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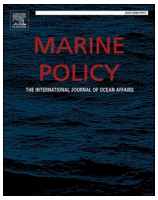

University-driven coastal partnerships to address ghost gear pollution: A case study in Penghu Islands of Taiwan

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ABSTRACT

Ghost gear has become a significant environmental and economic challenge affecting oceans worldwide. Preventing and eliminating ghost gear is essential for achieving sustainable development goals (SDGs), and partnerships between universities and multi-stakeholders are considered feasible solutions. This case study illuminates the implementation of the Partnerships for Ghost Gear Cleanups & Education Project (PGGCEP) conducted by the National Kaohsiung University of Science and Technology (NKUST) in the Penghu Islands of Taiwan, which involves engagement with local stakeholders to prevent and remediate ghost gear in Penghu seas, providing insights into coastal partnerships building to promote ocean sustainability. The conceptual schemes of PGGCEP include education projects, marine citizenship practices, and awareness campaigns. The outcomes of PGGCEP were analyzed under the framework of SDGs. The results showed that PGGCEP not only successfully supported SDG 14 life below water through the achievement of SDG17 partnerships for the goals, and it also contributed to other SDGs, including SDG 4 quality education, SDG 5 gender equality, SDG 8 decent work and economic growth, and SDG 10 reduced inequalities. Future directions for PGGCEP were subsequently provided to refine the project. Based on the findings, this study proposed a framework of university-driven coastal partnerships to address ghost gear pollution. This 4-phase framework highlights the pivotal role played by universities as facilitators of collaborative efforts that involve a broad spectrum of stakeholders for enhancing ocean sustainability.

1. Introduction

Ghost gear, known as derelict fishing gear or abandoned, lost, or discarded fishing gear (ALDFG), has emerged as a consequential environmental and economic predicament plaguing the global oceans. Ghost gear can harm marine life through entanglement, ingestion, and chemical contamination, impacting the marine ecosystem [50]. Furthermore, the harmful effects of ghost gear on vulnerable marine ecosystems, including but not limited to coral reefs and seagrass meadows, which serve as critical habitats for numerous marine species, must not be overlooked [27]. The repercussions resulting from ghost gear extend beyond ecological impacts and have also been shown to have substantial economic consequences, jeopardizing the livelihoods of fishermen and the whole fishing industry [36,53]. According to Richardson et al. [46], it is estimated that over 640,000 metric tons of ghost gear have been deposited into the ocean annually for more than a decade.

Initiatives to tackle the issue of ghost gear have been taken on a global and regional scale, and the commonly adopted measures to prevent the occurrence and alleviate the destructive effects of ALDFG can be classified into three categories: prevention, mitigation, and remediation (Global Ghost Gears Initiative, [26]). The Sustainable Development Goal 14 - life below water, established by the United Nations, seeks to minimize marine debris, including ghost gear, and many organizations are actively pursuing this aim [55]. According to the State of World Fisheries and Aquaculture (SOFIA) report published by the Food and Agriculture Organization of the United Nations (FAO), reducing pollution caused by discarded fishing gear and microplastics in marine environments is critical for fulfilling SDG 14 [19].

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Collaboration among various stakeholders is crucial to achieving Sustainable Development Goals (SDGs). To this end, all segments of society must collaborate and actively contribute to the SDGs. Among the key partners in the SDG discourse, Higher Education Institutions (HEIs) are frequently highlighted [39,64]. Recent research has demonstrated the importance of collaborations between HEIs and multiple stakeholders, including the community, industry, and government, to successfully manage and protect the marine and coastal environment (e.g., [24,32,34]). The collaborative network can be known as a coastal partnership, an established mechanism for facilitating stakeholder participation and encouraging knowledge exchange between sectors [21,22]. It is an effective way to facilitate stakeholder engagement [5]. This partnership is formed voluntarily, and its members are united by a shared sense of place and common interests related to the preservation and sustainable management of the coastal and marine ecosystem [21]. This is also a well-established mechanism that facilitates the active involvement of stakeholders and encourages the exchange of knowledge between various sectors [22]. Coastal partnerships are essential for improving collaboration and contributing to greater participatory democracy in coastal governance [51]. Even though there is a growing demand for universities to actively and extensively engage in coastal resource management to improve developmental issues and enhance community welfare [17], few studies have discussed university-driven partnerships in tackling ghost gear pollution in coastal areas, which motivates this investigation.

Another important motivation to conduct university-driven partnerships is that universities worldwide are increasingly adopting the trend of training students and involving them in local development [59,63]. The role of a university extends beyond promoting academic studies to enhancing culture, serving the local community, and facilitating national and regional development [35]. The role of a university extends beyond promoting academic studies to enhancing culture, serving the local community, and facilitating national and regional development. Article 1 of Taiwan's University Act states that "Universities shall have as their objectives conducting academic research, training and educating highly skilled people, enhancing culture, serving society, and boosting national development. Universities shall be guaranteed academic freedom and shall enjoy autonomy within the scope of laws and regulations."[37]. This Act and emerging trends provide a solid foundation for our initiative to address ghost gear issues in the fishing community.

Prior studies have suggested that education, law enforcement, and the implementation of surveillance systems are primary strategies to combat ghost gear pollution [25,65]. Additionally, the direct removal of abandoned or lost fishing equipment has been identified as an essential remediation method (e.g., [12,18]). Drawing on previous research, the authors' team has organized the Partnerships for Ghost Gear Cleanups & Education Project (PGGCEP) in the Penghu Islands of Taiwan, intending to collaborate with the local stakeholders to eradicate ghost gear in the ocean. This endeavor leverages the team's marine expertise, research capabilities, and the cooperative efforts of local Non-Governmental Organizations (NGOs). PGGCEP also targets the achievement of the SDGs by integrating ghost gear removal training and practice, ocean education, artworks, and sustainable management mechanisms.

As we embark on the "Decade of Action" [56], one of the primary political objectives in numerous developed nations revolves around addressing the challenges of implementing SDGs at the local level to bolster efforts to effect change where it has the most significant impact – in the lives of people, communities, and local organizations dedicated to this commitment [20].

The primary focus of this study is to elucidate how the implementation of PGGCEP can provide valuable insights to university-driven coastal partnerships seeking to promote ocean sustainability. Meanwhile, the study explores how these partnerships can contribute effectively to the achievement of the SDGs at the local level in the process of achieving SDG14.

2. Sustainable ocean and coastal partnerships: the role of the university

Ocean sustainability has emerged as an essential topic of research and policy interest in recent years due to the growing concern over the impact of human activities on marine ecosystems. The concept of sustainable ocean has been recognized in policy and governance frameworks. For instance, The United Nations has announced SDG 14, which aims to "conserve and sustainably use the oceans, seas, and marine resources for sustainable development" [57].

