



OSEAN
Our Sea of East Asia Network



ISSN 2287-8971

Marine Litter News

Volume 10 • Issue 2 • December 2018

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Asia Pacific Civil Forum on Marine Litter

Recommended Citation for the whole volume:

Hong, Sunwook.(ed.) (Dec 2018). Marine Litter News from Asia Pacific Civil Forum on Marine Litter, Our Sea of East Asia Network, Vol. 10(2): 34pp, Tongyeong, South Korea.

ISSN 2287-8971

Marine Litter News Vol. 10(2): 34pp. December 2018.

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The newsletter is biannually published by APML.

Preface

To the readers,

Marine Litter News aimed to encourage people who have devoted to marine environment protection from marine litter in the Asia Pacific region

This issue delivers 7 stories from Republic of Korea, Vietnam, Taiwan, and China. Three stories are from Our Sea of East Asia Network (OSEAN). OSEAN has focused on marine litter so many years and worked for clean ocean in this region. The first story is about their passion for research activities. They have held a webinar almost every Tuesday for 9 years and invited NGOs for capacity building. Here they celebrated 300 times on August 7, 2018. The second is about 'The 2nd Korea marine Debris Conference' held in Tongyeong. It was organized by OSEAN and KIOST (Korea Institute of Ocean Science and Technology) which is one of the most active research teams on microplastics in the world. The third introduces the launching event, panel discussion against recreational fishing litter such as hook, toxic metallic sinker, and monofilament line which seriously affect marine animals and ecosystem in South Korea.

We have two news from Vietnam. Both deliver NGOs' effort to encourage women trash pickers and housewives to separate recyclable wastes and to find some way to get financial benefits. Those happen in Ha Long City and Da Nang City, the most famous tourist attraction in Vietnam. The NGOs' role here shows how their activities are important in spreading environmentally sound and sustainable practices.

Chinese news is describing the NGO's continuous monitoring of marine litter along the coastline and seeking proactive measures at source to prevent.

A new scientific paper came out, which was based on citizen science of beach litter surveys for 12 years in Taiwan. A member of Asia Pacific Civil Forum on Marine Litter is included as a coauthor.

On behalf of the editorial board, I really appreciate all of the NGOs and researchers who participated in this issue. Their enthusiasm and continued dedication to combating marine litter will inspire various stakeholders in the globe as well as in the Asia Pacific region.

I am looking forward to hearing more about fantastic efforts in the globe in the next time.

At the end of December 2018,

With warm regards,

Sunny

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(Ph.D., President of OSEAN)



Assistant editor, Jongsu Lee
(Researcher of OSEAN)



To Celebrate the 300th Seminar of Learning Community OSEAN

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At 10:30 am on the August 7th 2018, the 300th seminar was held at OSEAN in Tongyeong. Six members of OSEAN and NGOs from Vietnam, mainland China and Taiwan participated in the seminar. For the first time, an activist from GreenHub, an NGO in Vietnam, presented and led the seminar.

This seminar, which has been continued for eight years and a half since the first seminar was held in mid-January 2010, has been held around 35 times per year. Since January 2017, we have held seminar almost every week since it has been open to the public including domestic NGOs. We have seldom skipped the seminar after participants outside joined it to keep an appointment with them.

OSEAN's seminar goes as follows. One of the most recent research achievements or quotations from marine litter papers in international journals is selected a week. Participants read it in advance, and one of OSEAN members leads the seminar. After reviewing the contents of the paper, we discuss the methodology, significance of the results what can be applied to us, and the main findings and limitations of the paper. The leader of the seminar summarizes the results and posts it on OSEAN's homepage. It is delivered to readers of OSEAN's monthly newsletter.

OSEAN's seminar is of great significance to OSEAN staffs, our sponsors and those who want to solve the marine litter problem.

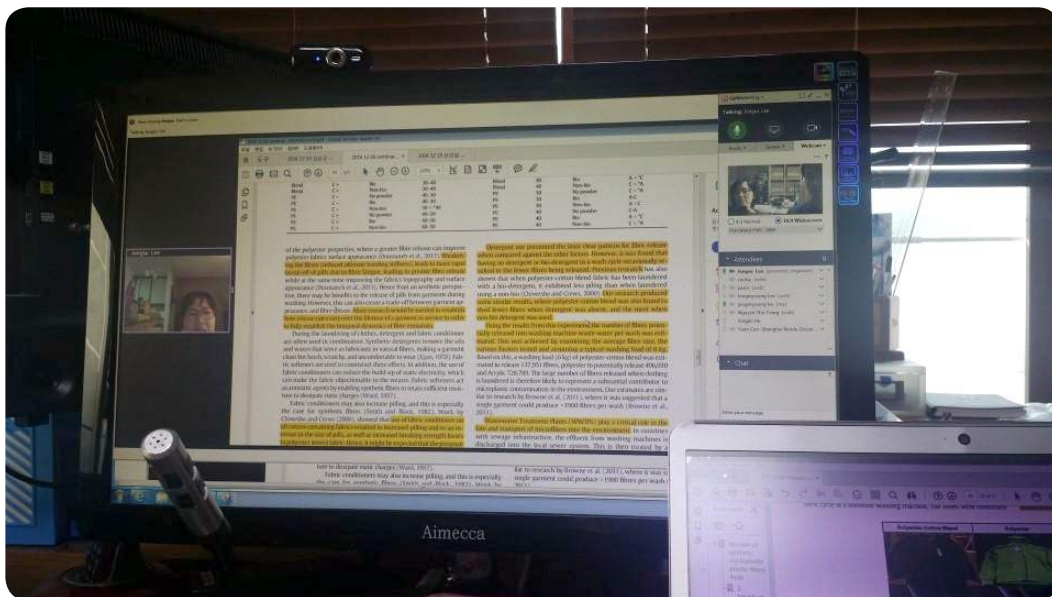
OSEAN was established as a learning community, to be an organization that learns from each other. Through selecting and studying the latest research papers, we have accumulated a very high level of knowledge and information on our own, translated and summarized the papers we studied, and continued to share knowledge with others by releasing them to people interested in marine litter through newsletters. From October 2011, once a month, we have been studying with our partner NGOs in Asia through international seminars, acquiring scientific knowledge, sharing previous experi-

ences and consulting each other. We adopted a webinar tool called 'Gotomeeting' to share the seminar with others out OSEAN.

