward, and the protection of the natural environment has also reached a new milestone [1].

Ubiquitous plastic pollution is one of the Triple Planetary Crisis. Due to its flexibility, convenience and low price, plastic products have begun to appear in our daily lives in large quantities, and human dependence on plastic has also increased since the 1950s. According to a United Nations report, between 1950 and 2017, approximately 9.2 billion tonnes of plastic were produced globally. Among them, only one third remains in use, and the rest two third become plastic waste, which is discarded in landfills or the natural environment. Part of the plastic waste leaks into rivers or oceans, and further spreads through air or ocean currents all over the world. Plastic waste that cannot be decomposed in the natural environment has become the biggest crisis on the planet. Among them, the ocean is the most severely affected. A study pointed out that plastic waste account for nearly 95% of marine debris. If it is not actively treated, the amount of plastic waste in the aquatic ecological environment is expected to triple by 2040 [2].

The adoption of the United Nations Environment Assembly resolution means that countries around the world have recognized the catastrophic and seriousness of plastic pollution and are willing to work together to solve the current crisis. At the same time, it is also recognized that the solution of plastic pollution cannot rely on the policies of individual countries alone, but requires the cooperation and efforts of all members of the world, and can succeed through a legally binding international treaty.

Key Issues [3]

The resolution contains the following goals: reaffirming the sustainable development goals, acknowledging the seriousness and scope of plastic pollution, emphasizing the full life cycle of plastics and the circular economy, and establishing an intergovernmental negotiating committee to initiate negotiations on a global plastics treaty.

I. Reaffirming Sustainable Development Goals

The resolution reiterates the principles of the 2030 Agenda for Sustainable Development and the Rio Declaration. Protecting the natural environment is at the core of sustainable development. In order to implement the goals of sustainable development, countries must reduce plastic waste through recycling and reuse, and achieve sustainable production and consumption of plastics. The resolution also echoes the relevant resolutions of the United Nations Environment Assembly in the past, and believes that the practice of sustainable goals depends on a global perspective and long-term collective cooperation and governance, and recognizes the efforts of governments, relevant international organizations, non-international organizations and the private sector, as well as relevant international conventions.

II. Defining the Scope of Plastics

The resolution first affirms that plastic pollution should include microplastics, and pays particular attention to the impact of plastic pollution on the marine environment. At the same time, it is also recognized that the current large-scale and rapidly increasing plastic pollution has become ubiquitous, forming a global crisis, which not only harms the natural environment, but also impacts sustainable development, and its impact on the social and economic levels should not be underestimated.

Microplastics are defined by the National Oceanic and Atmospheric Administration (NOAA) as plastic particles that are small, irregular, and less than 5 mm in length or diameter. Microplastics not only severely impact the Earth's environment, but also threaten the ability of the oceans to act as carbon sinks, worsening the climate crisis. In addition, the spread of microplastics through the ocean, air and food chain, not only endangers the survival of organisms, endangers the ecological environment, but also accumulates in the human body, seriously threatening human health and well-being. Plastic pollution not only has adverse effects on human health, but also significantly increases the management and cleaning costs of plastic waste. Marine plastic pollution has also caused huge economic losses to tourism, fisheries, aquaculture and other industries.

Second, the resolution advocates that an effective solution to the problem of plastic pollution should focus on the entire life cycle and cross-border characteristics of plastics. According to the United Nations report, about 90% of plastic waste is post-consumer products, most of which are plastic packaging; the remaining 10% are pre-consumer products, such as refined or manufactured plastics product. From 1950 to 2017, the global plastic recycling rate was less than 10 percent. Throughout the entire life cycle of plastics, 1.8 billion tons of greenhouse gases will be produced every year, which not only aggravates the negative effects of climate change, but also threatens the global carbon emission goals. However, if the circular economy approach is adopted, the world is expected to reduce 55% of virgin plastic production and 80% of the amount of plastic discharged into the ocean by 2024 [4].

Finally, the resolution emphasizes the transboundary nature of plastic pollution in the oceans and other environments, which not only affects the global ecological environment, but also harms the health of all human beings. Therefore, it is emphasized that Member States should adopt all possible means to address the full life cycle of plastics through cooperation. In other words, in the future, from the production, manufacture, design, disposal of plastic raw materials to recycling and reuse will be expected to be included in international treaties and establish a complete regulatory mechanism.

III. A comprehensive approach

The third point of the resolution formulates the normative principles and connotations of the future international plastics treaty. To address the full life cycle of plastic, the instrument should adopt a comprehensive approach that allows for both mandatory and voluntary measures, taking into account the principles of the Rio Declaration and national circumstances and capacities. Therefore, the following key points should be addressed in the future international plastics treaty:

i. Strengthen circular economy to achieve sustainable consumption and production

The provision of the new instrument should emphasize resource efficiency and a circular economy approach, from product design to environmentally friendly waste management, to promote sustainable production and consumption of plastics. Countries should be urged to develop and implement national action plans aimed at preventing, reducing and eliminating plastic pollution in support of regional and international cooperation.



Figure 1/ The ubiquitous plastic debris has become a planetary crisis
Source/ Pride Advertising Agency Ltd.

ii. comprehensive measures

The treaty should promote national and international cooperation and coordinate with other relevant regional and international conventions to address existing plastic pollution and plastic pollution in the marine environment. Public participation is also encouraged, and all stakeholders, including the private sector, are encouraged to participate in action to facilitate cooperation at local, national, regional and global levels.

In addition, increase knowledge through awareness raising, information exchange and education, and encourage investment in research to further develop sustainable, innovative, affordable and cost-effective ways. Finally, the article should establish a scientific and socio-economic evaluation mechanism, and regularly evaluate the progress of the implementation of the agreement and the effectiveness of related measures.

IV. The establishment of an intergovernmental negotiating committee

In order to formulate a legally binding international treaty as soon as possible in 2024, the first point of the resolution calls for the establishment of an Intergovernmental Negotiation Committee (International Negotiation Committee) to negotiate the details of the treaty and start action in the second half of 2022. Furthermore, in order to enable developing countries and countries with economies in transition to effectively implement their international obligations imposed by future international treaties, the second point of the resolution affirms that the necessary capacity building, technical and financial support should be given priority to developing countries and countries with economies in transition, enabling it to participate effectively in the work of the Ad Hoc Working Group and the Intergovernmental Negotiating Committee.

In addition, according to the fourth point of the resolution, the negotiating committee should consider the following elements when negotiating. First, some provisions should be flexible, allowing countries to take into account their national circumstances and have discretion in how to implement their commitments. Second, past experience or best practice should be drawn from the best scientific, traditional, indigenous and local knowledge systems, including various informal or collaborative approaches. Finally, consider the possibility of establishing a mechanism to provide policy-based scientific information, socio-economic information and assessments related to plastic pollution.

Challenges and Prospects

The ubiquitous plastic and its waste are the most urgent issues to be solved in the world today. Although various countries have actively adopted various policies or measures to limit plastics, most of the measures are only aimed at specific projects and lack systematic policies and standards, which can

neither solve the problem of environmental pollution nor effectively reduce the economic and social costs of plastics. The adoption of this resolution brings hope for a cure to the global crisis and establishes a global scale and a systematic framework for plastic pollution control, but it also brings new challenges and impacts to the entire human society.