One of the critical factors contributing to sustainable oceans is the preservation of marine biodiversity, so it is necessary to reduce overfishing and habitat destruction [14]. While overfishing can be managed and controlled by laws and regulations, habitat destruction cannot be alleviated without reducing pollution and other environmental degradation. As numerous studies have indicated, marine pollution, including plastics, derelict fishing gear, and other debris, is a significant threat to ocean sustainability because it causes marine species entanglement and ingestion, along with habitat destruction (e.g., [2,15,49]). The State of World Fisheries and Aquaculture (SOFIA) issued by the Food and Agriculture Organization of the United Nations (FAO) indicates that the pollution of abandoned fishing gear and marine microplastics should be decreased to achieve SDG 14 [19]. Because the issues related to ocean sustainability are quite complicated, coastal partnerships have been seen as a practical approach to bringing multi-stakeholders together to advocate sustainable ocean management [21,51].

Coastal Partnerships are various arrangements that bring together public, private, and voluntary stakeholders to advocate for sustainable coastal management or to address coastal issues ([52,51]). Coastal partnerships can be an effective means for facilitating stakeholder engagement, while stakeholder representatives can be effective conduits for their host organizations' values (Buchan & Yate, 2019). Moreover, building multi-stakeholder partnerships is crucial to meet the UN 2030 Agenda and reducing the likelihood of potential conflicts arising [16,29]. One important partner often discussed in SDGs is the university [39,64]. Studies have indicated that the partnerships between universities and multi-stakeholders (i.e., community, industry, and government) are imperative to effectively manage and protect the marine and coastal environment (e.g., [24,32,34]). Notably, a complete representation of the full range of coastal stakeholders will improve the ability of coastal partnerships to facilitate comprehensive knowledge exchange and ultimately contribute to more integrated management (Buchan & Yate, 2019).

Examples of universities engaging in partnerships are found mainly at the project and regional levels. For instance, a community-university partnership project for water education in Manglaralto, Ecuador, has been successful [7]. The primary objective of this project was to impart education and enhance awareness amongst the community on the significance of water as a finite resource. In addition, the project sought to establish an effective linkage process between the university and the community. As a result of the successful community-university partnership has generated pertinent information (e.g., water reserves, extraction processes, aquifer recharge, and care of the resource). This study highlights the importance of creating partnerships between universities and communities to address complex environmental issues, and Carrión-Mero et al. [7] suggest that such partnerships can lead to the co-creation of knowledge and promote sustainable development.

Collaboration between universities and governments is also essential. Paunović et al. [42] conducted a case study of the partnership between a German university of applied sciences and the local government in a rural area. They found that the partnership facilitated the development of a sustainable entrepreneurial culture in the region by providing resources and support for local businesses and fostering an entrepreneurial mindset among students and community members. The researchers highlight the importance of the SDGs as a framework for the partnership, which provided a shared language and vision for

sustainable development, as well as a means of measuring progress. Another example is the International Waste Platform, which is an innovative and structured approach to encourage collaboration across government, business, philanthropy, universities, nonprofit organizations, and citizens to reduce the impact of plastic debris and enhance public awareness of the issue [31]. In addition, according to Vieira Nunhes et al. [60], the synergy of collaborative endeavors amongst universities, governments, and organizations can facilitate sustainable development through innovative strategies and the exchange of knowledge. Furthermore, incorporating civil society and local communities in collaborative initiatives is needed. Moreover, the partnerships should be based on a shared commitment to sustainability and the willingness for open dialogue and exchanging ideas.

Overall, universities have a crucial and pivotal role in advancing sustainable development by forming strategic partnerships with governments, organizations, and communities. Moreover, universities are critical in contributing to the SDGs by conducting research, implementing educational programs, developing policies, and initiating innovation [48]. As the increasing demand for universities to expand their horizons and assume more significant roles in collaborating with the community and other external stakeholders to implement social responsibility [34], university-driven coastal partnerships are worth exploring more in addressing ghost gear.

3. Materials and methods

3.1. Context

Penghu is an archipelago located west of Taiwan Island, comprising 90 islands and reefs of varying sizes. According to the Penghu Country Government [43], the islands display typical square mountain terrain resulting from the eruption of basaltic lava from underwater volcanoes. This terrain has undergone multiple slow movements on the sea floor and has been shaped by the erosive effects of several sea-level fluctuations over time, resulting in a relatively flat underwater landscape. Penghu has the longest coastline in Taiwan, spanning 448.97 kilometers [43]. The water depth generally increases as one moves away from the coast, and the shallow areas receive sufficient sunlight throughout the year, making it an ideal location for marine-related activities. However, the ocean around Penghu County is plagued with ghost gear. Therefore, since 2000, the Penghu County government has employed contracted underwater personnel specifically to retrieve abandoned fishing nets from the seabed, thereby causing the removal of obstructions in the reef and artificial fishing net regions situated in the surrounding waters of Penghu. Although the county government has persistently carried out clearing operations for several years, human resources and expertise constraints have hindered the underwater verification process. Consequently, the efficacy of the operation can only be evaluated by relying on the corroborating evidence furnished by the contractor and the number of nets cleared.

The role of the university in serving society has been highlighted in Taiwan. In 2017, the Ministry of Education launched the "University Social Responsibility Practice Program" (USR program), which aims to serve as a significant catalyst in bridging the gap between universities and society. By promoting local identity and development, the USR program seeks to align with the global community and realize its vision [8]. Despite PGGCEP not being a project of the USR program, the authors' team adhered to the principles of USR in their efforts to serve society. Therefore, the Center of Marine Affairs Studies of the National Kaohsiung University of Science and Technology (NKUST) has collaborated with and been commissioned by the Penghu County Government to develop and implement PGGCEP. The project will not only enhance the ecological environment of the Penghu marine ecosystem, but it will also benefit the local fishing industry. Hopefully, this effort will serve as a model for the sustainable management of Taiwan's marine resources and contribute to achieving global marine conservation and SDGs.

The composition of the authors' team comprises academics such as professors, researchers, and assistants from NKUST. In addition, the team includes professionals and professors from National Penghu University of Science and Technology, Feng Chia University, and the National Museum of Marine Science & Technology as con-investigators or consultants. We thoroughly investigated the various stakeholders involved in the ghost gear issue at the project site. These stakeholders include local government officials, fishers, diving store owners, kindergarten and primary school teachers and students, tourism and renewable energy business owners, environmental NGOs leaders and members, and community opinion leaders. By including these diverse stakeholders, the team ensured a comprehensive analysis of the issue from multiple viewpoints. After identifying the relevant stakeholders, our research team conducted individual and focus group interviews on exploring potential collaboration opportunities for participation in the PGGCEP. If the stakeholders were willing to collaborate with us, further discussions were conducted to determine the specific methods and extent of collaboration. This approach enabled the stakeholders to become partners in the project. For example, following a meeting with the principal of Fenggui Elementary School in Penghu County, she agreed with the concepts and objectives of the PGGCEP. Consequently, she arranged for students to attend our events, such as picture book readings and toy theater boxes. Additionally, she assigned teachers to assist in developing and implementing our instructional materials. As a result, the teachers and students of Fenggui Elementary School transitioned from being mere stakeholders to active partners in the project.