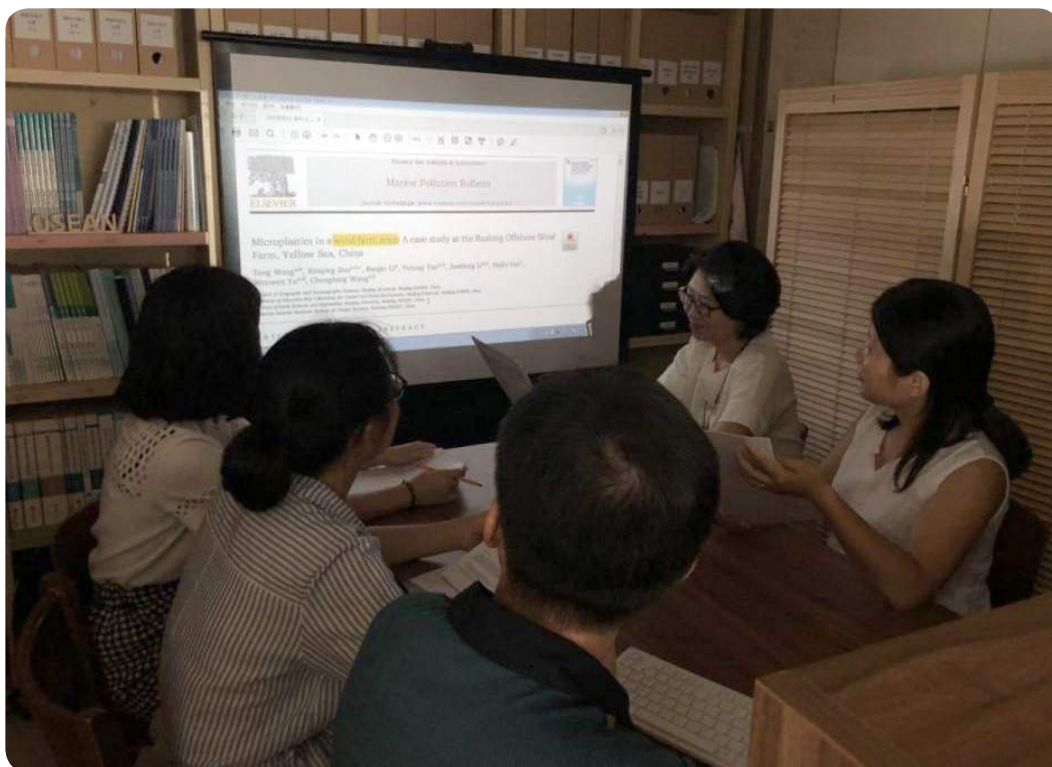
OSEAN's seminar results are good for graduate students and researchers writing papers related to marine litter, journalists writing articles, and government officials who need professional resources for policy-making. Read the latest research trends in our monthly newsletter. For more information, go to OSEAN's Cafe (cafe.naver.com/osean) or OSEAN's Homepage (www.osean.net) and do a keyword search. Understand the translated summary, key content, and discussion. When you use the material, make sure to quote the author of the original material to reveal the source. For more information, please contact us by email or cafe bulletin board.

If you want to participate in OSEAN's seminar, check the monthly seminar schedule announced in the newsletter. Check the downlinks and conference room links in the plan. The seminar starts every Tuesday at 10:30 am in Korean time and lasts about an hour. Download the paper in advance and read it. Enter the meeting room 10 minutes ago. We study together for an hour. On the first Tuesday of each month, the seminar proceeds in English because it is an international seminar with NGOs from Taiwan, China and Vietnam. All participants are not fluent in English, but when you read the paper in advance, you can understand the contents well.

Learning is endless. By reading more than 300 papers and articles written by many hardworking researchers around the world, OSEAN is growing into an organization that is constantly revitalizing its energy. What we learned is applied to the problem of marine litter. OSEAN's seminar and newsletters are in progress by sponsoring members. Thank them deeply. OSEAN's seminar will continue in the future, so attend the seminar every Tuesday morning!



Seminar materials are shared through Gotomeeting.



OSEAN members are participating in the seminar

Scientific Marine Debris Monitoring along China's Coastline

Team Coastal Cleanup and Monitoring Project in China

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Marine debris, especially plastic debris, has gained mass attention as a key global environmental issue. Currently, many governments, research institutes and organizations worldwide are taking extensive actions to address this problem.

To elucidate the status of the issue in China, Shanghai Rendu Ocean NPO Development Center (Rendu Ocean) initiated the project "Watching Coastline — Scientific Monitoring" in 2014 and conducted it at 12 monitoring sites along China's coastline in collaboration with 13 environmental NGOs (ENGOS). In 2017, Rendu Ocean, cooperating with 12 ENGOS, carried out 72 monitoring activities in 6 monitoring periods at 14 typical sites along China's coastline. Data was collected and analyzed to investigate the types of litter and their composition on beaches of different waters of China.

We measured the quantity, mass and type of beach litter using transect sampling method on a regular basis. The results of our research in 2017 showed that the quantity distribution density of all the beach litter was 1.34 items/m² and the total mass distribution density of beach litter was 38.45 g/m². In addition, the data was sorted by material and usage. In terms of material, plastic was the most pervasive one of all along China's coastline, which accounted for 77% of the total, and in terms of usage, packaging waste and domestic waste were the most common, accounting for 48% and 37% respectively.

Drawing from the results, we put forward a two-dimensional solution. It is composed of strategies grounded in the status and location of litter in accordance with different stages in marine debris management, as well as several other feasible measures for all walks of life.