First of all, this resolution recognizes on behalf of the entire international community that plastic pollution should shift from a linear model that focused on end-of-pipe disposal to a circular model that addresses the entire life cycle of plastics. Reduce plastic from the source, extend the economic use value of plastic products through reuse and recycling, and establish a clear and complete plastic regulatory framework. The resolution requires that the future global plastic agreement will take comprehensive measures, including mandatory and non-coercive measures, to comprehensively address plastic pollution. Member States can also take measures that meet their national needs as appropriate. The design of this flexible and dynamic structure allows countries to adjust their response to changes in national economic, technological, political and social conditions, and is more willing to give or strengthen their promise.

In addition, the establishment of a circular plastic economy and the reduction of plastic pollution require the actions of different stakeholders, including the government, consumers, plastic industry-related manufacturers, waste management and other public and private sectors. The resolution emphasizes the importance of the participation of the public and multiple stakeholders, and recognizes the necessity of the participation of international organizations and non-governmental organizations to strengthen the legitimacy and decision-making basis of plastic pollution control, and contribute to the promotion and practice of the global plastic treaty in the future.

At the 12th WTO Ministerial Conference in June 2022, the informal dialogue on plastic pollution and environmentally sustainable plastic trade involving 73 WTO member states made a public statement in support of the adoption of the resolution and advocated that trade and trade policies should address plastic pollution, one of the means. WTO members should and will continue to work together to reduce plastics globally through trade-related means. In addition, in order to implement the Basel Convention on Plastics Amendment, the World Customs Organization has revised the definition of plastic waste. In the future, the international trade of plastic products is bound to be significantly affected, and how to reconcile trade and plastic reduction measures to avoid creating new types of trade barriers is also an upcoming challenge for countries [5].

Furthermore, although member states have committed in the resolution to formulate and adopt a global plastics agreement in 2024, the negotiation of the treaty is not only about the rights, obligations and capabilities of each country, but also involves domestic political consultation. Negotiations for general treaties take an average of five to ten years to complete [6]. The more countries involved in the negotiation, the longer it will take to complete the treaty negotiations. So it remains to be seen how Member States will complete negotiations on a global plastics agreement within two years. In addition, the resolution mainly elaborates on abstract value, purpose and normative direction. As for the specific goals, measures and monitoring mechanism, it still depends on further consultation among member states. Therefore, it remains to be seen whether the Global Plastics Agreement can be completed and implemented as scheduled.

Although the public's awareness of the crisis of plastic pollution is gradually rising, the global demand for plastics has continued to increase in recent years. After the outbreak of Covid-19, the global demand for virgin plastic has increased substantially, and the global petrochemical and plastic industries have continued to invest heavily. It is expected that plastic production will continue to grow. After the adoption of the international treaty in the future, it will also change the mode of plastic production and management, which will also have a major impact on the plastic-related industry. Therefore, how countries should strike a balance between the implementation of plastic reduction obligations and industrial transformation and development will also be a major test.



Figure 2/ A global plastics treaty will bring a cure for the planetary crisis of plastic pollution
Source/ Pride Advertising Agency Ltd.

Finally, in recent years, Taiwan has also shown its determination to gradually implement the plastic restriction policy. Since 2002, plastic bags for free shopping have been banned. In 2018, an action plan for marine waste cleanup was announced. Regarding to the four major categories of single-use plastic products, disposable food containers, utensils, and straws were banned at all restaurants for customers dining on the premises in 2020. Plastic bags, disposable containers, utensils, and straws will be charged and restricted in all commercial places by 2025. The government aims to achieve a plastic free Taiwan by 2030. Although the government's determination is laudable, the current policies and resources are mostly focused on the end-of-pipe treatment of plastic waste, which cannot effectively solve plastic pollution. In response to the new type of international plastics standard mechanism in the future, it is suggested that the government should review the current plastics governance policy as soon as possible, and plan the national blueprint for reducing plastics and related supporting measures as soon as possible, so as to make efforts for the sustainable development of the earth.

References

- [1] United Nations Environment Program (2021). "From Pollution to Solution: a Global Assessment of Marine Litter and Plastic Pollution." <https://www.unep.org/resources/pollution-solution-global-assessment-marine-litter-and-plastic-pollution> (Sep. 2, 2022)
- [2] One Ocean Hub (May 4, 2022). REFLECTIONS ON THE NEW UN PROCESS TO DEVELOP A TREATY ON PLASTICS. <https://oneoceanhub.org/reflections-on-the-new-un-process-to-develop-a-treaty-on-plastics/> (Sep. 2, 2022)
- [3] UNEP/EA.5/Res.14 (Mar. 7, 2022). "End Plastic Pollution: Towards an International Legally Binding Instrument."
- [4] United Nations Environment Program (2021). "Drowning in Plastics: Marine Litter and Plastic Waste Vital Graphics." <https://www.unep.org/resources/report/drowning-plastics-marine-litter-and-plastic-waste-vital-graphics> (Sep. 2, 2022)
- [5] Informal Dialogue on Plastic Pollution and Environmentally Sustainable Plastics Trade (IDP), WT/MIN (22)/12 (Jun. 13, 2002). "Ministerial Statement on Plastic Pollution and Environmentally Sustainable Plastic Trade." <https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:WT/MIN22/12.pdf&Open=True> (Sep. 2, 2022)
- [6] The SDG Knowledge Hub (Mar. 10, 2022). UNEA Launches Negotiation of Plastic Pollution Treaty, Science Body on Chemicals. <https://sdg.iisd.org/news/unea-launches-negotiation-of-plastic-pollution-treaty-science-body-on-chemicals/> (Sep. 2, 2022)

The Ministry of Environment in Lithuania: Pursuing Environmental Protection and Leading Marine Spatial Planning

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Keywords: Lithuania, Ministry of Environment, National Environmental Protection Strategy, Marine spatial planning

Republic of Lithuania (briefly, Lithuania) is a member of the European Union as well as a contracting party of the United Nations Convention on the Law of the Sea. There is no institution dedicated to marine affairs and the things related to marine environments are under the auspice of the Ministry of Environment. The National Environmental Protection Strategy developed by the Ministry of Environment is a major policy document pertaining to the environmental governance. The principles of environmental protection policy laid out in this document, such as eco-efficiency, pollution prevention, polluter pays principle, Precaution, represent the core and values of environmental protection held by the Lithuanian government. They are of course applied in the marine environmental protection. Furthermore, the Ministry of Environment legalized the marine spatial planning (MSP) as early as in 2014, making the MSP as a component of the Comprehensive Plan of the Territory. The marine spatial plan was then adopted in 2015 by the Parliament, indicating Lithuania's strong political desire to engaging in marine spatial planning by seeing marine space as important territorial resources for the development of blue economic activities and protection of marine environments.

Overview of Lithuania

Lithuania lies on the eastern shore of the Baltic Sea, and shares land borders with Latvia to the north, Belarus to the east and south, Poland to the south, and Kaliningrad Oblast of Russia to the southwest. It lies between latitudes 53° and 57° N, and mostly between longitudes 21° and 27° E, and covers an area of 65,300 square kilometers, with a population of 2.8 million. The coastline is approximately 90.66 kilometer in length. The area of the territorial waters and the exclusive economic zone is about 1,810 square kilometers and 4,560 square kilometers, respectively [2]. The north section of the coastline faces the Baltic Sea, while the rest of the coast is close to the Curonian Lagoon. The sand dune on the sand spit of the Curonian Lagoon is the largest mobile sand dune in Europe and is designated as the national park as well as listed as a UNESCO world heritage site.



