

TICOG 2021

Taiwan International Conference on Ocean Governance 2021

September 23, 2021



Organizers



Implementer



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Taiwan International Conference on Ocean Governance 2021

September 23, 2021

About TICOG

Taiwan International Conference on Ocean Governance 2021 (TICOG 2021)

Conference Objectives:

The Ocean Affairs Council (OAC) mainly plans, promotes, and implements the integration of ocean affairs and ocean policies to build an ecologically sound, safe, and prosperous maritime nation.

As the National Ocean Policy White Paper sets out visions on "ecological sustainability", "maritime security" and "industrial prosperity", OAC in partnership with AIT/K cohosts the Taiwan International Conference on Ocean Governance 2021 to help achieve the white paper's six policy objectives, including 1. Building regional strategic thinking and defending maritime sovereign rights; 2. Implementing maritime law enforcement measures and promoting regional security cooperation; 3. Maintaining marine ecological health and optimizing marine environmental quality; 4. Setting industrial development goals and promoting blue industry upgrades; 5. Building an ocean-friendly culture among citizens and cultivating nationwide oceanic thinking; 6. Fostering the momentum of scientific development and enhancing scientific research capabilities.

The International Conference on Ocean Governance 2021 provides the latest ocean-related information and future trends, as well as a platform of information exchange for researchers from academic institutes, central and local governments, and public and private sectors both domestically and internationally.

This conference mainly focuses on six research areas, including Ocean Law and policy and Marine Education, Marine Science and Technology, Ocean Conservation, Maritime Safety and Security, Ocean Environmental Engineering, and Marine Industry. We hope this conference creates a sphere of exchange, contributes ideas of ocean governance for future policies, brings ocean professionals to the global stage, and expands their engagements in international meetings and maritime organizations.



Themes:

1. Ocean Law and Policy, Marine Education
2. Marine Science & Technology
3. Ocean Conservation
4. Maritime Safety & Security
5. Ocean Environmental Engineering
6. Marine Industry

Organized by:

1. Ocean Affairs Council
2. American Institute in Taiwan, Kaohsiung Branch Office

Implemented by:

National Kaohsiung University of Science and Technology



□ Agenda

Time	Agenda		
09:00~09:30	Registration		
09:30~09:50	Opening Remarks		
	1. Chief Mason Yu, Director of the American Institute in Taiwan, Kaohsiung Branch		
	2. Dr. Linwood Pendleton, Senior Vice President, Center for the Fourth Industrial Revolution and the Ocean		
	3. Yang Ching-Yu, President of the National Kaohsiung University of Science and Technology		
09:50~10:30	4. Tsai Ching-Piao, Deputy Minister of the Ocean Affairs Council		
	Keynote Speeches Speaker:		
09:50~10:30	1. Chiau Wen-Yen, Chair Professor, National Taiwan Ocean University / National Sun Yat-sen University		
	2. Virginia Shiang-Lan Shen, National Sun Yat-sen University Professor Si Wan College Associate Dean		
10:30~10:40	Break		
10:40~12:30	Paper Presentation		
	<u>Panel Discussion I</u> Ocean Law and Policy, Marine Education <u>Moderator</u> Associate Professor, Chi-Ting Tsai	<u>Panel Discussion II</u> Marine Science & Technology <u>Moderator</u> Honorary Professor, Forng-Chen Chiu	<u>Panel Discussion III</u> Ocean Conservation <u>Moderator</u> Associate Professor, Chia-Ying Ko
12:30~13:30	Lunch		
13:30~15:20	<u>Panel Discussion IV</u> Maritime Safety & Security <u>Moderator</u> Deputy Secretary General, Ting-Hui Lin	<u>Panel Discussion V</u> Ocean Environmental Engineering <u>Moderator</u> Honorary Professor, Chon-Lin Lee	<u>Panel Discussion VI</u> Marine Industry <u>Moderator</u> Professor, Chung-Ling Chen
15:20~15:30	Break		
15:30~16:00	Closing Ceremony		



□ Keynote Speakers

邱文彥 | 國立臺灣海洋大學/國立中山大學榮譽講座教授

Chiau Wen-Yen,
Chair Professor, National Taiwan Ocean
University/ National Sun Yat-sen University

Education

M.A. and Ph.D. in City and Regional Planning,
University of Pennsylvania, U.S.A.

Academic Experience

Legislator, Legislative Yuan.

Deputy Minister, Environmental Protection
Administration, Executive Yuan.

Dean, College of Ocean Law and Policy; Director, Institute of Marine Affairs
and Resource Management, National Taiwan Ocean University.

Areas of Specialization

Marine Affairs and Policy

Ocean & Coastal Management

Marine Spatial Planning

Wetland Conservation

Preservation of Underwater Cultural Heritage



李香蘭 | 國立中山大學西灣學院副院長/全英語卓越教學中心執行長

Virginia Shiang-Lan Shen
National Sun Yat-sen University
Professor
Si Wan College Associate Dean
Chief Executive Officer, Center for EMI
Teaching Excellence



Education

Ph. D. Spanish, Department of Foreign Languages (Concentration in Latin American Studies), Arizona State University
M. A. Latin American Literature, Instituto Caro y Cuervo, Bogotá, Colombia
B. A. Spanish, Fu Jen Catholic University (Minor in International Trade)

Academic Experience

Professor, Department of English, Foreign Languages and Literature, Chicago State University
Assistant Professor, Department of Foreign Languages, Louisiana State University in Shreveport
College Assistant Professor, Department of Foreign Languages, New Mexico State University

Areas of Specialization

Foreign Language Teaching and Learning
Cross- Cultural Studies
Spanish American Literature and Culture
Hispanic Women Writers
U. S. Latinx Literature and Culture



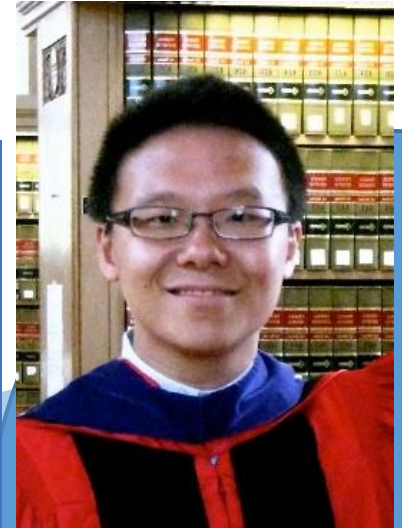
□ Moderators

Theme 1 : Ocean Law and Policy, Marine
Education

Moderator : Tsai Chi-Ting, Associate Professor

主題一：海洋法政及海洋教育

主持人：蔡季廷 副教授



Chi-Ting Tsai

Current Occupation

Associate Professor, Department of Political Science, National Taiwan
University

Education

Ph.D. Cornell University Law School

M.Sc. National Taiwan University Graduate Institute of National Development

B.Sc. National Taiwan University, College of Law

Experience

Department of Political Science National Taiwan
University Associate Professor

Expertise

Public International law, Constitutional law, Administrative Law, National
Security Law, Legal Empirical Studies



蔡季廷

現職/ 國立臺灣大學政治學系副教授

學歷/ 康乃爾大學法學 博士 (J.S.D.)
國立臺灣大學國家發展研究所 碩士
國立臺灣大學法律系 學士

經歷/ 國立臺灣大學政治學系副教授

研究專長/ 國際公法、憲法、行政法、國家安全法、法學實證研究



Theme 2 : Marine Science & Technology
Moderator : Chiu Forng-Chen, Honorary Professor

主題二：海洋科技
主持人：邱逢琛 名譽教授



Forng-Chen Chiu

Current Occupation

Honorary Professor, Department of Engineering Science and Ocean Engineering, National Taiwan University
chairman of Ship and Ocean Industries R&D Center (SOIC)

Education

Ph.D. Naval Engineering from the University of Tokyo
M.Sc. Naval Engineering from the University of Tokyo
M.Sc. National Taiwan University, Department of Engineering Science and Ocean Engineering
B.Sc. National Taiwan University, Department of Mechanical Engineering

Experience

Honorary Professor of the Department of Engineering; Science and Ocean Engineering; National Taiwan University
Chairman of Ship and Ocean Industries R&D Center (SOIC)

Expertise

Ship maneuvering and control, underwater vehicle dynamics, underwater technology, and marine renewable energy.



邱逢琛

現職/ 國立臺灣大學工程科學及海洋工程學系名譽教授
財團法人船舶暨海洋產業研發中心董事長

學歷/ 東京大學船舶工學 博士
東京大學船舶工學 碩士
國立台灣大學工程科學及海洋工程學系(前造船工程) 碩士
國立台灣大學機械工程 學士

經歷/ 財團法人船舶暨海洋產業研發中心 董事長
國立臺灣大學工程科學及海洋工程學系名譽教授
國立台灣大學工程科學及海洋工程學系 教授

研究專長/ 船舶運動操縱、水下載具動力學、水下技術以及海洋再生能源



Theme 3 : Ocean Conservation
Moderator : Ko Chia-Ying, Associate Professor

主題三：海洋保育
主持人：柯佳吟 副教授



Chia-Ying Ko

Current Occupation

Associate Professor, Institute of Fisheries Science, National Taiwan University
Associate Professor, Department of Life Science, National Taiwan University
Associate Professor, Department of Biochemical Science and Technology, National Taiwan University

Education

Ph.D. National Taiwan University, Institute of Ecology and Evolutionary Biology
M.Sc. National Taiwan University, Institute of Ecology and Evolutionary Biology
B.Sc. National Taiwan University, Department of Life Science

Experience

Assistant Professor, Institute of Fisheries Science, Department of Life Science & Department of Biochemical Science and Technology, National Taiwan University, Taiwan.
Postdoctoral Fellow, Research Center for Environmental Changes, Academia Sinica, Taiwan.
Postdoctoral Fellow, Department of Ecology and Evolutionary Biology & School of Forestry and Environmental Studies, Yale University, USA.
Postdoctoral Fellow, Institute of Ecology and Evolutionary Biology, National Taiwan University.
Visiting Research Fellow, Department of Biology, Stanford University, USA.



Expertise

Global Climate Change Biology, Big Data & Long-Term Data Analysis, Interdisciplinary & Transdisciplinary Sciences, Marine debris observation and simulation, Biogeography, Macroecology, Ecosystem Dynamics and Services, Biostatistics, Geographic Information Systems (GIS).

柯佳吟

現職/ 國立臺灣大學漁業科學研究所副教授

學歷/ 國立臺灣大學生態學與演化生物學研究所博士
國立臺灣大學生態學與演化生物學研究所 碩士
國立臺灣大學生命科學系 學士

經歷/ 中央研究院環境變遷研究中心 博士後研究員
美國耶魯大學森林環境學院與生態演化系 博士後研究員
國立臺灣大學生態學與演化生物學研究所 博士後研究員
美國史丹福大學生物系 研究學者

研究專長/ 氣候變遷生物學、大數據與長期資料分析、跨領域科學、海洋垃圾觀測及模擬、生物地理學、巨觀生態學、生態系統動態與服務、生物統計、地理資訊系統



Theme 4 : Maritime Safety & Security
Moderator : Lin Ting-Hui, Deputy
Secretary-General

主題四：海域安全
主持人：林廷輝 副秘書長



Ting-Hui Lin

Current Occupation

Deputy Secretary General, Taiwanese Society of International Law

Education

Ph.D. Department of Political Science, National Taiwan University

Experience

Deputy Secretary-General of Taiwan Society of International Law.

Vice President, TBT.

Vice President, Prospect Foundation.

Expertise

Assistant Researcher of the National Security Conference.

Research Fellow of the National Security Council, Taiwan.

Postdoctoral Fellow, Academia Sinica.

South China Sea, East China Sea, Maritime Law, Indo-Pacific Research.



林廷輝

現職/ 財團法人兩岸交流遠景基金會副執行長
中央警察大學水上警察學系兼任助理教授

學歷/ 國立臺灣大學政治學系博士

經歷/ 新台灣國策智庫副執行長
中研院人社中心博士後研究
國家安全會議助理研究員
臺灣國際法學會副秘書長

研究專長/ 新台灣國策智庫副執行長
中研院人社中心博士後研究
國家安全會議助理研究員
臺灣國際法學會副秘書長



**Theme 5 : Ocean Environmental
Engineering
Moderator : Lee Chon-Lin, Honorary
Professor**

**主題五：海洋工程
主持人：李宗霖 特聘教授**



Chon-Lin Lee

Current Occupation

Honorary Professor, Department of Marine Environment and Engineering,
National Sun Yat-Sen University

Joint-Appointment Chair Professor, Department of Applied Chemistry,
Providence University, Taiwan

Aerosol Science Research Center Aerosol and Atmospheric and Marine
Ecology Research Group, National Sun Yat-Sen University

Joint-Appointment Distinguished Researcher, Research Center for
Environmental Medicine, Kaohsiung Medical University, Taiwan

Education

Ph.D. (1989) in Chemical Engineering, University of Oklahoma, USA

M.S. (1983) in Chemical Engineering, Tennessee Technological University, USA

B.S. (1979) in Chemical Engineering, National Cheng Kung University, Taiwan

Experience

Vice President for Academic Affairs, NSYSU, Taiwan.

General Counsel and Advisory Committee, Chiara Lubich carisma
dell' unità Cultural Research Center, Providence University.

Director of the Division of Natural and Applied Science Education, Center for
General Education, National Sun Yat-Sen University, Taiwan.



Expertise

Pollution monitoring in marine areas.
Contaminant transmission mechanisms.
Environmental chemistry.