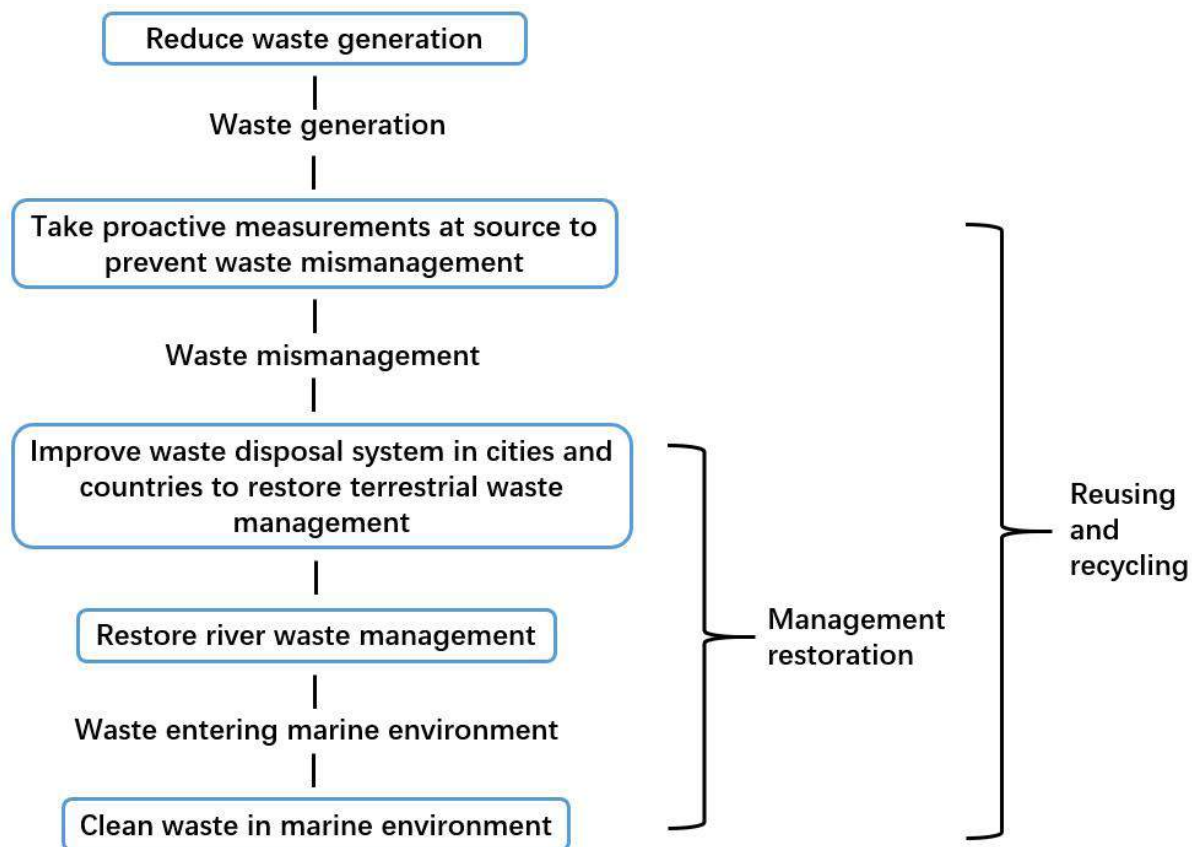


Fig. 1. Dimension 1 – Defense lines against marine debris

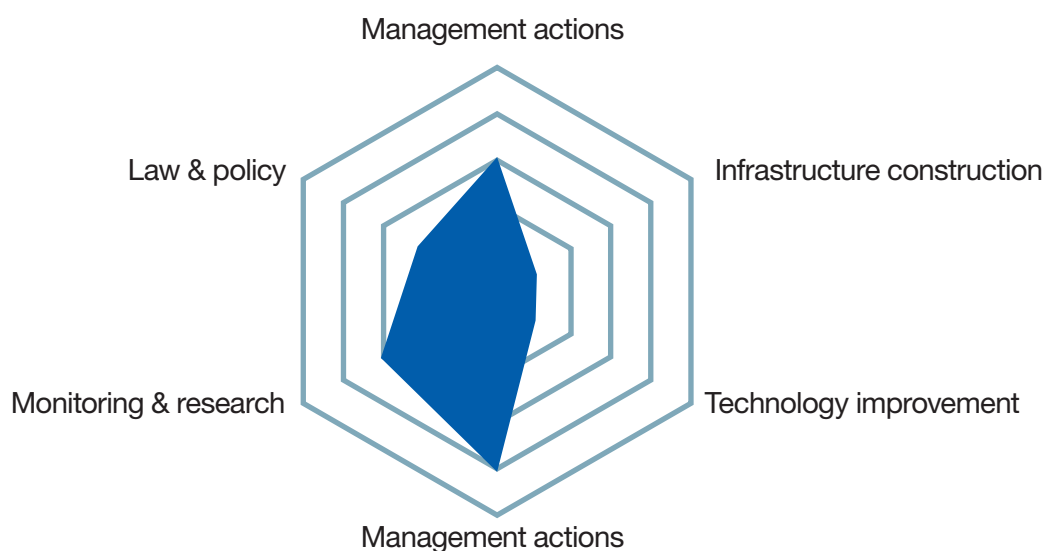


Fig. 2. Dimension 2 – 6 measures to consider for each defense line

A major feature of marine debris is that the later it is in its life cycle, the harder it is to be dealt with. Therefore, source reduction is regarded as the key solution to address the issue. But to put it well under control we should take every aspect into account. As for the litter which is not mismanaged, awareness of public environmental responsibility and waste disposal system should be strengthened to prevent mismanagement from happening. As for the litter which has entered the environment, i.e., mismanaged litter, establishment of cleanup mechanism is necessary to guarantee its getting back into control in order to reduce its negative effects on the environment.

Marine debris issue is a problem which we the whole world should face together. Only with concerted efforts from all sectors of society can it be effectively approached.

Plastic recycling for change: advancing women's lives and reducing plastic pollution of the oceans

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Plastics in Vietnam

The rapid economic growth, industrialization and consumer market expansion in Vietnam have been accompanied by a significant expansion in the import, export, production and use of plastics¹. There is a growing use of many different plastic products across many sectors and services in the daily lives of Vietnamese citizens. Average national plastic consumption is estimated at 41kg/person/year (Vietnam News, 2018). Government policy, including tax and capital incentives to expand plastics production has stimulated the plastics industry to have the highest industry annual growth rate in Vietnam (16-18% between 2010 and 2015), with plastic packaging accounting for about 37%.

More than 2,000 companies operate in the plastics industry, about 84% are concentrated in southern Vietnam and 14% in the north (VCBS, 2016). Businesses are mostly Small and Medium Enterprises (90%) with exports projected to exceed US \$2.5 billion, and total revenues \$15 billion in 2018 (VietnamNet, 2018). Vietnam has also been a receiver from other countries of waste plastics for industrial recycling and re-processing.

Solid waste generation in Vietnam is estimated to reach 69 million tons in 2020, not including sources related to regional river and coastal transfers, disasters or undocumented imports (Nguyen 2017), with plastics estimated at about 16% of solid waste (IUCN, 2018). The majority of handled waste is buried, burned or left in open landfills, however actions related to “Zero Waste”, “3R (*Reduce, Reuse, Recycle*)” and a “*Circular Economy*” are not yet adequately discussed, evaluated nor mainstreamed in policy or consumer practices. There have been however a number of supporting governmental

¹ The main export markets for Vietnam plastics (in value) are reported as Japan, USA, The Netherlands and South Korea; with rising exports to India, Hong Kong, Turkey, China, Ukraine, Russia and Bangladesh, and annual export growth of 12-14% (Vietnam News, 2018)

strategies², development of a Code of Conduct, action Plans, collaborations with civil society organizations and commitments by international agencies on their local practices in Vietnam³, and in financing projects. Plastic waste management practices however are a growing challenge in terms of capacity to handle increasing waste volumes, safe processing, disposal, environmental health and re-gaining value from waste. Marine plastics pollution often results from dysfunction in the systems that have developed over time for handling solid waste.