Ghost gear often exists below the sea surface, making it difficult for ordinary people to observe. Underwater net removal requires specialized underwater operation expertise and is associated with significant risks. The PGGCEP plays a vital role in the issue of underwater net removal, transforming the conventional approach by integrating marine education, professional underwater training, exhibition, and ghost gear removal. This operational model is innovative and has set a leading example in Taiwan.

3.2. Vision, objectives, and conceptual scheme of PGGCEP

The vision of PGGCEP is to establish a world where our oceans are free from the detrimental effects of ghost gear and marine life can flourish in a healthy and sustainable environment. This vision encompasses all stakeholders working collaboratively towards protecting and conserving our marine ecosystems for future generations, ultimately contributing to the achievement of SDG 14.

Accordingly, the primary objectives of PGGCEP are as follows: (1) establish partnerships involving various stakeholders in the marine environment. (2) raise awareness about the issue of ghost gear through diverse educational activities targeted towards society at large. (3) develop a volunteer team capable of cleaning up ghost gear, ensuring future self-operation and sustainability in addressing this problem.

Based on the vision and objectives, the conceptual scheme of PGGCEP comprises education projects, marine citizenship practices, and awareness campaigns (Fig. 1).

3.2.1. Education projects

The education projects involve three subprojects: editing a Guide for Ghost Gear Cleanup at Penghu Seas, forming a Ghost Gear Cleanup A-Team, and implementing educational programs for local primary school and kindergarten students in Penghu County.

The Guide for Ghost Gear Cleanup at Penghu Seas provides the knowledge and skill foundations for ghost gear cleanup personnel. Divers with sufficient capabilities may use this guidebook to understand the issue of ghost gear in the Penghu Seas and the resulting hazards.

The formation of the Ghost Gear Cleanup A-Team aims to establish a sustainable mechanism for ghost gear clearance operations in Penghu by implementing various initiatives. The main focus is to establish a system for recruiting, training, and incentivizing personnel for ghost gear

Fig. 1. The conceptual scheme of PGGCEP.

clearance operations in the Penghu seas, to educate and train diving professionals on the importance of ghost gear clearance and ensure their safe participation in these operations.

The educational programs for local primary school and kindergarten students utilize different pedagogical materials and methods, such as ghost gear drama plays and podcasts, to encourage the younger generation to adopt pro-environmental attitudes and behaviors toward the marine environment.

3.2.2. *Marine citizenship practices*

The marine citizenship practices consist of ghost gear cleanups, shoreline debris cleanups, and CoralWatch workshops. The activities of ghost gear cleanups align with the policies of the Penghu County Government and the central government. PGGCEP is committed to protecting fish habitats and ensuring the sustainability of coral reefs in the Penghu seas by actively engaging in the removal of ghost nets. Through the process of clearing ghost gear, the data of location, type, and quantity of ghost gear will be analyzed and used for policy-making and future actions.

Secondly, shoreline debris cleanup focuses on encouraging civic groups in Penghu to participate in the volunteer team for debris removal to conserve the coastal environment. As marine debris is a widespread and preventable issue that affects the health and functioning of the world's aquatic ecosystems, education, and outreach programs are considered essential solutions [49]. Therefore, during the cleanup activities, PGGCEP intends to educate people on reducing the production of marine waste, thereby improving the marine environment.

Lastly, CoralWatch training workshops have been held. CoralWatch is a citizen science initiative that empowers individuals to monitor the health of coral reefs; the program involves using a simple coral color chart to record and report changes in coral color, which can indicate stress or bleaching [13]. We have hosted workshops to encourage the citizens of Penghu who are passionate about diving to monitor the health of coral reefs. Participants in these workshops can better understand the importance of coral reef conservation and the impact their actions can have on the environment. Through these workshops, we hope to empower the citizens of Penghu to become active stewards of their local coral reefs. Moreover, we also launched philanthropic journeys to advance this initiative, allowing tourists visiting Penghu to promote coral reef health with us.

3.2.3. *Awareness campaigns*

Access to insightful and well-presented information is vital to raising and maintaining environmental awareness [54]. The development of activities in the specific environmental issue, which encourages a confrontation with reality, contributes to a critical reflection among the participants, fostering greater environmental awareness of biodiversity and nature preservation. This effort, in turn, creates new and more responsible attitudes and behaviors toward this theme [58]. Therefore, during the implementation of the project, campaigns and activities were developed for the general public and local fishermen to consolidate participants' knowledge of coastal and marine ecosystem biodiversity and to raise awareness of the main threats, problems, and risks associated with ghost gear.

The awareness campaigns encompass two distinct subprojects. The first involves a specialized exhibition on ghost gear prevention and cleanup, showcased at the Art & Literature Center of Penghu Airport and targeting the general public. The second is to organize workshops for local fishermen residing in the Penghu Islands, designed to increase their knowledge and awareness of the detrimental impact of ghost gear on the marine ecosystem.

3.3. *Research method*

The primary objective of this study is to understand the extent to which a university-driven project that addresses ghost gear pollution to achieve SDG 14 has contributed to the SDGs through coastal partnerships. Therefore, this study adapts the methodology from Ferreira et al.

[20], which is a three-step process. The first step is to evaluate the 2030 Agenda for Sustainable Development Report [57], where all 17 SDGs and their respective targets were cautiously reviewed and analyzed. The second step is to analyze PGGCEP actions and outcomes. The information gathered from the previous two steps is precisely and comprehensively analyzed to ascertain the number of SDGs the PGGCEP research project contributes to and the degree of apparent correlation. According to Ferreira et al. [20], the analysis is based on three criteria: (1) no connection: the actions and outcomes of the project do not address the target of the SDGs indirect connection; (2) indirect connection: the actions and outcomes of the project address the target of the SDGs indirectly; (3) direct connection: the actions and outcomes of the project address the target of the SDGs directly. The indirect and direct connection between the project actions and outcomes is the contribution to the SDGs.

Moreover, the participant observation method was utilized while the authors were observers. This study referred to the methodology recommended by Iacono et al. [30]. This approach involved selecting a research site and obtaining access, building rapport with the participants, observing and taking detailed notes on their behaviors and interactions, actively participating in the activities of the observed group, and subsequently analyzing the collected data through observation and reflection. Therefore, during the observation, the authors took notes on insightful situations, occasions, or scenarios related to the research question of what is happening around us, and the results of observations were discussed in the weekly meeting of PGGCEP. This method reduces the gap between the researchers and the subject, increases the possibility of uncovering new and relevant aspects of the research problem, and the researchers may obtain more profound insights into the research problem's practical implications [6].