李宗霖

現職/ 國立中山大學海洋環境及工程學系 特聘教授

學歷/ 美國奧克拉荷馬大學化學工程系博士

經歷/ 國立中山大學海洋環境及工程學系 特聘教授
國立中山大學氣膠科學研究中心氣膠與大氣及海洋生態研究組組長
國立中山大學新興污染物研究中心學術組組長

研究專長/ 海域污染監測
污染物傳輸機制
環境化學



Theme 6 : Marine Industry
Moderator : Chen Chung-Ling, Professor

主題六：海洋產業
主持人：陳璋玲 教授



Chung-Ling Chen

Current Occupation

Professor, Institute of Technology Marine Affairs, National Cheng Kung University

Education

Ph.D. of Marine Policy, University of Delaware
M.S. of Oceanography, National Taiwan University
B.S. of Zoology, National Taiwan University

Experience

Professor, Institute of Ocean Technology and Maritime Affairs (IOTMA), Cheng Kung University.
Professor, Department of Water Conservancy and Ocean Engineering (DHOE), Cheng Kung University.
Visiting Scholar, College of Marine Sciences, College of William and Mary, USA
Visiting Scholar, School of Earth, Ocean Environment, University of Delaware.

Expertise

Marine policy
Coastal management
Fishery management and marine conservation
Marine recreation management



陳璋玲

現職/ 成功大學海洋科技與事務研究所/
水利及海洋工程學系教授

學歷/ 美國德拉瓦大學海洋政策博士
國立台灣大學海洋研究所碩士
國立台灣大學動物系學士

經歷/ 成功大學海洋科技與事務研究所/
水利及海洋工程學系教授
美國威廉瑪麗學院海洋科學院訪問學者
美國德拉瓦大學地球海洋環境學院訪問學者

研究專長/ 海洋政策
海岸管理
漁業管理與海洋保育
海域遊憩管理



□ Abstracts

Theme 1 : Ocean Law and Policy, Marine Education

Date : September 23, 2021

Time : 10:40 ~ 12:30

主題一：海洋法政及海洋教育

日期：110年9月23日

時間：10:40 ~ 12:30



編號：ME01

The Research of Taiwan's Ocean Sustainable Development Policy from the Perspective of Marine Culture and Education

Chia-Dai Yen ¹, Meng-Tsung Lee², Chi-Lin Lee³, Ren-Ming Liou⁴, Ya-Fan Ho⁵, Shih-Han Yen⁶,
Yu-Rong Jhan⁶

1. Assistant Professor, Graduate Institute of Education, National Taiwan Ocean University
2. Associate Professor, Department of Marine Leisure Management, National Kaohsiung University
3. Associate Professor, Department of History, Tamkang University
4. Associated Professor, Department of Fisheries Reduction and Management, National Kaohsiung University
5. Research Assistant, Department of History, Tamkang University
6. Research Assistant, Graduate Institute of Education, National Taiwan Ocean University

Abstract

Taiwan has a rich marine culture offering marine education resources that have promoted marine professional education since 1953. However, marine general education and marine cultural education were not fully promoted until 2007 when the Ministry of Education issued a Marine Education White Paper on marine education policies. After 14 years, marine culture and education have become a popular educational issue in Taiwan. However, since marine culture and education spans across multiple marine-related disciplines, achieving a comprehensive balance across departmental affairs, and international integration remain the biggest challenges. This research is commissioned by the Ocean Affairs Commission to study the long-term governance of marine multiculturalism and sustainable education. The PEST analysis is proposed through the review of marine culture and education-related literature and the integration of domestic and international marine culture and education policies. Additionally, eight marine culture and education experts were interviewed in-depth, and four fishing village focus groups were formed for this study. Taken together, the results provide relevant research and marine committee policy references. Eight policy directions are suggested for marine culture and education.

Keywords: Marine Culture; Marine Education; Ocean literacy, Ocean Policy, Ocean Affairs Council.



編號：ME02

Exploring the University Social Responsibility on SDGs14 in Taiwan: Using a Textual Analysis

Wei-Ying Sung

Project Assistant Researcher, Institute of Marine Affairs and Business Management,
National Kaohsiung University of Science and Technology

Abstract

The idea that a University education should include and fulfill Social Responsibility (USR) has become a trend in higher education in Taiwan. Common values emphasized by Sustainable Development Goals (SDGs) are closely related to USR. In addition to disseminating knowledge and cultivating professionals, universities are required to effectively provide support and act as coordinators at both the local and global levels in the future. In other words, effective connection to SDGs is the driving factor of promoting USR in Taiwan. Of note, Taiwan is an island country and therefore surrounded by water. Therefore, ocean sustainability has a significant impact on the overall development of Taiwan.

Judging from past developments, SDGs14 has already become a key factor in the connection between the USR Program and SDGs. However, it is unclear as to whether any progress was made for synchronizing the development of SDG14 within the timeline of the USR Program. This study analyzes SDG14-based projects conducted in different phases of the USR Program to identify the corresponding targets of SDG 14 for each project and to collect data on important issues concerning the development of the marine environment in Taiwan. The results are as follows:

- a. Strengthen the connection with other targets because only the connections to SDGs 14.7 and 14.2 are found.
- b. Most marine projects are conducted by maritime universities and follow a trend of connecting their own features to that of local areas.
- c. Most marine projects are conducted in nearby coastal areas and fishing villages, and mainly focus on ocean pollution, the development of fishery products, or fishing culture conservation.

On the basis of these results, this study presents policy recommendations and areas for future research.

Keywords: Sustainable Development Goals 14 (SDGs 14), University Social Responsibility (USR), Developing Trend, Promoting Experience, Taiwan.

An Effectiveness Assessment of Marine Education in Taiwan

Luo, Wen-Jun¹, Ou Pei-Chun², Huang Xuan-Jin³

Kaohsiung Municipal Ruesiang Senior High, Taiwan; wenchun@gcloud.rssh.tw

Kaohsiung Municipal Ruesiang Senior High, Taiwan; nicole3805254@gmail.com

Kaohsiung Municipal Ruesiang Senior High, Taiwan; huangjean@gmail.com

Abstract

The purpose of the study is to investigate the effectiveness of contemporary marine education toward ocean literacy, based on the previous engagement experience. The analyzed data were collected from self-assessed questionnaire filled out by students aged 16-17 years old in one senior high. The students' ocean literacy was used as the outcome variable, while the students' previous engagement of marine education was used as the independent variables. Of all the final total valid respondents in the study were 121 with the response rate being 86%. Students' engagement was found to be a key factor influencing their self-assessed effectiveness on marine education, especially on the principles of ocean literacy "the ocean is a major influence on weather and climate" (principle 3), "the ocean and humans are inextricably interconnected (principle 5) and "the ocean is largely unexplored (principle 7). Additionally, a considerable contribution was detected between the engagement experience and participants' awareness, attitude and effective skills they used to protect ocean. Judging from the literacy, a kind of ability gradually developed, further studies about long-term impact of marine education on students' ocean literacy are needed.

Keywords: ocean literacy, engagement experience, environmental education, students self-effectiveness measurement



編號：OLP01

A Legal Analysis of the Freedom of Navigation Operations and Innocent Passage Carried out by U.S. Warships in the South China Sea

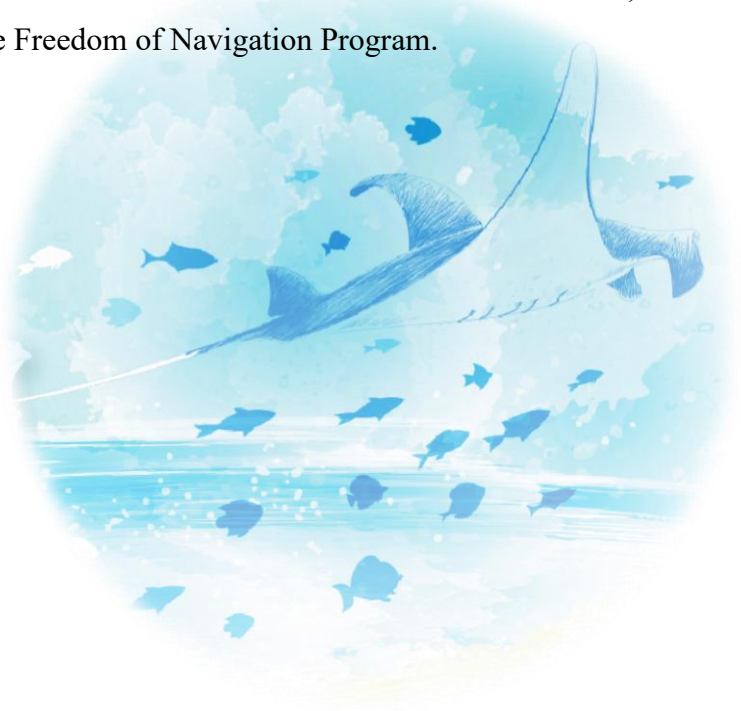
Dr.Li-Min Cheng

Adjunct Assistant Professor, Department of Public Administration, National Open University

Abstract

This research starts from the history of free navigation, analyzes the content and policies of the United States' free navigation operations through the relevant provisions of the United Nations Law of the Sea Convention, and discusses possible pros and cons. Through inspections of legal documents, it can be found that the US free navigation operation is in line with the United Nations Law of the Sea Convention and the interests of the Indo-Pacific region. As far as the Republic of China is concerned, in addition to adjusting its practices to avoid continuing situations where it is deemed to have excessive claims, it should also actively work on the implementation of the Freedom of Navigation Program.

Keywords: Freedom of Navigation Program.



South China Sea Dispute: Rising Tensions in the East Vietnam Sea

Tam T. T. Nguyen, Tuong C. Trinh

National Kaohsiung University of Science and Technology

Abstract

Tensions in the South China Sea are rising. Long-standing sovereignty conflicts over the 1.2 million square miles of sea dotted with atolls, shoals, and reefs, as well as extensive overlapping claims to marine space, have been a source of considerable interstate friction over the years, particularly during the 1990s. A brief lessening of tensions occurred in the first half of the last decade, thanks in part to China's more accommodating and flexible approach, which was part of a diplomatic "charm offensive" aimed at assuaging regional concerns about the country's expanding economic, political, and military dominance. However, in the years 2016-2021, the situation in Vietnam's East Sea has grown increasingly tense.

Keywords: South China Sea Dispute, Viet Nam, UNCLOS (1982).



編號 : OLP03

Comparison of the Responsibilities of Ocean Specialized Agencies between Taiwan and Other Countries

Syun-Hua Zeng, Chia-Jung Tsai

National Sun Yat-Sen University

Abstract

Due to the lack of assessment and management of the overall marine affairs in Taiwan, there appears to be a need for an ocean specialized agency in the central government. The aim of the ocean specialized agency is to efficiently coordinate lots of issues and interests concerning the implementation of marine policies and pursue an overall perception of marine policies and their structure of law. The overall marine policies could lead the country to manage the overall marine activities, such as shipping, fishing, marine science, defense, underwater cultural heritage, and marine pollution, etc.

In this study, we use three completely different types of marine specialized agencies for comparison, respectively being the Ocean Affairs Council (Taiwan), the National Oceanic and Atmospheric Administration (the United States), and the Ministry of Oceans and Fisheries (South Korea).

The Ocean Affairs Council and the National Oceanic and Atmospheric Administration are responsible for coordinating marine affairs delegated to different departments. While the Ministry of Oceans and Fisheries is classified as a ministry, and all the authorities are its subordinates.

According to the result of the comparison, the strength of coordination of the National Oceanic and Atmospheric Administration is less than that of the Ocean Affairs Council due to the concept of dominant agency in the United States. Korea has the best efficiency in executing marine policies and handling marine affairs and problems.

However, from our perspective, we accept the existing tradition of a functional division of labor, and through improving coordination, the government can still have a great efficiency in managing overall marine affairs without having to establish a unified system. We hope that the Ocean Affairs Council can lead Taiwan to become a global maritime power with "ecology sustainability, maritime security, and industrial prosperity".

Keywords: Ocean Specialized Agency, Marine Policy, Ocean Affairs Council, National Oceanic and Atmospheric Administration, Ministry of Oceans and Fisheries.



Theme 2 : Marine Science & Technology

Date : September 23, 2021

Time : 10:40 ~ 12:30

主題二：海洋科技

日期：110年9月23日

時間：10:40 ~ 12:30



編號 : MST01

Microplastic as Vectors for Heavy Metal Contaminants at Various Salinities

Beta Susanto Barus¹ ; Cheng,Sha-Yen ^{1*}

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

Abstract

Microplastic (MP) is a pollutant that has received great attention nowadays. MPs are reported to interact with heavy metals. However, the interaction between the two is still poorly understood. This study aims to examine the adsorption capacity and release rate of heavy metals concerning various types of MP particles, different heavy metals, the initial heavy metal concentrations, and salinity. The results show that there is an interaction between MP particles and heavy metals in all tests with different salinities. At higher salinity, the rate of adsorption and release of heavy metals in MP particles become lower and takes a longer time to reach equilibrium. Polypropylene (PP) MP particles have a higher absorption of heavy metals compared to other types of MP particles. In all tests with different salinities, Pb was consistently adsorbed the most by MPs, followed by Cu, Zn, and Cd. Different types of MPs also affect the release value of heavy metals. The heavy metal with the highest release rate was Cd, followed by Pb, Cu, and Zn. Increasing the concentration of heavy metals causes the adsorption capacity ($\mu\text{g/g}$) of MP particles to also increase, but the adsorption rate (%) decreases. Finally, our findings show that MP particles have potential as a vector for heavy metal contaminants in both freshwater, brackish water, and seawater environments.

Keywords: Microplastics, Heavy Metals, Adsorption, Release, Salinity.