Waste Recycling, Reuse – Improving Well-Being of Vulnerable Vietnamese Communities

Many pathways exist in Vietnam for waste processing and recycling in each city and province, comprised of waste pickers, small household and commercial recyclers, larger recyclers and manufacturers to produce recycled products. The informal waste collection sector, including waste pickers and junk buyers, while being low technology, low paid and largely unregulated, plays an important role in waste management and waste recovery nationally, but provides only a small and sometimes dangerous income for these workers.

While only a quarter of the population of Vietnam lives in urban areas, it produces nearly half of the country's. Vietnam has the rare distinction of nearly 3000 craft villages which manufacture handicrafts, but also specialize in recycling discarded plastic and other waste materials. The villages buy plastic from local depots or waste pickers and process it into plastic pellets or film that can then be used to make new plastic products such as coat hangers and chairs. Recycling is a vibrant industry in Vietnam, supported by the large informal network of waste pickers, itinerant buyers and recycling cottage industry. More than two-thirds of waste workers are women, who earn less than men working in the waste sector, and 9 percent of waste pickers are children. These groups tend to be socially marginalized. They frequently live on or near garbage disposal sites, and thus are exposed to environmental and safety hazards. A few efforts have been carried out to provide micro-credit to female waste pickers, and to reduce the number of children working at waste dumps. However, there is much to be done to support the informal waste sector. A waste picker in Vietnam earns approximately 20,000 to 30,000 Vietnamese Dong (VND) (1-1.5 USD) per day, well below the minimum wage of 37,000 to 51,000 (1.7-2 USD) VND⁴. It is clear that the well-being and welfare of workers in the informal sector, especially women and children need urgent attention and solutions to minimize these health and social risks as an essential part of an economic empowerment program for vulnerable workers.

Exposure to plastic waste poisons, however is not limited to workers in waste processing jobs. Studies in northern Vietnam show unsafe concentrations of PBDE (PolyBrominated Diphenyl Ethers) in consumed fish samples from ponds and canals near e-waste plastic processing sites, also in the milk of mothers who worked in plastic waste processing, and in the fish diet and dust particles ingested by children.⁵

2 Decision No. 2149/2009/QĐ-TTg (17 December, 2009) by the Prime Minister approving the National Strategy on Integrated Waste Management up to 2025, Vision toward 2050; Decision No. 1393/2012/QĐ-TTg (25 September, 2012) by the Prime Minister approving the National Strategy on Green Growth; Decision No. 1216/2012/QĐ-TTg (05 September, 2012) by the Prime Minister approving the National Environment Protection Strategy up to 2020 and toward 2030

3 In May 2018, a Code of Conduct “Joint effort by international partners in combating plastic pollution in Vietnam” was signed in Hanoi by 18 national embassies, United Nations agencies, the Asian Development Bank, The World Bank and the European Union. By January 2019, the partnership had increased to 59 members including international conservation agencies as the IUCN and WWF <http://globalrec.org/law-report/vietnam/>

4 <http://globalrec.org/law-report/vietnam/>

Showcase of Plastic recycling for change in Ha Long city (Quang Ninh) supported by GreenHub.

Ha Long city has a population of 242,938 persons (2015) and generating solid waste 115,274 tons per year, with a collection rate of 90%. Of this, 21% by weight can be recycling including papers, plastic (Quang Ninh Master plan of Solid Management Strategy to 2030). In order to transition towards a more circular economy, there is the need to capture the value of materials and keep them in use for as long as possible. In the case of plastics, business, society and governments have been faced with multiple challenges ranging from the large variety of applications for plastics, inadequate collection mechanisms, to quality issues from use of secondary plastics, to name a few. With the project “Plastic Action Network” funded by the Coca-Cola Foundation, and implemented by GreenHub in Vietnam, we are targeting waste generators at household level and schools and offices in Ha Long city for plastic separation and sorting.

With a simple way of collecting and sorting waste at home, Ha Long city’s women have “turned” garbage into money. This model is constantly being replicated and is becoming a bright spot on environmental hygiene in Ha Long, and at the same time greatly contributes to the effective implementation of the campaign “Building a Family with Five Zero and Three Clean” associated with green Ha Long for tourism attraction. After establishing five women clubs, the project organized a training course, instructed the women on how to classify and dispose of waste, recycle it into household items, how to compost fertilizer for plants and associated skills. The women members easily grasped how to sort garbage at home, collect garbage around the house, and quickly learned that plastic and metal items are inorganic garbage to be put into separate bags. At monthly meetings, each person carries a sorted garbage bag to bring it to the club. The Board of Managers of the clubs and scrap buyers buy all the rubbish carried to the meetings, each time selling the plastic rubbish at about VND 6,000 per kg, the club, so collecting several hundred thousand VND per event. The Women Clubs manage and use the financial proceeds according to the agreement of the members of the group, often to support disadvantaged women to borrow money to develop business, divide them among members or spending to further advance club activities. For organic garbage such as leftover food, vegetables, tubers, fruits etc., women collect and bury them into garbage holes behind their houses or compost fertilizers for vegetable gardens and fruit trees.

After three months of implementation, women members in 5 wards of Ha Long city continue to keep collecting and recycling waste (plastic bottles, plastic waste and paper) to raise funds for their activities. The result so far is that they obtain an average of about 50-70kg plastic/month of all types of plastic, with the amount of plastic obtained estimated at 325kg of plastic (all 5 wards). Ms. Pham Thi Thu Hien, of Hong Hai ward, a member of one club said that “Formerly, my house made cakes and used banana leaves to wrap cakes, and at the time most of them were environmentally friendly products. But now



5 Hoang Q.A. et al. (2016) Polybrominated diphenyl ethers in plastic products, indoor dust, sediment and fish from informal e-waste recycling sites in Vietnam: a comprehensive assessment of contamination, accumulation pattern, emissions, and human exposure. Environ Geochem Health DOI 10.1007/s10653-016-9865-6; 19 August 2016, 21p

there are too many plastic bags. In the past, many women did not understand about garbage causing harm to the environment". Joining one women's club, from the first day of the club meeting, she learned how to sort out the sale of trash to increase her income, and compost fertilizer to achieve lush crops. This approach has brought about clear benefits, while helping women accumulate capital to develop business opportunities while contributing to raising people's awareness in environmental protection, towards creating a clean, beautiful and healthy landscape.

Seeing the effectiveness of this model, the women excitedly invited others so clubs constantly are expanding to many localities in city, spreading to local communities, contributing to a significant reduction of the harmful effects of garbage waste to the environment, especially in rural areas. To extend the project activity, the Women's Union has called for a "Green Sunday" campaign to mobilize all 20 wards of the city, with about 5,000 women members to participate to collect nearly 42 tons of garbage in period of 2 months in 2019. The waste classification models in the wards of Ha Trung, Hong Gai and Hung Thang have been effectively implemented, earning over VND 30 million.