4. Results and discussion

4.1. Project outcomes of PGGCEP

4.1.1. Education projects

The education projects aim to enhance the capacity and expertise of personnel engaged in ghost gear cleanup operations and educate primary school and kindergarten students about the impact of ghost gear and ocean conservation.

The Guide for Ghost Gear Cleanup at Penghu Seas is tailored to the characteristics of the Penghu Seas based on the Dive Against Debris® survey guides of the international Project AWARE Foundation [45]. The initial release of our publication took place in 2020 [1]; however, the subsequent years of 2021 and 2022 were dedicated to carefully revising and modifying its contents. The guide editors comprised members of our research team, officials from the Penghu County Government, and experienced professionals from NGOs and the diving industry. The editors worked collaboratively with one another to refine and finalize the contents of the guide. The main contents of the current version include (1) an introduction to ghost gear, (2) the mission and capabilities of underwater intelligence and clearance personnel; (3) mission procedures, diving safety regulations, and crisis management strategies, as well as equipment and device; (4) Ghost gear identification, work log completion, and reporting; (5) Emergency notification and rescue; (6) coral reef monitoring; (7) underwater photography.

Based on The Guide for Ghost Gear Cleanup at Penghu Seas, the Ghost Gear Cleanup A-Team participants were trained by the guide editors, who served as instructors. The eligibility requirements of applicants must be at least 18 years old and hold a valid open-water diving certification with a minimum of 50 dives logged using scuba tanks. Alternatively, advanced divers with experience in boats and deep diving may apply if they have logged at least 50 dives. The requirements are set because it is essential to have extensive diving experience to ensure safety while exploring open-water environments. From 2020–2022, we trained 42 volunteers for the "Ghost Gear Cleanup A-Team" from the volunteer firemen brigade, marine national park, dive stores, tourism industry operators, and coastal protection NGOs. The training program garnered attention from society and was reported by the local press in Taiwan [11].

As to the task of educational programs aims to promote ocean environmental education targeting kindergartens and primary schools. Specifically, the approach involves providing prior knowledge on the influence of ghost gear on ocean environments and the prevention through picture books, videos, and lectures before conducting the theatrical performances, including drama play, toy theater box, and podcasts, thereby deepening the students' understanding. Afterward, a prize-winning quiz is held to evaluate students' learning outcomes. From 2020–2022, ten activities have been implemented, and the number of participants was 442.

Education plays a crucial role in enhancing public comprehension of the ocean and the significance of its sustainability and achieving SDGs [33]. Meanwhile, linking scientific knowledge and increasing ocean-related educational resources available to school curriculums are essential areas for improving ocean education practices. Freitas et al., ($year$) [23]. As such, the results suggest that both the Ghost Gear Cleanup A-Team and educational programs have made notable progress in raising awareness, engaging volunteers, and educating the younger generation about the issue of ghost gear in the Penghu Seas.

4.1.2. Marine citizenship practices

This category of PGGCEP encompasses three distinct activities: ghost gear cleanups, shoreline debris cleanups, and CoralWatch workshops.

As for ghost gear cleanups, from 2020 to 2022, the volunteers trained in Ghost Gear Cleanup A-Team" had cleaned over 400,000 m, approximately 100,000 kg of ghost gear in the ocean. This effort has been recognized by the Penghu Country Government officials and County Magistrate [44]. The results also align with the notion that directly removing ALDFG is an essential remediation method (e.g., [12,18]).

Secondly, we invited enterprises such as KY Solar Co., NGOs like the Chinese Taipei Underwater Federation, and local NGOs in Penghu, including the Penghu International Diving Center, to participate in a shoreline debris cleanup initiative. In 2022, the programs produced favorable results, removing 130 kg of debris, comprising ghost gears, from the shoreline [38].

For CoralWatch workshops, we have worked with the experts of the National Museum of Marine Science & Technology in Taiwan to organize CoralWatch workshops. The main contents of the workshop included basic coral ecology and coral bleaching, along with the methods and practices for coral reef monitoring. In 2019, 35 persons participated the workshop, and the participants included college students, divers, journalists, and NGO members. In 2022, we recruited 30 diving store owners as voluntary prospective teachers to monitor the health status of the Penghu reef area. After the training, we organized philanthropic journeys while the previous CoralWatch prospective teachers served as the instructors, and a total of 100 residents and tourists joined the journeys to monitor and report the health status of coral reef in 2019 and 2022. The outcome of this event has two implications: (1) empowering tourists to become citizen scientists can promote responsible tourism, which is a type of tourism that aims to improve the destination experience for both tourists and local communities while minimizing any negative impacts on the environment, economy, and society [9]; (2) through the CoralWatch, Penghu can synchronize its reef health index with the rest of the world, and share its findings with the global scientific community.

4.1.3. Awareness campaigns

The awareness campaigns in PGGCEP include a specialized exhibition and local fishermen workshop, which aim to improve knowledge and awareness of the general public and local fishermen about the threats of ghost gear to the marine environment.

The specialized exhibition, "Marine Revitalization Achievement

Exhibition," was about the significant outcome of PGGCEP, including the education projects and marine citizenship practices which were described in previous sections, with the media of posters, panels, videos, and podcasts. The exhibition period was September 20th to 26th, 2022. The exhibition was estimated to reach over 3500 people [38]. Drawing on the arguments made by Cherdymova et al. [10], who suggest that environmental exhibitions can enhance environmental consciousness and knowledge, it is likely that the "Marine Revitalization Achievement Exhibition" played a pivotal role in showcasing the outcomes of PGGCEP and informing the public about the significance of marine conservation efforts. By presenting the progress in tackling ghost gear pollution and promoting marine citizenship, the exhibition likely inspired and encouraged visitors to act in their own lives toward protecting the marine environment.

Regarding the local fishermen workshop, we collaborated with officials from Penghu County Government to organize a workshop about the measures to respond to the fishing gear loss on July 18th, 2022, with 25 fishermen participating in Penghu Islands [38]. In the workshop, we emphasized that accidentally losing fishing gear will not result in punishment by the authorities, and the fishermen are encouraged to report lost nets as soon as possible. This approach is hoped to significantly reduce the environmental harm caused by lost gears in the ocean.

4.2. The contribution to SDGs

According to our analysis, PGGCEP has contributed to 6 SDGs and 9 indicators. The findings exhibit that PGGCEP has contributed to the SDGs of quality education, gender equality, decent work and economic growth, and reduced inequalities in achieving SDG14 life below water through the university-driven coastal partnerships, which corresponds with SDG17 partnerships for the goals.