Extended Finite Element Method for a Plate with Two Holes and Multiple Cracks

Huu-Dien Nguyen^{1,2*}, Shyh-Chour Huang¹

1. Department of Mechanical Engineering, National Kaohsiung University of Science and Technology
2. Institute of Engineering, Ho Chi Minh City University of Technology – HUTECH

Abstract

In this paper, the nonlinear behavior of contact was incorporated into the linear global equations by an iterative scheme to resolve the nonlinear boundary value problem. The combination of this method with Extended Finite Element Modeling (X-FEM) enhanced the efficiency of the contact analysis solution procedure. An algorithm which couples the level set method with the X-FEM was proposed by Stolarska et al. (2001), in which a discontinuous function based on the Heaviside step function was employed in modeling two-dimensional (2D) linear elastic crack tip displacement fields.

Keywords: Extended finite element method, level set method, holes, model 2D crack.



Development of Oceanic Exploration and the Risks Faced

Gong-way Lee

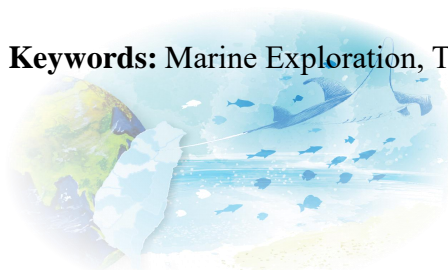
Chang Jung Christian University

Abstract

This essay discusses the development of oceanic exploration and the associated risks. It is divided into five parts: The first part introduces the background development of marine science technology, emphasizing the important contributions of Aristotle, Captain Cook, and W. Thompson in the aspects of marine ecology. Later on, explorers such as Captains Cook and Thompson also contributed to marine science and research. The second part discusses the application and breakthrough of marine technology. As early as the 8th century, the Vikings used strong ropes to measure the depth of the sea. After the 19th century, the sounding measurement was employed for the same purpose but with far better effects. In 1865, the first underwater breathing apparatus was invented. In 1946, the aqualung was invented and was used to explore the sea floor. Later on, newly invented underwater instruments were able to detect sounds from whales and the quantity of chemical elements of sea materials. Finally, autonomous underwater vehicles (AUVs) and remotely operated underwater vehicles (ROVs) were created to conduct research on the sea floor. These technological advancements now provide convenient means for deep sea exploration.

Second, the establishment of ecological observatories, such as Monterey Accelerated Research Systems (MARS), enabled researchers not only to observe sea bottom ecology but also to detect and predict earthquakes. The third part focuses on the problems and risks of off-shore explorations, which requires workers to employ heavy machinery and work in dangerous weather. It is extremely dangerous to work off-shore. Casualties are reported every year in the U.K. and many other countries. The fourth part deals with deep sea exploration. The deep sea is dark, cold, and its water pressure is about ten times higher than that of the sea surface. In order to reduce hazardous risk, researchers must not stay on the sea bottom too long, or else they must use submersibles or robots to do the work instead. These tools and equipment should be maintained often so that the researchers' safety can be guaranteed. In the last part of this essay, the author summarizes how modern marine technology offers tremendous conveniences for human exploration of the sea. Continuous studies on this subject are needed to further advance oceanic explorations. It is hoped that this essay will help those who are interested in marine exploration and science as well.

Keywords: Marine Exploration, Technology Development, Oceanic Research.



Bioprospecting of Marine Microalgae from Kaohsiung Seacoast for High Value Products

Akash Pralhad Vadrade¹, Anil Kumar Patel², Reeta Rani Singhania², Chiu-Wen Chen², Cheng Di Dong^{2*}

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2. Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology

Abstract

Bioprospecting of marine microalgae isolates were carried out from seawater samples from various locations of the Kaohsiung city harbor seacoast, Taiwan. The major focus of this research was to isolate fast-growing and high yielding potential microalgae strains (biomass) for value products that find applications in energy and health. First, a seawater sample was enriched in a Tris-Acetate-Phosphate (TAP) media prior to growth in a TAP agar plate. Once a single colony was obtained, it was grown into a 1 L culture successively to obtain adequate dried biomass prior to screening their potential for lutein and fatty acids. Several microalgae isolates were screened for lutein and lipids using a biorefinery concept and chromatographic methods. The major objectives of this research were (1) to identify the best microalgal strain for enhancing the yield of these products, (2) to explore process enhancement strategies including other trophic (autotrophic, heterotrophic, and mixotrophic) modes with different organic sources (glycerol, molasses, standard sugars), and (3) to optimize growth conditions, such as lighting, C/N ratio, pH, temperature, etc. The outcome of the above screenings will be disseminated in detail during the conference, and will cover several potential strains from the Taiwan seacoast which were discovered to be best for harvesting particular types of products.

Keywords: Marine Microalgae, Tris-Acetate-Phosphate.



A Comparative Study on the Production of Bacterial Cellulose of *Komagataeibacter europaeus* and *Komagataeibacter xylinus*

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5. Professor, College of Hydrosphere Science, National Kaohsiung University of Science and Technology

Abstract

Bacterial cellulose is an excellent biomaterial due to its remarkable properties and which finds applications in various areas. In this study, we have optimized the bioprocessing parameters for bacterial cellulose production. The effects of the cultivation/incubation period and the inoculum ratio on bacterial cellulose production by *Komagataeibacter europaeus* and *K. xylinus* were studied and compared. The sugar utilization efficiency was affected by the inoculum ratio of the two strains. An inoculum ratio of 5% was found best for both the bacterial strains for cellulose production. *K. europaeus* and *K. xylinus* showed a 57.58% sugar utilization efficiency at a 5% inoculum ratio, and a 49.27% sugar utilization efficiency at a 12.5% inoculum ratio, respectively. This work provides optimized parameters to execute the bioprocess production of bacterial cellulose.

Keywords: Bacterial Cellulose, *Komagataeibacter*, Bioprocess.



Discussion of Special Typhoon Generating Areas

Ann Lai

National Cheng Chi University, Taiwan Ocean International Youth Advisory Group

Abstract

In summer and autumn every year, typhoons always cause serious disasters to Taiwan, not only causing casualties, but also causing heavy losses to agriculture and industry. Furthermore, this occurs not only in Taiwan, but also tropical cyclones (typhoons or hurricanes, depending on the location of formation) occur in many other parts of the world. Interestingly, there are some tropical areas where cyclones rarely occur. Finding the reason why is the purpose of this work. Accounts from textbooks and literature surveys were too brief to provide us with a complete answer, and the information on the Internet was fragmented. This work attempts to provide this missing information, as relevant research sparsely comments on this question. Our curiosity and ambition invites us to unify the data found through this research and solve the confusion.

Keywords: Special Typhoon.



Theme 3 : Ocean Conservation

Date: September 23, 2021

Time: 10:40 ~ 12:30

主題三：海洋保育

日期：110年9月23日

時間：10:40 ~ 12:30



編號 : OC01

Exploring Fishery Management Options using System Dynamics

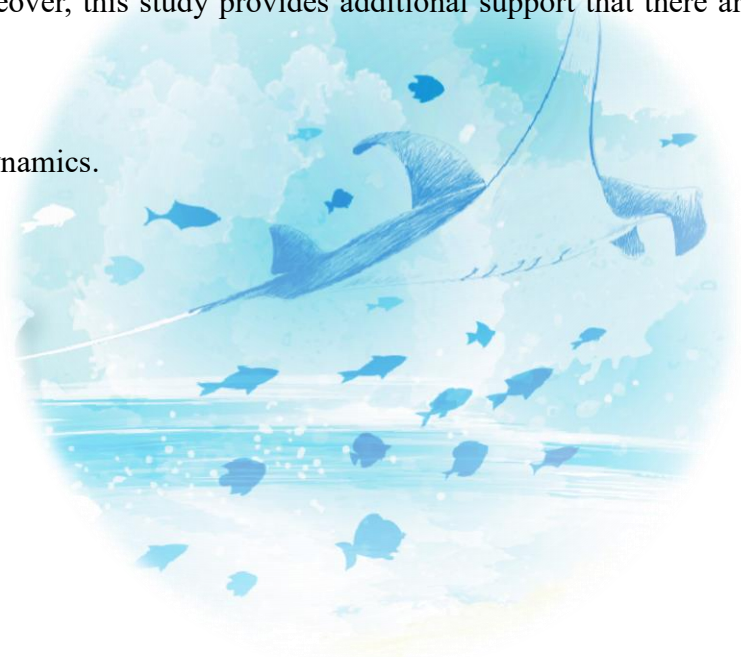
Monique Eloise T. Mercado¹, Pierre Alexandre Château², Yang-Chi Chang³

National Sun Yat-Sen University

Abstract

System Dynamics (SD) is a technique used to imitate real world phenomena through modeling. This study used SD to explore management options for sustainable fishery specifically to simulate the effects of supply and demand of fish and Marine Protected Areas (MPAs) on fish stocks. It was assumed that habitats inside and outside the MPA were similar. The model was calibrated with actual datasets taken from Pingtung, Taiwan. Three scenarios were built: (1) a varying percentage of protection, (2) policies that aim to reduce the demand for fish consumption, and (3) a composite scenario to determine how these may affect fishery production. Our results show that the calibrated model fits the reference model reasonably well. Based from our model, we also find that 15% protection will result in an optimal strategy to obtain equal benefits from both yield and stock, while 80% protection may be ineffective. It is also indicated in our results that 20% protection will result in the same yield as that of reducing 30% of the population demand and a combination of 15% reduction and approximately 12.5% protection. This study further shows the importance of SD and modeling in drawing possible conservation scenarios that may be beneficial for sustainable development. Moreover, this study provides additional support that there are multiple options to address a certain goal.

Keywords: Marine Protected Area; System Dynamics.



Marine Debris Identification based on Deep Learning Neural Network and Optimization Technology

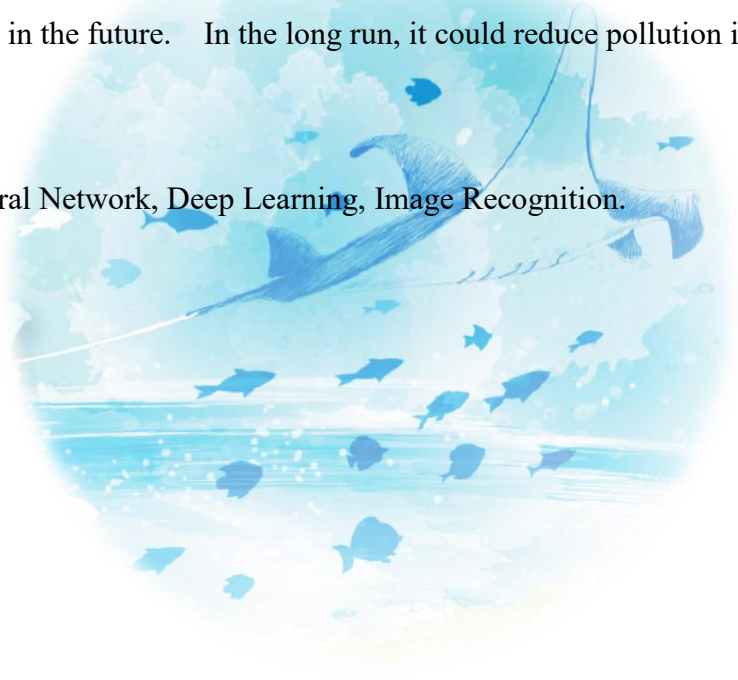
Cheng-Yun Lee

Department of Chemical and Materials Engineering, National Yunlin University of Science and Technology

Abstract

Recently, environmental conservationists have paid more and more attention to incidents of marine organisms eating plastic waste resulting in death. After taking part in beach cleaning activities, I observed a significant amount of marine debris on the coastline that required long working hours of sea waste classification. Therefore, I would like to solve the problem of identifying the types of sea waste and thereby reduce the burden on workers in recycling industries and the staff of beach cleaning events. With advanced technology on artificial intelligence (AI) in recent years, Deep Learning's Convolutional Neural Network (CNN) is booming. As a result, I have classified the types of marine debris into plastic bottles, plastic bottle caps, straws, and floats, using Deep Learning's Convolutional Neural Network as the basis of marine debris identification models. The number of marine debris may be estimated via image recognition technology in the near future, making recycling faster. I hope to transplant the trained CNN model to the smartphone as an application program software (APP) for real-time identification of marine debris. As a consequence, the software may help accelerate the speed of marine waste classification, and may possibly be utilized in other ways to manage recyclables in the future. In the long run, it could reduce pollution in the sea that is mainly caused by humans.

Keywords: Marine Debris, Convolutional Neural Network, Deep Learning, Image Recognition.