Figure 1/ Exclusive Economic Zone of each state bordering the Baltic Sea (red lines marking the EEZ boundary) and the maritime space of Lithuania (marked in orange oblique lines)

Source/ [1]



Figure 2/ Sand dune at the Curonian Lagoon, a UNESCO world heritage site (Note: The water area of the lagoon is on the side across the trees)
Image by Chung-Ling Chen

The Lithuanian government is a semi-presidential system. The head of state is the president, directly elected for a five-year term and serving a maximum of two terms. The president oversees foreign affairs and national security. The president appoints the prime minister, approved by the parliament. The prime minister appoints the ministers of the cabinet, approved by the President. Currently, there is a total of 14 ministries, including Ministry of Environment, Ministry of Energy, Ministry of Economy and Innovation, Ministry of Finance, Ministry of National Defence, Ministry of Culture, Ministry of Social Security and Labour, Ministry of Transportation and Communication, Ministry of Health, Ministry of Education, Science and Sport, Ministry of Justice, Ministry of Foreign Affairs, Ministry of the Interior, Ministry of Agriculture [3].

There is no institution dedicated to marine affairs. The things relate to marine environments is under the auspice of Ministry of Environment. The National Environmental Protection Strategy developed by the Ministry of Environment is a major policy document of environmental governance. In addition, the Ministry is also in charge of marine spatial planning (MSP). It is worth noting that Lithuania is a member of the EU and therefore the legal documents adopted by the EU have a binding effect for Lithuania, such as the EU Marine Strategy Framework, the EU Directive on Marine Spatial Planning (hereafter the EU MSP Directive), the Integrated Marine Policy of the EU. This essay is to introduce the Ministry of Environment and its two policy documents (i.e., National Environmental Protection Strategy and Marine Spatial Planning) in order to understand the things related to ocean governance.

Ministry of Environment and National Environmental Protection Strategy

The Ministry of Environment is in charge of the issues or activities related to climate change, ambient air, water, chemical substances, environmental impact assessment, waste management, pollution prevention, natural protection, forest, protected areas and landscape, territorial planning, sustainable development, etc. [4]. The National Environmental Protection Strategy, adopted by the Parliament on September 25, 2016, is a major policy document pertaining to environmental governance. The main content of this document includes principles of environmental protection policy, priorities areas of environmental protection and the key policy implementing directions [5].

The principles of environmental protection policy represent the core and values held by the Lithuania government in its pursuit of environmental protection. There are 11 principles, including eco-efficiency, pollution prevention, responsibility (polluter pays principle, rectification at source, integration of the environmental protection policy, use of the best available technologies, precaution, substitution,

subsidiarity, partnership and shared responsibility, and public participation and information. Among them, eco-efficiency refers to using fewer resources to generate more goods and services and decreasing the levels of waste and environmental pollution. Substitution means efforts are made to ensure that substances hazardous to humans and the environment are replaced with non-hazardous substances and non-sustainable resources with clean or less polluting renewable resources, while waste generated is returned for reuse, recycling or other uses (such as power generation). Subsidiarity means the strengthening of democracy and partnerships in decision making and implementation process. Efforts are made to assist local communities with taking care of their environment and increase opportunities for their participation in dealing with local environmental problems.

There are four priority areas of environmental protection, which are: sustainable use of natural resources and waste management, improvement of the quality of the environment, maintenance of ecosystem stability, and climate change mitigation and adaptation. These four priority areas represent the issues pertaining to the environment that Lithuania prioritize to deal with. It is worth noting that the issues pertaining to the marine environment are not dealt with in a standalone chapter or section in the Strategy. Instead, the marine environment is assimilated into the whole environment and the issues are dealt with in each priority area. For example, the issue of fish stocks is dealt in the priority area of sustainable use of natural resources and waste management. The issues of water quality of the Baltic Sea and the Curonian Lagoon is mentioned in the priority area of improvement of the quality of the environment. The issues relevant to biodiversity and ecosystem services are tackled in the priority area of maintenance of ecosystem stability.

As for the fish stocks, the issues were particularly mentioned that commercial fishing is intensive in the coastal zone of the Baltic Sea and in the Curonian Lagoon, and fish stocks suffer damage from illegal fishing, fishing gear without tools for deterring birds and marine mammals. Furthermore, key policy implementing directions for fish stocks are proposed, including assurance of the sustainable use of fish stocks, protection of fish (salmon and sea trout) migration routes and spawning grounds, and installation of fish migration routes from the coastal zone of the Baltic Sea to the upper reaches of rivers, proper regulations of fishing, etc.

Marine Spatial Planning

The European Council (EC) adopted the EU MSP Directive (Directive 2014/89/EU) in 2014. The Directive aims at promoting the sustainable growth of maritime economics, the sustainable development of marine areas and the sustainable use of marine resources [6]. In Europe, the 22 coastal Member States are obliged under the MSP Directive to develop a national maritime spatial plan at the latest by 31 March 2021, with a minimum review period of 10 years. To track the progress of MSP in each coastal member state, a European Maritime Spatial Planning Platform has been set up, containing the information of MSP pertaining to each member state [2]. In addition, HELCOM (Baltic Marine Environment Protection Commission) is a regional organization dedicated to establishing a healthy Baltic Sea environment. MSP is one of the tools used to fulfill this goal and a page in the website has been created to include the information of MSP of member states, including Lithuania [7]. The information regarding the MSP in Lithuania as seen below is thus mostly excerpted and compiled from these two websites.

Lithuania has one of the shortest shorelines among European countries. The country's marine area borders Latvia in the North, the Russian Federation in the South (Kaliningrad oblast) and the Kingdom of Sweden in the West. In response to the upcoming MSP Directive and to strengthen governance of sea space, Lithuania launched to revise Law on Territorial Planning as early as in 2013. The revised Law came into force on 1 January 2014. Since the legislation of marine spatial planning was completed, the

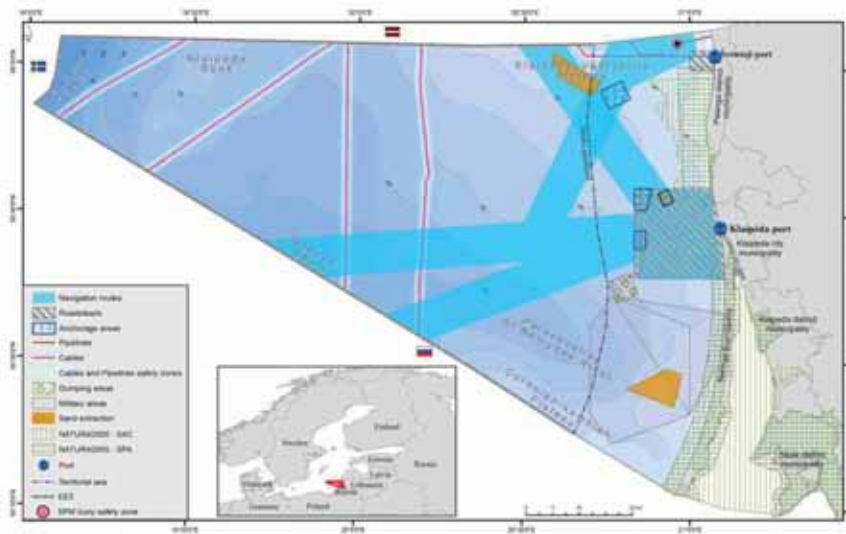


Figure 3/ Marine spatial planning of Lithuania, marking various uses pertaining to maritime spaces, including navigation routes, pipelines, cables, dumping areas, sand extraction, protection areas, etc
Source/ [8]

Ministry of Environment started to engage in marine spatial planning and the marine spatial plan was adopted by the Parliament on 11 June 2015, which becomes a part of the Comprehensive Plan of the Territory of the Republic of Lithuania. New Comprehensive Plan (2nd) that includes MSP was adopted by the Parliament on 29 September 2021.