4.2.1. Partnerships for the goals

The SDG17 partnerships for the goals, aims to revitalize the global partnership for sustainable development [57]. The specific target achieved by PGGCEP is indicator 17.17, to encourage effective partnerships, in which the goal is: encourage and promote effective public, public-private and civil society partnerships by 2030. The PGGCEP has involved various stakeholders related to ghost gear pollution and marine environment in Penghu Islands to build coastal partnerships for ocean sustainability. The partnerships are driven by the PGGCEP team from NKUST through tight connections with local government, enterprises, NGOs, community residents, fishermen, primary schools, and kindergartens. The outcomes and success have been built upon this coastal partnership.

4.2.2. Life below water

The SDG14 life below water, promotes to conserve and sustainably use the oceans, seas, and marine resources [57]. The major contributions of PGGCEP to the SDGs fall into this goal. The targets achieved by PGGCEP include indicator 14.1 reduce marine pollution, 14.2 protect and restore ecosystems, 14.4 sustainable fishing, and 14. A increase scientific knowledge, research and technology for ocean health. The program of ghost gear cleanup personnel training and cleanup practices, shoreline debris cleanup events, and CoralWatch workshops have directly contributed to the indicators of 14.1, 14.2, and 14.A. The local fishermen workshop has accomplished indicators 14.1, 14.2, and 14.4. The educational activities for students have achieved the indicators of 14.1 and 14. A directly, while also contributed to 14.2 and 14.4 indirectly. This is because, based on our experiences, it is shown that the kids might ask their parents or grandparents of fishermen to pay attention to the pollution of ghost gear. Moreover, the specialized exhibition has achieved indicators 14.1 and 14. A because it has drawn on the impact of ghost gears on the marine ecosystem to the general public.

4.2.3. Quality education

The SDG4 quality education is to ensure inclusive and quality education for all and promote lifelong learning [57]. The specific target achieved by PGGCEP is indicator 4.7 - education on sustainable development and global citizenship, in which the goal is: by 2030 ensure that all learners acquire the knowledge and skills needed to promote sustainable development. PGGCEP has solid educational value, which was established in collaboration with local government, enterprises, and community stakeholders, as well as primary schools and kindergartens. Moreover, PGGCEP has incorporated education and skills-building to foster active and responsible citizens throughout the education projects, marine citizenship practice, and awareness campaigns related to ghost gear cleanup and marine conservation; thus, it should be feasible to accomplish this target.

4.2.4. Gender equality

The SDG5 – Gender equality, is to achieve gender equality and empower all women and girls [57]. The specific target achieved by PGGCEP is indicator 5.1 - to end discrimination against women and girls, in which the goal is: by 2030 end all forms of discrimination against all women and girls everywhere. The educational materials and products developed by PGGCEP have been precisely crafted based on gender equality. These materials were designed with equal consideration for both male and female participants, with the explicit intention of deconstructing the entrenched stereotype of fishing villages where men are traditionally regarded as superior to women, despite most fishermen being male. Furthermore, PGGCEP has focused on inclusive participation in educational activities, community citizen practices, and awareness campaigns to promote gender equality and to create an environment that is welcoming to all, irrespective of gender. Consequently, the participation of women and girls has been encouraged without any form of prejudice.

4.2.5. Decent work and economic growth

The SDG8 decent work and economic growth, is to promote inclusive and sustainable economic growth, employment, and decent work for all [57]. The specific target achieved by PGGCEP is indicator 8.9 - promote beneficial and sustainable tourism, in which the goal is: by 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products. The PGGCEP has utilized the CoralWatch workshops for training local diving shop owners as prospective teachers, enabling them to lead diving tourists in coral health monitoring and reporting, thereby promoting responsible tourism in Penghu Islands. In addition, the media coverage on PGGCEP, like the formation of Ghost Gear Cleanup A-Team, shoreline debris cleanup activities, and the specialized exhibition, has also helped to achieve the goal, as the total news coverage from the year 2020–2022 was 120 posts on social media. Previous research has demonstrated that the media plays a significant role in shaping government environmental policy and increasing public awareness of environmental issues (e.g., [47,61]). Therefore, PGGCEP should have raised the awareness of the government and civil society on the issue of ghost gear, promoting local sustainable tourism consequently.

4.2.6. Reduced inequalities

The SDG10 reduced inequalities, aims to reduce inequality within and among countries [57]. The specific target achieved by PGGCEP is indicator 10.2 - promote universal social, economic and political inclusion, in which the goal is: by 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status. The programs of PGGCEP have been designed for different groups regarding age, skill, and occupation. For instance, participants of the ghost gear cleanups should be trained and join the Ghost Gear Cleanup A-Team; educational activities like drama plays and toy theater box performances are only for primary school and kindergarten students.

Meanwhile, the special exhibition displayed in the Art & Literature of Penghu Airport is open and accessible to the public regardless of age, gender, disability, race, ethnicity, origin, religion, or economic condition.

4.3. Future directions for PGGCEP

Based on the outcome analysis and operating practices, we offer the following suggestions to enhance PGGCEP in the future.

First, continuous refinement of the ghost gear cleanup program should be implemented. Considering the needs of participants for a longer duration for the classes within the program, our future courses will categorize our specialized courses as elective courses, such as CoralWatch and underwater photography, to enable participants to be more engaged in the core expertise of ghost gear cleanup knowledge and skills. This approach allows customized training based on the interests and expertise of the participants; meanwhile, it also enhances the richness and quality of the courses, thereby improving the program's quality.

Second, the web page for underwater ghost gear and ecology information in Penghu Islands should be developed. The current data on ghost gear cleanup is recorded in written work logs and requires manual conversion into digital data for processing and analysis, resulting in a lack of real-time information and making it difficult to preserve or transfer data. Therefore, it will be necessary to develop an information webpage for ghost gear clearance records and notifications, so that during future implementation of ghost gear clearance or when fishermen encounter fishing gear loss at sea, they can record and report the information as soon as possible. This approach might improve the accuracy and timeliness of clearance information, thereby minimizing the degree of ecological harm caused.

Third, the operation of marine ecological patrol can be enhanced. The PGGCEP can utilize the present partnership network to form a better marine ecological patrol team with ghost gear cleanup volunteers, divestore owners, and local fishermen with the assistance of the web page previously mentioned.

Last, the quantity and quality of local teachers for marine education should be enhanced. The teaching materials on ghost net removal and marine education for the local Penghu Islands are insufficient, resulting in a shortage of professional teachers and a lack of quality educational resources. Therefore, PGGCEP will focus more on developing diverse instructional materials for school-based curricula and activities. This approach is expected to cultivate a sense of coastal conservation in students and nurture the seeds of marine sustainability for the future.

5. Concluding remarks: the framework of university-driven coastal partnerships to address ghost gear pollution

According to the experience of PGGCEP, we propose an initial framework of the university-driven coastal partnerships for addressing ghost gear pollution, including 4 phases (Fig. 2). First, the university should investigate the local issues and build a strong connection with relevant stakeholders based on its expertise. Second, different conceptual schemes should be designed to engage stakeholders as much as possible. When addressing ghost gear pollution, it is essential to consider the various knowledge, attitudes, and skills different stakeholders can bring. The success of such efforts will depend on the level of engagement and contributions from various individuals and groups. This study suggests that education projects, citizenship practices, and awareness campaigns can be utilized. Third, the outcomes of the project should be analyzed in light of SDGs. This analysis should consider the various SDGs relevant to the project and evaluate the extent to which the project has contributed to their achievement. Lastly, the outcome analysis can serve as a basis for justifying any necessary modifications or future directions of the project. During the four-phase operation, the university should continue building mutual trust with the stakeholders, maintain a neutral standpoint, and be problem-based and place-based to demonstrate to stakeholders that it is worthy of being the platform for the stakeholders related to ghost gear issues.

The proposed framework is inspired by Liu [34], who has indicated that universities can act as facilitators to aid coastal communities in various aspects, such as self-management, marine environment and

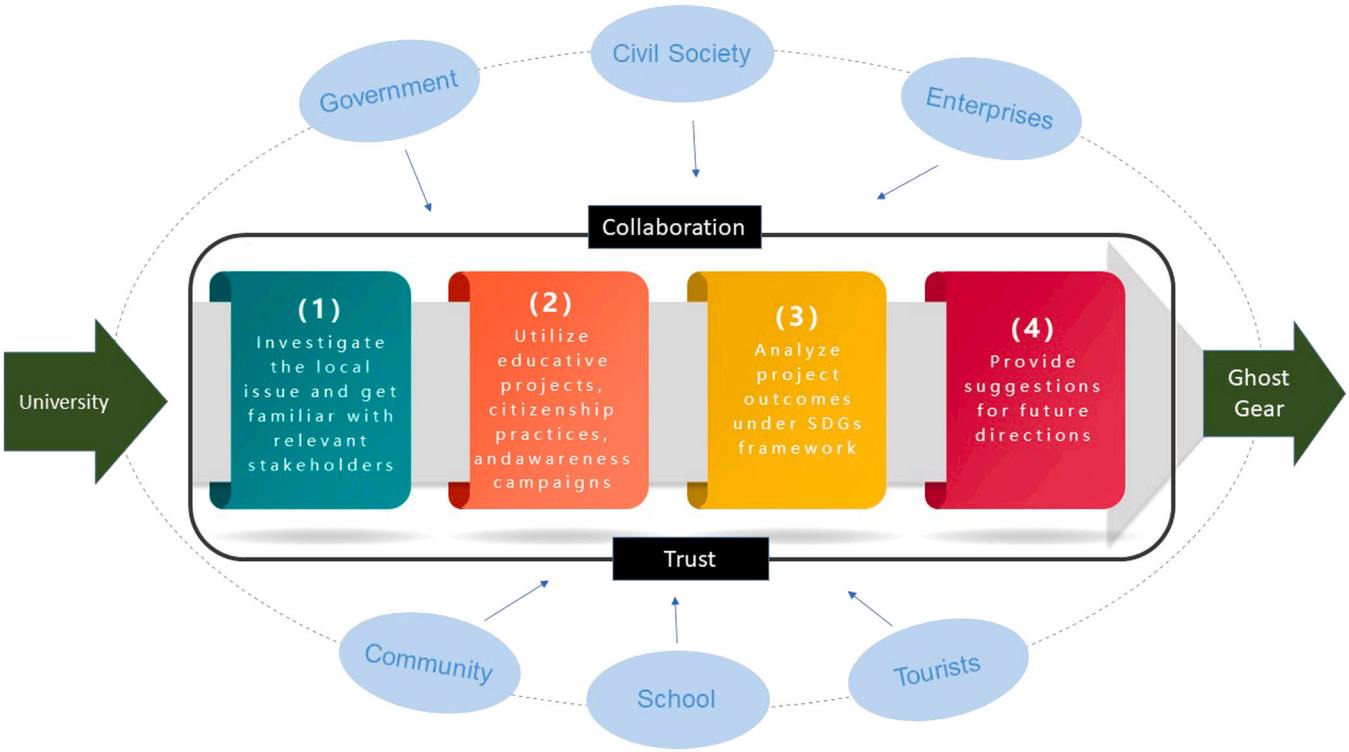

Fig. 2. The framework of the university-driven coastal partnerships for addressing ghost gear pollution.

resource management, local industry development, and ultimately fostering sustainable community development. Compared with previous studies in coastal partnerships (e.g., [21,28,40,62]), this framework highlights the university-driven mechanism, which has the potential to enable universities to serve as sustainable anchors and effectively drive impactful change through conviction, intention, and guiding principles centered on social justice, equity, and respect for the values of local communities [4].

For future research, this framework can be enhanced and validated by applying more rigorous scientific methods. For instance, the methodology of critical realism can be utilized, which was developed by Bhaskar [3] and aims to provide a framework that guides research in explaining social phenomena [41]. By adopting the critical realism approach, we can better understand the mechanisms underlying interactions and relationships between stakeholders during project implementation. Another possible method is to conduct surveys on participants of events and activities such as ghost gear cleanup programs and environmental education activities for local schools, utilizing a statistically rigorous approach such as pre-post testing to analyze the effectiveness of these programs on various environmental-related variables (i.e., ocean literacy, ecosystem services awareness, and awareness of SDGs). Additionally, exploring the relationships between the tested variables can be a potential research direction. In conclusion, the framework of the university-driven coastal partnerships for addressing ghost gear pollution can be seen as the very first attempt to address ghost gear pollution through university-driven coastal partnerships, and this framework may lead to future research and practices to achieve ocean sustainability.

CRediT authorship contribution statement

Chih-Cheng Lin: Formal analysis, Writing – original draft, Writing – review & editing. **Kuo-Huan Ting:** Project administration, Conceptualization, Investigation. **Hao-Tang Jhan:** Project administration, Investigation, Writing – review & editing. **Chung-Lun Liu:** Project administration, Investigation, Validation. **Li-Shu Chen:** Project administration, Investigation, Validation. **Wen-Hong Liu:** Conceptualization, Validation, Supervision, Project administration, Writing – review & editing.

Data Availability

No data was used for the research described in the article.

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References

[1] Agriculture and Fisheries Bureau of Penghu County, AFBPC. (2020). Guide for Ghost Gear Cleanup at Penghu Seas. https://www.penghu.gov.tw/farm/home.jsp?id=89&act=view&dataserno=202011260001&mserno=201110090002 [in Chinese].
[2] C.G. Avio, S. Gorbi, F. Regoli, Plastics and microplastics in the oceans: from emerging pollutants to emerged threat, Mar. Environ. Res. 128 (2017) 2–11.
[3] R. Bhaskar, A realist theory of science, Routledge, 1975.
[4] G. Bonilla-Santiago, Community development transformation of Cooper neighborhood: a Rutgers-Camden University and LEAP Academy school collaboration through sustainable development, Community Dev. 51 (5) (2020) 457–477.
[5] P.M. Buchan, K.L. Yates, Stakeholder dynamics, perceptions and representation in a regional coastal partnership, Mar. Policy 101 (2019) 125–136.
[6] L. Busetto, W. Wick, C. Gumbinger, How to use and assess qualitative research methods, Neurol. Res. Pract. 2 (2020) 1–10.
[7] P. Carrión-Mero, F. Morante-Carballo, G. Herrera-Franco, M. Jaya-Montalvo, D. Rodríguez, C. Loor-Flores de Valgas, E. Berrezueta, Community-university partnership in water education and linkage process. Study case: Manglaralto, Santa Elena, Ecuador, Water 13 (15) (2021) 1998, https://doi.org/10.3390/w13151998.
[8] Center for USR Ministry of Education, About the USR (University Social Responsibility) program: Focusing on societal issues and practicing sustainable development, Center for USR Ministry of Education, 2022 ([in Chinese]), ⟨https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=H0030001⟩.
[9] J.K.L. Chan, T.K. Xin, Exploring definitions and practices of responsible tourism in Kinabalu National Park, Sabah, Malays. *J. Tour. Hosp. Manag.* 3 (5–6) (2015) 87–101.
[10] E.I. Cherdymova, K.I. Vorobyeva, O.V. Romashkova, N.A. Mashkin, S.M. Grigoriev, L.N. Romanchenko, A.R. Bayanova, Photo exhibition influence on student environmental consciousness formation, Ekoloji 27 (106) (2018) 1271–1278.
[11] China Times. (2022, July 22). Ghost gear cleanup training to safeguard the ocean together, involving industry, government, and academia. China Times. https://www.chinatimes.com/campus/20220722003914–262301?chdtv [in Chinese].
[12] D.O. Cho, Removing derelict fishing gear from the deep seabed of the East Sea, Mar. Policy 35 (5) (2011) 610–614, https://doi.org/10.1016/j.marpol.2011.01.022.
[13] CoralWatch. (2023). Using the chart. https://coralwatch.org/monitoring/using-the-chart/.
[14] C. Costello, D. Ovando, R. Hilborn, S.D. Gaines, O. Deschenes, S.E. Lester, Status and solutions for the world's unassessed fisheries, Science 338 (6106) (2012) 517–520.
[15] P.C. Deshpande, D.M. Aspen, A framework to conceptualize sustainable development goals for fishing gear resource management, Handb. Sustain. Sci. Res. (2018) 727–744.
[16] A. Di Vaio, L. Varriale, M. Lekakou, M. Pozzoli, SDGs disclosure: evidence from cruise corporations' sustainability reporting (ahead-of-print), Corp. Gov. (2023), https://doi.org/10.1108/CG-04-2022-0174.
[17] T.M. Djafar, R. Ghazali, J. Saputra, R. Dewi, M. Zikri, The university's role in coastal resources management for achieving sustainable development, Opción: Rev. De. Cienc. Hum. Y. Soc. 91 (2020) 139–157.
[18] M.J. Donohue, R.C. Boland, C.M. Sramek, G.A. Antonelis, Derelict fishing gear in the Northwestern Hawaiian Islands: diving surveys and debris removal in 1999 confirm threat to coral reef ecosystems, Mar. Pollut. Bull. 42 (12) (2001) 1301–1312, https://doi.org/10.1016/S0025-326X(01)00139-4.
[19] FAO, The state of world fisheries and aquaculture 2022. Towards blue transformation, FAO, Rome, 2022. ⟨https://www.fao.org/3/cc0461en/cc0461en.pdf⟩.
[20] J.C. Ferreira, L. Vasconcelos, R. Monteiro, F.Z. Silva, C.M. Duarte, F. Ferreira, Ocean literacy to promote sustainable development goals and agenda 2030 in coastal communities, Educ. Sci. 11 (2) (2021) 62, https://doi.org/10.3390/educsci11020062.
[21] S. Fletcher, Stakeholder representation and the democratic basis of coastal partnerships in the UK, Mar. Policy 27 (3) (2003) 229–240.
[22] S. Fletcher, K. Pike, Coastal management in the Solent: The stakeholder perspective, Mar. Policy 31 (5) (2007) 638–644.
[23] C. Freitas, A. Bellgrove, P. Venzo, P. Francis, Towards a 2025 national ocean literacy strategy: current status and future needs in primary education, Front. Mar. Sci. 9 (2022) 1109, https://doi.org/10.3389/fmars.2022.883524.
[24] S. Gebbels, S.M. Evans, J.E. Delany, Promoting environmental citizenship and corporate social responsibility through a school/industry/university partnership, J. Biol. Educ. 45 (1) (2011) 13–19.
[25] E. Gilman, M. Musyl, P. Suuronen, M. Chaloupka, S. Gorgin, J. Wilson, B. Kuczenski, Highest risk abandoned, lost and discarded fishing gear, Sci. Rep. 11 (1) (2021) 7195, https://doi.org/10.1038/s41598-021-86123-3.
[26] Global Ghost Gear Initiative. (2021). Best Practice Framework for the Management of Aquaculture Gear. https://repository.oceanbestpractices.org/handle/11329/1728.
[27] Greenpeace (2019). Ghost gear: the abandoned fishing nets haunting our oceans. https://www.greenpeace.org/static/planet4-international-stateless/2019/11/8f290a4f-ghostgearfishingreport2019_greenpeace.pdf.
[28] T.W. Hartley, M. Gagne, R.A. Robertson, Cases of collaboration in New England coastal communities: an approach to manage change, Hum. Ecol. Rev. (2008) 213–226.
[29] C.W. Hutton, R.J. Nicholls, A.N. Lázár, A. Chapman, M. Schaafsma, M. Salehin, Potential trade-offs between the sustainable development goals in coastal Bangladesh, Sustainability 10 (4) (2018) 1108, https://doi.org/10.3390/su10041108.
[30] J. Iacono, A. Brown, C. Holtham, Research methods—a case example of participant observation, Electron. J. Bus. Res. Methods 7 (1) (2009) 39–46. ⟨https://academic-publishing.org/index.php/ejbrm/article/view/1241⟩.
[31] J.H. Kandziora, N. Van Toulon, P. Sobral, H.L. Taylor, A.J. Ribbink, J.R. Jambeck, S. Werner, The important role of marine debris networks to prevent and reduce ocean plastic pollution, Mar. Pollut. Bull. 141 (2019) 657–662.
[32] C. Kelly, S. Essex, G. Glegg, Reflective practice for marine planning: a case study of marine nature-based tourism partnerships, Mar. Policy 36 (3) (2012) 769–781.
[33] R. Kelly, K. Evans, K. Alexander, S. Bettiol, S. Corney, C. Cullen-Knox, G.T. Pecl, Connecting to the oceans: supporting ocean literacy and public engagement, Rev. Fsh Biol. Fish. 32 (2022) 123–143, https://doi.org/10.1007/s11160-020-09625-9.
[34] W.H. Liu, University social responsibility to promote coastal partnership: Introducing Taiwan coastal communities, Mar. Policy 146 (2022), 105303.
[35] W.H. Liu, H.C. Lee, W.Y. Sung, T.Y. Yang, The roles of Taiwanese universities in coastal revitalization: a study of two case projects, Mar. Policy 139 (2022), 105050, https://doi.org/10.1016/j.marpol.2022.105050.
[36] T. Matsuoka, T. Nakashima, N. Nagasawa, A review of ghost fishing: scientific approaches to evaluation and solutions, Fish. Sci. 71 (2005) 691–702.

[37] Ministry of Education (2019). University Act. Laws & Regulations Database of The Republic of China(Taiwan) https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=H0030001.
[38] National Kaohsiung University of Science and Technology, NKUST. (2022). Educational Promotion and Training Program for ALDFG Removal (AF-111–20). [in Chinese].
[39] J. Neary, M. Osborne, University engagement in achieving sustainable development goals: a synthesis of case studies from the SUEUAA study, Aust. J. Adult Learn. 58 (3) (2018) 336–364.
[40] O. Kweka R. Katikiro R.A. Minja F. Namkesa Partnerships for the Governance of Coastal Resources: A Literature Review. Copenhagen Business School, CBS. NEPSUS Working Paper, 2017(4). https://research.cbs.dk/en/publications/partnerships-for-the-governance-of-coastal-resources-a-literature.
[41] J. O'Mahoney, S. Vincent, Critical realism as an empirical project: a beginner's guide. Studying organizations using critical realism: A practical guide, Oxford University Press, 2014.
[42] I. Paunović, C. Müller, K. Deimel, Building a culture of entrepreneurial initiative in rural regions based on sustainable development goals: a case study of university of applied sciences–municipality innovation partnership, Sustainability 14 (19) (2022) 12108.
[43] Penghu County Government. (2018, January 29). Terrain. https://www.penghu.gov.tw/en/home.jsp?id=15.
[44] Penghu County Government. (2022, September 20). Penghu County Government Clears 400,000 Meters of Discarded Underwater Ghost Nets in 4 Years, Ranking 1st in Taiwan: Lai Feng-Wei and Liu Chen Chao-ling Affirm the Effectiveness of Clearance Operation. Penghu County Government - News. https://www.penghu.gov.tw/en/home.jsp?id=47&act=view&dataserno=202210210023&mserno=201706220001.
[45] Project AWARE Foundation. (2015). Dive Against Debris® Survey Guide. https://www.diveagainstdebris.org/sites/www.diveagainstdebris.org/files/2017–06/572DT_DAD_Survey_Guide_v2_4_EN.pdf.
[46] K. Richardson, C. Wilcox, J. Vince, B.D. Hardesty, Challenges and misperceptions around global fishing gear loss estimates, Mar. Policy 129 (2021), 104522, https://doi.org/10.1016/j.marpol.2021.104522.
[47] R. Saikia, Role of mass media in creating environmental awareness, Natl. J. Multidiscip Res Dev. 1 (2) (2017) 1–4.
[48] P.G. Serafini, J.M. de Moura, M.R. de Almeida, J.F.D. de Rezende, Sustainable development goals in higher education institutions: a systematic literature review, J. Clean. Prod. (2022), 133473.
[49] S.B. Sheavly, K.M. Register, Marine debris & plastics: environmental concerns, sources, impacts and solutions, J. Polym. Environ. 15 (2007) 301–305.
[50] M. Stelfox, J. Hudgins, M. Sweet, A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs, Mar. Pollut. Bull. 111 (1–2) (2016) 6–17.
[51] T. Stojanovic, N. Barker, Improving governance through local coastal partnerships in the UK, Geogr. J. 174 (4) (2008) 344–360.
[52] T. Stojanovic, R. Ballinger, Responding to coastal issues in the UK: managing information and collaborating through partnerships, Ocean Yearb. 23 (1) (2009) 445–472, https://doi.org/10.1163/22116001-90000204.
[53] M. Sullivan, S. Evert, P. Straub, M. Reding, N. Robinson, E. Zimmermann, D. Ambrose, Identification, recovery, and impact of ghost fishing gear in the Mullica River-Great Bay Estuary (New Jersey, USA): stakeholder-driven restoration for smaller-scale systems, Mar. Pollut. Bull. 138 (2019) 37–48.
[54] Thomas, I. (2004). Sustainability in tertiary curricula: what is stopping it happening?. International Journal of Sustainability in Higher Education.
[55] UNEP. (2016). Marine Litter and Microplastics: Global Lessons and Research to Inspire Action and Guide Policy Change. https://wedocs.unep.org/handle/20.500.11822/7720.
[56] United Nations. (2019). Decade of Action. https://www.un.org/sustainabledevelopment/decade-of-action.
[57] United Nations. (2022). Sustainable development report 2022. https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf.
[58] L. Vasconcelos, M.J.R. Pereira, U. Caser, G. Gonçalves, F. Silva, R. Sá, MARGov–setting the ground for the governance of marine protected areas, Ocean Coast. Manag. 72 (2013) 46–53.
[59] R. Vasilescu, C. Barna, M. Epure, C. Baicu, Developing university social responsibility: a model for the challenges of the new civil society, Procedia-Soc. Behav. Sci. 2 (2) (2010) 4177–4182.
[60] T. Vieira Nunhes, E. Viviani Garcia, M. Espuny, V. Homem de Mello Santos, R. Isaksson, O. José de Oliveira, Where to go with corporate sustainability? Opening paths for sustainable businesses through the collaboration between universities, governments, and organizations, Sustainability 13 (3) (2021) 1429.
[61] S. Walgrave, S. Soroka, M. Nuytemans, The mass media's political agenda-setting power: a longitudinal analysis of media, parliament, and government in Belgium (1993 to 2000), Comp. Political Stud. 41 (6) (2008) 814–836.
[62] G. Wescott, Partnerships for capacity building: community, governments and universities working together, Ocean Coast. Manag. 45 (9–10) (2002) 549–571.
[63] A. Wigmore-Álvarez, M. Ruiz-Lozano, University social responsibility (USR) in the global context: an overview of literature, Bus. Prof. Ethics J. (2012) 475–498.
[64] C. Wright, L.J. Ritter, C. Wisse Gonzales, Cultivating a collaborative culture for ensuring Sustainable Development Goals in higher education: an integrative case study, Sustainability 14 (3) (2022) 1273.
[65] C.M. Yang, Stakeholders' perspectives for taking action to prevent abandoned, lost, or otherwise discarded fishing gear in gillnet fisheries, Taiwan, Sustainability 15 (1) (2022) 318, https://doi.org/10.3390/su15010318.