The Effects of Underwater Acoustics on *Negaprion acutidens*

Chin-Ti Lin*, Keryea Soong

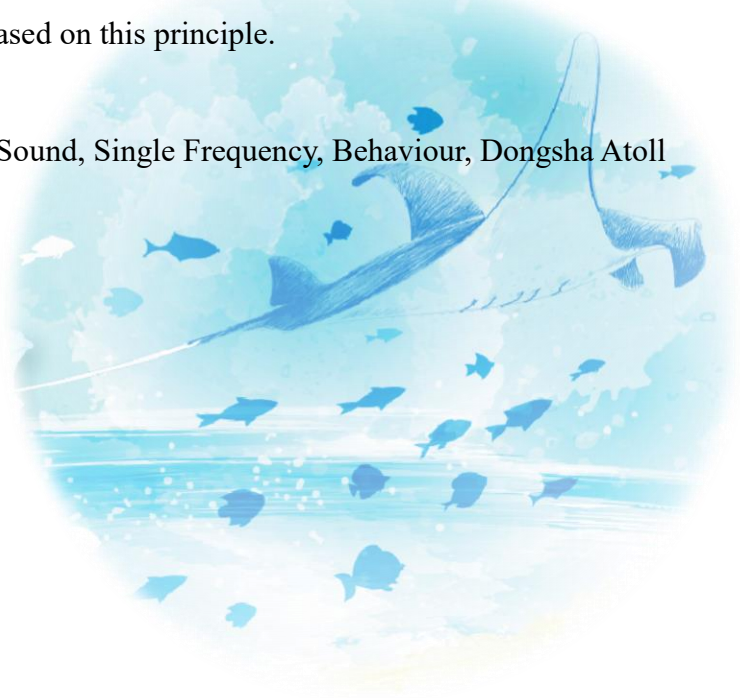
Department of Oceanography, National Sun Yat-Sen University

* Corresponding Author

Abstract

Sound is known to affect the behavior of sharks. It is suggested that this characteristic has the potential to be employed not only to protect the sharks but also prevent people from being harmed by sharks. In this study, the response of the sicklefin lemon sharks *Negaprion acutidens* were explored using single-frequency underwater sounds. In the experiment, bait tubes were kept to attract the sicklefin lemon sharks, and an underwater speaker was used to emit the sounds. Ten frequency ranges from 25~800Hz, were selected along with silent controls, and the behavior of sharks were filmed with an underwater camera. The study conducted 20 experiments, with data being gathered for all. Observations showed that there was a correlation between the presence of sound and the behavior of sharks, indicating that sharks had a higher probability of contacting the bait tubes in the absence of the sound treatment. However, there was no significant difference in the number of sicklefin lemon sharks in the video with or without sound. Overall, this preliminary study revealed that the sicklefin lemon sharks could hear and respond to the sound information accordingly. Their feeding behaviors were modified by the artificial sound, and it is plausible to develop conservation methods based on this principle.

Keywords: *Negaprion acutidens*, Underwater Sound, Single Frequency, Behaviour, Dongsha Atoll National Park.



編號：OC04

The Ocean's Future : When Marine Preservation Meets COVID-19

Wang Yi-Hsuan

Taiwan International Teen Ocean Counselling Group, International Affairs Counselling Committee

Abstract

We are living in a world of COVID-19 which has a significant impact on our lives. Yet, we probably never realized how much the pandemic has influenced marine wildlife. This paper attempts to emphasize the relations between marine conservation and COVID-19. At the same time, how each type of marine industry is affected by COVID-19 is thoroughly explained in context. Hopefully, the hidden astonishing facts revealed in this study will bring further awareness to the general public.

While world nations invest huge amounts of funds to save marine departments, it is our belief that ensuring these infusions of capital are beneficial towards rebuilding bluer and healthier oceans under sustainable and fair circumstances. By adopting evidence and data through the context, the primary objective of this study is to offer public and governmental guidelines for appropriate initiatives to resolve problems related to ocean sustainability during the crises. In conclusion, we propose that marine conservation efforts require a concentrated public effort. Consequently, we can restore “blue” and “green” marine ecosystems.

Keywords: COVID-19, Marine Conservation, Marine Industries, Blue Economy, Sustainability.



Ecology and Exploitation of Mud Lobsters in the Philippines: A Social Media Analysis

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2. Fisheries and Marine Research Station (FaMaRS), Fisheries and Marine Sciences Department, College of Fisheries and Allied Sciences, Northern Negros State College of Science and Technology, Philippines

3. Iloilo State College of Fisheries, Barotac Nuevo, Philippines

Abstract

Mud lobsters are burrowing crustaceans, somehow neglected in scientific studies in the Philippines. Increasing risks brought by this pandemic further impede field surveys as mobilization is highly regulated. Hence, the use of social media platforms was explored to study the ecology and exploitation of mud lobsters in the country. We used content analysis of YouTube videos. Key terms were searched to identify contents such as “Philippines”, “mud lobsters”, and local terms like “bulaso”, “uson”, and “urong”. A total of 30 videos were analysed. Videos were posted from 2015-2021 from at least 10 Provinces. Results reinforce already known wide distribution of mud lobsters in mangrove forests, fishpond areas and rice fields beside mangroves. Still, there were important mud lobster behaviours observed, such as surfacing during rainy season, and the timing of when a disturbed burrow is repaired. Mud lobsters were commonly caught using bamboo traps but some people developed unique fishing techniques, such as mound disturbance and the tali-tali method. Alarmingly, this study also discovered an illegal fishing activity hotspot where the use of toxic chemicals is concentrated. This study provides evidence on the potential use of social media to study aquatic organisms. Additional knowledge on mud lobster ecology and baseline information on some aspects of its fishery in the Philippines was observed.

Keywords: Behaviour, Fishing Methods, Illegal Fishing, Thalassinidae, YouTube Videos.



Comparing size and density fractionation in phytoplankton trace metal assessment

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Chiu Wei Chen¹, Cheng Di Dong¹

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2. Fisheries and Marine Research Station (FaMaRS), Fisheries and Marine Sciences Department, College of Fisheries and Allied Sciences, Northern Negros State College of Science and Technology, Philippines

Abstract

Studies on phytoplankton and its effects on trace metal biogeochemical process have increased in the past decades. However, determining trace metal stoichiometry for phytoplankton is challenging due to the difficulty of isolating phytoplankton assemblages from other suspended solids. Assessment in marine environments currently employs two distinct methods, size and density fractionation, where results were usually treated similarly in previous studies. Here, we compared trace metal concentrations in phytoplankton using the two aforesaid techniques. Trace metals such as Cu, Zn, As, Hg, and Pb were analysed using an inductively coupled plasma mass spectrometer. It was found that trace metals in density fractionated plankton were lower compared to those in size fractionated samples. A highly significant difference of $P < 0.01$ was found in both small (1.2 to 55 μm) and large (55 to 120 μm) fractions for As concentrations. Zn and Hg were also significantly lower at $P < 0.05$ in smaller fractions and in both fractions for Cu. Using both data from size and density fractionated plankton, we estimated that trace metals of abiogenic origin contribute 72-88% of the trace metals in the 1.2 to 120 μm plankton size fractions. This study proves that density fractionation can significantly reduce trace metals in plankton samples. Also, the high estimated trace metal concentration from abiogenic sources suggest that trace metals in size fractionated plankton reported as concentrations in phytoplankton may have been overestimated. Hence, the reduction of abiogenic materials present in plankton samples is important to provide a more accurate picture of phytoplankton contributions in trace metal biogeochemistry.

Keywords: Biogeochemistry, Heavy Metals, Kaohsiung Harbor, Phytoplankton, Stoichiometry.



Theme 4 : Maritime Safety & Security

Date: September 23, 2021

Time: 13:30 ~ 15:20

主題四：海域安全

日期：110年9月23日

時間：13:30 ~ 15:20



Identifying Safety Risk Control Factors in the Waters around Taiwan – A Case Study of Ship Collision

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2. Department of Marine Leisure Management, National Kaohsiung University of Science and Technology

* Corresponding Author

Abstract

The waters around Taiwan are a moderate risk environment with frequent ship collisions that result in not only injuries, missing and even death of ship's crew, but also devastation of marine ecology and the environment. In 2019, the Covid-19 pandemic caused global economic panic and most businesses went into a nose dive, including the shipping business. However, that did not lead to the decrease of ship collision incidents. On the other hand, the Covid-19 vaccination campaign in the second half of 2020 seemed to gradually keep the pandemic under control, and the shipping business started to experience explosive growth worldwide, which included Asian shipping routes. Because Taiwan is situated at the center of the Asian maritime hub, the complexity of maritime transportation started to increase. In response, this study is designed to investigate the risk factors of ship collisions in the waters around Taiwan. 29 initial risk factors were identified in a literature review, and 8 of these were selected as representative factors having a significant correlation and influence as determined by an expert decision-making team, rough set theory (RST), and rough sets theory for group decision making to representative indicators (RGRI). Finally, the bow-tie analysis is introduced to identify the causes of ship collision and the consequences, so as to keep the occurrence of ship collisions and the consequences of collisions in check.

Keywords: Rough Set Theory, Bow-tie Analysis, Ship Collision.

編號 : MSS02

Marine Spread of the Exotic Disease: The Need for Reinforcing Communication on African Swine Fever with the Upcoming Restorations of the Yanliao Fishing Port

Shih-Cheng Wang, DVM

Taiwan Sangxin Regional Office

Abstract

This paper (study) reflects important communications regarding the environmental efforts needed to restore a fishing port, and how to implement risk management concerning the possible spread of African Swine Fever (ASF) due to the marine transport of people and products from around the world. Several precautions are recommended as necessary to prevent the transmission of this deadly disease for pigs.

A meeting for discussing the status quo, restoration, and management of the Yanliao fishing port was held on Oct 8, 2020 in Hualien, Taiwan. One of the purposes of this meeting was to examine Yanliao as a possible hotspot of disease transmission that would deserve a regional response, regular monitoring, and compensation. Attendants ranging from governance officials, professors, and locals did not concur about how to prevent the spread of the exotic disease, and unanimity was not achieved on all the policy questions that were posed. Upon reflection, it can be seen that media communications complimentary to the issues posed at a meeting (conference) can assist the communication of risk factors and increase the consideration of risk assessments in the planning process. As part of the restoration campaign, risk communications were not made available to people of Yanliao to raise awareness of the risk of spreading the disease, such as posters, brochures, a short animation, and a general information video. Many of these media tools are still not available to the general public.

Keywords: Risk Communication, Yanliao, ASF.



編號：MSS03

A Study on Homicides at Sea and Preventive Strategies

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Abstract

Homicides at sea have become more serious in recent years, however very few studies have been conducted in Taiwan. This study intends to fill such a void, and hopefully explore the underlying factors of such heinous violent crimes. To achieve the above goal, data was collected from Taiwanese court cases from January 1974 to June 2021. A total of 92 homicide cases were found that matched the research criterion.

After processing and analyzing the data by frequency analysis, the basic attributes of 13 variables were obtained. The “seriousness of the homicide” was categorized into two groups, the “low group (1 death each case)” and the “high group (≥ 2 deaths)”. There were eight variables significantly related to these two groups, while four variables were unrelated by Chi-square test. This study employed the “Quantification Theory Type II” to determine which factors discriminate between the two groups. The order of importance of the eight relative factors is as follows: (1) seagoing duration, (2) motive of the assault, (3) the type of assault, (4) nationalities of the offender(s) and victim(s), (5) acting alone or with accomplice, (6) the geographic location of the assault, (7) drinking before the assault or not, (8) fallen (or thrown) into the sea or not. These eight variables constitute a discriminating model and a relatively high 73.91% positive identification rate was derived.

After completing the analysis, the preventive strategies are proposed as follows: (1) Appropriate seagoing duration. (2) Careful selection and appropriate training of the crew. (3) Improved local culture courses for foreign crew. (4) Improvement of management problems. (5) Strengthening of maritime law enforcement. (6) Construction of emergency systems. (7) The application of a secret satellite tracking system.

Keywords: Maritime Safety, Law Enforcement, Violence, Homicide, Quantification Theory Type II.



Border Security Management during a Pandemic – A Case Study on Coast Guard Authority

You-Kang Yang¹, Jao-Chuan Lin²

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2. Associate Professor, Dept. of Marine Leisure Management, National Kaohsiung University of Science and Technology

Abstract

The COVID-19 virus was first found at the end of 2019 and soon spread across the world in 2020, and turned into a global pandemic later. As of June 2021, 174 million were tested positive for the virus around the world, including more than 3.773 million deaths. This is one of the greatest pandemics in the human history (COVID-19 Pandemic 2021).

The Central Epidemic Command Center established an emergency protocol for large-scale infection events, such as the COVID-19 infection on board the cruise ship SuperStar Aquarius, and it was a significant success. In response, the Fleet Branch, the Coast Guard Administration, and the Ocean Affairs Council developed several quarantine practices as an indication that the government is taking the pandemic very seriously.

However, a closer look suggests that the quarantine actions taken, as presented above, were developed for vessels arriving at dock. Those who work on board the vessels under the command of the Fleet Branch are in fact frontline workers who investigate smuggling and stowaways, and perform emergency rescues at sea. They are addressing situations that happen out at sea in a harsh environment, within a confined space where resources are limited, and it is therefore not easy to provide support. On the other hand, standard operation procedures are lacking, ranging from how to conduct an investigation at sea to protocols for bringing a violating vessel back to Taiwan's territory. This study is designed to establish a standard operation procedure for the safety of those who enforce maritime law on the high seas.

A literature analysis was conducted to collect and compare the available knowledge, including "Port quarantine in the case of SuperStar Aquarius" on Feb 8 2020, the "Quarantine Practice for Duties on Vessels at Sea for Severe Pneumonia with Novel Pathogens", and "Rules for Quarantine of Transgressing Chinese Mainland Vessels with Violation Records during COVID-19 Pandemic" which was established by the Fleet Branch, the Coast Guard Administration, the Ocean Affairs Council, and the Executive Yuan in 2021. Suggestions were proposed for the COVID-19 quarantine of maritime investigations by the Coast Guard Administration in Taiwan after a series of data sorting, analysis, and compilation. To prevent the pandemic from further spreading, the following are concluded and suggested: (I) intruding vessels found outside of Taiwan's territorial waters should be driven away; (II) for smuggling found in Taiwan's territorial

waters, it is suggested that: (1) a dedicated quarantine site should be established with quarantine facilities and manpower to contain possible virus intrusions, and (2) the production of maritime smuggling investigation documents should be postponed in order to reduce the workload and exposure of the personnel on duty, and thereby reduce the risks of infection among frontline workers.

Keywords: COVID-19, Coast Guard, SuperStar Aquarius.