The maritime space includes internal waters, territorial waters, the exclusive economic zone, the sea bottom and the soil underneath. The marine spatial plan (the official name is Comprehensive Marine Territory Plan) specifically lays out the regulations that need to be met, including the EU MSP Directive, the Law on Klaipėda State Seaport of the Republic of Lithuania, and the EU regulations for establishing a secure ferry and port infrastructure.

Main objectives of the plan were:

- to maintain equilibrium between economic and ecological development;
- to form a healthy and harmonious environment for creating better living conditions in the whole state;
- to form an integrated policy of development of different fields of activity;
- to protect, restore and rationally use resources of nature and recreation, values of natural and cultural heritage;
- to reserve territories for infrastructure and for other development needs of various kind activities in the maritime territories;
- to promote investments for economic development, preserving and restoration of values of natural, cultural heritage and recreational resources;
- to reconcile the interests of natural and legal entities, municipalities an state as well rights of subject of international law with regard to the use of the maritime territories.

Current uses, future uses, issues and identified spatial conflicts are taken into account during the elaboration of the MSP project. Zones with specific functions and their associated maps have been prepared, including the zones for spatial development concept and functional priorities of the territory, the zones for economic activity development, the zones for ensuring ecological balance and preserving the cultural heritage, the zones reserved for the national needs, etc. While these zones carry specific

functions, most of them are mixed uses as long as the use does not intervene with the prioritized activities and functions of a sea region. For example, in the non-specific and free marine region, the priorities are allocated for fishing, aquaculture, and sea-way passage. To facilitate renewable energy production, the part of sea area is allocated for renewable energy infrastructure such as windmills, wave energy generation and other innovative solutions. Another sea region is for high ferry mobility. The coastal areas are prioritized for ecosystem protection. Figure 3 shows the allocation of spaces for different uses, including navigation routes, pipelines and cables, ports, dumping areas, sand extraction, military areas, Natura 2000 Special Area Conservation (SAC), Natura 2000 Special Protection Area (SPA), etc.

Public participation is ensured during the spatial planning process. Measures include making the information public in all stages of planning process, making the materials of the Plan publicly available on the webpage of the Ministry of Environment, presenting the Plan during national and international conferences, organizing public hearings, etc. In addition, transboundary consultations were conducted during the planning process. The countries consulted are Latvia and Sweden, which are also EU member states and border with the maritime space of Lithuania.

Conclusion

No institution dedicated to marine affairs exist in Lithuania. The things relate to marine environments is under the auspice of Ministry of Environment. The National Environmental Protection Strategy and marine spatial planning, developed and implemented by the Ministry of Environment, are important policy documents on environmental governance. In particular, Lithuania legalized MSP as early as in 2014, making the maritime space being a part of the territory, and further adopted the marine spatial plan in 2015. Lithuania is one of the EU member states who take the initiative to complete the MSP project, demonstrating its emphasis on the development of economic activities and environmental protection in the maritime space.

The coastline of Lithuania is short, being merely 90.66 kilometers and the area of maritime space under its competence is only 6,370 square kilometers. While both are far smaller than Taiwan's coastline (about 1,900 kilometers) and the combined area of Taiwan's territorial sea and contiguous zone (approximately 83,700 square kilometers), Lithuania boldly sees its maritime space as an important national asset and actively engaged in marine spatial planning in order to meet the needs of development of national economic activities and ensure environmental protection. The way of Lithuania dealing with its maritime space serves a good model for our reference.

References

- [1] The European MSP Platform (Feb. 22, 2022). Baltic Sea.
<https://maritime-spatial-planning.ec.europa.eu/sea-basins/baltic-sea-0> (Sep. 7, 2022)
- [2] The European MSP Platform (Jul. 07, 2022). Lithuania.
<https://maritime-spatial-planning.ec.europa.eu/countries/lithuania> (Aug. 11, 2022)
- [3] Government of the Republic of Lithuania (n.d.). My Government.
<https://lr.v.lt/en/> (Aug. 11, 2022)
- [4] Government of the Republic of Lithuania (n.d.). Ministry of Environment of the Republic of Lithuania.
<https://am.lrv.lt/en> (Aug. 11, 2022)
- [5] Ministry of Environment of the Republic of Lithuania (2016). National environmental protection strategy.
<https://am.lrv.lt/uploads/am/documents/files/National%20Environmental%20Protection%20Strategy.pdf> (Aug. 11, 2022)
- [6] The European MSP Platform (n.d.). Introduction to MSP.
<https://maritime-spatial-planning.ec.europa.eu/msp-eu/introduction-msp> (Aug. 11, 2022)
- [7] HELCOM (n.d.). HELCOM-VASAB cooperation.
<https://helcom.fi/action-areas/maritime-spatial-planning/msp-roadmap/> (Aug. 11, 2022)
- [8] The European MSP Platform (n.d.). Lithuanian Model Case.
<https://maritime-spatial-planning.ec.europa.eu/practices/lithuanian-model-case> (Sep. 7, 2022)

Invasive Alien Species and Ballast Water Management in Lithuania

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Keywords: Baltic Sea, aquatic invasive species, HELCOM, ballast water exchange

The 2005 Millennium Ecosystem Assessment indicated that the impact of invasive alien species will grow over the coming decades. Invasive alien species are now recognized as one of the main causes of biodiversity loss and ecosystem change. The volume of goods transported by sea is growing due to the increase of trade globalization, which also indirectly leads to ships transporting a large amount of ballast water worldwide. The introduction of alien species into new marine environments through ballast water is recognized as a significant threat to the global ocean and biodiversity. In 2004, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management Convention, BWMC) was formulated by the International Maritime Organization to ensure effective ballast water management. The BWMC aims to prevent or mitigate the introduction of alien species from ships' ballast water. Lithuania, located in the southeast of the Baltic Sea, is a contracting party to the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention). Based on the Helsinki Convention and BWMC, the countries of the Baltic Sea area cooperate in the measures of ballast water management to protect the marine environment and ecosystems of the Baltic Sea.