We believe that the recycling sector in Ha Long city can be an example of how transitioning towards a circular economy will help business, government, and society achieve Vietnam's targets towards the United Nations Sustainable Development Goals. The transversal nature of circular economy will help achieve many priority goals – from responsible consumption and production, to healthier oceans and waterways.



Traders in Cao Thang ward in Ha Long city engage in the Communication conference on 19 January, 2019 on reducing plastic bag use and replacing them with the of environmentally friendly bags.



Scrap collection activities - Ha Long city 's women have "turned" garbage into money

The 2nd Korea Marine Debris Conference was held in Tongyeong

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The 2nd Korean Marine Debris Conference was held with the attention of many people



Participants of the 2nd Korea Marine Debris Conference

The 2nd Korea Marine Debris Conference was held at Tongyeong Campus of Gyeongsang National University Marine Science University on January 24th. The marine debris conference was held for the second time in two years since it was held at Korea Institute of Ocean Science & Technology in February 2017. Marine debris has attracted a lot of attention in the world because of its quantity and damage, and is a matter for government officials, civic groups, businesses and the general public to work together on. Recently, the interest and participation of academia have been increasing, and many researchers have been working on the problem of marine debris including microplastics. However, there was a lack of opportunity to share and announce these achievements and efforts. Korea Institute of Ocean Science & Technology and OSEAN had organized the first Korea Marine Debris Conference in 2017 to solve this problem. This year, the event was held for the second time.

Sharing research results such as microplastics, marine debris damage, and countermeasures

The conference was organized in three sessions. At the first session held in the morning, the presenters announced the results of research on the contamination and environmental impact of microplastics. In this session, the results of recent research on microplastics in Korea, including research on fine plastics in salt, which has recently been reported in the media, were shared. Six presenters completed the presentation in this session and a second session was held after lunch. In the second session, four presenters presented researches on biological damage generated by marine plastic debris. This session raised awareness on the biological damage of marine debris and gave impression that this kind of damage did not occur in a far distant. In the last session, five presenters presented the direction of the 3rd Korean Marine Debris Plan, the assessment of the amount of marine debris in the local government, the status of recreational fishing debris, The stock of marine debris in Jeonnam Province, and building electronic system for fishing gear. This session gave opportunity to hear the status of marine debris in coasts and islands of in coasts and islands.

Marine debris art works and educational materials were also displayed

One feature of this conference was the exhibition of works of art outside the venue. Kim Jung-ah, who works as an art director of OSEAN, Lee Jong-ho, who is a teacher of Sanyang Elementary School at Tongyoung, and Dream Ocean Network (Kim Tae-hee, the representative) exhibited various works related to marine debris to help understand the reality of marine debris. These works were made or drawn on the subject of marine debris, and they were used for education, publicity, or newly produced for this conference. The marine debris is an important issue to solve in real life, although the results of research are also important. Therefore, these works also play an important role in education, promotion and awareness on marine debris. These works of art made a brilliant contribution to this conference.

About 160 people were participated, listened earnestly and joined discussion with enthusiasm

There were 163 participants at this conference, and many of them listened earnestly to the final presentation. What is more meaningful is that research results have been shared not only with researchers but also with the audience, so that they had chances to hear various approaches to the problem of marine debris. The problem of marine debris is widely reported in the press, but the solution tends to be general and repetitive. However, through this conference, participants were able to hear the current status of marine debris in real life as well as recent results of scientific research. This opportunity has provided a more scientific and realistic idea for solving marine debris problem.

Event without disposable plastic products

Another reason why the conference attracted much attention was that it was a event without disposable plastic products. Not only snack containers, but also banners, sign boards and nameplates were made of paper or made to be recycled. The dishes for snack were provided by I'MGreener, which has a mission of sustainable takeout solution. They were made of corn starch and usable as compost after use. These efforts and practices showed that this society is a place to share not only knowledge but also practical ways. Thank you for I'MGreener's support.

Environmental issues such as marine debris needs practical methods as well as researches in order to solve the problem. Therefore, it is necessary to share the research results and solve the problems together. In this respect, holding this marine debris conference has a big meaning and a role.



The representative of OSEAN, Sunwook Hong, announced the opening of the 2nd KMDC



Professor Kim, Seung-Kyu presented the abundances of microplastics in table salt around the world



Dr. Jung Hoon Kang presented the characteristics of microplastics in continental shelf of Korean coast



Dr. Won Joon Shim responded questions in discussion session



Art works themed marine debris-1



Art works themed marine debris-2

Meeting held to address recreational fishing debris

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We took the first steps to look for comprehensive measures to reduce fishing debris.

The fishing debris is one of the garbages that OSEAN has noticed for a long time. The reason is because of the various characteristics of the fishing debris. These are 1) the actors who cause it are limited and obvious, 2) the damage caused by it is serious, and 3) the problem related to fishing debris is getting bigger. Unlike other marine debris, fishing debris is a kind of garbage produced by anglers who have fishing as a hobby. It is different from garbages that people throw away in their daily life. Fishing lines and fishing hooks, which occupy the large proportions of fishing debris, are not used by others and there is no possibility of generating such garbage by them. Because the garbage has been generated by specific people, it does not account for a large percentage of the total garbage. But the damage caused by it is serious. For example, spoonbills was found to be wounded with fishing hooks caught in their necks. Sometimes they accidentally swallow fishing hooks and have serious damage on their necks and stomachs. In addition, it is no wonder that the amount of fishing debris has increased with the fishing population increasing. The media reported that the fishing population in Korea exceeded the mountain climbing people by number.

It is obvious that the actors who generate fishing debris are anglers and others have little chance to make it. In that sense, it is similar to the wasted Styrofoam buoy.

OSEAN has been trying to solve the problem of styrofoam by gathering various stakeholders and holding meetings for a couple of years to find solutions and establish policies.

The efforts have been fruitful and the wasted Styrofoam buoy has been showing a declining trend in national monitoring projects. Based on the experience of this best practice, OSEAN has adopted a new task to reduce fishing debris.

As the first step to achieve this goal, OSEAN held a meeting on fishing debris on November 22. The meeting was sponsored by Patagonia, which supported a OSEAN's fishing debris research project this year. Patagonia uses 1% of its sales revenue to support environmental groups around the world and in the community with a mission to make products that do not cause unnecessary environmental damage.

Before the discussion began, we watched a documentary called 'Blue Sea' produced by Human Story. The documentary was about fishing debris and on the air on "Fishing Channel" three years ago. It was a fresh shock that the fishing channel tried to inform anglers of fishing debris problem. The discussion began with the announcement of Lee Jong-myeong, Chief Science Officer of OSEAN. He explained the overall situation and problems of the fishing debris. He added counter measures against fishing debris, like fishing license and permits. After that, a total of 7 presenters announced the result of fishing debris monitoring and current status of the fishing debris.

Park eun-joo who is director of the Busan Marine Environmental Education Center, Kim Tae-hee, representative of Busan Dream Ocean Network, Lee Bo-kyung, director of Alternative Social Affairs of the Association for Environmental Movement, reported the status of fishing debris at their communities. Lee Jae-sung, head of the Hallyeo Marine National Park's eastern office, presented the results and outcomes of the project of Hallyeo Marine National Park titled 'The collection of derelict lead weight used to support fishing rods'.

The 'derelict lead weight' is the lead that the anglers melt the lead weight and put it on rock and use it as a fishing rod support. Not only does it threaten the marine ecosystem, but is also dangerous for anglers who handle it because the lead itself is a harmful heavy metal. Ahn Seung-min of the Human Story presented the process of making the program 'the blue sea' and the actual situation of the fishing debris that he experienced while making the program. Kim Young-chun, captain of nature friend of Geoje announced the status of fishing debris in Geoje Island and preventing measures.

A panel discussion was held after the presentation. In this section, the effective ways of fishing debris monitoring and countermeasures against it were discussed. Expansion of no fishing zone, improvement of fishing methods, educating anglers for fishing debris were presented as measures. Through these various opinions, the discussion was an opportunity for participants to realize that addressing fishing debris is a task to start right now, although it takes a lot of time and effort to reduce fishing debris from small practice to advanced improvement like law revision. Proposed measures from this forum should be put into practice, and biological and ecological damage by fishing debris should be improved.



Fishing line is the most abundant debris among recreational fishing debris



Waste generated in daily life is easily found on the recreational fishing spot



The representative of OSEAN, Sunwook Hong, opened the meeting



The representative of Dreaan Ocean Network, Kim Tae-hee, introduced the result of recreational fishing debris monitoring in Busan

Women's roles in plastic waste management in Son Tra and Thanh Khe districts, Da Nang city, Vietnam

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I. Introduction

Marine plastic waste is a critical threat to ocean in Vietnam. A recent research has found that Vietnam is one of the six countries with mismanaged plastic waste (Jambeck et al., 2015). Land based plastic waste, when it is not segregated and treated properly, will be transported by rivers and other waterways, discharged directly to the ocean, and threaten to life under the ocean. In Vietnam, conventional method of solid waste treatment remains the same in many years, meaning that all garbage and wastes end up in landfill without sorting at source (World Bank, 2018). In addition, cost of waste management is also controversial issue to the country. The facts show that every Vietnamese households pay a fee around \$0.30/person per month for sanitation and environment. This fee barely cover the costs for solid waste treatment. Both central government and provincial government have to subsidize on cost for solid waste treatment. For example, Hanoi Capital city and Ho Chi Minh City, each city has to pay around USD 56 million per year from the governmental budget for collection, transportation, treatment of the solid waste. But the government not be able to subsidize to these pricy SWM costs forever.

Waste recycling is one of the solution to tackle those problems. Plastic segregation and recycling is necessary to reduce plastic pollution of the ocean. This article will focus on important roles of women in plastic collection and recycling through analyzing women participation in waste sorting at household level and collecting and recycling by street women pickers and scavengers in Da Nang city.

In the beginning, the article will highlight a successful Women-led model in Son Tra and Thanh Khe districts. These women are residential, urban people who are quite active on waste segregation at household level, working under Viet Nam Women Union. Their contributions to waste management were highly appreciated by communities and local gov-

ernment. Secondly, the article will analyze contributions and obstacles to street women waste pickers and scavengers. Female scavengers who migrate from rural area to Da Nang city. They are quite poor and uneducated. Due to lower social status, Women Street waste pickers face many challenges to their daily life. Even though the benefits of women's participation on plastic collection and recycling at household level were recognized, acknowledgement of contributions of Women street waste pickers is still limited.

II. Women-led model on plastic waste management

In the framework of CECR's project on "Ocean without Plastic: Community based Recycling Program for Healthy Community and Green City" an initiative "Women – led Model of Community based Plastic Collection and Recycling Program" has been carried out in Son Tra and Thanh Khe Districts, Da Nang City. These are two main districts with total of population of 360,000 people living in 1,910 residential areas and there are 395 women's units operating under Viet Nam Women Union.

Community based recycling activities include household based waste segregation to resource waste (those waste could be sold to collectors), organic waste (green stuff from kitchen), low value plastic waste (plastic bags). Women unit play pioneering role in sorting activities at residential areas trained and help families to segregate waste at home. They organize to gather resource waste and sell to waste collectors. Organic waste is composted at home and compost is used for house gardening. For plastic bag waste, the family gather them in a aluminum container and waste collectors come to collect them in regular base.

All the plastic bags waste are transported and sold to recycling centers. This plastic bags waste value chain (household – collectors – recycling plants) is an innovation as solution to reduce and recycling plastic bags, preventing them from direct discharging to rivers and ocean.

The women-led model has succeed on bring several benefits such as money generated from selling of resource waste go into community fund to assist poor households, transforming habits of women to reducing plastic and separating waste at source.

In this model, women participated in consultation and discussion for planning with local authorities and other stakeholders and they developed strong communication program within communities. Every three months, they reported on results to communities, discussed lessons learnt and continued to maintain success and improve practices. They help to engage street women collectors and women working in recycling into plastic waste value chain, strengthen partnerships among residents, provincial government, informal sectors and collecting data on women's contributions in waste management. The women-led models of community based plastic collection and recycling program is widely expanded in other locations in the city. As a result, the promoting participation of women in plastic management creates great opportunity for reduction, reuse, recycling of plastics into the global marine.

III. Street women waste pickers on plastic recycling

There are about 300 women scavengers working in landfills in Da Nang and probably the same number of women working as street waste pickers. These women represent informal women workers and they still face many social stereotypes, which lead to three obstacles: 1) Gender discrimination; 2) Unequal Pay and 3) Difficulty in access to health opportunity. Firstly, informal women workers encounter with gender discrimination because their job. Based on results of field study, street women pickers and scavengers account for 90%. Scavenger and waste pickers are considered as dirty and un-respect jobs in Vietnam. People usually look down to female scavengers because of their social status as poor, inferior, dependent as well as their appearances as grubby clothes, black skin, and muddy. Thus, those female scavengers tend

to be bullied by other people.

Secondly, women face to imbalance income compared to men. Even though both of men and women are informally involved in collecting, recycling, segregating plastic, there are large contrasts on plastic waste recycling behaviors between men and women. The distinctive recycling behaviors affect women and men differently. Men pick up and purchase high-value recyclables as such old fridge, washing machine and electrical products while women collect lower-earning activities such as waste picking, plastic bottles, cans of beer and cardboard. Women tend to be paid less than men even they work in similar jobs.

Thirdly, women face to difficulty in access to health opportunity. Women contribute significantly to waste collection and recycling, however social status is in general low and work in unsafe and unhygienic environmental conditions for their health. In Da Nang, women waste pickers are most immigrants from rural area. Some lives under poverty line and literacy. They unceremoniously engage informally in plastic recycling with free services and work in low-quality standards. They tend to be more marginalized and vulnerable in insanitation at dumpsite because lacking social welfare policy to their health as well as no social insurance policy for their job.

IV. Conclusion

In conclusion, women are agents of changes because transforming women is not only for herself but also she is able to influence to their family and community change. Moreover, women were recognized that play significant roles on plastic debris management at household level and in the plastic waste value chain. Women – led model of Community – Based Plastic Collection and Recycling Program” is a strong evidence of advantages of women. However, the roles of female waste pickers are not appreciated by most of the people or the authorities. Therefore, there is a strong need for more attention and recognition from multi-stakeholders on women’s contribution to waste management should be considered in city policy to “formalize” the informal women pickers and scavengers.

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How citizen-scientists helped us to document the type and quantity of coastal debris pollution in Taiwan

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The beginnings of citizen-science and coastal cleanups in Taiwan

Coastal pollution with man-made debris, and especially plastic pollution, became an obvious problem in Taiwan in the early 2000s.

To highlight this emerging problem, Taiwanese environmental non-governmental organizations (ENGOS) began education campaigns and coastal cleanup events in the 2000s. Specifically, the “Society of Wilderness” (SOW, www.sow.org.tw) began to organize coastal cleanup events in order to decrease coastal pollution, involve and educate Taiwan’s public and media (cleanocean.sow.org.tw), and document the types, numbers, and weights of debris items. It was also the time period when the Taiwanese people began to embrace environmental issues, and therefore environmental activities such as coastal cleanup events found a growing number of volunteers.

The SOW seized this opportunity, and using the International Coastal Cleanup sampling scheme as a guide, began to collect data on 19 different types of man-made coastal debris. Data were collected by training volunteers to collect and enter the data and thus become citizen-scientists [Figures 1-3]. In order to gain a nationwide and long-term understanding of Taiwan’s coastal pollution problem, we analyzed the resulting 12-year dataset on coastal debris pollution which includes 541 cleanup events conducted between October 2004 and December 2016 [1]. This is a unique dataset for Taiwan because it is the only long-term dataset and the only dataset which covers the entire nation’s coastline. To collect a dataset of such great spatial and temporal scale would have been impossible without the help of the citizen-scientists [see reviews of this topic in 2-4].

The results from the dataset's analysis

The 502 cleanup events were distributed all around Taiwan Island's coastline, and another 39 events took place on nearby islands [Figure 4]. The number of volunteers per event varied from 1 to 1660 people, and the length of the coastal strip cleaned correspondingly varied from 9 to 7100 m. The five most recorded debris categories were plastic shopping bags, plastic bottle caps, disposable tablewares, fishing equipment, and plastic drinking straws. About 60% of the debris items originated from single-use food and drink packages, and another 15% from fishing equipment, and about 90% was made of plastic or made of plastic mixed with other materials. Using two different calculation methods, Walther et al. [1] estimated that, on average, between 3.7 and 7.9 million items weighing 560–1110 metric tons polluted Taiwan's coastline during the 12-year period of the study. However, they also pointed out that such an average is of course a generalization from the real situation which is highly dynamic and ever-changing because wind, waves, water currents, and visitors constantly deposit debris items, while professional and private cleanups continuously remove items. Without such removal, the overall level of coastal pollution would be magnitudes higher than the calculated average.

Implications for source-reduction policies and response by Taiwan's government

From the beginning, one of the aims of collecting these data was to be able to put pressure on Taiwan's government to consider source reduction policies. For example, by reporting the overwhelming presence of single-use plastics in the collected debris, which received widespread media coverage and raised public attention, the SOW was able to put pressure on the government. Indeed, Taiwan's government recently implement a timeline of banning certain single-use plastic items. By 2020, plastic shopping bags, plastic drinking straws, beverage cups, and disposable tablewares will be partially banned, with the intention of introducing payment costs in 2025 and likely complete bans in 2030 [5-6].

The growing realization of the urgency and magnitude of the plastic pollution problem [7] has further triggered an effort by Taiwan's EPA in collaboration with eight ENGOs to launch a large-scale quantitative beach debris monitoring program in 2018 as well as to educate the public and reduce the use of plastic products that cause marine pollution [8].

Walther et al. [1] also made seven recommendations about how to improve the data collection by Taiwanese citizen-scientists in the future. Recommendations included:

- better professional supervision and validation of data and samples [4];
- collection of additional variables, such as geographic coordinates, any information of source (e.g., photos of product labels), an estimate of human accessibility of the site [9], and coastal type (e.g., sandy beach, rocky shore, harbor, etc.);
- a subgroup of interested volunteers could be trained to sample a smaller subsection very intensively, perhaps even collecting mesoplastics and microplastics, and collecting up to a depth of 10 cm;
- given that debris also blows into the dunes and other areas adjacent to the coast, some collection should also take place in these areas;
- more efforts should be made to communicate the results of the cleanup events in a timely fashion back to the volunteers, the public, and the media [10-11]. Cigliano et al. [3] discussed how to involve citizen-scientists in policy change, education, community outcomes, and site management outcomes;
- other studies had very good results when involving school children [10, 12-13] so we recommend to make a more concerted effort to take school children to the cleanup events;
- To develop a smartphone application to enter data and geo-referenced photos [4, 14].

We hope that this study [1] inspires more and better citizen-science involvement in the various pollution crises which the Pacific region faces.

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Fig. 1. Volunteers collecting coastal debris in Dajia District, Taichung special municipality, on 20 September 2014. Photo taken by SOW.



Fig. 2. Volunteers sorting and counting the collected coastal debris in the Houji River estuary, Kaohsiung special municipality, on 18 April 2009. Photo taken by SOW.



Fig. 3. Volunteers weighing the collected coastal debris at Linyuan District, Kaohsiung special municipality, on 10 September 2017. Photo taken by SOW.

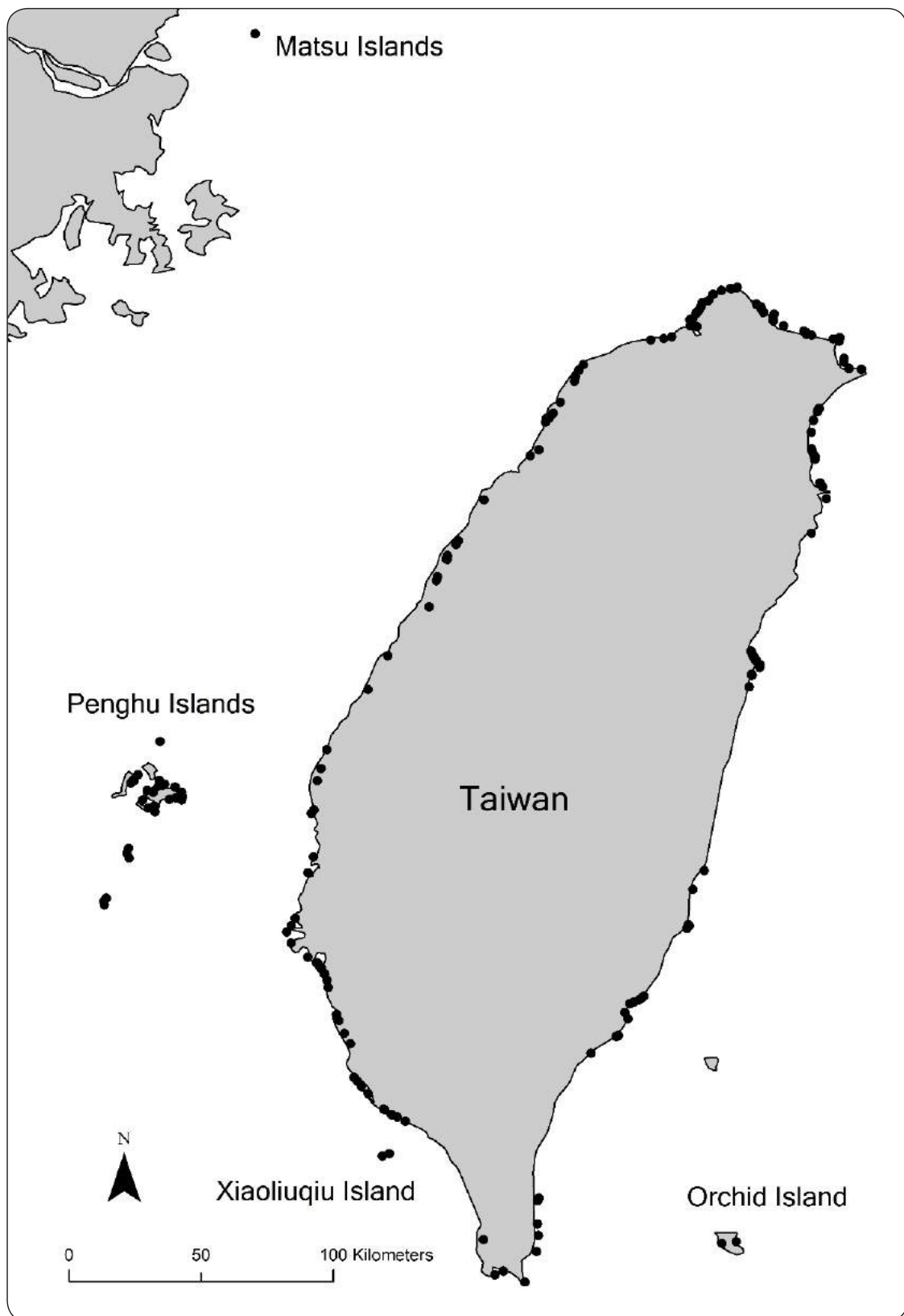


Fig. 4. Locations of 541 cleanup events conducted between October 2004 and December 2016 in Taiwan.



What is Asia Pacific Civil Forum on Marine Litter?

Asia Pacific Civil Forum on Marine Litter is a network established in 2009, made of NGO groups dedicated to protection of marine environment from marine litter in Asia Pacific countries.

Network member groups are:

Japan Environmental Action Network (JEAN)
 Our Sea of East Asia Network (OSEAN)
 Taiwan Ocean Cleanup Alliance (TOCA)
 Shanghai Rendu Ocean NPO Development Center
 Kewkradong Bangladesh
 ICC Philippines
 Tangaroa Blue Foundation
 Ocean Conservancy
 Greenhub

To the readers,

East Asian countries are connected to each other environmentally, geographically, historically, or culturally through shared regional seas. The East Asian region is one of the most dynamic economic centers with some of the busiest shipping lanes in the world. With the spread of mass production and consumption over the last decades came the huge increase in solid waste generation. There are, however, not enough waste treatment facilities and management measures, which makes the region vulnerable to marine debris pollution.

Entering the seas in large amounts, floating debris has become a source of concerns and conflicts among some neighboring countries. This transboundary environmental problem requires concerted efforts of all the relevant stakeholders beyond sectoral and political boundaries. In this regard, OSEAN (Our Sea of East Asia Network) and JEAN (Japan Environmental Action Network), the marine debris NGOs in Korea and Japan, have shared a vision in which people in the East Asia could act together as one community in protecting our precious marine ecosystems. We believe that NGOs in the East Asian countries have an important role in sharing experiences and acting together to address the marine debris issue in the region from the bottom up.

The city governments of Shimonoseki and Nagato, and JEAN co-organized '2009 Marine Litter Summit - Shimonoseki•Nagato Meeting' on October 16-18, 2009, in Shimonoseki, Japan. OSEAN suggested in the meeting to start an 'East Asian Civil Forum on Marine Litter' through which relevant NGOs and organizations in the East Asia could share experiences and information and work together on the marine debris problems. OSEAN and JEAN have reached a consensus to launch the forum and publish biannual newsletters. So we have launched the East Asian Civil Forum on Marine Litter and we are delivering marine debris news from member countries via e-mail to people who are concerned with this problem on local, national, and regional levels. In late 2012 now, we have four members above. We hope that the forum could provide a venue for all of us to share our vision, experiences, and creative actions.

This is the first effort to link the East Asian people beyond geographical and language barriers to a common goal of protecting our seas from marine debris pollution. NGOs and organizations that have interests and passion to make our seas clean and healthy are more than welcome to join us. For more information, you can contact us at loveseakorea@empas.com. Please let us know if you have any problem in receiving the newsletter. These articles are also available online at <http://cafe.naver.com/osean>.

Secretariat,
 Sunwook Hong (OSEAN) and Kojima Azusa (JEAN)

ISSN 2287-8971

Marine Litter News

Volume 10 • Issue 2 • December 2018

© Asia Pacific Civil Forum on Marine Litter (APML)
The newsletter is biannually published by APML.

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