編號 : MSS05

Continuous Berth and Dynamic Quay Crane Assignments by Using a Hybrid Approach Combining an Improved Shuffled Frog-Leaping Algorithm with a Simple Heuristic

Hsien-Pin Hsu

Department of Supply Chain Management, National Kaohsiung University of Science and Technology

Abstract

Berth Allocation Problem (BAP) and Quay Crane Assignment Problem (QCAP) are two essential operational problems in a container terminal. They can affect the performance of a container terminal considerably. This research focuses on dealing with the Dynamic and Continuous BAP (DCBAP) and Dynamic QCAP (DQCAP) by using a hybrid approach which combines an Improved Shuffled Frog-Leaping Algorithm (ISFLA) with a simple heuristic. A two-stage procedure is employed. The first stage employs ISFLA to initiate an operational sequence; the second stage uses a heuristic to deal with the DQCAP, while resolving the problem of overlapping shipping. The purpose of the hybrid approach aims to best allocate the berth and QCs in the DCBAP for ships calling in at container terminals. Here, a quay is used as a continuous line to accommodate calling ships. In the DQCAP, the number of QCs assigned to a ship can be further adjusted to best utilize the available QCs. Experiments have been conducted and the results showed good solutions have been achieved for the two focus problems in this research.

Keywords: Berth Allocation Problem (BAP), Quay Crane Assignment Problem, Shuffled Frog-Leaping Algorithm (SFLA).



編號：MSS06

“Semper Paratus” in the Tri-Service Maritime Strategy of American Seapower: How Can the Taiwan Coast Guard Deal with China’s Grey-Zone Conflict?

Tzu-Hao Liao

National Cheng Chi University

Abstract

The maritime grey-zone conflict has become the major concern of national and global security, especially with the rise of China. The US and its allies in East Asia are focusing on hybrid strategies to balance the security threats. In this article, we examine the mechanism of inter-operational cooperation and the joint strategic concept of the US Coast Guard (USCG) among maritime services, and provide further suggestions for the Taiwan Coast Guard Administration (CGA) in the contemporary era of grey-zone conflict. The article unfolds in four parts. The first part depicts the aggrandisement of national threats towards Taiwan and the US by outlining crucial actors and behaviour types in East-Asian maritime grey-zone conflicts. The second section discusses the current development and configuration of the CGA, a fairly new naval force established in 2000. The third part analyses the integrated approach of the unified maritime strategies of the USCG which plays a pivotal role in homeland security and international partnership. In the concluding segment, directions and implications of future bilateral cooperation in the Indo-Pacific strategy, and domestic improvements for CGA are considered. Building on these insights, this article suggests 4 focal points for forwarding Taiwan-US arrangements. (1) It is essential for Taiwan to review the grand combat environment in a more innovative way. (2) Multi-service interoperability should be prioritised when forming a united maritime strategy. (3) Operational conditions in the post-pandemic era act as a contributing factor of multi-domain warfare. (4) Also, emphasising the free circulation of intelligence and information in both domestic services and international alliances will serve Taiwan’s policy goals.

Keywords: US Coast Guard, Taiwan Coast Guard, Grey-Zone Conflict, National Security, Taiwan-US Cooperation.



Theme 5 : Ocean Environmental Engineering

Date: September 23, 2021

Time: 13:30 ~ 15:20

主題五：海洋工程

日期：110年9月23日

時間：13:30 ~ 15:20



A P-Y Based Approach to Predict the Displacement of Monopiles Embedded in Soft Clay due to Long-Term Cyclic Loading

Chi-Chin Tsai¹, Yu-Pai Li²

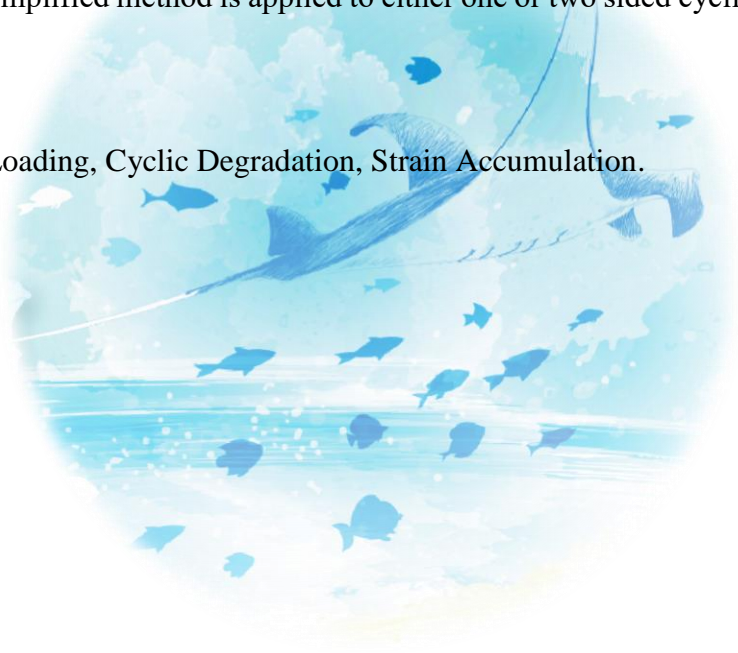
1. Professor, Department of Civil Engineering, National Chung Hsing University

2. Research Assistant, Department of Civil Engineering, National Chung Hsing University

Abstract

Offshore wind turbines (OWTs) are subjected to environmental loadings such as those induced by waves or wind, typically comprising up to millions of cycles with small to moderate amplitudes (so-called high-cycle loading). To evaluate the performance of OWTs during a lifetime cycle, this study proposed a P-Y based approach to predict monopile displacement due to long-term cyclic loading. Cyclic loading may cause an accumulation of strain and a build-up of excess pore water pressure under undrained conditions, accompanied by a corresponding change of stiffness and shear strength in soft marine clay. Therefore, in the proposed procedure, a P-multiplier and a Y-multiplier are first determined based on the cyclic degradation and strain accumulation, respectively estimated by a generalized empirical model built on a given loading condition. Afterward, the responses of piles subjected to long-term cyclic loading are predicted by modifying the preselected P-Y curve with the P-multiplier and the Y-multiplier. An example is presented to demonstrate how the proposed simplified method is applied to either one or two sided cyclic loading.

Keywords: P-Y Analysis, Long Term Cyclic Loading, Cyclic Degradation, Strain Accumulation.



編號 : OE02

Synthesis of NiCo₂O₄/MnOOH/GO Heterojunctions to Enhance Catalytic Activity for PMS Activation toward Ciprofloxacin Degradation.

Van-Re Le¹, Thanh-Binh Nguyen¹, Chiu-Wen Chen¹, Cheng-Di Dong¹

¹ Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology

Abstract

In this research, the fabrications of manganese oxyhydroxide (MnOOH), MnOOH-reduced graphene oxide (MnOOH/GO), and ternary heterojunctions of NiCo₂O₄/MnOOH/GO were successfully synthesized by thermal methods. The morphological structure of the catalyst was determined by scanning electron microscope (SEM) observation. These catalysts were used with a peroxymonosulfate (PMS) activator to enhance the catalytic activity for the ciprofloxacin (CIP) degradation. Results showed that NiCo₂O₄/MnOOH/GO demonstrated the highest performance. The removal efficiency of CIP (0.02 mM) was 94% after a 30 min reaction at a dosage of 0.2 mM PMS and 0.15 g/L NiCo₂O₄/MnOOH/GO. The observed kinetics rate constant (k_{obs}) of the NiCo₂O₄/MnOOH/GO system was $1.77 \times 10^{-1} \text{ min}^{-1}$, which was 7.5 and 4.5 times higher than that of MnOOH and MnOOH/GO, respectively.

Keywords: NiCo₂O₄, MnOOH, GO, Peroxymonosulfate, Ciprofloxacin.



Adsorption of Tetracycline by Polyethylene Microplastics under Different Wavelengths of UV Light Irradiation

Thi-Bao-Chau Ho, Thanh-Binh Nguyen, Chiu-Wen Chen, Cheng-Di Dong

Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology

Abstract

One of the main factors impacting the microstructural changes of polymers is UV light. This study provides a basic comparison of the different effects that varying wavelengths of UV light have on polyethylene microplastics (PE MPs). Here, the aging mechanism of PE MPs under the influence of different wavelengths of UV light (254 nm and 360 nm) and the adsorption behavior of tetracycline (TC) after aging has been studied. The results show that under different wavelengths, the characteristics of PE MPs undergo different chemical changes. A kinetics model is offered to illustrate that the adsorption capacity of TC on the PE MPs particle surface is higher after aging compared to before. Based on the Langmuir model, the adsorption amounts of the original PE MPs, after aging by 245 nm UV light, and after aging by 360 nm UV light, is 9.77 mg g^{-1} , 14.15 mg g^{-1} , and 40.03 mg g^{-1} , respectively.

Keywords: Adsorption, Polyethylene, Tetracycline, UV Light.



Modification of Zeolitic Imidazole Framework-67 (ZIF-67) by Nitrogen as a Predominant, Adsorbent, and Highly Efficient Peroxymonosulfate Activator for Ciprofloxacin Degradation

Van-Anh Thai, Thanh-Binh Nguyen, Chiu-Wen Chen, Cheng-Di Dong*

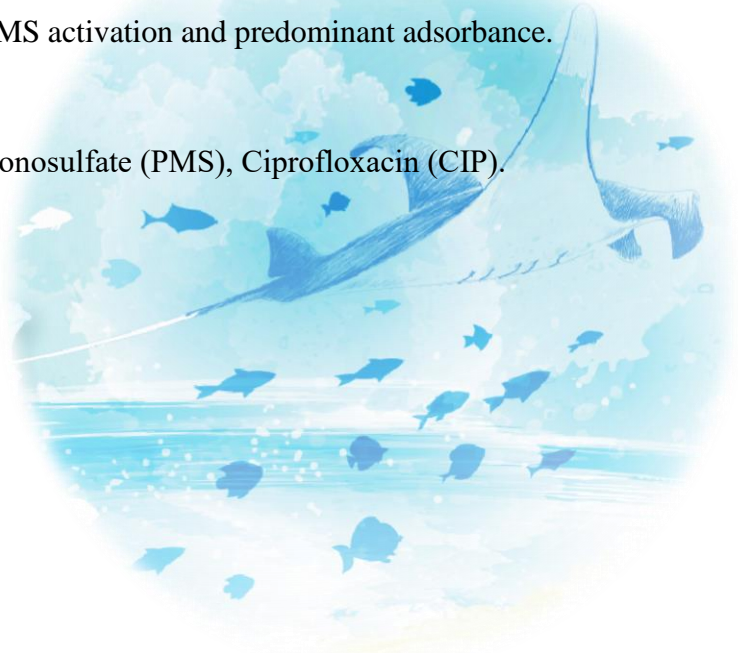
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Abstract

In this study, N doped ZIF-67 was facilely prepared via hydrothermal methods and applied in a heterogeneous catalytic activation of peroxymonosulfate (PMS) and adsorption for ciprofloxacin (CIP) degradation. The catalytic activities were systematically studied on an adsorption isotherm, catalyst dosage, and PMS dosage. The results showed that the removal of CIP (87%) was achieved using N@ZIF-67/PMS system after 30 min of reaction under optimal conditions. Based on HPLC results, the degradation pathway of CIP in N@ZIF-67/PMS system was put forward. The results showed that the synergistic effect between N and the ZIF-67 structure not only significantly boosted the removal efficiency, but also added to the long-term stability of the composite. This proof-of-concept method for the development of N@ZIF-67 paves a new way for wastewater remediation through PMS activation and predominant adsorbance.

Keywords: Nitrogen Doping ZIF-67, Peroxymonosulfate (PMS), Ciprofloxacin (CIP).



編號 : OE05

Mesoporous and Adsorption Behavior of Algal Biochar Prepared via Sequential Hydrothermal Carbonization and ZnCl_2 Activation

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Abstract

In this study, biochar derived from brown algal *Ascophyllum nodosum* was synthesized through coupling hydrothermal carbonization (HTC) with ZnCl_2 chemical activation, and was used as a sustainable adsorbent for the removal of ciprofloxacin (CIP) from water. Fourier transform infrared (FTIR) spectroscopy was used to clarify the surface properties of the prepared biochars. Batch adsorption experiments were conducted to explore the adsorption performance of biochars under the effects of different parameters (initial pH, adsorbate concentration, temperature, etc.). The results showed that mesoporous biochar with remarkable adsorptive properties was successfully prepared by combining the HTC and ZnCl_2 activation methods. The application of the prepared biochar in CIP removal showed a favorable adsorption capacity ($350\text{--}400\text{ mg g}^{-1}$). Overall, algal biochars, as a product recycled from biowaste, demonstrate a novel and promising adsorbent for the effective and sustainable removal of pollutants from water.

Keywords: Algal Biochar, Hydrothermal Carbonization, ZnCl_2 , Ciprofloxacin (CIP), Adsorption.



Removal of Tetracycline Hydrochloride from Water via Peroxymonosulfate Activation by Oxidation Biochar Supported Nickel Cobaltite Particles

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Abstract

The objective of this study was to develop the use of modified biochar as an adsorbant. Here, sunflower seed husk biochar modified by $ZnCl_2$ (ZSF), and sunflower seed husk doped with Nickel and Cobalt ($NiCo_2O_4@ZSF$), showed high catalytic activity using peroxymonosulfate (PMS) as an activator to decompose tetracycline hydrochloride (TC) in water. The materials were characterized by Raman spectra analysis, Thermogravimetric analysis (TGA), and measurements of the specific surface area (BET). The $NiCo_2O_4$ NPs dispersed over biochar resulted in the formation of $NiCo_2O_4@ZSF$ having a specific surface area of $1013.06\text{ m}^2\text{ g}^{-1}$ and a total pore volume of $1.17\text{ cm}^3\text{ g}^{-1}$. The results showed that the $NiCo_2O_4@ZSF$ was effectively activated by PMS, leading to a high degradation of TC in water. $NiCo_2O_4@ZSF$ could be an efficient and environmentally friendly activator for the decomposition of organic pollutants, a new strategy for water treatment.

Keywords: Sunflower Seed Husks, AOPs, Tetracycline Hydrochloride, Peroxymonosulfate.



Theme 6 : Marine Industry

Date : September 23, 2021

Time : 13:30 ~ 15:20

主題六：海洋產業

日期：110年9月23日

時間：13:30 ~ 15:20



A Decision Support Framework for the Sustainable Performance Assessment of the Maritime Transport Industry: The Case in Vietnam

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Abstract:

Over the past decades, container shipping companies (CSCs) have grown exponentially with high capacities. Container shipping plays a vital role in the global cargo transportation market, thus measuring the efficiency of CSCs has been a concern of practitioners. This paper adopts a combinational approach using the Fuzzy Analytic Hierarchy Process (FAHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) for evaluating and selecting the top CSCs in Vietnam. In the proposed model, criteria concerning the economic, service level, environmental, social, and risk aspects were taken into the FAHP and TOPSIS models. Linguistic variables were used to minimize the unpredictable levels in the criterion weights when dealing with fuzzy knowledge in the natural decision-making process. As a result, FAHP was used to determine and quantify the relative significant weight of each criterion. After that, the TOPSIS was used to rate the options. The results of the FAHP and TOPSIS methods provide a more consistent and reliable ranking. Among the criteria, “reliability and delivery time”, “voice of customer”, “logistics cost”, “network management”, and “quality of service” were the most influential factors in the container shipping context. The developed integrated model provides comprehensive insights that assist CSCs in making strategic decisions to promote their performance. Based on these findings, extensive expertise and appropriate strategies are leading elements for CSCs to survive and operate more efficiently.

Keywords: Maritime, Container Shipping Companies, Performance, Decision-Making, Fuzzy Theory.



Electricity Cost Assessment of Offshore Wind Energy Underlying Uncertainty of Capacity Factor: Case Studies

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2. Department of Industrial Management and Information, Southern Taiwan University of Science and Technology
3. Department of Finance, National Sun Yat-Sen University

Abstract

The Levelized Cost of Electricity (LCOE) model is a widely used model to assess the electricity cost of renewable energy including offshore wind energy. To capture the uncertainty of input variables in the LCOE model, a probabilistic approach and a Monte Carlo technique are commonly used to obtain a probability distribution of the LCOE output. However, a simple assumption for the range of values of the capacity factor (CF), a main input variable in the LCOE model, might exaggerate its impact on the LCOE output distribution. This study uses the chronological approach to directly investigate the probability function of the capacity factor for a specific wind farm site. Through case studies of wind projects in Vietnam and Taiwan, the proposed model shows its superiority for analyzing a specific project's LCOE, especially when accounting for a location-based impact on the uncertainty of capacity factor.

Keywords: Wind Energy, Levelized Cost of Energy, Uncertainty, Capacity Factor, Monte Carlo.



Applying Service Quality to Evaluate Key Success Factors of Ocean Freight Forwarders in the Post-Pandemic Era

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Abstract

This study designed the basic characteristics and service quality of ocean freight forwarders and subdivided the five dimensions into 19 appropriate evaluation indicators to make an expert questionnaire based on the SERVQUAL scale questionnaire structure. The indicators of satisfaction and the importance of service quality are identified through the analytic hierarchy process (AHP) for decision-makers to explore their key abilities. According to the results, ocean freight forwarders can identify the key success factors of service quality and explore the standard service model as a reference to build competitive advantages and ensure sustainable business decisions. Furthermore, the indicators of the key success factors based on the results are as follows: (1) “Companies can grasp the market information at any time to provide customers with an emergency response and reduce risks”, (2) “Scheduled freighters are highly flexible and punctual”, (3) “Transportation and business personnel have good communication skills and are trustworthy”, (4) “Transportation and business personnel are able to deal with emergencies”, and (5) “Containers with good cargo worthiness can be provided”.

Keywords: AHP, SERVQUAL, Ocean Freight Forwarders.



A Window-DEA Based Efficiency Evaluation of Harbors in Vietnam

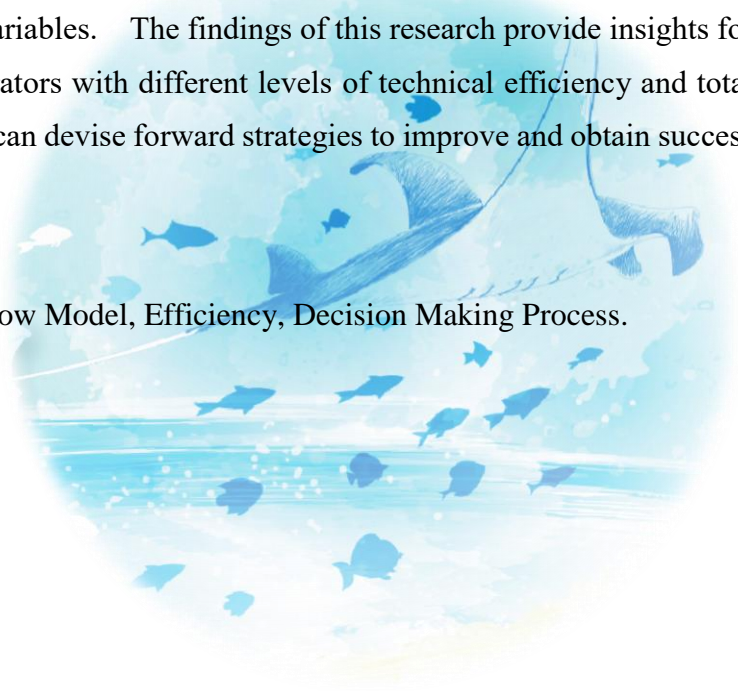
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Abstract

Maritime transport remains the backbone of the ever-increasing globalized economy and international trade system, significantly supporting the ongoing and complex processes of global supply chains. Seaport terminals (i.e. harbors) form vital links in the overall trading chain, acting as an incentive to the development of the marine economy and a key contributor to a nation's international competitiveness. In this paper, a Data Envelopment Analysis (DEA) with a Window model is proposed towards addressing the issue of performance evaluation of seaport terminal operators. By using the prescribed approach, the authors considered the top 10 potential seaport companies of Vietnam with respect to their efficiency evaluations during the research period (2016-2020). Based on the importance of financial indicators, three input variables were listed, which are "total assets", "owner's equity", and "operation expenses", whereas revenue and net profit were chosen as output variables. The findings of this research provide insights for management and policymakers of seaport operators with different levels of technical efficiency and total performance advancement. In so doing, they can devise forward strategies to improve and obtain success in the industry.

Keywords: Data Envelopment Analysis, Window Model, Efficiency, Decision Making Process.



編號 : MI05

Assessing Suez Canal Risks after Covid-19 and the Evergiven Crisis: Multimodal Logistics and Smart Solutions

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Abstract

This paper aims to assess the Evergiven crisis in the Suez Canal, fluctuations in trade as a result of the Covid19 epidemic, as well as to explore and assess alternative logistical solutions, such as multimodal routes and smart transportation solutions for a smoother Eurasian trade. Rather than the commonly used experimental or empirical approaches, this paper adopts a critical and analytical approach to assess and find solutions regarding the key risks threatening international trade and logistics along the Suez route between Europe and Asia. The results of this assessment find that the alternative multimodal routes between Europe and Asia are not yet reliable and therefore suggest that the further development of multimodal alternatives may be of great service.

Several alternatives are assessed based on industry management tools for analysis and risk assessment. One approach is based on designing tools for new product and service developments, such as the product service system blueprint, and a prototype concept design for a multimodal hybrid vehicle (known as *Cargo Jumper*) that can operate as a truck, vessel, and airship. Using SolidWorks Computer Aided Design (CAD) software, the prototype concept vehicle is designed to be able transport a 40-foot-long container with a maximum weight of 30 tons, and it relies on renewable energy to achieve social, economic and environmental sustainability. This vehicle is a market-shifting innovation that can be a convenient and competitive solution for end-users in need of intercontinental door-to-door logistics.

Finally, this paper is lacking the empirical and experimental simulation testing which are discussed in future research directions and the recommendations section.

Keywords: Sustainable Smart Logistics, Suez-Evergiven Crisis, Amphibious Airship, Industry Analysis\Design, SolidWorks.



編號 : MI06

Determinants of Access to Formal Credit Available to Fisherman Households in the Mekong Delta, Vietnam

Phan Thi Kieu, Pham Van Ca

Abstract

The primary purpose of this study is to analyze the factors affecting the ability to access formal credit by fisherman households in the Mekong Delta, Vietnam. This research is based on a survey of 300 fisherman households, conducted between Oct 2020 and Feb 2021, and proposes six independent variables affecting the capacity to access traditional credit. A binary logistic regression analysis was applied to evaluate the impact of the independent variable on the dependent variable. The results indicate that there are five independent variables affecting credit access in the Mekong Delta region. The level of importance from high to low is as follows: (i) Job experience, (ii) Collateral, (iii) Education level, (iv) Social prestige, and (v) Interest rate. Of particular note, the interest rate has a significant negative impact on real access to formal credit (because when the interest rate increases, then fishermen must pay more on the loan cost). Collectively, these five factors explain 56.7% of the variation in formal credit accessibility in the Mekong Delta, Vietnam. (The remaining 43.3% is due to errors and other factors.)

Keywords: Formal Credit, Fisherman Households, Mekong Delta Region, Vietnam.



□ Poster Presentations

第一屆台灣海洋青年諮詢小組委員的海報投稿





Investigation and analysis of attached microorganisms of marine plastics in the tourist hot spots in the Northeast of Taiwan

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Abstract

As of 2017, it's estimated that more than 350 million tons of plastic production has been in the environment where we live. Of this, about 12 million tons have flowed into the ocean. Marine plastics are barely degraded but become fragmented over time and spread to the world by currents and wind. In brief, marine plastic litter can be found in sea waters all over the globe with kinds of color, shape, size and material. There are classified in three categories of marine plastic litter: nanoplastics (<100nm), microplastics (100nm-5mm), macroplastics (>5mm). For marine organism, plastic has created another ecosystem with high biodiversity. These plankton, larvae and microorganisms will inhabit, migrate and exchange genes on the plastic, and they quickly spread on the surface of the plastic to form a biofilm which is called "Plastisphere". The community composition of the plastisphere is driven by spatial and seasonal effects. In addition to diverse marine organisms living on marine plastics, they may even carry superbugs with antibiotic-resistance genes. This study hopes to investigate the analysis of the microbial communities on the marine plastics located in tourism hotspot which is the largest amounts of marine plastics accumulated in the northeastern of Taiwan. With a convenient and simple water vehicle to collect the marine plastics around the northeastern sea area. Plastics attached bacteria can still grow normally in the antibiotic medium by using culture dependent approaches. These results can be used evaluating potential risk to the health of tourists, or whether it carries pathogens from other areas or exotic species, which may cause ecological damage.

Keywords: Marine plastic, plastisphere, northeast of Taiwan, marine microorganism, pathogens

Materials and methods

A. Collect Plastics

Stand Up Paddle

- Inflatable and easy to carry
- Suitable for a variety of area
- Low cost
- Poor wave resistance

Handmade Net

- Mesh size: 1mm
- Light weight and low cost
- Can't calculate sea water flow

Sample bottle

- Load samples and sea water
- Culturing in 48 hours
- Anaerobic inside bottle

Sample

- Plastic particles
- 1mm < sample < 5mm
- No contact with hands

B. Location



C. Experiment protocol



Figure. 1 Marine plastic sampling and microbial culture experiment process.

A. In this experiment, Stand Up Paddle is used as the experimental tool to go to sea, and the marine garbage accumulation area will be set as the target for random sampling. By rowing, the marine garbage will enter the fishing net along the water flow. The plastic debris would be picked up and made into an analyzable sample as soon as possible liquid to ensure that the creatures on the plastic are in the same state as the sea.

B. This experiment will conduct in popular tourist attractions as the experimental field, divided into 6 experimental locations.

C. The experimental procedure is to use different culture medium to culture the bacteria after retrieving the sample, perform 16S rRNA sequencing after isolate purification and finally identify the isolate.

Primary result

A.

Color: Blue
Material: Hard plastic
Size: 4mm

象鼻岩
25.13356, 121.81405

No.	medium	antibiotic	name
1	Marine Broth	(Blank)	MBB
2	Marine Broth	Tetracycline 四环素	MBT
3	Marine Broth	Penicillin 青霉素	MBP
4	Marine Broth	Erythromycin 红霉素	MBE

Concentration: 10^6-10^7

B.

*Strain_name : Medium type - sample concentration - number

Strain_name	Colour	Shape	Margin	Elevation	Texture	Source	Medium
MBE-10 ⁻⁰⁰¹	milky	round	entire	flat	slimy	marine plastic01	MBE
MBE-10 ⁻⁰⁰²	white	filamentous	filamentous	flat	dry	marine plastic01	MBE
MBB-10 ⁻⁰⁰³	pink	round	entire	flat	slimy	marine plastic01	MBB
MBB-10 ⁻⁰⁰⁴	pink	round	entire	flat	slimy	marine plastic01	MBB
MBT-10 ⁻⁰⁰⁵	milky	round	entire	flat	slimy	marine plastic01	MBT
MBT-10 ⁻⁰⁰⁶	pink	irregular	wavy	flat	slimy	marine plastic01	MBT
MBT-10 ⁻⁰⁰⁷	red	round	entire	flat	slimy	marine plastic01	MBT
MBT-10 ⁻⁰⁰⁸	pink	round	entire	flat	slimy	marine plastic01	MBT
MBP-10 ⁻⁰⁰⁹	red	irregular	wavy	flat	slimy	marine plastic01	MBP
MBP-10 ⁻⁰¹⁰	pink	irregular	curled	flat	shiny	marine plastic01	MBP
MBP-10 ⁻⁰¹¹	pink	round	entire	convex	shiny	marine plastic01	MBP

C.

001 002
003 007

BLAST

• 10Ex Taq Buffer
• dNTP
• TaKaRa Ex Taq (5 U/μl)
• ddH₂O
• 16S-PB60 primer
• DNA sample

ATCCGTAGGA
TACGATTAC
ATACAGATG
CAGCATAGCT
TAGCATCAA

002 *Bacillus* sp.
007 *Shewanella* sp.

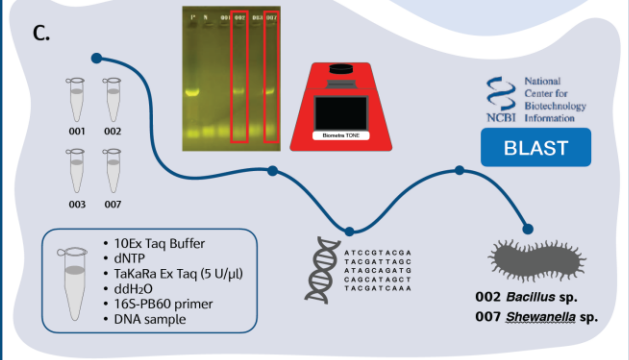


Figure. 2 The experiment of sample "marine plastic01" from Elephant Rock sea area in Ruifang District, New Taipei city

A. Put the sample in sterile seawater and obtain marine bacterial liquid by shaking. Marine Broth will be used as the based culture medium, and three antibiotics will be added separately, Tetracycline(10mg/L), Penicillin(10mg/L), Erythromycin(100mg/L), and a control group without antibiotics to obtain a total of four culture medium. Then, the sample solution with serial dilution of 10^6-10^9 is plated and cultured.

B. Pick out the bacteria from the colonies and coat them on plates for purification, save the 11 species of bacteria picked out and record their characteristics

C. Extract the DNA of 001, 002, 003 and 007 isolates, add the 10Ex Taq DNA Polymerase Buffer, dNTP, TaKaRa Ex Taq DNA Polymerase, ddH₂O and 16S primer, run it in the Biometra Tone PCR Thermal Cycler. Next, sequence the two displayed samples 002 and 007, and obtain the gene sequences of the two bacteria, blast the gene sequences to National Center for Biotechnology Information database to identify the genus names of the two bacteria, they are identified as *Bacillus* and *Shewanella*.

Conclusion and further experiment

This experiment confirmed that there are indeed bacteria with antibiotic resistant genes on the marine plastics drifting around the Northeast of Taiwan. These antibiotic resistance genes are existing in the ocean, and then exchange genes with various organisms on marine plastics, including some pathogens, which means that these marine plastics may carry pathogens to the world. In addition, whether the organisms inhabited by the marine plastisphere might become a way for exotic species to invade is also a straightforward direction for discussion. It would be a research direction in a new field of marine plastics in the future.

Plastic Pollution in the World's Oceans: What should We do?

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Abstract

Human activity has led to plastic pollution throughout the marine environment. As slow-degrading microplastics become more readily available and affordable, many marine species often ingest these toxic artificial chemicals, adversely affecting marine life and human health. Studies are beginning to uncover the epidemiology, significance and long-term harms of microplastic toxicity. This review characterizes current knowledge, highlights gaps in mitigation and adaptation strategies towards microplastics, and raises suggestions to alleviate these issues above.

Introduction

Since the 1950s, global production of plastics has skyrocketed exponentially and exceeded 320 million tons annually since 2014. (Ostle et al., 2019) Due to plastics' durability and poor waste management, plastics produced worldwide enter marine ecosystems. Shorelines, sea beds, and water columns are negatively affected by river transport, ocean debris, aquaculture, fishing, and shipping. (Lebreton et al., 2017) We highlighted evidence of plastics on human health and marine environments.

Methods

We review research and literature about ocean plastic pollution, quantify the sources and devastation of ocean plastic pollution, and summarize present guidelines to reduce plastic pollution. We also highlight gaps in current strategies towards microplastics and raise suggestions to improve these measures.

Results

A significant amount of plastic is rapidly converted into waste and discarded into landfills or oceans (Lebreton et al., 2018). We estimate that approximately 1.15 to 2.41 million tons of plastic annually enter the ocean from rivers (Figure 1), with the top 122 polluted rivers, covering 4% of the continental surface area, contribute to 490% plastic input. However, the top 20 polluted rivers cover 2.2% of the continental surface area accounting for 67% of the global input (Table 1) (Lebreton et al., 2017).



Figure 1. Mass of river plastic flowing into oceans in tons per year. The red spot density is calibrated against river plastic concentration measurements.

Table 1. Top 20 Polluted Rivers Worldwide with the Highest Plastic Inputs*

Amazon/ Brazil, Columbia, Ecuador, Peru	Brantas/ Indonesia	Cross/ Nigeria, Cameroon	Dong/ China	Ganges/ Bangladesh, India
Hanjiang/ China	Huangpu/ China	Imo/ Nigeria	Irrawaddy/ Myanmar	Kwa Ibo/ Nigeria
Magdalena/ Colombia	Mekong/ Cambodia, China, Laos, Myanmar, Thailand, Vietnam	Pasig/ Philippines	Progo/ Indonesia	Serayu/ Indonesia
Solo/ Indonesia	Tamsui/ Taiwan	Xi/ China	Yangtze/ China	Zhejiang/ China

Land-based sources like agricultural run-off and untreated sewage from Low and Middle-Income Countries (Landrigan et al., 2020) contributed to 80% of plastic pollution, and approximately 4.8 to 12.7 million tons of plastic annually enter the ocean from coastal populations (Lebreton et al., 2017). Buoyant plastic in ocean environments can be transported by wind and ocean currents to ocean gyres or degraded by ultraviolet radiation from sunlight and temperature variations, then sink to the ocean floors (Lebreton et al., 2018).

Discussion

More than 40% of the global population lives within 200 kilometers of the ocean, and twelve out of the world's fifteen megacities are coastal. Rapid industrial growth and the skyrocketing world population worsen ocean pollution. (Visbeck et al., 2018). Approximately eight million tons of plastic annually enter the oceans, and most microplastics are buried in the ocean floors.

The degradation rate of plastics and microplastics varies by type of polymer, shape, density, and chemical composition. Microplastics in oceans are heterogeneous groups of particles (< 5 mm) found in sediments, sea surfaces, and water columns (Thompson et al., 2004) (Gall et al., 2015). These particles are often concentrated in marine organisms' digestive tracts, discovered during carcass dissections and laboratory researches. Phytoplankton (one food chain base creature) and other filter-feeding animals such as oysters ingest these microplastics. Thus, many microplastics in species, mainly crustaceans, and fish, enter the human body through seafood consumption (Smith et al., 2018). This pollution threatens both the ocean environment and our health.

Governments, civil societies, manufacturing industries, and supply chains must protect the marine environment (Smith et al., 2018). The amount of plastic trash production has increased by 8.7% every year and evolved into a global industry worth \$600 billion (Jambeck et al., 2015). This plastic pollution issue requires integrated solutions that involve non-governmental organizations (NGOs), companies, and civil societies than traditional responses that only involved states and specific sectors (Haward et al., 2018). These measures should reform pre-existing international, regional, national, and local initiatives.

What should we do?

1. Reform education, research, and awareness campaigns to spark change from individuals and revolutionize waste management and product design.
2. Develop consistent, standardized monitoring systems regarding plastic debris in oceans.
3. Demand, as consumers, industries to reduce plastic production and support codes of conduct and certification of practices.
4. Promote recycling and improved waste management to encourage sustainable production and consumption, increase ocean resilience, and promote ocean prosperity.
5. Strengthen global beach cleanup programs by nongovernmental organizations to remove materials that would gradually degrade into microplastics.

Conclusion

We should prevent and control plastic pollution by deploying data-driven strategies through technology, policies, and collective action. Humankind is responsible for destroying the ocean, and we need to fix it. We need to take immediate action to save our Earth from plastic pollution.



The effects of underwater acoustics on *Negaprion acutidens*

Chin-Ti, Lin*, Keryea Soong

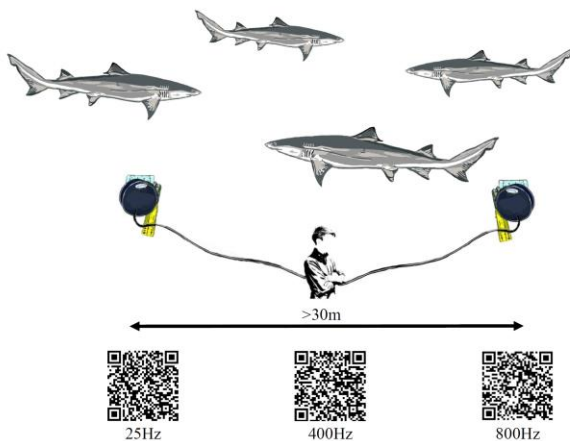
Department of Oceanography, National Sun Yat-sen University, Kaohsiung, 804, Taiwan.



Abstract

Sound is known to affect the behavior of sharks. It is suggested that this characteristic has the potential to be employed to not only to protect the sharks but also prevent people harm from the sharks. In this study, the response of the sicklefin lemon sharks *Negaprion acutidens* were explored using single-frequency underwater sounds. In the experiment, bait tubes were kept to attract the sicklefin lemon sharks, and an underwater speaker was used to emit the sounds. Ten frequency ranges from 25~800Hz, were selected along with silent controls, and the behavior of sharks were filmed with an underwater camera. The study was conducted by 20 experiments, with data being gathered 1111 observation showed that there was dependence between the sound presence and the behavior of sharks, this result indicated that sharks had a higher percentage of contacting the bait tubes occurred in the absence of the sound treatment. However, there was no significant difference in the number of occurrences on the sicklefin lemon sharks in the video with and without sound. Overall, this preliminary study revealed that the sicklefin lemon sharks could hear and use the sound information accordingly. Their feeding behaviors were modified by the artificial sound, and it is plausible to develop conservation methods based on this principle.

Method and Materials

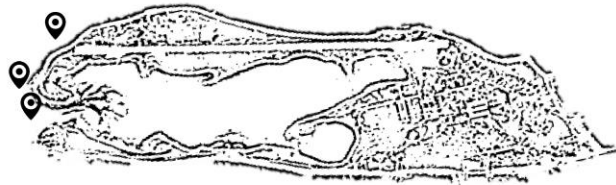


In the sound experiment, we have chosen 10 frequencies to see if a single frequency would repellent to sicklefin lemon sharks or not and we placed bait jar next to the underwater speaker to attract them.

The bait-tube contact frequency depended on the sound condition in sicklefin lemon shark.

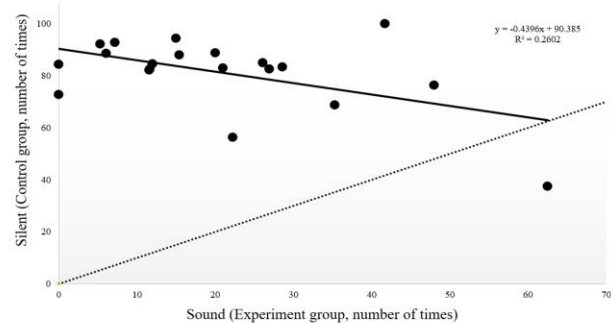
Frequency	Sound		Silent		p-value (Chi-square)
	Contact	No contact	Contact	No contact	
25Hz	2	14	63	8	<0.001
50Hz	11	47	49	13	<0.001
100Hz	16	85	71	14	<0.001
200Hz	13	41	36	7	<0.001
300Hz	12	20	11	11	0.361
400Hz	4	18	30	4	<0.001
500Hz	5	22	54	9	<0.001
600Hz	30	91	60	10	<0.001
700Hz	6	15	20	1	<0.001
800Hz	10	107	43	30	<0.001

Experimental site

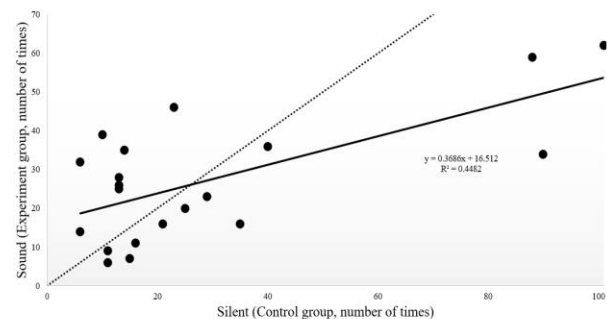


Bitmap of sampling points of Dongsha island (20°42'23"N 116°42'39"E).

Results of single frequency response to sicklefin lemon shark



The ratio of each frequency to the instrument contact (The dots are the number of times that the shark touched the instrument with and without sound in the experiment. The dashed line represents the 1:1 line).



The number of sicklefin lemon sharks at each frequency (The dots are the number of times that the shark touched the instrument with and without sound in the experiment. The dashed line represents the 1:1 line).

Discussion

The previous study found that most sicklefin lemon sharks had significant withdrawal reactions to different single frequency sounds. Therefore, we recorded number of times to understand their behaviors by experimental group (sound) and the control group (silent) within a range of underwater camera. This result showed that sound affected shark behaviors. Besides, the reaction distance of sicklefin lemon sharks underwater couldn't be estimated from the above because the total number of sharks was unknown under the water, which didn't support the hypothesis that underwater sound affects large area of them. In conclusion, the effects of single-frequency sound on the behavior of sicklefin lemon sharks have not been understood before. Sea grass beds around Dongsha Island are breeding grounds for sicklefin lemon sharks. If we can learn more about the ecology through underwater acoustic technology, there will be more ways to protect local species from a conservation point of view.

Ethical standards

National Sun Yat-sen University Institutional Animal Care and Use Committee Review Consent No. 10907.

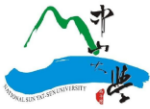
Acknowledgments

This study was supported by the Ocean Affairs Council Special Research Program for College Students OAC-NSYSU-109-08 (Research Report).

Comparison of the Responsibilities of Ocean Specialized Agency between Taiwan and Other Countries.

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Abstract

Due to the lack of assessment and management of the country's overall marine affairs in the country, the need for ocean specialized agency in central government appears. The aim of the ocean specialized agency is to efficiently coordinate lots of issues and interests concerning the implementation of marine policies and pursue an overall perception of marine policies and their structure of law. The overall marine policies could lead the country to manage the overall marine activities, such as shipping, fishing, marine science, defense, underwater cultural heritage, and marine pollution etc.

In this study, we use three completely different types of marine specialized agencies for comparison, respectively being Ocean Affairs Council (Taiwan), National Oceanic and Atmospheric Administration (the United States), and Ministry of Oceans and Fisheries (South Korea).

Ocean Affairs Council and National Oceanic and Atmospheric Administration are responsible for coordinating marine affairs delegated to different departments. While Ministry of Oceans and Fisheries is classified as a ministry, and all the authorities are its subordinates.

According to the result of the comparison, the strength of coordination of National Oceanic and Atmospheric Administration is lesser than Ocean Affairs Council due to the concept of dominant agency in the United States. Korea has better efficiency in executing marine policy and handling marine affairs and problems.

However, from our perspective, we accept the existing traditional functional division of labor, and through improving coordinated function, the government can still have a great efficiency in managing overall marine affairs without having to establish a unified system. We hope that Ocean Affairs Council can lead Taiwan to become a global maritime power with "ecology sustainability, maritime security, and industrial prosperity".

Introduction

• What is ocean specialized agency?

The specialized agency is the agency that is mainly responsible for a specific business. Due to the lack of evaluation, administration, and management of the overall marine affairs in the country, the need for ocean specialized agency in central government appears. The main purpose of the agency is to comprehend the authorities falling in various departments and design an overall marine policy to lead the country to manage the overall marine activities, such as shipping, fishing, marine science, defense, underwater cultural heritage, and marine pollution etc. Constructing a single marine specialized agency has become the goal that modern marine countries must pursue and think about. There are a lot of countries who already have such department, including the UK, US, Korea, China, Australia, Canada, and Taiwan etc.

• The Ocean Specialized Agency of Taiwan

Taiwan is a centralized country. To manage the overall marine affairs in Taiwan, we established Ocean Affairs Council in 2018 as the specialized agency. Ocean Affairs Council is a second level agency. Directions for Preparation of 2021 Budget is NTS 46 billion. Its subordinate units include National Academy of Marine Research (NAMR), Ocean Conservation Administration (OCA), Coast Guard Administration (CGA).

However, some responsibilities are still handled by other different agencies. Consequently, Ocean Affairs Council is authorized to "integrate planning, review, coordination, and promotion" of many marine affairs.

• The Ocean Specialized Agency of the United States

The United States is a federal country. According to the Constitution, power mainly belongs to the state, federal power comes from approval of states. The marine affairs management agency can be divided into two major parts. The first one is the coordination agency which is National Oceanic and Atmospheric Administration (NOAA). The second is the agency with law enforcement — the United States Coast Guard. NOAA is the third-level agency. For FY 2021, NOAA proposes a budget of NTS165 billion in discretionary appropriations. The aims are to predict environmental changes, protect people's life and property, provide reliable and scientific information, and promote global environmental management. Its subordinate units include National Marine Fisheries Service, National Ocean Service, Oceanic and Atmospheric Research, Office of Marine and Aviation Operations & NOAA corps, National Weather Service, National Environmental Satellite, Data, and Information Service.

• The Ocean Specialized Agency of South Korea

South Korea is a presidential country, so President can control all the department below the government. Korea set an ocean specialized agency known as Ministry of Oceans and Fisheries (MOF), which is a second level agency. It has 7 offices, 22 affiliated agencies, and Coast Guard under MOF to carry out the policy. The total budget for 2021 is around SNT 190 billion. MOF is trying to make Korea to become a global shipping and transportation center, and they want to develop marine leisure and tourism industry. On the other hand, they want to promote their aquatic products, protecting marine environment.

Results & Discussion

According to the introduction of the three countries, we classify the differences into four categories in this study. (Table1.)

• Mission

In sum, three countries have similar directions, and all are moving in the direction of environmental sustainability.

• System

The marine affairs in Taiwan delegated to different departments so that the coordination function of the OAC is particularly important.

The range of the responsibilities of NOAA is broader than Taiwan. Although there are still some businesses falling in different ministry, the USA adopt the concept of dominant agency to select the most proper department to be the leader, which makes better efficiency. Hence, NOAA requires less coordination than OAC in Taiwan.

Korea, the ocean specialized agency is a ministry, with all the job subordinating to MOF. Centralizing affairs in a ministry shortens chain of command. Korea has better efficiency than Taiwan and America.

• Budget

$$\text{Percentage of total budget} = \frac{\text{budget in ocean specialized agency}}{\text{total central government budget}}$$

Korea attaches great importance to the development of marine affairs. Taiwan also attaches the importance to marine affairs. Although the USA has the smallest proportion, it still has a large amount of budget to promote marine affairs because of its huge total central government budget.

	Taiwan OAC	The United States NOAA	South Korea MOF
Level	2	3	2
Mission	National	Global	Global
System	Council	Administration	Ministry
Budget (2021)	SNT 50 billion	SNT 165 billion	SNT 190 billion
Percentage of total budget	2%	0.12%	13%

Table1. Comparison of the ocean specialized agency in three countries.

Conclusions

There is no ideal agency model that can truly and adequately coordinate the formulation of ocean policies involving many issues and interests. Therefore, the concept of this article is that we respect and accept the existing traditional functional division of labor, and through adequate consultation and coordination, the government can still respond to marine affairs in policy without having to establish a unified system for all marine affairs and activities.

Suggestions:

- OAC must enhance its expertise in marine affairs
- The central government can provide timely assistance and support

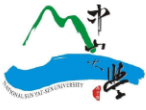
Prospect:

We hope that OAC can lead Taiwan to become a global marine leader.



Research on the impact of COVID-19 pandemic on the ocean tourism industry- taking international cruise industry as an example.

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Abstract

The purpose of this research is to realize the development trends of cruise tourism industry, to linking with implementing the Salute to the Seas policy of Executive Yuan, to promote the development of Taiwan's cruise tourism industry. The impact and challenges of the Coronavirus (COVID-19) pandemic on the cruise tourism industry development will also be discussed.

The research method is to analyze the growth trend of global cruise passengers, the stock prices and the earnings per share of the top 3 global cruise companies in the world will be discussed.

Introduction

The international cruise tourism industry developed from European and American countries, and then expanded to Asia-Pacific countries. Asia has become the most prosperous region in the global cruise tourism industry in recent years. More and more people choose cruises as their first choice for leisure and vacation. Cruise industry contributed considerable economic output and employment opportunities for all countries, especially the development of cruise industry in Asia. Asian ocean cruise passenger numbers are 4.26 million in 2018, accounted a 15 percent of global ocean cruise passenger numbers. The impact and challenges of the Coronavirus (COVID-19) pandemic on the global cruise tourism industry development are seriously.

Results & Discussion

• Analysis of number of passengers and market share of global top 3 cruise companies

From 2015 to 2019, the global cruise tourism industry has developed vigorously, and the number of global cruise passengers has grown steadily year by year, showing that cruise tourism has become one of the world's important marine leisure activities in recent years. The number of passengers of the top 3 cruise companies in the world were shown as table 1 and figure 1, has also shown a growing trend.

Table 1 Number of passengers and market share of global top 3 cruise companies, 2015–2019

Unit: person, %

Company	2015	2016	2017	2018	2019	Growing rate
Carnival Corporation & plc	10,840,000	11,520,000	12,130,000	12,407,000	12,866,000	18.7%
market share of Carnival Corporation & plc	47.0%	45.7%	45.4%	43.5%	42.9%	-8.7%
Royal Caribbean International	5,401,899	5,754,747	5,768,496	6,084,201	6,553,865	21.3%
market share of Royal Caribbean International	23.4%	22.8%	21.6%	21.4%	21.8%	-6.8%
Norwegian Cruise Line Holdings LTD.	2,164,404	2,337,311	2,519,324	2,795,101	2,695,718	24.5%
market share of Norwegian Cruise Line Holdings LTD.	9.4%	9.3%	9.5%	9.8%	9.0%	-4.3%
Other companies	4,653,697	5,587,942	6,282,180	7,213,698	7,884,417	69.4%
market share of other companies	20.2%	22.2%	23.5%	25.3%	26.3%	30.2%
Total	23,060,000	25,200,000	26,700,000	28,500,000	30,000,000	30.1%

(Carnival Corporation & PLC, 2016, 2017, 2018, 2019, 2020) 、(Royal Caribbean Cruises LTD, 2016, 2017, 2018, 2019, 2020) 、(Norwegian Cruise Line Holdings LTD, 2016, 2017, 2018, 2019, 2020)

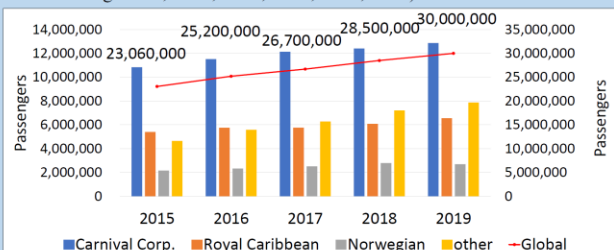


Figure 1 Rising trend of number of passengers and market share of global and top 3 cruise companies, 2015–2019

• The impact of coronavirus disease (COVID-19) on the development of international cruise industry.

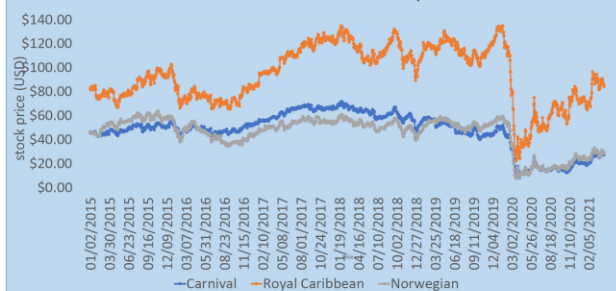
• **The development situation of coronavirus disease 2019 (COVID-19)**
185.557387million cases related to coronavirus disease 2019 (COVID-19) were reported on July 8th, 2021. Of confirmed cases, 4.010591 million died from the COVID-19 (National Experimental Research Institute, 2021). Many countries have entry bans on citizens or tourists from COVID-19 disease areas. Some countries even implement a global travel ban. The isolation, entry restrictions, and travel bans for over one year, have greatly affected the global economy.

• The impact of the COVID-19 global epidemic on the cruise industry

The global cruise companies have announced the suspension of operations in middle of March, 2020 since COVID-19 outbreak on the Diamond Princess cruise in Japan and the Ruby Princess cruise in Australia in February and in March, 2020. Due to the epidemic has not been effectively controlled, operations pause has been extended for many times.

• Analysis of stock prices of global top 3 international cruise companies

The stock prices of global top 3 international cruise companies were shown as figure 2, Carnival Corporation & plc were between \$40.13–\$71.94, Royal Caribbean International were between \$65.48–\$134.98 and Norwegian Cruise Line Holdings LTD. were between \$34.40–\$63.76 from 2015 to 2019. The stock prices of global top 3 international cruise companies, Carnival Corporation & plc, Royal Caribbean International and Norwegian Cruise Line Holdings LTD. were \$50.83, \$179.92 and \$58.41 on December 31st, 2019, lost 74.1%、82.1%、81.2%, and had closing prices of \$13.17, \$32.17 and \$10.96 on March 31st, 2020, and lost 58.5%, 39.4%, and 63.9%, and had closing prices of \$13.88, \$48.71 and \$13.45 on July 31st, 2020. It means that, due to the impact of the COVID-19 global epidemic, the market investors' confidence in cruise industry is shaken.



Conclusions

During the coronavirus (COVID-19) pandemic, many crew members stay on ships without pay, or their contracts have been paused at a time. They suffered from lost wages and lost employment opportunities since March, 2020. Carnival Corp. decided to sell 15 of its ships by the end of 2020, in order to reduce expenditure of operation cash. Carnival Corporation & plc and Royal Caribbean International are also slowing down their fleet growth, and postpone the delivery date of new ships.

Although global cruise passengers, total output value and employees grew year by year in the past. But the cruise tourism is an industry, in which the activity spaces are relatively closed, the density of passengers is high, are close contacts and social gathering frequently, and it is difficult to maintain social distance. The COVID-19 global epidemic has caused global cruise companies huge financial losses, and will have a pronounced detrimental effect on the global economy.



TICOG 2021

Taiwan International Conference on Ocean Governance 2021