Figure 1/ Port of Klaipėda, Lithuania

Source/ <https://portofklaipeda.lt/en/naujienos/eu-funds-to-dredge-the-navigation-channel-up-to-15-meters-in-klaipeda-port/>

Invasive Alien Species and Ballast Water

Alien species are non-indigenous species introduced unintentionally or intentionally through human activities. Some biological species overcome geographic range limits and expand to areas beyond their natural distribution due to the frequent human activities around the world. Some alien species may dramatically change local ecosystems in the absence of natural controls such as predators, parasites or disease. Such species are called invasive alien species [1].

As international trade grows, shipping is crucial to the global economy. Shipping is the most cost-effective way to transport goods over long distances, with 80% of goods currently transported by ships. It is important for ship sailing to draw or discharge seawater as ballast water because it ensures the seaworthiness of ships. The main functions of ballast water are as follows [2]:

- Adjusting the ship's load and draft.
- Keeping the hull balanced when the weight of the load is unevenly distributed.
- Controlling the stability of ships under different weather conditions.
- Improving the usage efficiency of ship fuel.

Under natural conditions, most marine aquatic species will migrate or spread, but it is more difficult for species to spread to distant sea due to geographic barriers. However, when ships draw ballast water at source port, a large number of aquatic species enter ship's ballast tanks. Subsequently, at destination port, these species are transferred to another sea areas as the cargo is loaded into the ship and the ballast water is discharged. Ballast water is considered to be one of the main vectors for the invasive spread of potential alien species. As much as 14 billion tons per day of ballast water is transported around the world, and there may be approximately 7,000 to 10,000 different species of marine microorganisms, plants and animals in ballast water [3]. Table 1 lists the most invasive species transferred through ballast water. Currently, most countries are affected by ballast water discharge and realize that uncontrolled discharge of ships' ballast water may lead to the invasion of alien species and the transfer of pathogens, causing damage related to the ecological environment, economy and human health.

International Maritime Organization (IMO) Marine Environment Protection committee (MEPC) is also concerned about ballast water and the invasion of aquatic alien species. In 2004, the IMO Assembly in London, UK adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWMC) to prevent or mitigate the introduction of invasive alien species from ships' ballast water. The BWMC entered into force in September 2017. As of April 2022, 89 states ratified the BWMC, accounting for approximately 91.20% of the gross tonnage of the world's merchant fleet [4].

Table 1/ The 10 most invasive species transferred through ships' ballast water

Common Name	Scientific Name
Cholera	<i>Vibrio cholera</i>
Cladoceran water flea	<i>Cercopagis pengoi</i>
Mitten crab	<i>Eriocheir sinensis</i>
Toxic algae	various species
Round goby	<i>Neogobius melanostomus</i>
Zebra mussel	<i>Dreissena polymorpha</i>
Comb jellyfish	<i>Mnemiopsis leidyi</i>
North Pacific seastar	<i>Asterias amurensis</i>
European green crab	<i>Carcinus maenas</i>
Asian kelp	<i>Undaria pinnatifida</i>

Source/ https://wwwcdn.imo.org/localresources/en/OurWork/PartnershipsProjects/Documents/Mono25_English.pdf

Aquatic Invasive Alien Species in the Baltic Sea and Lithuania

The Baltic Sea is a semi-closed water body, and the salinity of the upper and lower water layers is significantly different, which results in obvious stratification of the water body. Invasive alien species in the Baltic sea have increased over the past 50 years. Compared with previous data, relatively active maritime transportation have caused ships to transport a large amount of ballast water from more areas in shorter time, which made it easy for alien species in ballast water to be introduced into the Baltic Sea [5].

In order to protect the marine environment of the Baltic Sea, the coastal countries of the Baltic Sea (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden) and the European Union jointly signed the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention). One of the aim of Helsinki Convention is to protect the Baltic Sea from land-based, air and marine pollution sources for the purpose of maintaining biodiversity and habitats. The Baltic Marine Environment Protection Commission (HELCOM), also known as the Helsinki Commission, is an intergovernmental organization. The purpose of HELCOM is to administer the Helsinki Convention, serving as a platform for regional marine environmental policy development. Since 2008, the HELCOM has compiled and updated the comprehensive list of invasive alien species in the Baltic Sea. Based on the historical data from the comprehensive list, the trend of introduction of alien species in the Baltic Sea has grown with the years [6]. It is estimated that approximately 120 aquatic invasive species have been recorded in the Baltic Sea, of which nearly 80 species have established breeding populations. Most of these invasive species have been introduced in the past 100 years, and shipping is the most important vector of introduction [7].

Lithuania is located in the southeast of the Baltic Sea with a coastline of 90.66 kilometers. Previous studies indicated that 17 species of bottom fauna introduced via ship's hull or ballast water were observed in the waters of the Lithuanian coastline. The species include one species of hydroids, one species of multi-bristle worms, 11 species of crustacean and four species of limpets [8]. The round goby, well-known invasive alien species, first appeared in the Gulf of Gdansk in Poland in 1990, and appeared off the coast of Lithuania in 2002. According to previous studies, it was indicated that the round goby found in Lithuanian coast may be from the ballast water of the Black Sea, the Azov Sea and the Caspian Sea [5]. Currently, the round goby is expanding further and up to a stable population in the Curonian Lagoon off the coast of Lithuania, which may affect the habitat and food resources of the ruffe (*Gymnocephalus cernua*), the native bottom fish [9].

Ballast Water Management in Lithuania

The Port of Klaipeda is the only commercial seaport in Lithuania with an annual cargo turnover of approximately 20 million tons. About 7,000 ships enter the Port of Klaipeda each year, discharging approximately 2 to 4 million tons of ballast water. Furthermore, the Port of Butinge Oil Terminal, operating since 1999, is another source of ballast water off the coast of Lithuania. Oil tankers are loaded at the Port of Butinger which is capable of accommodating tankers up to 150,000 tons [5]. The Klaipeda State Seaport Authority and the Butinge Port Authority are the competent authorities for ballast water management in the two ports respectively. The HELCOM and the Oslo-Paris Commission (OSPAR Commission) jointly adopt the measures of ballast water management to protect the Baltic Sea and the North-East Atlantic. Therefore, the competent authorities of ballast water management in Lithuania are subject to the regulations or guidelines established by these two regional organizations.

According to BWMC and "IMO 2017 Guidelines on designation of areas for ballast water exchange (G14)", ships should conduct ballast water exchange at least 200 nautical miles from the nearest land and at a water depth of at least 200 meters. If the aforementioned conditions cannot be met, ballast water exchange must be conducted at least 50 nautical miles from the nearest land and at a water depth of at least 200 meters. However, the water depth and distance from the land requirements for ballast water exchange cannot be met in the Baltic Sea area. Therefore, according to BWMC and G14, as well as most alien species in the Baltic Sea have a wide tolerance in salinity, the HELCOM considered that the Baltic Sea is unsuitable for ballast water exchange [10].

The HELCOM, OSPAR Commission and Barcelona Convention have co-operated on a set of three joint IMO voluntary interim guidelines. The guidelines specify the location of ballast water exchange based on the ship's route involving three sea areas. It should be noted that these interim guidelines do not apply when BWMC's D-2 standard (refer to Regulation D2 in Table 2) is applied to ships [6][10]. For ships sailing in the Baltic Sea, the Northeast Atlantic and the Mediterranean Sea, the relevant guidance for the exchange of ballast water are as follows:

- Since April 2008, ships transiting the Atlantic or entering the North-East Atlantic from routes passing the West African Coast are requested to discharge their ballast water at least 200 nautical miles from the nearest land and at a water depth of at least 200 meters before arriving at or passing through the OSPAR area. The volume of ballast water is exchanged in accordance with the D-1 standard (refer to Regulation D1 in Table 2).
- Since January 2010, ships leaving the Baltic sea and transiting the OSPAR area to other destinations are requested to discharge their ballast water at least 200 nautical miles off the coast of North West Europe and at a water depth of more than 200 meters. The volume of ballast water is exchanged in accordance with the D-1 standard.
- Since October 2012, ships sailing between the Mediterranean Sea and the North East Atlantic and/or the Baltic Sea are requested to exchange ballast water at least 200 nautical miles from the nearest land and at a water depth of at least 200 meters, as soon as they enter or leave the North-East Atlantic. The volume of ballast water is exchanged in accordance with the D-1 standard.

Additionally, the HELCOM and OSPAR Commission have adopted and amended the "Joint Harmonized Procedure for the Contracting Parties of OSPAR and HELCOM on the granting of exemptions under the BWM Convention, Regulation A-4 (JHP)" between 2013 and 2020. According to BWMC's regulation, JHP allows ships passing through the Baltic Sea and the Northeast Atlantic to apply for exemptions from ballast water management between specified ports. These specified ports are areas with low risk of harmful aquatic organisms and pathogens (HAOP). However, according to BWMC and IMO regulations, all ships must treat ballast water with an approved onboard Ballast Water Management System (BWMS) to meet D-2 standards by September 2024. Therefore, JHP is only an interim program for the transitional period (2017 to 2024). The transitional period will end by 2024 when the D-2 ballast water standard applies in full based on BWMC [11].

Conclusion

Invasive alien species introduced by improper discharge of ship's ballast water constitute a threat to the ecological environment, economic losses and human health of the sea area. The BWMC has been adopted by the IMO in 2004 to prevent or mitigate the issues of invasive alien species, and entered into force in September 2017. Lithuania, a Baltic country, is a contracting party to both the BWMC

Table 2/ Standards for ballast water discharge under the BWMC

Ballast Water Management Standards	Content
Regulation D1 Ballast water exchange standard	If the ship uses the sequential method, the exchange rate of 95% of the carried ballast water should be achieved. If the dilution method is used, the volume of water injected and discharged should be at least 3 times the volume of ballast water.
Regulation D2 Ballast water performance standard	Ballast water treated by the Ballast Water Management System (BWMS) must meet the standard of maximum allowable viable organism limits before it can be discharged into the sea. The standards are explained as follows: I. <10 living organisms per m ³ , sized ≥50µm; II. As well as <10 living organisms per ml of water, sized <50µm and ≥ 10µm, with a predetermined number of indicator microorganisms.

Source/ <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Implementing-the-BWM-Convention.aspx>

and the Helsinki Convention. Therefore, Lithuania follows the norms of the HELCOM, and implement the BWMC based on the joint measures of ballast water management with other Baltic states. The HELCOM has collaborated with other regional organizations to develop voluntary interim guidelines. The guidelines specify the location of ballast water exchange based on the ship's route to comply with the D-1 standard. In addition, the HELCOM and OSPAR Commission have adopted and amended the joint harmonized procedure (JHP) for ballast water exemptions as an interim program until the full application to the D-2 standard in 2024.

References

- [1] Tamelander J., Riddering L., Haag F. & Matheickal J. (2010). Guidelines for Development of National Ballast Water Management Strategies. GEF-UNDP-IMO GloBallast, London, UK and IUCN, Gland, Switzerland. GloBallast Monographs No. 18.
- [2] David, M. (2015). Vessels and Ballast Water. In: David, M., Gollasch, S. (eds) Global Maritime Transport and Ballast Water Management. Invading Nature - Springer Series in Invasion Ecology, vol 8. Springer, Dordrecht.
- [3] Lakshmi, E., Priya, M., & Achari, V. S. (2021). An overview on the treatment of ballast water in ships. *Ocean & Coastal Management*, 199, 105296.
- [4] International Maritime Organization (2022). Status of Conventions - Ratification by Treaty. <https://www.imo.org/en/About/Conventions/Pages/StatusOfConventions.aspx> (Apr. 30, 2022).
- [5] Olenin, S. (2005). Invasive aquatic species in the Baltic states. Klaipėda University Press, Klaipėda, Lithuania.
- [6] HELCOM (2014). HELCOM Guide to Alien Species and Ballast Water Management in the Baltic Sea. https://helcom.fi/post_type_public/helcom-guide-to-alien-species-and-ballast-water-management-in-the-baltic-sea (Jun. 10, 2022).
- [7] Gollasch, S., & Leppäkoski, E. (2007). Risk assessment and management scenarios for ballast water mediated species introductions into the Baltic Sea. *Aquatic Invasions*, 2(4), 313-340.
- [8] Ignatavičius, G., & Vilutienė, V. (2007). Impact of Lithuanian Sea Harbors on Environmental Stability and Local Ecosystems. In *Environmental Security in Harbors and Coastal Areas* (pp. 395-407). Springer, Dordrecht.
- [9] Rakauskas, V., Pūtys, Ž., Dainys, J., Lesutienė, J., LOŽYS, L., & ARBAČIAUSKAS, K. (2013). Increasing population of the invader round goby, *Neogobius melanostomus* (Actinopterygii: Perciformes: Gobiidae), and its trophic role in the Curonian Lagoon, SE Baltic Sea. *Acta Ichthyologica et Piscatoria*, 43(2).
- [10] HELCOM (2017). Baltic Sea clean Shipping guide. <https://helcom.fi/wp-content/uploads/2019/08/Baltic-Sea-Clean-Shipping-Guide-2017.pdf> (Jun. 15, 2022).
- [11] Outinen, O., Bailey, S. A., Broeg, K., Chasse, J., Clarke, S., Daigle, R. M., Gollasch, S., Kakkonen, J. E., Lehtiniemi, M., Normant-Saremba, M., Ogilvie, D. & Viard, F. (2021). Exceptions and exemptions under the ballast water management convention—Sustainable alternatives for ballast water management?. *Journal of Environmental Management*, 293, 112823.

Maritime Delimitation Agreements and Relevant Practice of Lithuania

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After the dissolution of the former Soviet Union, Lithuania has concluded maritime delimitation agreements with Russia, Latvia, and Sweden. Disagreements concerning economic activities at sea and exploitation of natural resources can be observed, and other factors, such as the changing state of the Baltic region and sovereignty disputes further complicate matters, leading to differing outcomes of such delimitation agreements. Through the introduction and analysis of the process and experience related to each of the agreements, this contribution seeks to aid in the understanding of how delimitation disputes can be resolved in order to promote regional peace.

Introduction: Delimitation Agreements in the Baltic Sea

All States surrounding the Baltic Sea are parties to the United Nations Convention on the Law of the Sea (UNCLOS) [1]. In addition to rules on the nature, scope, and rights and obligations of coastal and other States, the UNCLOS also contain provisions on delimitation between States of opposite and adjacent coasts. While different delimitation principles are provided for territorial sea (Article 15) vis-à-vis the exclusive economic zone (Article 74) and continental shelf (Article 83), agreements remain the common primary means of settling such disputes. For States with delimitation agreements, questions of delimitation are determined by the provisions of such agreements.

The Baltic Sea is relatively confined, and its average width is far shorter than 400 nautical miles. Considering that, pursuant to the UNCLOS, States may claim 200 nautical miles of exclusive economic zone, delimitation discussions with other States have become necessary for all States in the region, and the process and outcome of negotiations varies depending on the bilateral relations between the relevant States. Professor Erik Franckx, a prominent scholar with expertise concerning the region, often presents the analysis of relevant State practice in four time periods [2]:

- I. 1945-1972: This period covers the height of the Cold War. The first delimitation agreement was concluded in 1958 between Poland and the former Soviet Union concerning territorial sea, and the vast majority of subsequent agreements were concluded between States of the Eastern Bloc. Finland was the only non-Eastern Bloc State taking part in Baltic delimitation agreements during this period.
- II. 1973-1985: With the conclusion of the Basic Treaty between the two Germanies in 1972, partial normalization of relations between the two Blocs was under way, and cross-Bloc delimitation agreements were concluded during this period.
- III. 1985-1990: States worked on resolving more complicated issues (e.g., the effect of islands on delimitation) and new issues arising out of the conclusion of the UNCLOS (e.g., exclusive economic zones and their delimitation). This period marked the most productive one, with the higher number of agreements concluded compared to the forty years preceding this period.
- IV. 1990 to present: With the dissolution of the former Soviet Union, the legal effect of delimitation agreements concluded by it were questions, and the re-emergence of the Baltic States also prompted new delimitation needs.

At the end of the third period described above, most of the Baltic Sea had been delimited, with the exception of a small portion of the region. However, the dissolution of the former Soviet Union had a profound impact on the maritime delimitation of the region. While international law has developed theories concerning the effect of the unification and separation of international legal persons or the transfer of territory, and the Vienna Convention on Succession of States in respect of Treaties was concluded in 1978 [3], many theories and rules within the 1978 Vienna Convention remain disputed. Additionally, Baltic States are often of the opinion that they are not the successor States of the former Soviet Union [4]. Thus, new delimitation negotiations became pertinent, and the following section introduces the agreements concluded by Lithuania with other States.

Maritime Delimitation Agreements Concluded between Lithuania and Other States

The 1992 Constitution of the Republic of Lithuania declares that: "The Republic of Lithuania shall have the exclusive rights to the airspace over its territory, its continental shelf, and the economic zone in the Baltic Sea" [5], without stipulating further rules concerning maritime zones and their delimitation [6]. In June of the same year, Lithuania adopted the Law on the State Border of the Republic of Lithuania, confirming its 12-nautical mile claim of territorial sea. Subsequent legislation and resolutions have provided its claims of contiguous zone, exclusive economic zone, and continental shelf [7]. Among the official documents, an illustrative map of the maritime boundaries with other States was enclosed with a 2004 resolution by the Lithuania government (Figure 1).

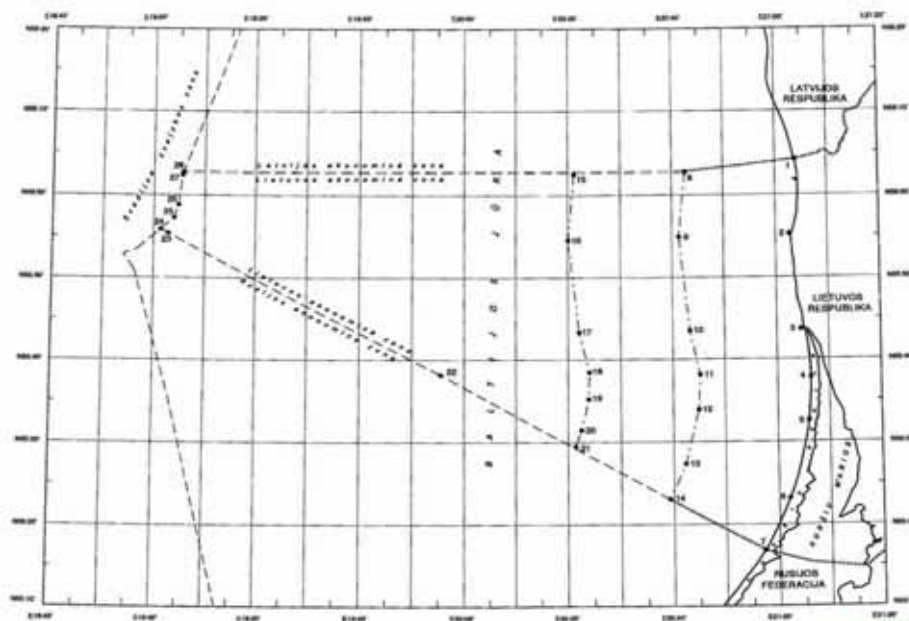


Figure 1/ Illustrative Map of Lithuania's Maritime Boundaries with Other States

Source/ Lithuanian Government (submitted to the United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea database) [8]

According to the information provided by Lithuania to the Division for Ocean Affairs and the Law of the Sea, United Nations Office of Legal Affairs, three delimitation agreements were concluded by Lithuania and other States and entered into force. These agreements all deal with the delimitation of both the exclusive economic zones and the continental shelf. Two are bilateral agreements with Russia and Sweden respectively, and one trilateral agreement with both Russia and Sweden. Practice of States in the region shows that if three States have overlapping maritime claims, States tend to initiate bilateral delimitation negotiations first. After the relevant States concluded bilateral agreements, the three States would then begin negotiations for a tri-point agreement [9]. Lithuania's practice, which is somewhat different, will be explained below.

Lithuania shares a border with Russia's Kaliningrad, and the two States concluded the Treaty between the Republic of Lithuania and the Russian Federation on the Delimitation of the Exclusive

Economic Zone and the Continental Shelf in the Baltic Sea in 1997. An equidistance line was used as a starting point for delimitation. As the two States proposed changes to the line, Russia placed more emphasis on the development of oil field off the coast, and Lithuania sought to keep a corridor to the center of the Baltic Sea. At the end, the first segment of the maritime boundary was close to the Russian approach, while the second segment took into account Lithuania's considerations for a corridor [10]. After the Treaty was signed, sensitive issues between the two States, including Russia's claim over Klaipeda and Lithuania's plan to join the North Atlantic Treaty Organization, brought uncertainties of how Russia's Duma would view the deal [11]. Despite these doubts, the Treaty eventually entered into force after Duma approved the ratification in 2003 [12].

Among the Lithuania's delimitation agreements that are in force, the second one is a tri-point agreement, namely the Agreement between the Government of the Republic of Lithuania, the Government of the Russian Federation and the Government of the Kingdom of Sweden on the Common Point of Boundaries of the Exclusive Economic Zones and Continental shelf in the Baltic Sea. This Agreement was concluded on November 30, 2005, and entered into force in 2011 [13]. Unlike the practice of States in the region described above, before the 2005 Agreement was concluded, there were only two bilateral delimitation agreements in force: the 1988 Soviet-Sweden Agreement and the 1997 Lithuania-Russia Agreement. In other words, Lithuania has not concluded a delimitation agreement with Sweden. From Lithuania's domestic legislation and the abovementioned 2004 resolution, it can be observed that, while these instruments do not make direct reference to the 1988 Soviet-Sweden Agreement, the boundary and points used in that Agreements have in fact been adopted by Lithuania [14]. In the tripoint agreement concluded in 2005, Article 1 explicitly refers to the 1988 Soviet-Sweden Agreement. This echoes the position of Russia and Sweden, who consider that the boundaries established in that Agreement continue in effect after the dissolution of the former Soviet Union. However, this explicit reference proved to be controversial at the domestic level in Lithuania, and the Seimas, Lithuania's parliament ratified the Agreement nearly six years later, allowing the Agreement to enter into force on June 17, 2011 [15].

The next delimitation agreement concluded is the 2014 Agreement between the Government of the Republic of Lithuania and the Government of the Kingdom of Sweden on the Delimitation of the Exclusive Economic Zones and the Continental Shelf in the Baltic Sea. This Agreement essentially builds on the consensus reached in the 1988 Soviet-Sweden Agreement and the 2005 tri-point Agreement. One major difference between this Agreement and the 1988 Agreement relates to fishery activities, which was a point of major contention between the former Soviet Union and Sweden. While the 1988 Agreement delimited the disputed areas, the two States concluded a separate fishery agreement, setting up quota and other rules for fishing activities in those areas. After the dissolution of the former Soviet Union, the fishing arrangements ceased to apply, and fishing activities were not a major concern in the discussions between Lithuania and Sweden.

In addition to the three agreements in force introduced above, Lithuania also concluded another delimitation agreement with Latvia in 1999, the Agreement between the Republic of Latvia and the Republic of Lithuania on the Delimitation of the Territorial Sea, Exclusive Economic Zone and the Continental Shelf in the Baltic Sea. This Agreement is directly related to the dissolution of the former Soviet Union and was sparked by the potential non-living resources in the disputed waters, including oil and natural gas. While Lithuania and Latvia decided on land and maritime boundaries in the 1920s [17], maritime claims at the time were significantly different from what States can now make under the UNCLOS. Delimitation negotiations were thus needed, and the two States concluded the Agreement on July 9, 1999, using an equidistance line as basis and taking into

consideration fishing and other economic activities. Lithuania ratified the Agreement in October of the same year. However, Latvia faced protests by the fishing industry [18], and it also sought to explore oil resources before committing to a delimitation agreement, thus failing to ratify the Agreement until now [19].

Conclusion

A few observations can be made from the Lithuania's delimitation agreements and relevant developments: Firstly, parties of a delimitation negotiation may have different priorities. It is important to have a firm grasp of the party's own goals and agree to compromise in a proper manner, in order to reach an agreement. Secondly, while the negotiation and conclusion of a maritime delimitation agreement involve discussions of delimitation methods, economic activities, resources exploitation, and other typical concerns, the eventual ratification and entry into force of an agreement can often be influenced by external factors. Successful resolution of delimitation disputes requires the meeting of minds on a broad range of issues. Finally, after the conclusion of a delimitation agreement, much effort needs to be made to ensure the ratification, entry into force, and implementation. It is incumbent upon the relevant State to maintain relations which are conducive to peaceful use of maritime spaces and to avoid the continuance or escalation of disputes.

參考資料

- [1] United Nations Treaty Collection, United Nations Convention on the Law of the Sea.
https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21 (Aug. 10, 2022)
- [2] Franckx教授在多篇文章中使用此方式分析 - See, e.g., Erik Franckx, *Maritime Boundaries in the Baltic Sea: Post 1991 Developments*, 28 GA. J. INT'L & COMP. L. 249, 254-5 (2000); Erik Franckx, *Gaps in Baltic Sea Maritime Boundaries*, in REGULATORY GAPS IN BALTIC SEA GOVERNANCE 7, 13-16 (Henrik Ringbom ed., 2018).
- [3] 國家繼承相關討論請見：丘宏達著、陳純一修訂·《現代國際法》·修訂四版·第七章·2021年10月·三民書局·
- [4] See, e.g., Erik Franckx, *Current Legal Developments: Baltic Sea*, 16 INT'L J. MARINE & COSTAL L. 645, 651 (2001).
- [5] The Constitution of the Republic of Lithuania, Article 47.
<https://www.lrs.lt/home/Konstitucija/Constitution.htm> (Aug. 10, 2022)
- [6] Indrė Isokaitė-Valužė, *30 Years of Lithuania's Restored Independence: A Coastal State's Prescriptive Jurisdiction over Inland Waters*, 117 TEISĖ 64, 67 (2020).
- [7] For relevant legislation, see United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, Lithuania.
<https://www.un.org/depts/los/LEGISLATIONANDTREATIES/STATEFILES/LTU.htm> (Aug. 10, 2022)
- [8] United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, Illustrative Map.
https://www.un.org/depts/los/LEGISLATIONANDTREATIES/PDFFILES/MAPS/LTU_MZN57_2006_00III.jpg (Aug. 10, 2022)
- [9] Erik Franckx, *Maritime Delimitation in the Baltic Sea: An Update*, 15 INT'L J. MARINE NAVIGATION & SAFETY OF SEA TRANSP. 885, 887 (2021).
- [10] Erik Franckx, *Treaty between the Republic of Lithuania and the Russian Federation on the Delimitation of the Exclusive Economic Zone and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-18 (1) (Jonathan I. Charney & Robert W. Smith eds., 2002).
- [11] See, e.g., Erik Franckx, *Two More Maritime Boundary Agreements Concluded in the Eastern Baltic Sea in 1997*, 13 INT'L J. MARINE & COSTAL L. 274, 279 (1998).
- [12] *Treaty between the Republic of Lithuania and the Russian Federation on the Delimitation of the Exclusive Economic Zone and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-18 (1&2) (Add. 1) (David A. Colson & Robert W. Smith eds., 2005).
- [13] United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, *supra* note 7.
- [14] Erik Franckx, *Agreement between the Government of the Republic of Lithuania, the Government of the Russian Federation and the Government of the Kingdom of Sweden on the Common Point of Boundaries of the Exclusive Economic Zones and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-23 (Coalter Lathrop ed., 2019).
- [15] *Id.*
- [16] United Nations Office of Legal Affairs, Division for Ocean Affairs and the Law of the Sea, *Agreement between the Government of the Republic of Lithuania and the Government of the Kingdom of Sweden on the Delimitation of the Exclusive Economic Zones and the Continental Shelf in the Baltic Sea*.
<https://www.un.org/depts/los/LEGISLATIONANDTREATIES/PDFFILES/TREATIES/LithuaniaSwedenTreaty.pdf> (Aug. 10, 2022)
- [17] Erik Franckx, *Agreement between the Republic of Latvia and the Republic of Lithuania on the Delimitation of the Territorial Sea, Exclusive Economic Zone and the Continental Shelf in the Baltic Sea*, in INTERNATIONAL MARITIME BOUNDARIES, Report Number 10-20 (Jonathan I. Charney & Robert W. Smith eds., 2002).
- [18] *Id.*
- [19] Lithuania and Latvia Disagree over Maritime Boundary, LIETUVOS NACIONALINIS RADIJAS IR TELEVIZIJA, Apr. 15, 2019.
<https://www.lrt.lt/en/news-in-english/19/1048887/lithuania-and-latvia-disagree-over-maritime-boundary>

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