Asia-Pacific
Economic Cooperation

Capacity Building for Marine Debris Prevention and Management in the APEC Region

Workshop Report

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APEC Oceans and Fisheries Working Group

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Ministry of Oceans and Fisheries

KOEM
Korea Marine Environment Management Corporation

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I. BACKGROUND AND OBJECTIVES

1. Capacity Building for Marine Debris Prevention and Management in the APEC Region, a training program for the APEC economies, was held in Yeosu, Korea on 12-18 June 2017 which had 28 participants from 14 APEC member economies, including Chile; China; Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Mexico; Papua New Guinea; Peru; the Philippines; Russia; Thailand; and Viet Nam. Expert speakers from 7 organizations - China; Republic of Korea; Chinese Taipei; The United States; UNEP; NOWPAP; and NOWPAP POMRAC were also invited to the program to give lectures on subject of their expertise.

2. Marine debris and its impacts to threaten marine life and reduce economic potential in the APEC region is becoming a serious issue. The amount of plastic marine debris discharged to waterways and finally to the Pacific Ocean is expected to grow. This has serious consequences to shipping, tourism, and fishing industries. Furthermore, there is growing concern for impacts of micro-plastics on seafood and human health. In order to reduce the impact of marine debris, this project in the APEC region proposes the following steps; 1) raise awareness and attention for marine debris among the APEC economies, especially those from developing economies, through information sharing, policy formation, social and economic impact analysis and technical training on marine debris 2) share information about the resources and techniques that are available to assist economies with the environmental impact 3) provide technical assistance to develop an operational manual for economies lacking effective marine debris response procedures, and 4) guide in helping APEC economies to prepare for marine debris emergencies.

3. The objectives of the workshop are:

   1) Raising awareness of the social, economic, and environmental damage and impact caused by marine debris which disrupts and impacts the trade, growth and livelihood of the APEC region;

   2) Strengthening government officials' capacity to enhance marine debris management related policies of the APEC region; and

   3) Aligning with international standards by effective management of marine debris

   In light of the above objectives, this program focused on:

1) Development of proceedings on the training standards and educational contents, including best practices; 2) Organization of education and training course and its evaluation; and 3) Establishing a network between participants and experts.

II. OPENING CEREMONY

12 June 2017 (Day 1)

Opening Address

Mr Yong-Seok Kang, Director General of Marine Environment Policy Bureau, Ministry of Oceans and Fisheries

4. Mr Yong-Seok Kang, Director General of Marine Environment Policy Bureau, Ministry of Oceans and Fisheries welcomed the participants from the APEC economies to the 'Capacity Building for Marine Debris Prevention and Management in the APEC Region' training program at the City of Yeosu, where the 2012 Yeosu World Expo was held and is known for its significance as a marine port in Korea. He stated that there is rising awareness of marine debris in the APEC region, referencing to United Nations announcement of increased concern for marine debris, plastic and micro-plastic. In particular, he highlighted the importance of collaborative preparedness and response capacities in preparation for marine debris.

5. The Korean government has invested a great deal of effort into solving marine debris problems. Marine debris poses a great threat to economies, marine ecosystem, marine trade and human safety. He hopes that through the workshop, participants can collaborate and share their own ideas to create an appropriate response and assessment of marine debris situation.

6. Through the training program, he hopes that participants can gain a better understanding of marine debris as well as insight into procedures and practices. Also he stated that long-term approach and attitude is required to resolve marine debris issues. Lastly, Mr Kang hoped that participants and experts enjoy their time in Yeosu.

Welcome Address

Mr Tae-Gon Kim, Director of Policy Coordination, Korea Marine Environment Management Corporation (KOEM)

7. Mr Tae-Gon Kim welcomed participants and experts and expressed his sincere appreciation to the APEC Secretariat for giving the opportunity to launch a meaningful workshop in Korea. As a global leader of marine environment management, KOEM has conducted various training programs to stimulate the collaboration among economies.

8. He explained that there is significance in sharing information from each economy and collaboratively trying to find solution through debate. Marine debris presents a serious threat to the international community. Marine debris not only threatens the safety of vessels at sea but also the survival of marine species. Numerous governments have taken note of the increasing gravity of marine debris issues and have launched efforts to ensure protection and possibly prevention.

9. He wished that the workshop will help participants to gain a better understanding of marine debris and the serious consequences of the problem, and further strengthen international cooperation between economies to develop a solution to this issue. Also, he hoped that participants can take back valuable information to strengthen each economies marine debris management.

III. LECTURES

Introduction of the Training Program

Ms Joon- Young Chang, International Affairs Team Head, Korea Marine Environment Management Corporation (KOEM)

10. Ms Joon-Young Chang of KOEM introduced the objectives as well as the schedule of the training program. The objectives of the program are to i) raising awareness of the social, economic, and environmental damages and impacts caused by marine debris in the APEC region ii) strengthening government officials' capacity to enhance

marine debris management related to policies of the APEC region iii) aligning with international standards through effective management of marine debris.

11. Ms Chang explained that the current workshop is aimed as Phase 1 of the project. She highlighted the importance of Phase I and sincerely hoped to continue to Phase 2 that will aim to enhance marine debris policy management in the APEC region as well as the development of a regional manual. She asked participants to share their valuable opinions and show support for the program.

Workshop Schedule and Safety Introduction

Ms Sunyoung Chae, Assistant Manager of International Affairs Team, Korea Marine Environment Management Corporation (KOEM)

12. Ms Chae briefed the participants on the training program agenda, daily activities and field trip venues. Furthermore, safety instructions were given.

Introduction of Participants and Expert Speakers

Dr Young Nam Kim, Senior Researcher of the International Affairs Team, Korea Marine Environment Management Corporation (KOEM)

13. Dr Young Nam Kim introduced the participants and experts/lecturers and asked each participants and experts to comment on what they wish to learn from the workshop. Next, he informed the participants on the facilities around the workshop venue.

Introduction of KOEM

Mr Tae-Gon Kim, KOEM

14. Mr Tae-Gon Kim introduced the history and works of KOEM. A PR video was played to offer participants insight into KOEM's mission and vision. KOEM was founded in 2008 under the Marine Environment Management Act of 2007. Previously known as the Korea Marine Pollution Response Corporation (KMPRC) in 1997, KOEM has evolved from an oil spill response corporation of oil tanker owners association into a public owned corporation for marine environment management. Now, KOEM's major expertise and businesses include:
    - Oil spill response
    - Marine towage

- Marine environment protection
- Education and international cooperation

15. For marine environment protection, KOEM carries out investigation and management of marine environment; collection and treatment of marine contamination materials; efficient collection and disposal of marine waste; and provision of marine environment information. Marine towage includes tugboat projects and floating crane fleet. KOEM's oil spill response includes: prevention of marine pollution accidents; response to marine pollution accidents. KOEM also conducts education and international cooperation through research strategy, policy establishment; education on marine environment and oil spill response as well as building international cooperation networks.
16. KOEM is based on creating synergy between their businesses. Through oil spill response, disposal of contaminated oil and marine debris, sea water quality monitoring, and marine ecosystem management, KOEM is able to create total management of the marine environment.
17. In conclusion, Mr Kim expressed that KOEM can be part of improving public's quality of life by ensuring a clean and safe marine environment.

Marine Debris Management Policy and System in Korea

Dr Young Nam Kim, KOEM

18. Dr Young Nam Kim started with figures that represented the status of marine debris in Korea. Annually, 176,000 tons of marine debris is generated in Korea. This is caused by both land-based and sea based where land-based accounts for 67% and 33% from sea-based. 83,000 tons are collected annually which costs approximately KRW 60 billion, excluding the projects led by local government.
19. There are different departments in Korea that oversee marine debris. First, Ministry of Environment is in charge of overseeing the management of rivers and estuaries. Their focus is to prevent debris from entering the sea through collecting and managing waste through cooperation with other agencies.
20. The Ministry of Oceans and Fisheries focuses on overseeing marine debris policies to prevent, collect and manage marine waste. The local government is in charge of implementing marine debris projects under their jurisdiction in areas that are in need of assistance. Other agencies include the Ministry of land, Infrastructure and Transport; Ministry of Agriculture, Food and Rural Affairs; and the Korea Forest Service.

21. By 2017, three policies are expected to be implemented. First, the establishment of the “Waste Management Act” that reinforces more responsibility, recycling and eco-friendly management. This aims to enhance the management and monitoring of debris to prevent further inflow into the ocean. Second, establishment of the “Fishing Gear Management Act” that aims to monitor before, during and after use of fishing gear. Lastly, from 2016 local government evaluation system has been adopted to improve the cooperation and communication between local and central government.

Overview of Marine Debris

Mr Thomas Barry, Management and Program Analyst/Cooperative Agreements Specialist, National Oceanic and Atmosphere Administration (NOAA); Mr Andrew Horan, International Environmental Protection Specialist, the U.S. Environmental Protection Agency (USEPA)

22. Mr Barry started the lecture by defining marine debris as “Any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes.”
23. The sources of marine debris can be divided into land-based and sea-based. Among marine debris, consumer products such as cigarette butts, food wrappers, beverage bottles, bottle caps and straws are top five items collected.
24. Mr Barry explained that one of the causes of marine debris is attributed to poor waste management system. 80% of the marine debris found on beaches during cleanup and surveys were from littering or improperly disposed waste. In the United States, from 1960 to 2013, the average amount of trash generated by each person doubled from 2.68 to 4.40 pounds per day. Other causes are due to natural disasters such as tsunami, floods and hurricanes.
25. Mr Barry emphasized that marine debris is a problem considering it impacts marine life, coastal ecosystem, maritime transport and human health. Plastic is a common type of debris which is especially harmful considering it does not fully biodegrade for hundreds of years or longer. The economic loss from removing the marine debris to reduction of tourism and recreation in that region can be especially damaging to some economies. Wildlife is also in danger from ingestion of waste or entanglement. Derelict nets, ropes, line and other fishing gear can lead to injury, illness, suffocation, starvation and even death.
26. Abandoned and derelict vessels can also cause several problems. On May 20th,

2013, NOAA presented the U.S. Coast Guard national report that found 36 sunken vessels scattered across the U.S. seafloor which could pose an oil pollution threat to the nation's coastal and marine resources.

27. Debris and trash that escapes to open sea from poor waste management can pose potential human health risks by being vectors of disease, such as the Zika virus in certain economies. Furthermore, micro-plastics ingested by fish can also be a vector for PCB transfer that can further risk human life.
28. Mr Barry suggested steps for preventive interventions:
    - Reduce plastic production
    - Innovative materials and product design
    - Reduce waste generation
    - Improve global waste management
    - Improve litter capture
    - Reduce input concentration (zero goal)

    Adding onto the steps for prevention and for successful marine debris management, all stakeholders from government, non-profit, academia, private sector and individual citizens all need to play a role in minimizing waste that can enter into the marine environment.

29. In the United States, NOAA and the Environmental Protection Agency (EPA) acts at the federal level to respond to marine debris. NOAA investigates and prevents the harmful impact of marine debris by acting as the lead agency on marine debris response and removal. It is based on five program pillars – removal; prevention; research; emergency response; and regional coordination. The EPA, on the other hand, is the regulatory agency that gives legal authority to empower States, cities, and local communities to effectively manage waste and limit waste entering waterways.

Global Efforts to Combat Marine Debris

Mr Thomas Barry, NOAA; Mr Andrew Horan, EPA; Mr Min Kang, Pacific and Indian Ocean Affairs Officer, the U.S. Department of State (DOS)

30. Mr Barry listed some of the international engagements that deal with marine debris.
    - Asia-Pacific Economic Cooperation OFWG and VWGMD: This group was formed in 2014 by the Chemical Dialogue in collaboration with OFWG. The

Virtual Working Group (VWG) on marine debris aims to “promote innovative solutions to the issue of marine debris with a particular focus on innovations in land-based solid waste management to prevent debris from ever entering the ocean.” VWG follows six objectives that reflect VWG’s terms of reference as: 1) promote plastic recycling 2) pilot innovative technologies 3) education and information sharing 4) develop public-private partnership 5) share and develop best practices 6) create partnership.

- G7/G20 efforts on marine debris: The issue of marine debris was added to the agenda in 2015 when Germany became the president of G7. The implementation of marine litter action plan focused on financing opportunities, monitoring protocols and share best practices by working with UNEP and IMO.
- UNEP Global Partnership on Marine Litter and steering committee: This is an open-ended partnership with different parties with the objective of protecting human health and the global environment by reducing and managing marine litter. Through this partnership, stakeholders can complement each other’s efforts and optimize resources to the fullest efficiency and efficacy.
- North Pacific Marine Science Organization (PICES): This organization was established to share research and data to promote and coordinate marine research in the North Pacific and adjacent seas.
- Global Ghost Gear Initiatives (GGGI): GGGI aims to improve the health of marine ecosystem, protect marine animals and safeguard human health and livelihood. NOAA provides technical assistance on variety of derelict gear issues.
- Multi-lateral engagements: Protocols such as MARPOL Annex V, London Protocol, and Cartagena Convention in Wider Caribbean are some of the engagements created with focus on marine debris.
- Bi-lateral engagement: Bilateral engagement often focuses on technical assistance and third party facilitation, such as Trash Free Waters.

APEC VWG on Marine Debris

Mr Min Kang, U.S. DOS

31. Mr Kang introduced the Virtual Working Group (VWG) on marine debris which was formed in 2014 that involved both the private and public sectors to focus on innovative solutions to land-based waste management.

32. Around 80% of marine debris is from land based resources. Through examination of

collected marine debris, often the primary cause is due to insufficient or ineffective waste management systems.

33. The initial work plan consists of 5 stages: 1) draft a baseline report 2) host an awareness raising session 3) promote pilot projects of innovative technologies 4) develop principles and definitions 5) contribute to discussions and urbanization. Mr Kang explained that VWG hopes to promote technologies to develop and adopt them in the future. Also, VWG seeks to partner with APEC Committee on Trade and Investment to create a consistent definition of key terms. The lack of uniformity in definitions can become a barrier to adoption and growth of innovative technologies in APEC economies. In the end, VWG aims to use the urbanization initiatives as an opportunity to accept innovative technologies to mitigate marine debris

34. Mr Kang emphasized that without leader level attention, and recognition of need, it is difficult to get domestic agencies to work together. Therefore, the high level meeting can be a group for government officials, finance community, civil society, plastic and consumer goods sector and experts to come together to identify barriers, create policy and practice and overcome obstacles to establish the political, economic, legal conditions to incentivize investment in waste management solutions by public investors.

13 June 2017 (Day 2)

Regulations and Management of Marine Debris in the U.S.

Mr Andrew Horan, USEPA

35. Mr Horan gave some insight into the regulations in the United States. He emphasized that different regions have different cultures leading to support in separate local municipal legislation. He explained that often money related actions are effective such as the bottle deposit bills. This was a success in increasing recycling rate by six to seven times in states that implemented this action to states that did not.

36. For the national legislation, marine debris research, prevention, and reduction act of 2006 was introduced. This allowed NOAA's marine debris program to be authorized by congress to work on marine debris. This act required the program to "identify,

determine sources of assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, marine environment, and navigation safety."

37. Mr Horan further mentioned other national and volunteer legislatives that the EPA and the United States takes part in
    - Superfund (CERCLA) focused on removing threats, such as abandoned vessels that harbor harmful substances or oil, that could harm human health
    - Micro-bead Free Water act of 2015 prohibited manufacture, delivery or introduction of plastic micro-beads in cosmetics by July 2018.
    - Clean Water Act (CWA) focused on preventing trash from the land-based source
    - Pollution Prevention Act (PPA) and Resource Conservation and Recovery Act (RCRA) supported the reduction, reuse, and recovery of EPA

38. In the United States, there have been bottle deposit bills that have passed on state level and plastic bag bans that mostly occur at local or municipal level. However, there are no EPR laws that have been passed yet. On the other hand, there have been two legislations for sea-based litter that USEPA enforce. First, the MARPOL Annex V aims at "regulating to prevent pollution by garbage at ships". To remove garbage from ships, it must be collected at adequate port facilities. These facilities are managed by the Coast Guard and USEPA to ensure these facilities comply with the guidelines. Next, the London Convention/ London Protocol deals with "deliberate disposal at sea of wastes or other matter from vessels, aircrafts, platforms, and other man-made structures at sea." This protocol is also enforced by the U.S. Coast Guard and USEPA to prevent any waste from reaching the open ocean.

U.S. NOAA's Activity

Mr Thomas Barry, NOAA

39. Mr Barry started by talking about the available grant programs for marine debris. The first grant program is related to the removal of marine debris. Recipients of these grants include NGOs, state and local governments, and academia. Second grant program is education. There have been partnerships with zoos, museums, and aquaria to educate visiting students. Educational curriculums are developed that includes the significance of marine debris and the harmful effects on ecosystem and

human health. Lastly, research grant focuses on micro-plastics, derelict fishing gear impacts and economic impacts of marine debris.

40. There have also been partnerships between the public and private sector. Mr Barry mentioned two partnerships – Fishing for Energy Partnership and the Bin Program. The Bin program provides no cost disposal service to commercial fishermen to dispose of unwanted gear.

41. Mr Barry showed a video of lobster traps becoming marine debris which harmfully impacting the marine ecosystem. These lobster traps are made of metal wire and can easily get lost in the sea. When it gets lost, it becomes a “ghost trap” that catches thousands of fish or lobster killing them by starvation. They can also damage corals and sponges when moved around during storms. These traps take up to two years to degrade their trapping capabilities. Through this video, Mr Barry expressed the seriousness of marine debris and the impacts on the marine ecosystem.

42. NOAA’s Marine Debris Program (MDP) includes emergency response planning and action planning. Based on the legislative mandates, NOAA is part of addressing “severe marine debris events” by identifying, determining source, assessing, preventing, reducing, and removing marine debris. The response planning also includes educating people. Mr Barry explained that problems are often tackled through several core program pillars: removal; research; prevention through education and outreach; emergency response.

43. Mr Barry emphasized that the MDP is not a response organization but functions to provide support and guidance during emergency response. For instance, NOAA will coordinate information to improve response through mapping debris targets, debris trajectory and modeling or supplementing funds to states for debris removal. Mr Barry used Hurricane Katrina and Rita as an example. During the hurricane, large amount of debris was deposited throughout the coastal Gulf of Mexico. NOAA’s project team participated by surveying more than 1,500 square nautical miles of near shore waters, mapping more than 7,100 individual items, conducting risk assessment and leading outreach programs.

44. NOAA has developed response framework and list of core services for internal use. Externally, NOAA continues to work with relevant agencies to create regional response plans.

45. Mr Barry moved on to explaining the action planning phase which aims to coordinate efforts to reduce marine debris. Plans developed by local stakeholders are important as it acts as a powerful tool to inform decision makers. To help participants gain a better understanding of what the guide looks like, Mr Barry provided an outline of what a guide entails. A guide generally has six sections

    - Introduction: includes purpose, scope of plan and plan maintenance
    - Background risk: foreseeable incidents and debris types: includes details about types of debris found from result of events and types of risks that are likely to occur
    - Agency roles, responsibilities, and jurisdictions: this gives a detail of each organization's role and authority when responding to events
    - Permitting and compliance requirements
    - Gaps and recommended actions: to gain understanding in the gaps and challenges to responding to marine debris or issues that pertain to specific states
    - Agency response capabilities: this gives insight into resources an agency could have and could potentially provide access during emergency
    - Agency contact information: this part is often updated regularly so that in emergency scenario, the guide can be a useful tool

46. Mr Barry moved onto introducing the Marine Debris Monitoring and Assessment (MDMS) project that partners with various organizations with goals to
    - Provide tools to partners
    - Promote standardization
    - Address research questions, detect marine debris arrival
    - Raise awareness
    - Guide prevention

    The monitoring process is conducted by partners on a site they have self-selected. On a monthly basis, partners will update the online database to include surveys emphasizing material type and number of debris found. Mr Barry stated that currently, 320 shoreline sites have been surveyed, 5,792 surveys uploaded and 345 database account holders are part of this program. Based on the database, 78% of marine debris found was plastic, 10% metal and 2% rubber. This program is showing promising results with high level of participation from citizen science and qualified partners.

The U.S. EPA's Activity

Mr Andrew Horan, USEPA

47. Mr Horan focused on EPA's Trash Free Waters Program that aimed to prevent and reduce marine debris. To understand the program, the background and significance of marine debris was explained. Mr Horan explained that 80% of marine debris originates from land-based sources. This is especially true for plastics as it accounts for 60 to 80 percentage of marine debris. Hence, solid waste management and long-term sustainable material management is important to preventing marine debris and mitigating risks to animals and ultimately to humans.

48. Trash Free Waters program focuses on land-based sources with participation from government at all levels, business community, and individual citizens to reach zero loadings of trash entering marine ecosystem within ten years.

49. The program focuses on four areas 1) research 2) international 3) regional 4) public/ private partnership. At each area, EPA focuses on helping others to gain better understanding of the effects from marine debris, internationally and domestically, by building strategies that can be implemented at regional level and connect the private and public sector to address source reduction.

50. Mr Horan discussed various Trash Free water programs that happened internationally and nationally. For instance, in Jamaica, the economy strongly relied on tourism hence focusing on cleaning the ocean and shoreline became a priority. In addition, the EPA participated in helping to improve the nation's recycling capacity.

51. Another case was in Puerto Rico where the main problem was associated with plastics, bags, micro-beads, plastic bottles, food service container and cigarette butts. Several projects were proposed to solve their debris problem which included changing food service boxes to combustible ones and placing cigarette butts bins at public spaces. This action was especially meaningful in showing that some actions are simple but effective in raising awareness and changing behaviors. There was also the storm water management that aimed at catching trash before it entered waterways. This was implemented in 12 different areas where waste often escapes into ocean. After three months, over 400 pounds of debris was collected where 62% was plastic. During this action, Mr Horan commented that 60% of the people did not understand the importance of recycling further suggesting the significance of social

education.

52. Other projects included reducing plastics on college campuses. This aimed at reducing plastic from source on California college campuses. Toolkits for college and universities were developed to provide guidelines in reduction planning, help determine plastic footprint and identify steps to reduce packaging on campus.

53. Mr Horan showed a video of how pollution negatively affecting water. In this video, as plastic has low cost and is easily disposable, there has been an increase in production and usage. Already 80% of solid waste reaches the sea through human activities and has affected 192 coasts with 35% of ecosystem in critically damaged states.

54. Mr Horan commented that unlike what many people believe, recycling and reusing is not the best option for plastic considering it eventually ends up in landfills. