「環境生物與漁業科學學系研究所第二屆學術交流會」

時間：112 年 5 月 20 日(六)09:00 至 16:10

地點：本校漁學館 103、206、305

111 學年度環境生物與漁業科學學系
研究所研究生論文成果暨進度公開發表時間表

時　間：112 年 5 月 20 日（六）上午場

地　點：漁學館 103 室

時 間	發表人	指導教授	主持人	論文題目
08:30-09:00	繳交簡報 & 測試投影片			
09:00-09:10	師長期勉			
09:10-09:30	李柏霖	廖正信	李依柔 & 吳玲毅	基北地區國小教師對海洋及環保行為之認知（**預口試**）
09:30-09:50	詹能傑	曾煥昇		船舶火災搶救之研究（**進度報告**）
09:50-10:10	陳美辰	廖正信		在地海洋教育課程融入小學教育的現況與發展（**進度報告**）
10:10-10:30	謝品芳	歐慶賢		用 AR2VR 融入海洋教育-以基隆市和平島為例（**進度報告**）
10:30-10:40	綜合討論/休息			
10:40-11:00	吳玲毅	王佳惠	李依柔 & 吳玲毅	生態標章之漁業管理：水產品和消費者屬性分析（**博士班**）
11:00-11:20	鄭資穎	呂昱姮		台灣消費者對日本水產品之消費偏好研究-以帆立貝為例（**進度報告**）
11:20-11:40	呂俞男	曾煥昇		岸際水域意外搶救之研究-以基隆地區為例（**進度報告**）
11:40-12:00	歐陽儀	呂學榮		漁家婦女投入與漁村永續發展之研究（**進度報告**）
12:00-13:30	綜合討論暨餐敘交流			

請<u>全程參與</u>該場次的老師及同學，幫忙填寫<u>評分表</u>：

※每人限填一次。

111 學年度環境生物與漁業科學學系
研究所研究生論文成果暨進度公開發表時間表

時 間：112 年 5 月 20 日（六）下午場

地 點：漁學館 103 室

時 間	發表人	指導教授	主持人	論文題目
12:00-13:30	綜合討論暨餐敘交流			
13:30-13:50	賴孚特	歐慶賢	蕭文庭 & 林祈泓	臺灣海洋空間規劃下離岸風電商之調適（**博士班**）
13:50-14:10	蘇禹禔	曾煥昇		台灣海洋保育政策發展之研究（**進度報告**）
14:10-14:30	陳義典	呂昱姮		漁電共生產業經濟分析-以白蝦養殖為例（**進度報告**）
14:30-14:50	林祈泓	曾煥昇		歐美日韓與我國之廢棄漁具管理政策與法規分析（**預口試**）
14:50-15:10	綜合討論/休息			
15:10-15:30	周佳璇	李明安	蕭文庭 & 林祈泓	國小教師對於海洋永續發展的認知差異與融入課程教學意願-以基隆市及雙北市小學為例（**預口試**）
15:30-15:50	劉本莉	廖正信		臺灣媒體對海洋議題報導內容之演變（**預口試**）
15:50-16:10	蕭文庭	曾煥昇		兩岸海洋與漁業政策發展對臺灣海峽漁權衝突之研究（**預口試**）
16:10~	綜合討論暨閉幕			

111 學年度環境生物與漁業科學學系
研究所研究生論文成果暨進度公開發表時間表

時　間：112 年 5 月 20 日（六）上午場

地　點：漁學館 206 室

時 間	發表人	指導教授	主持人	論文題目
08:30-09:00	繳交簡報 & 測試投影片			
09:00-09:10	師長期勉			
09:10-09:30	王偉	廖正信	伍晟禮 & 蕾亞拉	臺灣西南海域中國槍鎖管生殖生物學與潛在產卵場之研究（**預口試**）
09:30-09:50	廖翊君	莊守正		利用脊椎骨穩定性同位素分析探討臺灣東北部海域鼬鮫(*Galeocerdo cuvier*)的棲地利用與和攝食生態（**預口試**）
09:50-10:10	蕭民煌	王佳惠		利用碳氮穩定同位素探討臺灣淺灘中國槍魷(*Uroteuthis chinensis*)及貝瑞氏四盤耳烏賊(*Euprymna berryi*)之營養特徵（**進度報告**）
10:10-10:30	陳進盛	莊守正		西北太平洋長臂灰鯖鮫之年齡與成長研究（**進度報告**）
10:30-10:40	綜合討論/休息			
10:40-11:00	李閔萱	莊守正	伍晟禮 & 蕾亞拉	臺灣西南部海域梭氏蜥鮫之攝食生態學研究（**預口試**）
11:00-11:20	蘇正晨	鄭學淵		雙齒圍沙蠶(*Perinereis aibuhitensis*)作為塑膠微粒指標生物之可行性研究（**進度報告**）
11:20-11:40	廖怡媗	莊守正		臺灣西南部海域梭氏蜥鮫之生殖生物學研究（**預口試**）
11:40-12:00	伍晟禮	莊守正		印度西太平洋中部燈籠鯊屬系統分類學研究（**博士班**）
12:00-13:30	綜合討論暨餐敘交流			

請<u>全程參與</u>該場次的老師及同學，幫忙填寫<u>評分表</u>：

※每人限填一次。

111 學年度環境生物與漁業科學學系
研究所研究生論文成果暨進度公開發表時間表

時 間：112 年 5 月 20 日（六）下午場

地 點：漁學館 206 室

時 間	發表人	指導教授	主持人	論文題目
12:00-13:30	綜合討論暨餐敘交流			
13:30-13:50	黃郁心	李明安/王怡甄	粘育苓 & 伊菈	透過拖網資料建立澎湖周邊海域魚類晚春及冬季之營養階層結構及攝食生態（**預口試**）
13:50-14:10	胡瑞瑾	莊守正		台灣東岸沿近海漁業與鯨豚互動的調查及可行忌避措施建議（**預口試**）
14:10-14:30	莎薇	李明安		Dietary and feeding habit of Silver croaker (*Pennahia argentata*)（**進度報告**）
14:30-14:50	尤彥凱	莊守正		台灣沿近海延繩釣漁業忌避措施之成果效益研究（**預口試**）
14:50-15:10	綜合討論/休息			
15:10-15:30	高彣和	藍國瑋	粘育苓 & 伊菈	臺灣沿近海遠海梭子蟹漁業概況暨籠具逃脫環選擇性之研究（**預口試**）
15:30-15:50	黃玟毓	莊守正		台灣西南部海域梭氏蜥鮫之年齡與成長研究（**預口試**）
15:50-16:10	蘇子翔	鄭學淵		無機砷對淡水長臂大蝦(*Macrobrachium rosenbergii*)組織蓄積及金屬硫蛋白影響（**進度報告**）
16:10~	綜合討論暨閉幕			

111 學年度環境生物與漁業科學學系
研究所研究生論文成果暨進度公開發表時間表

時　間：112 年 5 月 20 日（六）上午場

地　點：漁學館 305 室

時 間	發表人	指導教授	主持人	論文題目
08:30-09:00	繳交簡報 & 測試投影片			
09:00-09:10	師長期勉			
09:10-09:30	楊雨溱	藍國瑋	蕭博元 & 許雯淇	利用 IPCC AR6 情境模式分析氣候變遷對臺灣沿近海尾槍魷屬棲地脆弱度之影響（**預口試**）
09:30-09:50	姜凱淇	蘇楠傑		利用水下聲學探討離岸風場魚群活動與風機聚魚效果（**進度報告**）
09:50-10:10	阮則毅	廖正信		臺灣北部沿近海拖網漁業活動之研究（**進度報告**）
10:10-10:30	林品妤	呂學榮		臺灣東北部海域鯖魚棲地經驗模型之建構（**預口試**）
10:30-10:40	綜合討論/休息			
10:40-11:00	吳昀庭	藍國瑋	蕭博元 & 許雯淇	拖網漁業台灣海峽對棲地跟生物多樣性脆弱度模式建置之研究（**進度報告**）
11:00-11:20	邵子軒	鄭學淵		臺灣北海岸珠螺（*Lunella coronata*）分布熱點之環境因子分析（**進度報告**）
11:20-11:40	梁婷淯	藍國瑋		印度洋熱帶性鮪類豐度與餌料生物群聚特性受氣候變動影響之研究（**預口試**）
11:40-12:00	戴維明	廖正信		臺灣沿近海以鎖管為標的之拖網漁業活動特性（**進度報告**）
12:00-13:30	綜合討論暨餐敘交流			

請<u>全程參與</u>該場次的老師及同學，幫忙填寫<u>評分表</u>：

※每人限填一次。

111 學年度環境生物與漁業科學學系

研究所研究生論文成果暨進度公開發表時間表

時 間：112 年 5 月 20 日（六）下午場

地 點：漁學館 305 室

時 間	發表人	指導教授	主持人	論文題目
12:00-13:30	綜合討論暨餐敘交流			
13:30-13:50	李椏涵	蘇楠傑	鄧勝元 & 林治瑜	臺灣西部家計型漁業碳排估算模式（**預口試**）
13:50-14:10	馬拉加	李明安		Satellite Derived Sea Surface Temperature Observations in the Taiwan Bank Upwelling Area（**進度報告**）
14:10-14:30	張雅淳	廖正信		臺灣東北海域中小型拖網漁業資源結構之分析（**進度報告**）
14:30-14:50	周芷萱	廖正信		苗栗離岸風場開發對漁業活動之影響研究（**預口試**）
14:50-15:10	綜合討論/休息			
15:10-15:30	邱逸恬	藍國瑋	鄧勝元 & 林治瑜	利用氣候變遷情境模式分析臺灣沿近海鏽斑蟳捕獲率與分布變動之影響（**進度報告**）
15:30-15:50	邱思惟	鄭學淵		台灣北部沿岸浮游生物生產力之推估（**進度報告**）
15:50~	綜合討論暨閉幕			

注意事項：

1. 上午場及下午場的口頭報告者請統一於上午 08:30-09:00，至教室上傳簡報檔，並進行測試。
2. 每人論文發表時間為 20 分鐘(報告時間 15 分鐘，討論 5 分鐘)，其中 15 分鐘響鈴一次，20 分鐘時按鈴二次，應立即結束報告，避免拖延論文發表之議程。
3. 請自行指派同學計時，俾利時間控制。
4. **依據本系 101 年 3 月 30 日召開 100 學年第 2 學期第 2 次系務會議決議，當天排定之各場次發表學生，應在該場次全程參與發表會，以瞭解同儕間之研究成果及進度。**

103 教室

基北地區國小教師對海洋及環保行為的認知

李柏霖[1]、廖正信[1]

[1]國立臺灣海洋大學環境生物與漁業科學學系

摘 要

本研究旨在了解國小教師對於海洋的認識與海洋環境保護的行為，本研究利用問卷，以現職國小教師為對象進行調查。利用統計方法分析歸納，探討國小教師對於海洋環境的認識。

數據研究指出，每年約有 800 萬噸的塑膠垃圾流入海洋，嚴重影響海洋生態系統，也威脅著各種生物的生存，塑膠產生的物品有著便利、耐用、便宜的特性，與大家日常生活息息相關，因為非常普及好用，但不能在環境中自然分解，造成全球環境的負擔與損害。

本論文以研究塑膠垃圾影響海洋環境為中心，探究國小教師對海洋的認知做行為探究，瞭解一般人對塑膠垃圾對日常生活的影響，進而延伸到海洋環境汙染的議題，藉由研析文獻與問卷調查，希望喚起一般人對環保意識的覺醒，降低塑膠垃圾對海洋環境的嚴重危害，保護海洋環境得以永續發展。

海洋對於氣候調節、水資源循環及生態系統的運作，都發揮了重要的功能，同時海洋在支持海、陸和人類的永續發展中扮演關鍵角色。

關鍵詞：國小教師、海洋知識、海洋汙染、環保行為

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Teachers' knowledge, attitude and behaviors of marine environment protection in elementary school of Keelung city and New Taipei city.

Bo-Lin Li[1], Zeng-Xin Liao[1]

[1]Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University

Abstract

This research aimed to explore the status of the elementary school teachers' knowledge attitudes and behaviors toward the marine environmental protection. The questionnaire survey was used and took stratified random samples from primary school teachers in Keelung City and New Taipei City.

Research indicates that almost 800 tons garbage through into the ocean every year. This influences severely to marine biology system and threat the survival of marine creatures. Plastic products are convenient, durable, cheap and relevent to our life. But the plastic couldn't decompose naturally in the environment, it cause the burden and damage to the global.

This research aimed to plastic garbage has influence in marine environment. It explore the status of the primary school teachers' knowledge attitudes and behaviors toward the marine environmental protection. Realizing the plastic garbage how to impact our life and extend to the issue of marine protection. Hope to arouse people' awareness of environment protection and reduce the plastic garbage damage to marine. Protecting marine is sustainable development.

Marine has the important function of adjusting climate, recycling water and biology system. At the same time, it plays a key role in supporting land and the human's sustainable development.

Keywords: elementary school teacher, marine knowledge, marine pollution, environmental protection.

船舶火災搶救之研究

詹能傑[1]

[1]國立臺灣海洋大學環境生物與漁業科學學系

摘 要

船舶在船舶法、海商法、國際海上避碰規則等法律之中，各有其定義，一般解釋為能搭載人員或貨物於水面或水中航行。因此，船舶具有浮性、穩性、抗沉性、快速性、耐波性及操縱性等六大特點。

台灣漁船依據重量可分為 CT0 至 CT8 共 9 個等級，再依據捕魚方法、裝備及捕獵對象的不同，又可以分為圍網漁船、拖網漁船、刺網漁船、魷釣漁船、鈲釣漁船.....等等。其船上所裝設的儀器昂貴，是每位船東重要的資產，若有損壞必定造成重大的損失。各項設備需要用到大量電力，使用大量電力之時，會造成大量熱源，又當各項設備逐漸老舊或疏於保養，火災的發生便無法避免，故搶救之對策就十分重要。

船舶火災被公認為最恐怖的海難，其原因船舶火災內部容易充滿高溫及濃煙，內部區劃複雜，火點不易確認，無相對可避難之處。又裝載大量的船舶用油，火載量極大。故在所有火災之中，船舶火災對生命財產的威脅應屬最大。特別是一般人不易進入底層船艙，其搶救難度遠高於一般建築物。為保障消防人員搶救安全，保護及減少漁民財產損失，對於船舶上的滅火系統、構造、船艙分布、通風管路圖等應有相當了解，才能在船舶火災時，知道如何搶救。

關鍵詞：船舶火災、船舶搶救、搶救對策

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Research on Ship Fire Rescue

Neng-Chieh Chan[1]

[1]Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University

Abstract

Ships have their own definitions in laws such as The Law of Ships, Maritime Law, and International Regulations for Preventing Collisions at Sea. It is generally interpreted as the ability to carry people or goods to sail on the water or in the water. Therefore, the ship has buoyancy, stability, Six characteristics of anti-sinking, rapidity, seakeeping and maneuverability.

Taiwanese fishing boats can be divided into 9 grades from CT0 to CT8 according to weight, and then according to fishing methods and equipment. According to different hunting objects, it can be divided into seine fishing boats, trawler fishing boats, gillnet fishing boats, squid fishing boats, Europium fishing boats...etc. The equipment installed on the ship is expensive and is an important asset for every ship owner. If there is damage must cause great loss. Various devices require a lot of power. When using a lot of power, it will cause a large number of heat sources, and when the equipment is gradually old or neglected, the occurrence of fires cannot be avoided, so rescue measures are very important.

Ship fire is recognized as the most terrifying shipwreck, the reason is that the interior of ship fire is easily filled with high temperature and dense smoke, the internal division is complicated, the fire point is not easy to confirm, and there is no relative refuge. And loaded with a large number of ships oil, high fire load. Therefore, among all fires, ship fires pose the greatest threat to life and property. Especially ordinary people are not easy to enter the bottom cabin, and its rescue difficulty is much higher than that of general buildings. To protect fire protection personnel rescue safety, protection and reduction of fisherman's property loss, fire extinguishing system, structure, ship in order to know how to rescue a ship in case of fire, it is necessary to have a good understanding of the cabin distribution and ventilation pipeline diagram.

Keywords: ship fire, ship rescue, rescue countermeasures

在地海洋教育課程融入小學教育的現況與發展

陳美辰[1]、廖正信[1]

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摘 要

海洋是地球生命支持系統重要的一環，除孕育多種多樣的海洋生物外，亦 具有調節氣候、提供能源、糧食及休閒娛樂等多樣化的功能，人類經濟活動高 度依賴海洋，但長期以來的開發與利用也影響了海洋的健康與完整。臺灣四面 環海，對海洋的依賴應無庸置疑，所以瞭解海洋、保護海洋是臺灣永續發展重 要的議題，因此教育海洋相關知識與培養海洋素養至關重要。 我國雖於 2008 年推動海洋教育，但根據教育部於 2017 年指出，我國教育 政策著重陸權思維，海洋教育問題包括教育現場缺乏海洋教育相關教材，導致 我 K-12 年級學生對海洋的認知及體驗不足，且對海洋缺乏認同和保護的意識， 其原因可能是相關主副科目教學極少融入海洋意識之內容。 海洋教育應從小扎根，國小階段教師為將海洋教育融入課程的關鍵角色， 因此本研究擬透過網路問卷調查臺灣基隆市、新北市及台北市公立小學教育階 段教師實踐海洋教育之現況，希望能透過本研究了解目前國小教師面臨之問題 與需求，進而推廣海洋科學教育普及。

關鍵詞：海洋素養、海洋科學教育、學校學生、正式教育、教師、調查

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The current situation and development of marine education curriculum integrated into primary education in Taiwan

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Abstract

The ocean is an important support system for the Earth's life. In addition to nurturing a variety of marine organisms, it also has diverse functions such as regulating climate, providing energy, food and entertainment. Human economic activities are highly dependent on the ocean, but long-term development and use have also affected the health and integrity of the ocean. Taiwan is surrounded by the ocean, so people are highly dependent on marine resources. Therefore, understanding and protecting the ocean are important issues for Taiwan's sustainable development. Therefore, educating people about marine-related knowledge and cultivating marine literacy are crucially important.

Although our country promoted marine education in 2008, according to the Ministry of Education's statement in 2017, our country's education policy focuses on land-based thinking. The problems with marine education include a lack of relevant teaching materials for educational sites, which leads to insufficient understanding of the ocean among K-12 students and a lack of awareness, protection and experience for the ocean. The reason may be that related subjects rarely incorporate content related to marine consciousness."

Marine education should be rooted from an early age. Elementary school teachers play a key role in integrating marine education into the curriculum, so this study intends to investigate the current status of Marine education among elementary school teachers from public schools in Keelung City, New Taipei City, and Taipei City through online questionnaires. It is trying to clarify not only the problems and needs of primary school teachers but also promote the popularization of marine education.

Keywords: ocean literacy, marine science education, school students, formal education, teachers, survey

用 AR2VR 融入海洋教育-以基隆市和平島為例

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摘 要

二○一九年末嚴重特殊傳染性肺炎(COVID-19)疫情影響至今,已劃分為前 AI 人工智慧(artificial intelligence)時代與後 AI 時代,教育知識與具備之轉型素養須重新檢視。本研究以二○二三年之和平島地區為藍本,探討海洋教育融入當地國小中高年級科技領域教學之實施與成效。

傳統教學重視知識本身,本研究透過擴增實境(Augmented Reality,簡稱 AR)與虛擬實境(Virtual reality,縮寫 VR),由學童製作當地環境生態 AR2VR 之過程,將知識本身延伸至生活體驗,並於情境脈絡中模擬;「海洋」與「社區」即是在地國小學習的場域,以海洋休閒、海洋社會、海洋文化、海洋科學技術及海洋資源永續為五大主題軸。

本研究採「行動、觀察、省思、修正」循環之行動研究方式,以質性研究「深度訪談法」,研究者以礦工(miner)及旅者(traveler)的模式,建立有目的性的互動談話,前者模式假設研究對象具有豐富知識,如寶貴礦產加以挖掘。後者模式,如旅者走進當地,與居民攀談對話,一同漫步其中並進行提問,引導研究對象訴說生活故事,形成新知識。

訪談內容採用半結構訪談方式。研究對象為研究團隊教師、當地居民及學童,資料以會議記錄、觀察記錄、訪談錄音及學童探索心得學習單為主,輔以問卷進行交叉分析、檢核。本研究發現在地環境數位遊戲化之成就感、社交互動感、沉浸感可堆疊學童海洋教育素養,觸發家鄉情感與維護家鄉環境之使命感。

關鍵詞:擴增實境、虛擬實境、海洋教育、轉型素養

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Integrating AR2VR into Marine Education - A Case Study of Heping Island in Keelung City.

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Abstract

Since the outbreak of COVID-19 at the end of 2019, it has been divided into the pre-AI (artificial intelligence) era and post-AI era. The transformational skills required for education and knowledge need to be re-examined. This study takes the Heping Island area in 2023 as a blueprint to explore the implementation and effectiveness of integrating marine education into technology teaching for elementary and junior high school students.

Traditional teaching focuses on knowledge itself. This study uses augmented reality (AR) and virtual reality (VR) to extend knowledge beyond learning by experience through children's production of local ecological AR2VR processes, simulating them in contextual scenarios. "Marine" and "community" are two fields where primary schools can learn about marine leisure, society, culture, science & technology, as well as sustainable use of marine resources.

This research adopts an action research method with a cycle of "action observation-reflection-revision." Qualitative research is conducted using in-depth interviews based on models such as miners or travelers who establish purposeful interactions with subjects assuming that they have rich knowledge like valuable minerals waiting to be excavated or walking around talking with locals asking questions while exploring their life stories leading to new insights.

Semi-structured interviews were used for data collection from teachers, local residents, and students involved in this project. Data sources include meeting records, observation notes, interview recordings along with student exploration experiences learning sheets supplemented by questionnaires for cross-analysis verification.

The findings show that digital gamification of local environments can stack up student's sense of achievement, social interaction feeling & immersion sensation towards enhancing their marine educational literacy which triggers emotional attachment towards hometowns & mission awareness regarding environmental protection.

Keywords: Augmented Reality, Virtual Reality, marine education, Transformational Competencies.

生態標章之漁業管理：水產品和消費者屬性分析

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摘 要

生態標章計畫是以市場為導向之漁業管理方式，藉由消費者的選購力，引起生產者轉而實施生態永續的生產方式。本研究為瞭解水產品及消費者之特徵屬性與生態標章之關係，以提供制定生態標章相關措施之綜合建議。研究透過多變量統計分析，評估臺灣海鮮選擇指南中所列之分級，與魚類物種 6 個屬性(最大體長、成熟體長、成熟年齡、成長係數、營養階層及平均單價)之關係。並進行消費者問卷調查，以敘述統計方式探察臺灣消費者之認知態度、知識概念及社會經濟背景等屬性對生態標章的影響。最後進一步應用選擇試驗法，評估臺灣消費者對於生態標章多重屬性之偏好及其願付價格。綜上，期能對生態標章評估標準及推廣策略提供綜合建議。

關鍵詞：生態標章、永續漁業、消費者屬性、生活史參數。

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Eco-labelling in fisheries management: Attributes analysis of seafood and consumer

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Abstract

Eco-labelling is a fisheries management approach with a market-based incentive that creates market-pull by consumers' selective purchasing power, which encourages producers to adopt sustainable fishing practices. This study analysis attributes of the impact of seafood and consumer with eco-labelling program to provide a reference for the future development of eco-labelling schemes. Six attributes (maximum length, length at maturity, age at maturity, growth coefficient, trophic level and unit price) of 35 marine fishes in the waters around Taiwan were examined through multivariate statistical analysis and compared against the Seafood Guide Taiwan 2021. The online survey and analysis will be conducted on Taiwanese consumers. Descriptive statistics will be used to examine the variations in Taiwanese consumers' perceptions of eco-labels, as well as their attitudes, knowledge ideas, socioeconomic backgrounds. The choices experiment method was used to estimate Taiwanese consumers' preference for different eco-label multiple attributes and their willingness to pay, to contribute to eco-labelling scheme development.

Keywords: eco-labelling; sustainable fisheries; consumer’s attributes; life-history traits.

台灣消費者對日本水產品之偏好研究– 以帆立貝為例

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摘 要

台灣水產品的糧食自給率相當充足，但進口水產品量值卻逐年攀升。其中，自日本進口的帆立貝進口量雖不高，但其進口產值卻能使日本成為台灣前三名的進口國。由於缺乏水產品相關的消費者偏好分析，加上已十餘年未有政府機構所主導的水產品消費分析調查與研究計畫。故本研究預計針對台灣消費者的行為意識進行調查，目的是找出其願意購買高單價水產品的因素，並使用有序邏輯模型(Ordered logit model, OLM)分析這些消費者的特質。

本研究在疫情尚未緩和的情況下，為維持樣本多樣性，預計採用線上問卷的方式，針對台灣地區，發放 1,000 份調查問卷，並希冀在後續研究中，透過結合相關資訊，可以提供對於消費者飲食習慣趨勢的預測，或提升未來水產品附加價值的參考。

關鍵詞：消費者偏好、日本水產品、日本帆立貝、OLM。

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Consumer Preferences for Japanese Seafood in Taiwan: A Case Study of Scallops

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Abstract

The food self-sufficiency rate in Taiwan is maintained at an adequate level; however, both import volume and import value have been increasing yearly. Among all imported aquatic products, scallops are one of the high-priced seafood items. This means that although the import volume of scallops is not high, the import value can make the importing country rank among the top three in Taiwan's import value. Even though there have been relevant studies on imported agricultural products from Japan, there is a lack of consumer preference analysis related to aquatic products. Additionally, the survey of aquatic product consumption analysis led by government agencies was planned more than ten years ago, and there is no ongoing survey at present. Therefore, this research aims to investigate the consumption behavior and awareness of Taiwanese consumers towards high unit price aquatic products and find out the factors that motivate consumers to buy them. The ordered logic model (OLM) will be used to analyze these traits of consumers.

To maintain sample diversity during the ongoing COVID-19 pandemic, this study plans to use online questionnaires to distribute 1,000 questionnaires for Taiwan, with the expectation that the collected data will be closer to the actual consumption of Taiwanese consumers. In future research, combining historical records and economic growth-related information can be used to predict the trend of consumers' eating habits in the aquaculture industry. This can assist local fishermen in their fishery operations and provide a way to increase the added value of aquatic products in the future.

Keywords: consumer preference, Japanese seafood, the Scallops, OLM.

岸際水域意外搶救之研究-以基隆地區為例

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摘 要

自 2012 年至 2022 年，基隆市平均每年有 30 起以上的溺水事件發生。其中，大部分事件都發生在夏季和秋季，各縣市消防機關於每年 5 至 10 月期間加強防溺重點勤務。針對基隆市的溺水事件，消防局已經採取了多項措施防備，包括加強海上巡邏和搜救力量，提高公眾對水域安全的意識和教育，平時需提升救災人員水域救援技術以及配備更先進的海上救援設備等。這些措施有助於減少基隆市的溺水事件數量，同時也提高了當地公眾的海上安全意識。本研究採用「半結構訪談」及「無結構訪談」的深度訪談方式，透過相關文獻探討、案例探討及比較分析法，凝聚專家共識，歸納分析影響之因素指標，並將這些因素建立起層級架構。有效提升水域救援能力，並加以彙整及分析。研究結果可以了解水域活動意外搶救執行面重要性及需要性，本研究結果得知，「水域搶救裝備及訓練」、「提升水域搶救系統構面」及「強化水域搶救效能構面」重要性。在民眾基礎知識方面應加強防溺宣導相關知識，消防機關應訂定計畫整合「民間救災團體」來提升救災品質。期許政府能重視水域救援，並增編消防裝備採購預算案，配合購置救援裝備及提升救災能力，來保障市民及救災人員。此研究結果可供給基隆市政府及消防機關作為日後辦理防溺與水域搶救執行能力資訊內容之參考依據，讓民眾普遍了解水域安全的重要性，降低水域意外事故發生。

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Research on Coastal Waters Emergency Rescue - A Case Study of Keelung Area

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Abstract

From 2012 to 2022, there were an average of more than 30 drowning incidents per year in Keelung City. Most of these incidents occurred during the summer and autumn seasons. Fire departments in various counties and cities strengthen their focus on preventing drowning from May to October each year. Regarding the drowning incidents in Keelung City, the Fire Department has taken multiple measures to prevent them, including strengthening sea patrols and search and rescue capabilities, raising public awareness and education on water safety, improving disaster relief personnel's water rescue techniques during normal times, and equipping more advanced sea rescue equipment. These measures help reduce the number of drowning incidents in Keelung City while also increasing local public awareness of maritime safety.

This study adopts the method of "semi-structured interviews" and "unstructured interviews" for in-depth interviews. Through relevant literature review, case studies, and comparative analysis methods, expert consensus is gathered to summarize and analyze the indicators of influencing factors, and these factors are established into a hierarchical structure. The effective improvement of water rescue capabilities is then consolidated and analyzed.

The research results can help us understand the importance and necessity of executing water rescue operations in aquatic activities. The study found that "water rescue equipment and training," "enhancing the structure of water rescue systems," and "strengthening the effectiveness of water rescue" are important. In terms of public knowledge, drowning prevention education should be strengthened, and fire departments should develop plans to integrate "civilian disaster relief groups" to improve the quality of disaster relief. We hope that the government will pay attention to water rescues, increase budgets for purchasing firefighting equipment, purchase rescue equipment, and enhance disaster response capabilities to protect citizens and rescuers. This research result can serve as a reference for Keelung City Government and fire departments in organizing drowning prevention and water rescue information content in the future so that people can understand the importance of aquatic safety better while reducing accidental incidents.

Keywords: Water Accident, Drowning, Disaster relief, aerial drones, training, drowning prevention education.

漁家婦女投入與漁村永續發展之研究

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摘 要

在全球氣候變遷加劇下，海洋資源急遽萎縮，繼而影響傳統漁業產業，未來該產業面臨之衝擊，顯而易見。近年，政府積極推動漁業多元發展，結合漁村在地地理特色、人文教育等面向，推動永續發展之目標。其中漁家婦女推動漁村發展，扮演著不可或缺的重要角色，是漁村社區的基礎和支柱，更是漁村社區的動力及發展的關鍵因素，然而卻往往受限於傳統習俗、教育技能或性別歧視等諸多問題，進而導致漁村發展穩定性低且脆弱性高。為探討漁家婦女對漁村發展之影響，本研究採問卷調查法及透過開放性問答，請受試者提供寶貴意見，瞭解漁家婦女投入漁村永續發展各面向之變數，期引起重視漁家婦女之潛在重要性，並將分析結果應用於建構未來漁村永續發展之參考依據。

關鍵詞：永續發展、漁村婦女

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A Study on the Involvement of Fishermen's Wives in Sustainable Development of Fishing Villages

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Abstract

Under the intensification of global climate change, marine resources are shrinking rapidly, which in turn affects the traditional fishery industry. The impact this industry will face in the future is obvious. In recent years, the government has actively promoted the diversified development of the fishery industry, combining the local geographical characteristics of fishing villages, humanistic education and other aspects to promote the goal of sustainable development. Among them, fishermen's women play an indispensable and important role in promoting the development of fishing villages. They are the foundation and pillar of fishing village communities, and they are also the key factors in the motivation and development of fishing village communities. However, they are often limited by traditional customs, educational skills or gender discrimination. And many other problems, which in turn lead to low development stability and high vulnerability of fishing villages. In order to explore the impact of fishermen's women on the development of fishing villages, this study adopts the questionnaire survey method and through open questions and answers, asking the subjects to provide valuable opinions and understand the variables of fishermen's women's participation in various aspects of sustainable development of fishing villages, hoping to draw attention to the potential of fishermen's women importance, and apply the analysis results to construct a reference basis for the sustainable development of fishing villages in the future.

Keywords: Sustainable development, fishing village women

臺灣海洋空間規劃下離岸風電商之調適

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摘 要

本文係針對臺灣無海洋空間規劃下離岸風電場域之調適研究，就相關資料彙整分析、意見蒐集、推動策略、以及相關建議等，供海洋委員會與國家海洋研究院參考。本文發現為解決海域多目標使用之間可能產生衝突，「海洋空間規劃」當為國家重大事務，此已獲得歐盟、中國、美英和其他國家之認同與支持，並制定相關法律。尤其，離岸風電在海洋空間規劃應基於生態系統為基礎，尊重海洋屬性，並納入權益關係者參與規劃，是離岸風電規劃管理之基礎。我國現行法制規範不足，制定《海域管理法》或《海洋空間規劃與管理法》，以因應海域快速且大規模開發離岸風電所需，以及均衡協調海域發展秩序，應為當務之急。未來應加速立法和建立完善海洋空間計畫體系。本文研究內容包含如下：(一)研析我國海域管理法基本架構與核心內容；(二)研提海洋空間規劃應具備之原則、基本架構與核心內容；(三)蒐集分析與洋空間規劃下離岸風電場域管理相關之權責機關與調適等專家學者之意見，藉以廣泛收集建言；(四)研提臺灣無海洋空間規劃下離岸風電商如何調適內容與策略；(五)其他針對未來相關洋空間規劃下離岸風電場之制度研究之建議。

關鍵詞: 海域管理法；海洋空間規劃；離岸風電；調適；權益關係者

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Adaptation of Offshore Wind Power under Taiwan's Ocean Space Planning

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Abstract

This article is aimed at the adjustment research of offshore wind power field under Taiwan's non-ocean space planning. It collects and analyzes relevant data, collects opinions, promotion strategies, and related suggestions, etc., for the reference of the Oceanic Commission and the National Institute of Oceanography. This paper found that in order to solve the possible conflicts between the use of multiple targets in the sea area, "Marine spatial planning" should be a major national event, This has been recognized and supported by the European Union, China, the United States, the United Kingdom and other countries. And enact relevant laws. In particular, offshore wind power planning in marine space should be based on ecosystems, Respect the attributes of the ocean and incorporate stakeholders into the planning, It is the foundation of offshore wind power planning and management.my country's current legal system is insufficient, and the "Sea Area Management Law" or "Marine Space Planning and Management Law" has been formulated. In response to the rapid and large-scale development of offshore wind power in sea areas, as well as balancing and coordinating the development order of sea areas, it should be a top priority. In the future, we should speed up legislation and establish a sound marine space planning system.

The research content of this paper includes the following: (1) Research and analysis of the basic structure and core content of my country's coastal management law; Opinions of experts and scholars related to the management of offshore wind power fields and adjustments, so as to widely collect suggestions; (4) to study how to adjust the content and strategies of offshore wind power companies under the absence of marine space planning in Taiwan; (5) other targets Suggestions for institutional research on offshore wind farms under the relevant ocean space planning in the future.

Keywords**:** Sea Area Management Act; Marine Spatial Planning; Offshore Wind Power; Adaptation Stakeholder

台灣海洋保育政策發展之研究

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摘 要

臺灣鄰近的海域原本擁有豐富的生物多樣性，光是魚類就高達 3,000 多種，佔全球十分之一；全球 7 種的海龜品種，有 5 種會在臺灣出沒；珊瑚種類豐富，多達超過 700 種，是全球約三分之一，但是在長期的漁業消耗、開發、污染等破壞之下，臺灣的海洋健康已經大不如前。過去數十年間，過度捕撈導致 20 種魚類的漁獲量銳減，比起 80 年代已減少超過 90%，更有近一半至三分之二的常見物種變得稀少。

目前台灣海洋保育規定分散於各法規，如《野生動物保育法》、《漁業法》等，但都沒有本於生態系統的保護政策。《海洋保育法草案》肩負整合整體海洋保育目標，法案通過將可以建立海洋保育工作協調機制，促進永續的海洋未來。本研究將透過分析海洋保育制度完整國家之政策，及國際上海洋保育未來目標，提出台灣海洋保育政策之不足及策進方法，期以提供未來台灣海洋保育政策參考。

關鍵詞:海洋保育、海洋保育法草案、海洋保育政策

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Research on the Development of Marine Conservation Policy in Taiwan

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Abstract

The waters adjacent to Taiwan originally had rich biodiversity. There are more than 3,000 species of fish alone, accounting for one-tenth of the world; 5 of the 7 species of sea turtles in the world can be found in Taiwan; there are more than 700 species of coral species, about one-third of the world's total. However, under the long-term destruction of fishery consumption, development, and pollution, Taiwan's ocean health has deteriorated significantly. In the past few decades, overfishing has caused the catch of 20 fish species to drop sharply, which has decreased by more than 90% since the 1980s, and nearly half to two-thirds of common species have become scarce.

At present, Taiwan's marine conservation regulations are scattered in various laws and regulations, such as the " Wildlife Conservation Act ", " Fisheries Act ", etc., but there is no protection policy based on the ecosystem. The Draft Marine Conservation Law is responsible for integrating the overall goals of marine conservation. The passage of the bill will establish a coordination mechanism for marine conservation to promote a sustainable ocean future. This study will analyze the policies of countries with a complete marine conservation system and the future goals of marine conservation in the world, and propose the shortcomings of Taiwan's marine conservation policies and ways to promote them. To provide reference for Taiwan's marine conservation policies in the future.

Keywords**:** Marine Conservation, The draft of Marine Conservation Law, Marine Conservation Policy

漁電共生產業經濟分析-以白蝦養殖為例

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摘 要

南美白對蝦（*Litopenaeus vannamei*）為台灣重要養殖經濟物種，近年來極端天氣頻繁，養殖生物受到外在環境影響，易爆發疾病死亡，目前國內白蝦生產量不足供應所需，2020 年國內生產量僅達需求量 25%，因此需提高白蝦養殖收獲量以補足市場缺口。

目前能源局推廣「養殖為本，綠電加值」，屋頂型的太陽能光電設施結合養殖的共構模式，不僅提高土地利用價值，亦可降低白蝦養殖風險，且能有效隔絕外在環境對養殖生物的影響，保持生物安全及防疫優點，進而提升養殖經濟效益。

本研究針對漁電共生白蝦養殖收集生物性變數、生產成本類群及獲利變數類群，收集多個太陽能共構養殖場資料進行分析，期以提供未來太陽能共構白蝦養殖之參考依據。

關鍵詞：漁電共生、白蝦養殖

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Industrial Economic Analysis For The Aquavoltaics - Take *Litopenaeus vannamei* Farming as an Example

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Abstract

Litopenaeus vannamei is an important aquaculture economic species in Taiwan, in recent years, extreme weather is frequent, farmed organisms are affected by the external environment, prone to outbreak of disease death, the current domestic white shrimp production is insufficient to supply the demand, in 2020 domestic production only reached 25% of the demand, so it is necessary to increase the harvest of white shrimp aquaculture to make up for the market gap.

At present, the Energy Bureau promotes "aquaculture-oriented, green power value-added", and the co-construction mode of roof pv systems photovoltaic facilities combined with aquaculture not only improves the land use value, but also reduces the risk of *Litopenaeus vannamei* farming, and can effectively isolate the impact of the external environment on farmed organisms, maintain the advantages of biosecurity and epidemic prevention, and thus improve the economic benefits of aquaculture.

In this study, the biovariables, production cost taxa and profit variable taxa were collected for *Litopenaeus vannamei* farming by Aquavoltaics, and the data of multiple solar co-constructed farms were collected for analysis, in order to provide a reference basis for future solar co-constructed *Litopenaeus vannamei* farming.

Keywords: The Fishery and electricity symbiosis, *Litopenaeus vannamei* farming

歐美日韓與我國之廢棄漁具管理政策與法規分析

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摘 要

遭拋棄、遺失或其他原因的無主漁具稱為廢棄漁具，因天候、礁石或漁具纏繞造成損壞而遺失、拋棄於海洋，也是對於海洋生物與海洋棲地最具傷害性的海洋垃圾，對於海洋生物與環境健康，廢棄漁具已成為亟需優先面對課題。

聯合國呼籲成員國採取減少廢棄漁具行動，並在 2030 永續發展目標訂下目標 14，「保育及永續利用海洋生態系，以確保生物多樣性並防止海洋環境劣化」。FAO 也透過各漁業委員會、負責任漁業守則等強調廢棄漁具減少與報告的重要。

本研究將蒐集歐、美、日、韓國家中廢棄漁具之影響、減少廢棄漁具相關規定、政策與做法，並與我國比較相對應作法，並提出適當的法規與政策建議，作為往後擬定參考。

關鍵詞：廢棄漁具、幽靈漁具、漁業法規、漁業政策

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A Study on the Management Policies and Regulations of Abandoned Fishing Gear in Europe, America, Japan, South Korea and Taiwan

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Abstract

Abandoned, lost or otherwise ownerless fishing gear is known as abandoned fishing gear. It is the most harmful marine debris to marine life and habitats when damaged by weather, reefs or entanglement and discarded into the ocean. Abandoned fishing gear has become an urgent priority for addressing issues related to marine life and environmental health.

The United Nations calls on member states to take action to reduce abandoned fishing gear and set Goal 14 under the 2030 Sustainable Development Goals: "Conserve and sustainably use the oceans, seas and marine resources for sustainable development." The FAO also emphasizes the importance of reducing and reporting abandoned fishing gear through various fisheries commissions, responsible fisheries guidelines, etc.

This study will collect information on the impact of abandoned fishing gear in European, American, Japanese, Korean countries; relevant regulations, policies and practices for reducing it; compare them with those in our country; propose appropriate regulatory measures and policy recommendations as a reference for future planning.

Keywords: Abandoned fishing gear, Ghost fishing gear, Fisheries regulations, Fisheries policy

國小教師對於海洋永續發展的認知差異與融入課程教學意願-以基隆市及雙北市小學為例

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摘 要

希臘 Zakynthose 海洋公園研究指出從小接收海洋教育對提升海洋知識及保育上有顯著的效果(Dimitrios et al.,)只有站在教育第一線的教育者開始推動海洋教育，才能讓所有民眾對海洋有實際的保護行動及更深一層的認知，而教師本身若具備充分的海洋知識，就能應用在實際的教學現場，故本研究想了解基隆地區和雙北地區的國小教師對於海洋永續的認知程度是否會受到環境的限制。

本論文以研究海洋永續發展為目的，挑選其中的三個指標 SDG14.1 海洋汙染防治、SDG14.2 海洋與海岸永續管理和 SDG14.3 減緩海洋酸化來做問卷研究，以基隆市和雙北市不同背景教師為研究對象，做各 100 份問卷，探討不同背景國小教師對於 SDG14 的認知是否會受到學校的環境影響，透過問卷調查瞭解一般人對於海洋環境保護的意願，進而喚起大眾的海洋意識，提升國民的海洋素養，減少對於海洋環境的傷害，達到海洋永續發展的目標。

關鍵詞：SDG14、海洋永續發展、海洋教育、海洋環境保護、海洋汙染

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Differences in Teachers' Cognition of Ocean Sustainable Development and Their Willingness to Integrate into Curriculum Teaching: A Case Study of Primary Schools in Keelung City and Shuangbei City

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Abstract

A study by Zakynthose Marine Park in Greece pointed out that receiving marine education from an early age has a significant effect on improving marine knowledge and conservation (Dimitrios et al.), only educators who are at the forefront of education begin to promote marine education, so that all people can have actual protection actions and a deeper understanding of the ocean, and teachers themselves can apply it to the actual teaching site if they have sufficient marine knowledge. Therefore, this study aims to find out whether the awareness of marine sustainability among primary school teachers in Keelung and Shuangbei is limited by the environment.

For the purpose of studying marine sustainable development, this paper selects three indicators: SDG14.1 marine pollution prevention and control, SDG14.2 Sustainable Management of Ocean and Coast and SDG14.3 Mitigation of Ocean Acidification were conducted for questionnaire research, with teachers from different backgrounds in Keelung City and Shuangbei City as the research objects, 100 questionnaires were conducted to explore whether the cognition of SDG14 by primary school teachers of different backgrounds would be affected by the school's environment, and through the questionnaire survey to understand the willingness of conventional people for marine environmental protection, so as to arouse the public's marine awareness, improve the national marine literacy, reduce the harm to the marine environment, and achieve the goal of sustainable marine development.

Keywords: SDG14, marine sustainable development, marine education, marine environmental protection, marine pollution

灣媒體報導海洋議題的內容分析及演變

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摘 要

台灣四面環海，但我們的教育是背離海洋(廖鴻基，十六歲的海洋課程)，大眾對於海洋知識有限，這樣的侷限主要有二：一是教育、二是媒體。媒體在民主社會中有兩個重要角色：一是作為監督權力機制的第四權，檢視國家施政、二是促成公討論。故本研究想瞭解新聞媒體，在海洋議題上的關注方向與內容和演變的趨勢為何?

本研究從聯合知識庫以「海」為關鍵字搜出 989,640 則新聞，以人工閱讀新聞標題和內容第一段，將聯合報 70 年關於海洋及漁撈相關新聞篩選出 15,350 則，依據永續發展三要素:經濟、社會及環境，及永續發展目標(SDGs)，採用文本分析，依分類後各要素的新聞則數占比，分析了解台灣新聞媒體對於海洋議題的報導內容分析及演變。

三要素中經濟占 39%、環境 36%、社會 25%，顯示聯合報對於經濟議題的新聞報導較多、其次為環境、社會要素，本研究顯示 1985 年前，新聞報導以經濟和社會相關內容為主，環境要素的報導自 1984 年起有增長趨勢，到 1986 年環境相關新聞則數 42.66%首次超經濟要素新聞 29.37%，顯示對環境議題的關注逐漸增長。永續發展三要素是相互促進的，但需要在發展中考慮各種因素彼此消長,從新聞報導的三要素變化,可略窺出政府和民眾對於海洋關注的重點的變化。

關鍵詞：海、大眾媒體、聯合報、永續發展三要素、永續發展目標(SDGs)

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Analysis and Evolution of Taiwanese Media News on Ocean Related Issues

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Abstract

Taiwan is surrounded by the sea, yet our education system and media have shown limited focus on ocean-related knowledge. This study aims to understand the attention, content, and trends of news media regarding marine issues.

Using the UDN database ' 70-year archive and searching for articles related to the sea, a total of 15,350 news articles were selected and analyzed. The analysis employed text analysis and categorized the articles based on the SDGs three pillars: economic, social, and environmental aspects, as well as the Sustainable development Goals (SDGs).

The results show that the economic aspect accounted for 39%, followed by environmental (36%) and social aspects (25%). This indicates that the United Daily News has a higher number of news reports on economic issues, followed by environmental and social issues. The study reveals that before 1985, news reports mainly focused on economic and social content, while the coverage of environmental issues began to increase from 1984 onwards. In 1986, environmental news articles (42.66%) exceeded economic news articles (29.37%) for the first time, indicating a growing concern for environmental issues. The three pillars of sustainability are mutually reinforcing but require consideration of various factors during development. By observing the changes in news coverage of the three aspects, we can gain insights into the shifting priorities of the government and the public regarding marine issues.

Keywords: Sea, Mass Media, United Daily News, Three Elements of Sustainable Development, Sustainable Development Goals (SDGs)

兩岸海洋與漁業政策發展對臺灣海峽漁權衝突之研究

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摘 要

臺灣海峽為臺灣與中國大陸間之重要傳統漁場，近年來，由於兩岸沿近海漁業資源驟減，為保護沿近海海洋生態與漁業資源，中國大陸方面採取更為嚴格之海洋及漁業管理政策與執法作為，使得其漁民紛紛前往臺灣海峽經濟水域與其他灰色地帶作業，造成臺灣海峽漁權衝突事件加劇之情事。

本研究從兩岸海洋及漁業發展與沿革歸納漁權衝突之緣由，並彙整及分析政府機關各項統計數據，如漁業統計年鑑、漁業年報及海上執法機關之執法成效等，綜整兩岸在各階段所實行之海洋及漁業政策、法規，剖析其對兩岸漁權衝突之直接及間接性影響；另透過分析兩岸未來海洋及漁業政策趨勢，總結與歸納臺灣在面對兩岸漁權衝突上，所能採取之應對策略與管理建議。

關鍵詞：臺灣海峽、兩岸海洋與漁業政策、漁權衝突、海洋與漁業資源、海上執法

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Study on The Ocean and Fishery Policy Development between Taiwan and Mainland China on the Conflict of Fishery Rights in the Taiwan Strait

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Abstract

Taiwan Strait is an important traditional fishing ground between Taiwan and Mainland China. In recent years, since the fishery resources in this area have decreased substantially, Taiwan and Mainland China have adopted stricter fishery management policies and law enforcement actions to protect their coastal fishery resources and marine ecology, Mainland China has adopted more stringent ocean and fishing management policies and law enforcement actions, causing its fishermen to go to the economic zone of the Taiwan Strait and other gray areas of Cross-Strait to fishing, resulting in the intensification of conflicts over fishing rights in the Taiwan Strait..

This study in based on the development and evolution of the fishery policies in Taiwan and Mainland China. Through analyzing various statistical data, relevant policies and regulations from Cross-Strait government agencies, such as fishery statistical yearbooks, fishery annual reports, the effectiveness of law enforcement by various maritime law enforcement agencies, and relevant policies and regulations to analyze whether policies have direct and indirect impacts on Cross-Strait fishing rights conflicts. This study also evaluates the future impact of Cross-Strait on marine policy and fishery policy promotion goals. The results of the study provide some advice for fishery management of facing the conflicts in Taiwan's Cross-Strait fishing right.

Keywords：Taiwan Strait、The ocean＆fishing policies of Cross-Strait、The fishing conflict of Cross-Strait、The ocean＆fishing resourse of Cross-Strait、Maritime law enforcement

206 教室

臺灣西南海域中國槍鎖管生殖生物學與潛在產卵場之研究

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摘 要

中國槍鎖管為臺灣西南海域之重要經濟物種，其產卵族群的時空分布特性及喜好環境因子仍未有相關的研究。因此，本研究蒐集 2014-2022 年間於西南海域(高雄、澎湖)之沿近海漁獲樣本，進行種類鑑別、成熟階段判定以及各項生物學參數量測。進一步將成熟樣本所佔比例與樣本船作業位置等資料進行整合，分析產卵族群的時空分布特性。此外，利用泛加成模式(GAM)解析產卵族群喜好的環境特性。結果顯示，產卵族群出現於 5~9 月且主要位於 119.9-120.7°E，22.1-23°N 與 119.0-119.7°E，23.3-24.5°N 水域。此外，本研究亦探究產卵族群喜好的環境因子，包括海表面溫度、海底溫度、海表面鹽度、海表面高度、海底深度、葉綠素濃度等。綜合上述結果，本研究可提供中國槍鎖管產卵場預測與漁業管理之參據。

關鍵詞：中國槍鎖管、生殖生物學、泛加成模式、漁場
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Reproductive biology and potential spawning ground of the squid *Uroteuthis (Photololigo) chinensis* in the southwestern water off Taiwan

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Abstract

Uroteuthis (Photololigo) chinensis is an economically important species in the coastal water off southwestern Taiwan. Spatial and temporal characteristics and preferred environmental conditions of its spawning population are rarely characterized. Hence, specimens from coastal fisheries in the water off southwestern Taiwan (Kaohsiung & Penghu area) were collected between 2014 and 2022 to conduct specie identification, maturity determination, and various biological parameter measurements. The proportion of mature specimens and vessel position information were further integrated to analyze spatiotemporal characteristics of spawning populations. Additionally, the preferred environmental conditions of spawning populations were analyzed using Generalized Additive Model (GAM). Results from this work indicated that spawning populations mainly occurred from May to September and distributed in waters ranging from 119.9-120.7°E and 22.1-23°N, 119-119.7°E and 23.3-24.5°N. The preferred environmental conditions were also investigated, including SST, BT, SSS, SSH, Bathymetric, and Chla. Taken together, results from this work can provide the reference for the prediction of spawning grounds and fisheries management.

Keywords: *U. (P.) chinensis*, growth and reproduction, Generalized Additive Model, fishing ground

利用脊椎骨穩定性同位素分析探討臺灣東北部海域鼬鮫(*Galeocerdo cuvier*)的棲地利用與和攝食生態

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摘 要

鼬鮫(*Galeocerdo cuvier*)廣泛分布於全球溫熱帶水域，但西北太平洋區域中相關的研究仍屬缺乏。本研究目的乃透過脊椎骨的穩定性同位素分析，探討西北太平洋鼬鮫在不同性別、不同生活史階段的棲地利用和攝食生態。本研究自 2021 年 10 月至 2022 年 12 月間從宜蘭南方澳漁港採集得 20 尾脊椎骨樣本進行穩定性同位素分析。研究結果 $\delta^{13}C$ 值範圍在-15.32 與-12.55‰之間，平均值為-13.96±0.7‰；$\delta^{15}N$ 值範圍在 10.54 與 14.07‰之間，平均值為 11.92±0.8，營養位階介於 3.78 到 4.8 之間，平均為 4.18±0.24。經比較顯示鼬鮫的穩定性同位素值在不同因子之間並無顯著差異，而透過 SIBER 分析卻可看出雌雄魚之間攝食寬度和棲地利用有所不同，顯示雌魚的生態區位和移動範圍都較雄魚寬；而未成熟階段的生態區位和移動範圍也較成熟階段寬。

關鍵詞:鼬鮫、穩定同位素分析、脊椎骨、棲地利用

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Habitat and feeding ecology of the tiger shark (*Galeocerdo cuvier*) in the northeastern water off Taiwan based on stable isotope analysis

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Abstract

The tiger shark (*Galeocerdo cuvier*) is distributed in temperate and tropical waters around the world and has been studied in different sea areas, but research in the Northwest Pacific is still lacking. The purpose of this study is to investigate the habitat use and feeding ecology of different sexes and the life history stages of tiger sharks off the Northwest Pacific Ocean through stable isotope analysis of the vertebrae of tiger sharks. 20 samples were collected from Yilan Nanfang-ao during October 2021 and December 2022. The $\delta^{13}C$ value of the Northwest Pacific tiger shark range from -15.32 to -12.55‰, with an average of -13.96±0.7‰; the $\delta^{15}N$ value ranges from 10.54 to 14.07‰, with an average of 11.92±0.8‰, and the trophic position ranges from 3.78 to 4.8, with an average of 4.18 ±0.24. Statistical analysis results showed that there was no significant difference between the different factors. However, the result of SIBER analysis results showed that the trophic niche and movement of the female was wider than the male, and the immature individual was wider than the mature individual.

Keywords: tiger sharks, stable isotopes analysis, vertebrae, habitat use

利用碳氮穩定同位素探討臺灣淺灘中國槍魷(*Uroteuthis chinensis*)及貝瑞氏四盤耳烏賊(*Euprymna berryi*)之營養特徵

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摘 要

臺灣淺灘(Taiwan Bank)為臺灣西南海域之重要漁場，其中頭足類是常見的經濟性物種，扮演著傳遞浮游生物與中表層掠食者能量的關鍵角色。然而，目前對於該海域的頭足類之營養特徵尚無完整瞭解。本研究以底拖網採集臺灣淺灘之中國槍魷(*Uroteuthis chinensis*)及貝瑞氏四盤耳烏賊(*Euprymna berryi*)樣本，測量外觀形質，並分析兩頭足類物種及其共存之魚蝦類物種之肌肉碳氮穩定同位素 ($\delta^{13}C$, $\delta^{15}N$)值，用以估算營養區位(trophic position)及攝食寬度(feeding width)。

中國槍魷樣本之體長範圍在 48~205 mm，肌肉的 $\delta^{15}N$ 值及 $\delta^{13}C$ 值分別為 11.1±0.6‰及-18.2±0.7‰。貝瑞氏四盤耳烏賊樣本的體長範圍 20~32mm，肌肉的 $\delta^{15}N$ 值及 $\delta^{13}C$ 值分別為9.9±0.7‰及-18.0±0.5‰。以臺灣淺灘海域採集之浮游動物碳氮同位素作為基準值，所估算中國槍魷之營養區位為 3.5±0.4，貝瑞氏四盤耳烏賊為 3.3±0.3，兩物種之營養區位具中度重疊(67.5%)。根據標準橢圓面積(SEA_C)估算結果，貝瑞氏四盤耳烏賊的攝食寬度較中國槍魷寬，且介於其他共存魚蝦類物種之間 (日本緋鯉 (*Upeneus japonicus*):1.45；半線鸚天竺鯛 (*Ostorhinchus semilineatus*):0.13)。營養區位及攝食寬度可能與生態習性和棲地有關，中國槍魷具垂直洄游行為使其有機會攝食到中表層營養區位較高的魚類，而貝瑞氏四盤耳烏賊底棲的特性則攝食較多樣化的底棲餌料。本研究結果有助於更加了解西南海域頭足類之生物學及營養特徵，提供未來該海域漁業資源管理所需之參考資訊。

關鍵詞：體長體重關係、浮游動物基準值、營養區位、攝食寬度。

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Inferring tropic characteristics of *Uroteuthis chinensis* and *Euprymna berryi* in Taiwan Bank with carbon and nitrogen stable isotope analysis

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Abstract

Taiwan Bank is an important fishing ground in the southwestern waters of Taiwan, Cephalopod is common commercial species and plays key roles in transferring energy from planktons to predators. However, the trophic characteristics of cephalopods in Taiwan Bank waters are not understood yet. *Uroteuthis chinensis* and *Euprymna berryi* were collected in Taiwan Bank waters through bottom trawling., and their morphological features were measured. Stable isotopic values ($\delta^{13}C$, $\delta^{15}N$) in the muscle of the two cephalopod species and coexisting fish and shrimp were analyzed to estimate the trophic position and feeding width. The mantle length of *Uroteuthis chinensis* ranged between 48-205 mm, and $\delta^{15}N$ and $\delta^{13}C$ values were 11.1±0.6‰ and -18.2±0.7‰, respectively. The mantle length of *Euprymna berryi* ranged between 2032 mm, and $\delta^{15}N$ and $\delta^{13}C$ values were 9.9±0.7‰ and -18.0±0.5‰ respectively. Based on $\delta^{15}N$ and $\delta^{13}C$ values of zooplanktons collected from Taiwan Bank waters as the baselines, the estimated trophic positions of *Uroteuthis chinensis* and *Euprymna berryi* were 3.5±0.4 and 3.3±0.3, respectively, with a moderate overlap (67.5%). According to Standard Ellipse Area (SEA_C) estimation, the feeding width of *Euprymna berryi* was wider than that of *Uroteuthis chinensis*, and fell between other coexisting fish and shrimp species (*Upeneus japonicus*: 1.45; *Ostorhinchus semilineatus*: 0.13). Ecological behavior and habitat may influence the trophic position and feeding width. *Uroteuthis chinensis* can feed the neritic fishes with higher trophic positions during vertical migration, whereas *Euprymna berryi* has more diverse benthic prey because of its benthic habitat. This study facilitates a better understanding of cephalopod biology and trophic characteristics in the southwestern waters of Taiwan, providing essential information for fishery management in the future.

Keyword: Mantle length-body weight relationship, trophic baseline from zooplanktons, trophic position, feeding width

西北太平洋長臂灰鯖鮫之年齡與成長研究

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摘 要

本研究針對長臂灰鯖鮫進行年齡與成長研究，自 2021 年 4 月至 2023 年 3 月間至宜蘭南方澳進行採樣，共採集 269 尾個體樣本，包含雄魚 138 尾(115 - 234 cm fork length, FL)，雌魚 131 尾(127 - 274 cm FL)。體長體重關係式分別為，雄魚 $W = 0.00029 \times FL^{2.3554}$，雌魚 $W = 0.000035 \times FL^{2.7702}$。為與其他資料進行比較，本研究對各體長進行迴歸求得轉換式，分別是尾叉長與體全長(Total length, TL)：$TL = 0.815 \times FL + 13.974$，以及尾前長(Precaudal length, PCL)與體全長：$TL = 0.8357 \times PCL - 5.653$。年齡形質選用尾柄之脊椎骨，對其進行包埋以及切片處理，以利後續進行年齡判讀。本研究預計以四種常用於描述大型鮫類成長的方程式進行套適，再以改良之赤池訊息準則(AICc)選出最佳長方程式，並繪製成長曲線圖。

關鍵詞：年齡成長、成長方程式、長臂灰鯖鮫、西北太平洋

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Age and growth of the longfin mako shark (*Isurus paucus*) in the Northwestern Pacific

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Abstract

This study is to understand the age and growth of the longfin mako shark (*Isurus paucus*) in the Northwestern Pacific. A total of 269 individuals were collected from Nanfang'ao fish market, Yilan from April 2021 to March 2023. There were 138 males (115 - 234 cm fork length, FL) and 131 females (127 - 274 cm, FL) included in this study. The fork length (FL)–Weight (W) relationships were established as $W = 0.00029 \times FL^{2.3554}$ for males and $W = 0.000035 \times FL^{2.7702}$ for females. The total length (TL), FL, and precaudal length (PCL) conversion formulas were also established for literature comparison: $TL = 0.815 \times FL + 13.974$; $TL = 0.8357 \times PCL - 5.653$. The vertebrae were collected as the aging material near the caudal fin in this study. First, the muscle and connective tissue was removed from the vertebrae. Second, the vertebrae were air-dried and embedded with paraffin and sliced in to cross-sections. This study proposes to fit the age-length data into four growth equations, and use the Akaike information criterion (AICc) to determine the best interpretive growth model in longfin mako sharks.

Keywords: Age and growth, longfin mako (*Isurus paucus*), Northwest Pacific

臺灣西南部海域梭氏蜥鮫之攝食生態學研究

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摘 要

梭氏蜥鮫(*Galeus sauteri*)為臺灣周邊海域多獲性的小型底棲性鯊魚，其體型屬於中階掠食者(mesopredator)，連結食物鏈中的高低營養階級生物，在生態系扮演著重要的角色。然而針對本種詳細的攝食生態研究較為缺乏。本研究透過胃內容物分析，了解梭氏蜥鮫在生態系中所扮演的角色和與其他生物間的相互關係。樣本自 2021 年 11 月起至 2022 年 10 月於屏東縣東港漁港採集，共計採得 400 尾樣本(雌魚 205 尾，雄魚 195 尾)，全長範圍為 7.9–43.7 公分，其中空胃樣本佔 4.75%。胃內容物分析結果顯示，梭氏蜥鮫所攝食的餌料生物包含了 35 種類別，其中以無法識別的硬骨魚類(unidentified teleost)所佔的比例最高(%IRI=36.99%)，其次為七星底燈魚(*Benthosema pterotum*)(%IRI=23.98%)和真蝦下目(Caridea)(%IRI=14.71)。研究結果顯示空胃率(%VI)在不同成熟階段之間有所差異，成熟個體的空胃率相對未成熟個體較低。另外兩性攝食重疊度較高，可推斷本種性別間可能無分開棲息，或是其主要餌料生物分布廣泛。季節之間其攝食重疊相對較低，於夏季及秋季時攝食甲殼類的比例明顯增加，顯示梭氏蜥鮫可能於不同季節攝食之餌料生物會有所改變，亦或是因季節間漁場改變導致攝食差異。餌料生物多樣性（H’）為 1.85，相對較低，而攝食寬度(Ba)為 0.09，可推測本種為專一的獵食者。

關鍵詞: 梭氏蜥鮫、攝食生態、胃內容物分析、餌料生物

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Feeding ecology of the blacktip sawtail catshark *Galeus sauteri* from southwestern waters off Taiwan

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Abstract

The blacktip sawtail catshark *Galeus sauteri* is a neritic small shark species inhabiting coastal waters off Taiwan, its body size resembles mesopredator, which link the high and low trophic levels in the food chain and plays an important role in the ecosystem. However, detailed information on feeding habits of this species is limited. Our study aims at characterizing their ecological role and their relationships with other organisms through stomach content analysis. A total of 400 samples (205 females and 195 males) was collected in Donggang, Pingtung County from November 2021 to October 2022, with a total length ranging from 7.9–43.7 cm TL, including 4.75% samples with empty stomach. Results of stomach content analysis revealed a total of 35 prey taxa, for which unidentified teleost comprised the highest proportion (%IRI=36.99%), followed by *Benthosema pterotum* (%IRI=23.98%) and Caridea (%IRI=14.71%). Vacuity index (%VI) varies between different mature stages, that the proportion of mature individuals with empty stomachs was lower than immature individuals. The high dietary overlap between sexes suggested that this species may not exhibit sexual segregation, or the overlap was contributed by the wide distribution of the main prey taxa. Contrastingly, the low seasonal dietary overlap, and the increased proportion of crustaceans in summer and autumn, indicated a potential seasonal migratory behavior, or shifts in fishing grounds among seasons. Both the relatively low prey diversity index (H') (1.85), and the narrow diet breadth (Ba) (0.09), suggested that *G. sauteri* is a specialist predator.

Keywords: *Galeus sauteri*, feeding ecology, stomach content analysis, prey

雙齒圍沙蠶(*Perinereis aibuhitensis*)作為塑膠微粒指標生物之可行性研究

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摘 要

近年來，塑膠微粒汙染逐漸成為國際關注的議題，塑膠微粒容易作為汙染物載體將其傳播至更遙遠的地方。沙蠶為底棲性生物，在沉積物表面掘穴生活，是優良的生物指標。淡水河流域經人口密集的大台北地區，並且為北部最大出海口。因此本研究以雙齒圍沙蠶體內之塑膠微粒蓄積，調查淡水河口之塑膠微粒汙染。本研究在實驗環境下模擬淡水河口之塑膠微粒濃度，將雙齒圍沙蠶(*P. aibuhitensis*)以體重、塑膠微粒濃度、塑膠微粒大小及蓄積時間分組，觀察其體內蓄積，建立模型，並與野外採集之樣本進行比對分析，以了解雙齒圍沙蠶(*P. aibuhitensis*)作為塑膠微粒指標生物之可行性。

關鍵詞：塑膠微粒、雙齒圍沙蠶、淡水河口

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Feasibility of using *Perinereis aibuhitensis* as a bioindicator for microplastic particles

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Abstract

In recent years, microplastic pollution has gradually become an international concern, as plastic particles can easily act as carriers of pollutants and spread them to more distant areas. The lugworm is a benthic organism that lives on the surface of sediments and is an excellent bioindicator. The Danshui River basin is located near the densely populated Taipei area and is the largest estuary in northern Taiwan. Therefore, this study will investigate microplastic pollution in the Danshui River estuary by examining the accumulation of microplastic particles in the lugworm (*P. aibuhitensis*). The study will simulate microplastic particle concentrations in the experimental environment and group the lugworms according to body weight, microplastic particle concentration, particle size, and accumulation time to observe their accumulation in the body and establish a model. The model was then compared and analyzed with samples collected from the wild to determine the feasibility of using the lugworm (*P. aibuhitensis*) as a bioindicator for microplastic particles.

Keywords：microplastic, *Perinereis aibuhitensis*, Danshui estuary

臺灣西南部海域梭氏蜥鮫之生殖生物學研究

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摘 要

梭氏蜥鮫（*Galeus sauteri*）屬於多獲性的小型底棲物種，分布於臺灣西南海域水深 100 – 400 m 的沙泥底海床。其經濟價值較低，相關的生物學研究亦較缺乏。本研究以臺灣西南海域所採之樣本進行生殖學研究。樣本自 2021 年 11 月至 2022 年 10 月由東港底拖網漁船所捕獲。本研究共採 721 尾樣本，雌魚 366 尾（9.5–43.7 cm TL），雄魚 355 尾（6.8–39.1 cm TL）。卡方檢定顯示雌雄性比沒有顯著差異（$p>0.05$）。體重（BW）體全長關係式經最大概似比檢定判斷雌、雄間具有顯著差異，雌性之體長體重關係式為 $BW = 0.00214TL^{3.0762}$，雄性為 $BW = 0.00204TL^{3.1097}$。雌、雄魚之性成熟體長（TL_{50}）分別為 36.2 cm TL 及 33.8 cm TL。梭氏蜥鮫為卵生，僅右側卵巢具有功能。經組織切片觀察，本種雌魚卵細胞為非同步成熟（asynchronous）。生殖腺指數（GSI）、肝臟指數（HSI）、卵徑及生殖腺各成熟階段之月別變化結果可判斷梭氏蜥鮫為終年生殖的物種，無特定繁殖季節。

關鍵詞:梭氏蜥鮫、生殖生物學、生殖腺指數、性成熟體長、性比

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Reproductive biology of the Blacktip sawtail catshark Galeus sauteri from southwestern waters off Taiwan

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Abstract

The blacktip sawtail catshark *Galeus sauteri* is a common small benthic shark widely distributed in sandy habitats under depth 100 – 400 m off southwestern Taiwanese waters. With low economic value, information on their reproductive biology is limited. The present study aims at characterizing the reproductive biology of *G. sauteri* of southwestern Taiwanese waters. Samples were collected from bottom trawlers in Donggang port, Pingtung County between November 2021 and October 2022. A total of 721 samples were collected, including 366 females (9.5–43.7 cm TL) and 355 males (6.8–39.1 cm TL). Chi-square test indicated no significant difference in sex ratio ($p > 0.05$). The relationships between body weight and total length of *G. sauteri* were significantly different between females $BW=0.00214TL^{3.0762}$ and males $BW=0.00204TL^{3.1097}$. Sizes at 50% sexual maturity were 36.2 and 33.8 cm TL for females and males respectively. The minimum size-at-maturity was 34.2 and 32.0 cm TL for females and males respectively. Our results suggested that *G. sauteri* is an oviparous species with the right ovary functional only. Based on the histological examination, the oocytes developed asynchronously. The monthly trends in ovary gonadosomatic index (GSI), hepatosomatic index (HSI), egg diameters, and the ratio of gonads in each maturity stage, showed that the spawning season was all year round, without a specific mating or breeding season.

Keywords: *Galeus sauteri*, reproductive biology, gonadosomatic index, length at maturity, sex ratio

印度西太平洋中部燈籠鯊屬系統分類學研究

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摘 要

燈籠鯊屬為多樣性最高的鯊魚，具至少 41 種。雖然其屬級以上之親緣關係已有共識，但屬內種間之分類問題有待整理。本研究旨在利用外部形態及分子生物學，解決印度西太平洋中部燈籠鯊種類長久的分類學問題。本研究目前檢視 30 種，共 420 尾標本，並選定 100 個形質及粒腺體 DNA 之 NADH2 片段以釐清種間關係。目前初步結果顯示: 1) *E. burgessi* 可能為 *E. lucifer* 之次異名；2) *E. abernethyi* 可能為西南太平洋過往被誤鑑成 *E. lucifer* 之個體並需要被復名；3) *E. schmidti* 可能為表西北太平洋過往被誤鑑成 *E. molleri* 之個體並需要被復名；4) *E. evansi* 可能為 *E. decacuspidatus* 之次異名。本研究認為一些特徵及形質如翼斑長度、體色及上頜齒齒尖等具個體差異，於未來研究需謹慎使用。

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Systematic taxonomy of the lanternshark genus *Etmopterus* of the central Indo-west Pacific

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Abstract

The lanternshark genus *Etmopterus* is the most diverse group in extant sharks, contains at least 41 species. Although the phylogeny of higher taxonomic units is well resolved, interspecific relationships remains poorly studied. The present study aims at solving the long-term taxonomic confusions of *Etmopterus* of the central Indo-west Pacific based on morphology and genetics. A total of 420 specimens regarding 30 species were examined. An integrated taxonomic approach based on 100 morphological characters and molecular analyses of the mitochondrial NADH2 marker (1044 bp) was used to elucidate the interspecific taxonomic uncertainties. Our preliminary results suggested that: 1) *E. burgessi* is possibly a junior synonym of *E. lucifer*; 2) *E. abernethyi* Garrick, 1957 should be resurrected for specimens hitherto assigned to *E. lucifer* around Australian waters; 3) *E. schmidti* Dolganov, 1986 should be resurrected for specimens assigned to *E. molleri* in the northwestern Pacific; 4) *E. evansi* is possibly a junior synonym of the poorly known *E. decacuspidatus*. We conclude that several morphological characters such as the lateral flank-marking shape and length, body coloration, as well as cusplet numbers on the upper teeth, are quite variable within species, and should be used cautiously for species identification.

透過拖網資料建立澎湖周邊海域魚類晚春及冬季之營養階層結構及攝食生態

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摘 要

澎湖周邊海域為臺灣沿近海重要漁場之一，其漁獲組成會隨著季節推移而有所變化。本研究於 2020 年 5 月 (晚春)及 12 月 (冬季)透過商業性拖網進行採樣，除建立該海域之生物相外，亦探討部分功能組之食性組成及營養位階。晚春的樣本中，共採集到魚類 1260 隻 (分屬於 34 科 61 種)，其他尚有蝦類、蝦蛄類、蟹類、頭足類、螺貝類及其他底棲生物等；將物種劃分成 29 個功能組；17 個魚類功能組中，有 12 組為主要攝食浮游動物，2 組為主要攝食魚類，而主要攝食蟹類、蝦蛄類及底棲動物之功能組則各有 1 組。冬季共採集到魚類 865 隻 (分屬於 31 科 47 種)，其他尚有蝦類、蝦蛄類、蟹類、頭足類及其他底棲生物等；劃分為 28 個功能組；其中 16 個魚類功能組，有 6 組為主要攝食浮游動物，4 組主要攝食魚類，主要攝食蝦類及蟹類各有 2 組，主要攝食底棲動物及頭足類則各 1 組。兩季透過生態模式所計算之營養階層皆介於 1-5 之間。關於綜合生態影響之分析結果亦於本研究中進行探討。

關鍵詞：澎湖海域、胃內容物組成、氮穩定同位素分析、營養位階、Ecopath

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Constructing the Trophic Structure and Feeding Ecology of fish in the waters of Penghu in late spring and winter by Trawl data

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Abstract

Penghu surrounding sea area is one of the important fishing grounds along the coastal of Taiwan. And the species composition of this sea area changes between seasons. In present study, we collect samples in May (late spring) and December (winter) by the commercial trawl. To collect the organism in the waters as complete as possible to construct the biota. Also discuss the diet composition and trophic position of some functional groups. Among the samples of late spring, there were 1260 fish included 34 families 61 species. Shrimp, mantis shrimp, crab, Cephalopod, shells, and other benthos are also included. Dividing all species into 29 functional groups. In 17 fish functional groups, 12 of them mainly feed on zooplankton, 2 groups mainly feed on fish. Mainly feed on crabs and mantis shrimps, benthic animals are 1 group each. As for the samples collected in the winter, 865 fish included 31 families 47 species, shrimp, mantis shrimp, crabs, Cephalopod, and other benthos are also included. 28 functional groups are divided. Among 16 of fish functional groups, 6 groups mainly feed on zooplankton, 4 groups mainly feed on fish. Groups that mainly feed on shrimps and crabs have 2 groups each, as for benthos and Cephalopods have 1group each. The trophic flow diagrams show that the trophic levels are between 1 to 5 in both two seasons. The result of mixed trophic impact are illustrated in present study too.

Keywords: Penghu, Stomach content composition, Nitrogen stable isotope analysis, Trophic position, Ecopath

台灣東岸沿近海漁業與鯨豚互動的調查及可行忌避措施建議

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摘 要

漁撈作業與保育類海洋野生動物的互動時有所聞，每每造成漁業經營者與保育團體的對立，沿近海漁業由於高度的多樣性，因而具更高的複雜程度。本研究之目的在於了解台灣東岸沿近海各漁業與鯨豚的互動情形，並彙整國內外相關文獻提出可行的忌避措施建議。本研究採問卷調查方式，於我國重點港口進行訪調，所調查的漁業包含延繩釣、刺網、拖網、一支釣、曳繩釣、棒受網等。2020年4月至2022年8月期間，共獲得198份問卷，有87%的漁民在作業時曾受鯨豚干擾或咬食。並針對與鯨豚互動之重點漁業，彙整國內外忌避措施文獻，以求了解降低鯨豚與漁業互動之可行方式。目前國際間以透過發出超音波干擾鯨豚的回聲定位功能，以達到驅趕效果的小型音波干擾器(pinger)有較多相關的研究成果。

關鍵詞：鯨豚保育、沿近海漁業、混獲、咬食、忌避措施

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Investigation of Cetacean Interaction with Offshore Fisheries along the East Coast of Taiwan and Suggestions for Possible Avoidance Measures

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Abstract

The interaction between fisheries and marine conservation species become a big issue, resulting in conflicts between the fishers and conservation groups. Among these, coastal fisheries are more complex and diverse than distant fisheries. The purpose of this study is to understand the interaction between various fisheries and cetaceans along the eastern coastal waters of Taiwan, and to compile literature in order to propose feasible mitigation strategies. A total of 198 questionnaires were collected from April 2020 to August 2022 around ports, including the longline, gill net, trawl, pole and lines boote, trolling, and stich-held dispnet fishery. 87% of the fishery operators had the experience of depredation or accidental catch of cetaceans. This study also compiles the literature on domestic and international mitigation strategies to reduce interaction between the coastal fisheries and cetaceans. The present studies indicated that pinger would be a potential mitigation tool for reducing depredation and accidental catch of cetaceans due to the echolocation features.

Keywords: cetacean conservation, coastal fisheries, bycatch, depredation, mitigation

銀魚 (*Pennahia Argentata*) 的食性和攝食習性

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摘 要

石首魚科(白姑魚,drummers or Jew fishes)屬於生活在沿海泥、沙或岩石底質的底 棲性海洋魚類。攝食為所有生物之重要生理功能，由魚類的食物和攝食習性的 資訊有助於了解其攝食適應、洄遊、生長等方面。基於胃內容物分析的魚類攝食習性研究已成為魚類生態學中一種重要方法，可用來調查和檢驗水生生物在 區域基礎上的攝食行為，並提供對可持續管理、規劃和保護重要資訊。樣本為 每月收集，IRI%指數將用於描述白姑魚的攝食，以便更好地了解白姑魚的攝食組成和胃內容物。

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Dietary and Feeding habit of Silver croaker (*Pennahia Argentata*)

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Abstract

Sciaenidae (Croakers,drummers or Jew fishes) constitute marine, demersal fish that live in coastal waters over muddy, sandy or rock bottoms. Feeding is one if the vital functions of all living organisms and the information on the food and feeding habits of fish facilitate understanding and their feeding adaptation, migration, growth and other aspects. The study of fish dietary habit based on stomach content analysis has been used in fish ecology as an important means of investigating and examining the feeding behavior of aquatic organisms on their regional basis which then can provide information that is critical for sustainable management and plans and conservation. Samples will be collected monthly and IRI % index will be used to describe the dietary of the Silver croaker that can facilitate in understanding the diet composition of the croakers and the items in the stomach.

Keywords: Silver croaker, feeding habit, dietary, stomach content analysis

台灣沿近海延繩釣漁業忌避措施之成果效益研究

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摘 要

近年來海洋保育類生物被意外捕獲導致漁業經營者和保育人士之間的衝突對立時有所聞。不論是意外捕獲導致保育類物種受傷死亡，或是漁獲過程中目標漁種遭受咬食等損失皆為目前所面臨的問題，為此許多管理方開始嘗試以忌避措施降低保育類物種與漁業互動機率。本研究以台灣沿近海之延繩釣漁船為研究對象，委託樣本船在部分釣組分別裝設 LED 燈以及小型水中音波器(pinger)，並比較裝設及未裝設忌避措施之釣組的單位努力漁獲量(CPUE)與互動頻率（意外捕獲及咬食）。自 2021 年 6 月至今已回收來自宜蘭南方澳、台東成功以及屏東東港共 11 艘漁船總計 261 次作業紀錄資料。未來將持續尋找樣本船協助實驗同時進行數據分析，期盼本研究之結果有助於了解忌避措施之成效性。

關鍵詞: 延繩釣漁業、LED 燈、小型水中音波器、意外捕獲、咬食

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Accessing the effectiveness of mitigation measures on interactions between marine protected species and Taiwanese artisanal longline fisheries

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Abstract

The accidental catch of marine protected species is a worldwide issue in recent years, often trigger conflicts between fisheries and conservationists. Problems including injuries and mortality in bycaught protected species, and economic loss caused by depredation on catches and fish baits, still remain unresolved. As such, mitigation measures are gradually developing to minimize the interaction between the protected species and fisheries. In the present study, LED lights and pingers are attached on the branch line from some artisanal longline vessels in Taiwan. CPUE and interactions (bycatch and depredation) are compared between attached line and control set. Since June 2021, data of 261 hauls from 11 vessels from Nanfangao, Yilan County, Chengkung, Taitung county and Donggang, Pingtung county, are obtained. More vessels will be found for experiments, and data analyses will be conducted, so as to determine the effectiveness of different mitigation measures.

Keywords: longline fishery, LED lights, pingers, accidental catch, depredation

臺灣沿近海遠海梭子蟹漁業概況暨籠具逃脫環選擇性之研究

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摘要

遠海梭子蟹為臺灣沿近海梭子蟹科重要經濟漁獲對象之一，本研究先收集近三年籠具漁業捕撈遠海梭子蟹之漁獲資料，分析臺灣沿近海遠海梭子蟹漁業概況。分析結果顯示遠海梭子蟹主要漁獲季節為 7 月~11 月，年平均漁獲量 29 噸、漁獲率 8%，分佈海域主要是臺灣海峽南部和北部，以高雄興達港(73.47%)為主要捕獲港口。另本研究嘗試改良籠具逃脫環型態，以蟹類樣本進行人工塞選不同逃脫環尺寸，以挑選出合適保育 L_{50} 性成熟體長範圍的逃脫環規格以進行活蟹試驗和驗證。人工塞選實驗共進行 242 隻樣本塞選，結果顯示 L_{50} 性成熟甲殼寬遠海梭子蟹(11.4~15.6 cm)通過之逃脫環尺寸為寬度介於 3.2~3.6cm 與長度 8cm 以上。以活蟹進行逃脫環實驗共 18 組，甲殼寬度為 11.6~14.5cm，統計通過個數在 H5(長 xx:9cm 寬：3.2cm)及 S5(長: 9cm 寬：3.6cm)的組別，甲殼寬小於 13.5cm 的樣本均能通過逃脫環，在 S3(長:8cm 寬：3.2cm)組別，甲殼寬小於 12.5cm 的樣本均能通過逃脫環，並且 H5 和 S5 與 S3 間具顯著差異，本研究可供未來進行保育型籠具改良減少幼蟹捕獲率之重要參考依據。

關鍵詞：籠具漁業、遠海梭子蟹、性成熟體長、人工塞選實驗

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Fishery status of *Portunus pelagicus* in coastal fisheries and the catch selectivity of escape devices in crab traps in Taiwan

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Abstract

The blue swimming crab *Portunus pelagicus* is one of the important economic catches for Portunidae species in the coastal water of Taiwan. In this study, the collection of catch data over a period of three years for *P. pelagicus* using traps was recorded and the fishery status of P. pelagicus in coastal waters of Taiwan was conducted. The results showed that the main fishing season for *P. pelagicus* in Taiwan is from July to November, with an average annual catch of 29 tons and a catch composition of 8% from trap fisheries. The catch distribution is mainly in the southern and northern Taiwan Strait, with Kaohsiung Xingda Port (73.47%) as the main fishing port for *P. pelagicus*. In addition, in this study, the improvements of the escape device in the trap were carried out using the fall-through experiment, to determine the suitable escape device size to maintain the length range of the sexually mature body (Lm50) of *P. pelagicus*. A total of 242 samples of *P. pelagicus* were tested with the data analysis showed that the suitable escape device size that maintains Lm50 sexually mature crabs (11.4–15.6 cm) is between 3.2–3.6 cm in width and >8.0 cm in length. A total of 18 sizes of escape devices were carried out using the live crabs with *P. pelagicus* carapace width (CW) between 11.6–14.5 cm tested. In the H5 (Length: 9cm, Width: 3.2cm) and S5(Length: 9cm, Width: 3.6cm) groups, the *P. pelagicus* with CW less than 13.5cm can pass the escape device, whereas for the S3 (Length: 8cm, Width: 3.2cm) group, the *P. pelagicus* with CW less than 12.5 cm can pass the escape device with significant differences between S5 and S3 size. Therefore, this study can provide an important reference for the future improvement of conservation cages to reduce the catch rate of juvenile crabs.

keywords: crab trap, escape rate, blue swimming crab, size selectivity

台灣西南部海域梭氏蜥鮫之年齡與成長研究

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摘 要

本研究針對台灣西南部海域底拖網所混獲之梭氏蜥鮫（*Galeus sauteri*）進行年齡與成長研究。2021 年 11 月至 2022 年 10 月期間，本研究於屏東東港漁港，共採得 777 尾樣本，包含雄魚 395 尾 (7.9 – 39.1 cm total length, TL) 以及雌魚 382 尾 (9.5 – 43.7 cm TL)，體長體重關係式分別為雄魚：$W=0.00199TL^{3.0981}$、雌魚：$W=0.00202TL^{3.1131}$。本研究以脊椎骨作為年齡查定之形質，初步針對 78 尾雌魚以及 79 尾雄魚進行年齡判讀，最大判讀年齡分別為雌魚 13 歲及雄魚 10 歲。最佳套適成長方程式為 Robertson 成長方程式，雄魚理論極限體長 (L_∞) 為 45.08 cm TL，成長係數 (k) 為 0.35 yr^{-1}，雌魚理論極限體長為 47.68 cm TL，成長係數為 0.33 yr^{-1}。

關鍵詞：梭氏蜥鮫、板鰓類、椎體定齡、年齡與成長

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Age and growth of the blacktip sawtail catshark, *Galeus sauteri*, in the southwestern waters off Taiwan.

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Abstract

The study aimed at the age and growth of *Galeus sauteri* which were caught by the bottom trawlers in the southwestern waters of Taiwan. Samples were collected from Donggang, Pingtung from November 2021 to October 2022. A total of 777 samples were collected, including 395 males (7.9–39.1 cm total length, TL) and 382 females (9.5–43.7 cm TL). The length–weight relationship was $W=0.00199TL^{3.0981}$ in males, and $W=0.00202TL^{3.1131}$ in females, respectively. The vertebrae were sectioned for age determination. The age of 78 females and 79 males were estimated, preliminary. The maximum observed band pairs were 13 and 10 for males and females, respectively. The Robretson function was choose as the best fitted growth function to explain the growth of *G. sauteri* for male and female. The asymptotic total length L_∞=45.08 cm TL, growth coefficient k_R =0.35 for male; and L_∞=47.68 cm TL, k_R=0.33 for females.

Keywords: *Galeus sauteri*, Elasmobranch, Vertebrae ageing, Age and growth

無機砷對淡水長臂大蝦(*Macrobrachium rosenbergii*)組織蓄積及金屬硫蛋白影響

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摘 要

金屬硫蛋白已經被廣泛使用在重金屬汙染檢測上,但大部分都注重在鉛、鎘、銅、鋅等常見的重金屬上,相對於同樣常見的砷則較少研究其蓄積和金屬硫蛋白的關聯性,因此選擇淡水長臂大蝦(*M. rosenbergii*)這種常見的食用蝦種,來探討淡水長臂大蝦在不同砷濃度與暴露天數下對各組織蓄積與金屬硫蛋白的表現量,實驗所得數據利用單因子變異數分析法(One-way ANOVA)及雙因子變異數分析法(Two-way ANOVA)及鄧肯斯多重差距檢定(Duncan's New Multiple Range Test),檢測各組織暴露在重金屬中濃度與時間是否有顯著差異,利用結果關聯性得出結論,用以判斷淡水長臂大蝦體內的金屬硫蛋白,在未來檢測中是否適合用來當作環境砷汙染的標記性指標。

關鍵詞 ： 金屬硫蛋白、砷、蓄積、淡水長臂大蝦

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The effects of inorganic arsenic on accumulation of arsenic and inorganic arsenic and metallothionein induced for *Macrobrachium rosenbergii*

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Abstract

Metallothionein has been widely used in the detection of heavy metal pollution, but most of them focus on common heavy metals such as lead, cadmium, copper, zinc, etc. Compared with the same common arsenic, there is less research on its accumulation and metallothionein. Therefore, the giant river prawn (*M. rosenbergii*), a common edible shrimp species, was chosen to investigate the expression of giant river prawn on tissue accumulation and metallothionein under different arsenic concentrations and exposure days. The obtained data were detected by using one-way ANOVA, two-way ANOVA and Duncan's New Multiple Range Test to detect the concentration of heavy metals in each tissue. Whether there is a significant difference with the time, and use the correlation of the results to draw a conclusion to judge whether the metallothionein in the giant river prawn is suitable for being used as a marker indicator of environmental arsenic pollution in the future detection.

Keywords: metallothionein, arsenic, accumulation, *Macrobrachium rosenbergi*

305 教室

利用 IPCC AR6 情境模式分析氣候變遷對臺灣沿近海尾槍魷屬棲地脆弱度之影響

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摘 要

尾槍魷屬(*Uroteuthis*)為臺灣沿近海漁業重要經濟性漁獲物種。為探究氣候變遷不同情境下海洋環境變化與人為活動對臺灣沿近海尾槍魷屬棲地脆弱度之影響，本研究收集 2011-2019 年港口查報員查報資料結合漁船航程紀錄器的漁獲資料，加入 IPCC AR6 中 SSP1-1.9、SSP1-2.6 和 SSP5-8.5 情境模擬模式，結合棲地適宜度模式預測氣候變遷對臺灣沿近海尾槍魷屬棲地之變動情形。另外並透過曝露度、敏感度與調適力等三種風險評估指數，計算各空間網格脆弱度指數來評估潛在影響與可能衝擊，建立物種棲地脆弱度。分析結果顯示 IPCC AR6 的模擬預估在未來 2060 年氣候變遷加劇時水溫上升(15.7℃)、溶氧量減少(0.265 mol m^{-3})，而尾槍魷屬的最適棲地逐漸向北推移(HSI>0.5)，臺灣西南方海域則逐漸下降 (HSI<0.4)。棲地脆弱度分析指數包含環境變異、努力量、漁法組成、漁船數量、物種豐度與漁獲熱點區域。結果顯示，中國沿岸海域為高暴露度，東北部海域則為高敏感度與高調適力，整體而言脆弱度指數最高海域為主要分布在澎湖海域與中國沿岸。

關鍵詞：尾槍魷屬 、氣候變遷、IPCC、棲地適宜性、脆弱度

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IPCC AR6 simulates the impact of climate change under different scenarios on the *Uroteuthis spp* habitat vulnerability in the southern Eastern China Sea

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Abstract

Uroteuthis spp is an important economic species for Taiwanese coastal and offshore fishery. In this study, we examined the habitat and spatial distribution of *Uroteuthis* spp by using logbooks and voyage data from the commercial fishery vessels (2011–2019). Furthermore, the environmental variables under the latest global Shared Socioeconomic Pathways (SSPs; 1-19, 1-2.6, and 5-8.5) were used to predict the habitat variations of *Uroteuthis* spp in different scenarios. The results of the analysis showed that the the sea surface temperature would increase (15.7℃) and dissolved oxygen would decrease (0.265 mol m-3) in furture 2060 years when climate change more serious under the SSPs 5-8.5. The habitat suitability of the *Uroteuthis* spp would gradually move northward (HSI>0.5) and decline in the southwestern waters of Taiwan (HSI<0.4). The Habitat Vulnerability analysis index includes habitat variations, effort, fishing method, number of ship, abundance, thermal habitat area. Habitat vulnerability results show that China's coastal waters are highly exposure and in the northeastern Taiwan waters are highly sensitivity and adaptive capacity. On the whole vulnerability index is highest in the Penghu waters and China's coastal waters.

Keywords: *Uroteuthis* spp, IPCC, suitable habitat index, Climate Change

利用水下聲學探討離岸風場魚群活動與風機聚魚效果

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摘 要

隨著綠色能源的需求增加，且臺灣海峽具有多處良好風場，其中以彰化外海的區域為最佳場域，因此有越來越多的離岸風場劃設於此。在建設風場的同時，與漁業的衝突也越加明顯，因此本研究使用聲學儀器來探討風機的設立對漁業的影響程度。目前已完成距離測試，初步瞭解海域可接收最大距離為 350 公尺，之後接收器均勻佈放在風場內，可進行更大尺度的觀測，了解魚群的活動情況及風場內棲地使用，接著改變接收器佈放位置，以進行小尺度的觀測，透過蒐集活動範圍資料加以分析，進而探討風機潛在的聚魚效果，作為未來在離岸風場建立海洋牧場的參考依據。

關鍵詞:水下聲學儀器、離岸風場、生物紀錄

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Using underwater acoustic analysis to discover fish movement in the offshore wind farm and the effect of fish aggregation

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Abstract

As the demand for green energy increases and there are many potential wind farms in the Taiwan Strait, the area off the Changhua coast is one of the best wind farms, so more and more offshore wind farms are located here. While building the wind farm, the conflict with the fishery is becoming more and more obvious, so this study uses acoustic analysis to explore the impact of the installation of the wind turbine on the fishery. Based on the results from range test, we preliminarily understand the maximum receiving distance of 350 meters in this area. Then we will place the receivers evenly in the wind farm, first conduct large-scale observations, understand the activities of fish schools, whether they stay in the wind farm, then change the location of the receivers, conduct small-scale observations, and collect fine the scope of activities to analyzed. The potential benefits on wind turbines on fish aggregation will be discussed in this study. Results can be used as a reference for establishing marine ranches in offshore wind farm areas.

Keywords: underwater acoustic analysis, offshore wind farm, biologging

臺灣北部沿近海拖網漁業活動之研究

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摘 要

拖網為臺灣沿近海漁業的重要漁業之一，但拖網有極容易破壞底棲生態及產卵場之特點，加上漁網選擇性低亦造成混獲。根據臺灣行政院農業委員會漁業署之漁業統計年報表示，在 2021 年時臺灣沿近海的拖網漁業漁獲量達 20,361 公噸，佔整體近海漁業的 13.72%，故拖網漁業活動的管理成為當務之急。

本研究蒐集了 2013-2021 年共 9 年之拖網進入基隆地區漁港卸魚資料，並配合船載航程資料記錄儀(VDR)，透過利用漁獲組成、年度漁獲量、月別漁獲量以及季節間之漁具轉換等方式分析漁船捕撈能力。透過瞭解臺灣北部沿近海拖網漁業活動及資源結構等特性，達成對拖網漁業資源之合理開發，亦將有助於未來發展區域性管理之參考依據。

關鍵詞：拖網漁業、船載航程資料記錄儀、捕撈能力、區域性管理

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A study on the coastal trawl fishery activities in northern Taiwan

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Abstract

Trawling is one of the important fishing industries in Taiwan's nearshore fisheries. However, trawling is known to have the characteristic of easily damaging benthic ecology and spawning grounds, and its low selectivity also leads to bycatch. According to the Fisheries Statistics Yearbook released by Taiwan's Council of Agriculture, in 2021, the catch from Taiwan's nearshore trawling industry reached 20,361 tons, accounting for 13.72% of the total nearshore fisheries. Therefore, managing trawling activities has become an urgent issue.

This study collected nine years of trawl landing data (2013-2021) from fishing ports in the Keelung area and used vessel monitoring data from Voyage Data Recorders (VDR) to analyze fishing vessel capacity, such as catch composition, annual catch volume, monthly catch volume, and seasonal gear changes. By understanding the characteristics of the nearshore trawling industry and resource structures in northern Taiwan, this study aims to achieve a reasonable development of trawling resources, which can also serve as a reference for future regional management.

Keywords: trawling, voyage data recorder, fishing capacity, regional management.

臺灣東北部海域鯖魚棲地經驗模型之建構

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摘 要

鯖魚為臺灣沿近海重要商業性漁業資源之一，主要漁場為臺灣東北海域，近年其資源量呈下降且漁況變動劇烈。為了解鯖魚棲地分佈變動與海洋環境之關係，本研究以 2013 至 2020 年間臺灣東北海域之扒網船漁獲資料、衛星遙測資料及地形資料作為訓練資料，分別利用泛加成模型(Generalized additive model, GAM)及棲地適合度指數 (Habitat Suitable Index, HSI)建構台灣東北海域鯖魚之模型，HSI 能透過算術平均數模式 (Arithmetic Mean Model, AMM)或幾何平均數模式(Geometric Mean Model, GMM)建立；經由分析單位努力漁獲量與環境因子間之關係；比較不同模型推估之漁場與實際漁場之分布；最後再以 2021 年之資料加以驗證，選出較佳模型。初步結果顯示 AMM 所建立之 HSI 解釋程度較高，後續將加入 GAM 一同進行驗證，相互比較並選出最適合用來建立臺灣東北海域鯖魚棲地之經驗模型。

關鍵字：鯖魚、棲地模式、漁場、環境因子
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Habitat empirical model establishment of mackerels in the northeast waters off Taiwan

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Abstract

Mackerels are importantly economic fish of coastal and off shore fishery in Taiwan, which the main catch is coming from the northeast region of Taiwan. In recent years, the resource of mackerel has decreased and its fishing conditions have strongly variation. To investigate the relationship between the spatial pattern of habitat distribution and the marine environment. In present study, the fishery data from seine vessels of Taiwanese, remote sensing data and terrain data in the northeast waters off Taiwan from 2013 to 2020 were used as training data. Then, the generalized additive model (GAM) and the habitat suitability index (HSI) were used to construct the model in the northeastern waters off Taiwan. Firstly, the HSI can be established through the arithmetic mean model (AMM) or geometric mean model (GMM). Secondary, through analyzing the relationship between unit effort catch and environmental factors. Thirdly, comparing the distribution of fishing grounds estimated by different models and the actual one. Finally, using the data of 2021 to verify and select a better model. Preliminary results show that the HSI established by AMM has a higher explanatory power. In the next step, the GAM will be incorporated for validation and comparison. This study aims to select the most suitable model for establishing an empirical habitat model of mackerel in the northeast waters off Taiwan.

Keywords: mackerel, habitat model, fishing grounds, environmental factors.

拖網漁業台灣海峽對棲地跟生物多樣性脆弱度模式建置之研究

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摘 要

台灣海峽為台灣沿近海漁業重要作業漁區，主要種類有拖網漁業、刺網漁業及延繩釣漁業等不同型態漁法。其中拖網漁業以拖行漁網的方式追捕目標魚群，屬積極型漁法，漁獲效率高。然由於網具選擇性低，易導致過度捕撈與混獲發生，作業時也容易對海底環境造成破壞。因此，本研究收集 100-108 年台灣沿近海地區之拖網漁業資料，資料內容包含作業位置(0.1 度網格)、努力量(小時)、漁船噸數、捕撈魚種和漁獲量，並透過脆弱度模式指標建置作為評估對棲地跟生物多樣性壓力之影響。脆弱度模式建置分為漁業壓力與生物多樣性兩個主要指標，再將指標中不同因素分為五種不同干擾程度等級。漁業壓力以各網格拖網作業漁船累積時數與年間變動為因子觀察研究期間不同海域的漁業壓力及變化，結果顯示壓力程度較高之區域多集中在台灣中、南部沿海。未來將對針對拖網之漁業活動與漁獲組成、生物多樣性等進行更深入的分析。為拖網漁業相關之管理計畫提供依據。

關鍵詞：拖網、漁業資源、漁業壓力、棲地
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Modeling construction of trawl fisheries on the vulnerability of habitat and biodiversity in the Taiwan Strait

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Abstract

The Taiwan Strait is an important fishing area for Taiwan's coastal fishery, with the main types of fisheries being trawl, gill net and long line. The trawl fishery uses trawling nets to pursue target fish, which is an active fishing method with high catch efficiency. However, due to the low selectivity of gears, overfishing and bycatch are likely to occur, and the bottom environment is easily damaged during operation.

Therefore, this study collected data on trawl fisheries along the coastal areas of Taiwan from 2011 to 2019. The number of operating hours and the total tonnage of fishing vessels were used as indicators to assess the fishing pressure. A 0.1 degree latitude and longitude grid was drawn to analyze and map the disturbance caused by trawling to different areas of the Taiwan Strait. The results were classified into five different levels of disturbance. Changes in fishing pressure, fish catch and CPUE were observed in each latitude and longitude grid over a 9-year period. The results showed that the areas with high interference levels were mostly concentrated in the central and southern coast of Taiwan. In the future, more in-depth analysis will be conducted on trawling activities, catch composition, and biodiversity. This will provide a basis for management plans related to trawl fisheries.

Keywords: trawl, fishery resources, fishing pressure, habitat

臺灣北海岸珠螺(*Lunella coronata*)分布熱點之環境因子分析

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摘 要

珠螺(*Lunella coronata*)為台灣北部、東北部及澎湖潮間帶常見的螺類，亦為撿拾漁業的經濟漁獲對象。本研究選定台灣北海岸(六塊厝、石門、國聖埔、龜吼日出亭、萬里澳底、大坪海岸六處地點)作為研究地點,棲地種類為砂岩、海蝕平台、生物礁混礫石，不同季節於潮間帶利用垂直穿越線進行方框調查。調查結果使用集群分析來解析時間與空間變化的影響和使用 ANOVA 判別水中營養物(NH_4^+、NO_3^-、PO_4^{3-})濃度是否存在季節性或地點變化，以了解珠螺在台灣北海岸環境棲地選擇及群族變動情形。

關鍵詞：台灣北海岸、珠螺、集群分析、棲地選擇、族群變動

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Analysis of environmental factors on the distribution hot spots of *Lunella coronata* in the north coast of Taiwan

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Abstract

Lunella coronata is one popular shell in intertidal zone. The study was conducted in the north coast of Taiwan (Liukuaicuo, Shimen, Guihou Sunrise Pavilion, Wanli Aodi, Guoshengpu and Daping Coast), including sandstone, abrasion platform and reef mixed gravel. Under different seasons, sampler were carried out using vertical crossing lines in the intertidal zone. The survey results were used by cluster analysis to analyze the impact of time and space changes and ANOVA to identify whether there are seasonal or site changes in water nutrients concentration (NH_4^+、NO_3^-、PO_4^{3-}) to understand the differences in environmental habitats and population changes of snails in the northern coast of Taiwan.

Keywords: The north coast of Taiwan, *Lunella coronata*, cluster analysis, habitat selection, population change

印度洋熱帶性鮪類豐度與餌料生物群聚特性受氣候變動影響之研究

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摘 要

本研究探討鮪類與餌料生物之間豐度受氣候變動影響之關係。藉由小波交叉關聯性分析中得知黃鰭鮪與大目鮪於 1980-2000 年存在 4-10 年正相關循環週期，另透過鮪類分佈區域劃分兩個區域，分別為黃鰭鮪與大目鮪重疊高釣獲區域(A 區)以及黃鰭鮪高釣獲區域(B 區)，將兩區鮪類標準化 CPUE 與餌料生物豐度年別變動趨勢利用非度量多元尺度法(Non-metric multidimensional scaling)分群結合典型相關分析探討鮪類與餌料生物間受何氣候變動所影響，結果顯示，A 區中鮪類與鯖科及鯵科屬同一分群受 PDO、ENSO 以及 DMI 所影響，B 區鮪類與其同群之餌料生物槍魷科、鯖科、真蝦下目及鯵科則主要受 PDO 以及 ENSO 所影響，另外於相關性分析結果可知，兩區中鮪類與其餌料生物中斑點蝦、甲殼類、軟體動物及櫻蝦科呈正相關趨勢，與其他餌料生物皆為負相關趨勢。綜上結果顯示，推測兩區中鮪類與餌料生物之間變動可能受到 PDO 以及 ENSO 所影響並存在下行控制的現象

關鍵詞:下行控制特性、熱帶性鮪類、氣候變動影響
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Indicators of pelagic forage community shifts related with the abundance of economic tunas by climate effect in the Indian Ocean

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Abstract

In this study we explored the relationship between the abundance of tropical tunas and pelagic forage community affected by climate change. Through wavelet cross-correlation analysis, it is known that yellowfin tuna and bigeye tuna had a positive correlation cycle of 4-10 years from 1980 to 2000. In addition, the distribution area of tuna was divided into two regions, which were the overlapping high CPUE of yellowfin tuna and bigeye tuna (area A) and the yellowfin tuna high CPUE area (area B),then combined non-metric multidimensional scaling and canonical correlation analysis to explore tunas standardized CPUE and pelagic forage community abundance variation within climate effect. The results showed that the same group of tuna, *Scombridae* and *Carangidae* in area A were affected by PDO, ENSO and DMI, the same group in area B for tunas and *Loliginidae*, *Dendrobranchiata*, Carangidae and Scombridae were affected by PDO and ENSO. In addition the results of correlation analysis showed that the tuna and their *Metapenaeus*, *Miscellaneous marine crustaceans*, *Mollusca* and *Sergestidae* showed a positive correlation trend, and other species showed a negative correlation trend. In summary, it is speculated that the variation between tunas and pelagic forage community in the two areas may be affected by PDO and ENSO and have top-down control.

Keywords: Top-down control, tropical tunas, climate effect

臺灣沿近海以鎖管為標的之拖網漁業活動特性

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摘 要

拖網為臺灣沿近海主要漁業之一，其作業型態複雜。由於其網具選擇性較低，漁獲物種組成易較為複雜與多元。其中，鎖管為臺灣沿近海域拖網漁獲中重要的經濟性物種。因此，本研究擬針對臺灣沿近海域拖網漁業鎖管資源漁業活動特性進行探究。我們先蒐集了 2013 年臺灣沿近海域拖網漁業活動資料，共 14,014 航次，並使用階層式集群分析來分析漁獲物種重量百分比組成以及區分不同目標物種之漁撈屬性群(Catch métiers)，以便進一步探究鎖管漁撈屬性群的漁業活動特性。未來將持續針對其漁業活動特性進行探究，包括作業時空分布、目標物種轉換等，完整瞭解臺灣沿近海域拖網漁業鎖管資源漁業活動特性，提供漁業管理與決策之參據。

關鍵詞:拖網、鎖管資源、漁撈屬性群、漁獲組成、群集分析

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Characteristics of trawl fisheries activity for neritic squid resources in the coastal waters of Taiwan

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Abstract

Trawl fisheries represent one of the major coastal fisheries in Taiwan, characterized by complex fishing operations. The relatively low selectivity of trawl fishing gear results in a complex and diverse species composition of catches. Among these species, neritic squid is economically vital for coastal trawl fisheries in Taiwan. Consequently, this study aims to investigate the characteristics of trawl fisheries activity for neritic squid resources in the coastal water of Taiwan. We collected data from 14,014 coastal trawl fishing trips in 2013 first and further analyzed their catch species composition using Hierarchical Cluster Analysis (HCA) to classify catch métiers with different major targeted species. Future research will examine the characteristics of trawl fisheries activity, such as spatial and temporal distribution of fishing operations and the transition of targeted species. This will provide a comprehensive understanding on the characteristics of trawl fisheries activity for neritic squid resources in the coastal waters of Taiwan, offering reference for fisheries management and decision-making.

Keywords: trawl, neritic squid resources, catch métier, fishing composition, cluster analysis

臺灣西部家計型漁業碳排估算模式

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摘 要

工業革命後石化燃料燃燒及人類行為活動所帶來的二氧化碳排放快速增加，造成全球性氣候變遷災害，因此推動減碳政策已成為國際間的共識，為此建立公正、精確的碳排放盤查機制迫在眉睫，更是我國「2050 年淨零碳排」發展節能減碳與負碳技術等重點項目。

對於臺灣沿近海漁業，碳排放估算及盤查為重要管理策略之一。本研究透過燃料基礎法以及活動基礎法，建立臺灣沿近海漁業碳排放量估算模式，以二氧化碳排放當量(Carbon dioxide equivalent; CO_2e)作為依據，比較監測系統觀察之作業形態排放強度以及實際燃料燃燒排放。

透過漁業的碳排估算及盤查，有助於邊境碳關稅、氣候變遷等議題的發展，更可幫助沿近海漁業永續發展，提供有效的漁業管理政策建議，以因應氣候變遷的挑戰。

關鍵詞：淨零碳排、漁業碳排估算、氣候變遷、減碳與負碳技術

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Carbon emission estimation models for artisanal fishery in waters off western Taiwan

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Abstract

The rapid increase in carbon dioxide emissions resulting from the combustion of fossil fuels and human activities has caused global climate change disasters since the Industrial Revolution. Therefore, promoting carbon reduction policies has become an international consensus, and imperative to establish a fair and accurate carbon emission inventory mechanism. This is especially true for Taiwan, which has set the goal of achieving " Net-zero Carbon Emissions by 2050 ", and focuses on energy conservation, carbon reduction, and carbon negative technology development.

For Taiwan's coastal fisheries, carbon emission estimation and inventory are important to the management strategies. A model was developed for estimating the carbon emissions of Taiwan's coastal fisheries based on the fuel-based and activity-based methods, using carbon dioxide equivalent (CO2e) as the basis for comparison. The emissions intensity of the operation mode observed by the monitoring system and the actual fuel combustion emissions were compared.

Through the estimation and inventory of carbon emissions in the fishing industry, it can help the development of issues such as border carbon tariffs and climate change, and also contribute to the sustainable development of the nearshore fishing industry. Results from this study provide effective policy recommendations for fisheries management to respond to the challenges of climate change.

Keywords: Net Zero Emissions, fishery emission estimation、Climate Change、Carbon reduction and carbon negative technologies

台灣灘湧升區之衛星海表溫度觀測

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摘 要

台灣灘(TB) 湧升區位於台灣海峽南部，全年均有不同強度和規模的次表層湧升發生。 由於來自南海 (SCS) 和黑潮支流 (KBC) 的底層水向上流動，形成該湧升區域之海表溫（SST）低於周圍，使其成為高產量漁場。 本研究將利用由 Copernicus 取得之長達 28 年（1993-2021）的 海表溫 觀測資料，空間解析度為 0.083° x 0.083°，分析其年代際、月別和季別 SST 平均值和變化，以及對台灣灘上湧之影響。利用國立臺灣海洋大學地面站之衛星海表溫資料，其在台灣周圍海域之準確度約為 0.6°C。分析海面風向量和應力，以確定風力驅動及其對研究期間台灣灘湧升流強度之影響。

關鍵詞：海表溫，台灣灘，湧升流，風力

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Satellite Derived Sea Surface Temperature Observations in the Taiwan Bank Upwelling Area

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Abstract

Taiwan Bank (TB) Upwelling region is located in the Southern Taiwan Strait and known for subsurface upwelling occurring all year-round with varying strengths and scale. It is characterized by lower Sea Surface Temperature (SST) than in the surrounding upwelling regions due to upward flows of bottom water from South China Sea (SCS) and Kuroshio Branch Current (KBC) making it a very high productive fishing ground. Long-term SST Observations data obtained from Copernicus over a period of 28 years (1993-2021) at spatial resolution 0.083° x 0.083° will be analyzed to determine the decadal, monthly and sessional SST mean and variations and their impact TB upwelling. Satellite SST data from ground station at National Taiwan Ocean University will be used at the accuracy of retrieved SST data at about 0.6℃ in the seas around Taiwan. The sea surface wind vector and stress will be analyzed to determine the wind forcing and its effect on the Upwelling intensity in TB during the study period.

Keywords: Sea Surface Temperature, Taiwan Bank, Upwelling, Wind forcing

臺灣東北海域中小型拖網漁業資源結構之分析

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摘 要

根據漁業署臺灣地區漁業統計年報的資料顯示，2021 年時臺灣近海漁業的總產量為 148,374 公噸，其中「中小型拖網」的產量為 20,361 公噸，佔臺灣近海漁業產量的 13.72%，僅次於扒網漁業，顯見其是臺灣近海漁業中重要的漁業項目之一。由於拖網是一種作業效率高、漁具選擇性較低、混獲率高的漁法（Andrew and Pepperell, 1992；Kennelly, 1995）其對底棲生態及魚類資源的傷害亦較高（Hung，1993）。由於 1959-2021 年間臺灣地區漁業統計年報的資料顯示，中小型拖網的總產量，近幾年來有相當明顯的驟降的趨勢，因此台灣近海中小型拖網漁業面臨產官學界各方的關注與爭議，並需建立其漁業管理之規範。

本研究擬收集在臺灣東北海域作業之中小型拖網漁業標本船的漁撈日誌資料，而主要研究海域會是基隆八斗子與宜蘭南方澳，主要透過利用漁獲魚種組成、生態優勢度、種類相似性係數、群落多樣性指數、群落季節更替指數與遷移指數等分析法，探究臺灣東北海域中小型拖網漁業資源結構之變動特性，以做為日後漁業資源評估、管理及漁業政策擬訂時之參考依據。

關鍵詞：台灣東北海域、中小型拖網、臺灣近海漁業、管理策略評估

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Analysis on the Structure of drag net Fishery Resources in the Northeast Sea Area of Taiwan

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Abstract

According to the Fisheries Administration Taiwan Fishery Statistical Annual Report, the total output of Taiwan's offshore fisheries in 2021 will be 148,374 metric tons. The output of "drag net" was 20,361 metric tons, accounting for 13.72% of Taiwan's offshore fishery production, second only to Taiwanese seine, which clearly shows that it is one of the important fishery items in Taiwan's offshore fishery. Since trawling is a fishing method with high operating efficiency, low selectivity of fishing gear, and high bycatch rate (Andrew and Pepperell, 1992; Kennelly, 1995), its damage to benthic ecology and fish resources is also relatively high (Hung, 1993). Since the data in Taiwan's fishery statistical annual report from 1959 to 2021 shows that the total output of drag net has shown a sharp decline in recent years, the drag net fishery in the coastal waters of Taiwan is facing concerns and disputes from all the world, and it is necessary to establish norms for its fishery management.

This study collects fishing data and of drag net fishing specimen vessels operating in the northeastern waters of Taiwan. The main research areas are Badouzi in Keelung and Nanfangao in Yilan. By using the fish species composition, ecological dominance, species similarity coefficient, and community diversity Using analysis methods such as sex index, community seasonal turnover index and migration index, to explore the changing characteristics of the structure of small and medium-sized trawl fishery resources, so as to serve as a reference for future fishery resource assessment, management, and policy formulation.

苗栗離岸風場開發對漁業活動之影響研究

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摘 要

離岸風場開發是臺灣當前重要議題之一，其對於沿近海漁業活動之影響亦受到許多關注。緣此，本研究蒐集與整合 2013-2021 年間於苗栗縣沿近海域作業漁船之商業卸魚及船位資訊，探究苗栗沿近海域作業漁船於離岸風場建置過程中，作業模式以及漁獲物種的相對漁獲量與漁獲頻度等變動情況。研究結果顯示，該水域主要以刺網漁業為主，其作業漁場與離岸風場位址具有高度地空間重疊性。當地漁獲物種主要包括，烏魚、烏賊以等。此外，亦進一步分析與比較 5 個不同階段的離岸風場開發下，作業模式與漁獲物種的變動情況。本研究結果，除可了解離岸風場開發過程中沿近漁業活動所受影響，亦作為助於評估風電場域開發與漁業活動之間潛在的衝突依據。

關鍵詞: 商業性卸魚資料、沿近海漁業、魚種組成、漁船行為、離岸風電

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Impacts of offshore wind farm development on fishing activities in Miaoli

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Abstract

Offshore wind farm development is currently one of the major issues in Taiwan and its impacts on the coastal fisheries activities also have received much attention. Hence, we collected and integrated commercial landing data and vessel position information from those fishing vessels operating in the coastal water off Miaoli county between 2013 and 2021 to explore variations in the pattern of fishing operation, and relative abundance and occurrence frequency of catch species during the construction of offshore wind farms. Our results indicate that gillnet fisheries predominate in the study area and its fishing ground is highly overlapped with the location of offshore wind farms. Major catch species include mullet, and cuttlefish, etc. Additionally, we have further analyzed and compared variations in in the pattern of fishing operation, and relative abundance and occurrence frequency of catch species over 5 different stage of offshore wind farm development. Taken together, results from this study are expected to provide understanding for the impacts of offshore wind farm development on coastal fishing activities as well as provide the reference to evaluate the potential conflicts between offshore wind power development and fishing activities.

Keywords: commercial landing data, coastal fisheries, species composition, offshore wind power

利用氣候變遷情境模式分析臺灣沿近海鏽斑蟳捕獲率與分布變動之影響

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摘 要

聯合國政府間氣候變遷專門委員會公布氣候變遷第六次評估報告內容顯示 持續的全球暖化將進一步增強全球水循環，且臺灣年平均氣溫在近 30 年亦增溫 有加速的趨勢。梭子蟹科為臺灣周邊海域重要經濟物種，其中又以鏽斑蟳（*Charybdis feriatus*）產值為最高，因此本研究以鏽斑蟳為研究對象物種，收集 籠具漁業漁獲資料與分布特性，探究氣候變遷對臺灣沿近海洋環境變化情境下， 鏽斑蟳捕獲率與分布變動之影響生態之衝擊。海洋環境資料收集至聯合國政府 間氣候變遷專門委員會第六次評估報告（IPCC AR6）之兩種共享社會經濟路徑 情境—極低度溫室氣體排放情境（SSP1-1.9）和極高度溫室氣體排放情境（SSP5-8.5），收集海洋環境因子包含表水溫、基礎生產力、溶氧量與底層水溫 等資料，並結合泛加乘模式（Generalized Additive Model, GAM）分析方法，推 估出鏽斑蟳之捕獲率與分布在氣候變遷不同情境模擬下的可能長期變化，並進 一步分析多層面的潛在衝擊與影響。相關結果將可供漁政單位作為參考制定相 關的保護調適策略，藉此達到沿近海蟳蟹類資源再生和永續利用之目的。

關鍵詞：氣候變遷、臺灣沿近海、鏽斑蟳、IPCC

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Analysis of the future effects in habitat changes and catch rate variation of Cross crabs (Charybdis feriatus) along Taiwan's coastal waters using IPCC scenarios of climate change projections

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Abstract

The Intergovernmental Panel on Climate Change (IPCC) of the United Nations has released its sixth assessment report (AR6) which shows that ongoing global warming will further intensify the global hydrological cycle. Additionally, the average annual temperature in Taiwan has been increasing at an accelerating rate over the past 30 years. The Portunidae family is an important economic species in the surrounding waters of Taiwan, with Crucifix crabs (*Charybdis feriatus*) being the highest value commercial species among its family. Hence, this study focuses on the investigation of *Charybdis feriatus* through collecting data on its trap catch and distribution characteristics to explore the impact of climate change on variation in catch rates and distribution under changing marine environmental conditions in Taiwan's coastal waters. Marine environmental data were collected from two Shared Socioeconomic Pathways in IPCC AR6: SSP1-1.9 (low greenhouse gas emissions) and SSP5-8.5 (high greenhouse gas emissions). Environmental factors including sea surface temperature, primary productivity, dissolved oxygen and bottom water temperatures were analyzed using Generalized Additive Model to estimate possible long-term changes in catch rates and distribution of *Charybdis feriatus* under different climate change scenarios while exploring potential impacts across multiple dimensions. The results can be used by fisheries management agencies as a reference for developing relevant protection strategies to achieve sustainable use of crab resources along Taiwan's coasts.

Keywords: climate change, Taiwan, coastal waters, Crucifix crabs (*Charybdis feriatus*), IPCC

台灣北部沿岸浮游生物生產力之推估

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摘 要

以往浮游植物初級生產力作為漁業資源生產力指標,為觀察食物鏈持續傳遞之狀態,應將浮游植物食性的浮游動物納入考量,其在海中快速攝食浮游植物將其轉化為自身組織並佔據原有浮游植物生物量之比例,因此次級生產力在浮游生物生產力中至關重要,本研究將了解浮游植物被浮游動物攝食後轉化之次級生產力與剩餘基礎生產力之關係。本研究在不同季節於八斗子沿岸採樣分析浮游生物群:包括浮游植物、浮游植物食性之浮游動物,了解其豐度、物種比例及沿岸優勢種之變動,選擇優勢浮游植物物種於實驗室進行光暗瓶溶氧差值培養法測量初級生產力,之後進行浮游動物攝食浮游植物比率之實驗,給予浮游動物不同浮游植物攝食,得知各浮游動物於不同藻類豐度下其生物量隨時間之消長關係,建立各物種之生產力轉化能力,以用於估計日後採樣浮游生物量計算生產力之參考。

關鍵詞:浮游植物、浮游動物、基礎生產力、次級生產力
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Estimation of Plankton Productivity along the Coast of Northern Taiwan

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Abstract

In previous studies, the primary productivity of phytoplankton was used as an indicator of the productivity of fishery resources. In order to observe the state of continuous transmission of food chains, zooplankton and phytoplankton feeding habits should be taken into consideration. They ingest phytoplankton quickly in the marine environment, transform them into their own tissues, and occupy the original phytoplankton organisms. Therefore, secondary productivity is crucial to plankton productivity. This study will understand the relationship between the secondary productivity transformed by phytoplankton after being ingested by zooplankton and the remaining primary productivity. In this study, sampling and analysis of plankton groups along the coast of Badouzi in different seasons, plankton groups including phytoplankton and zooplankton with phytoplankton feeding habits, to understand its abundance, species ratio and variable in coastal dominant species, and to select dominant phytoplankton species in the laboratory, measure primary productivity with the method of dissolved oxygen in light and dark bottles technique, and then do the experiment of the ratio of zooplankton to ingest on phytoplankton, and the zooplankton were fed with different phytoplankton, and the biomass of each zooplankton under different algae abundances relationship between growth and decline varied with time. To establish the productivity conversion capacity of each species, it can be used as a reference for estimating the productivity of plankton sampled in the future.

Keywords: phytoplankton, zooplankton, primary productivity, secondary productivity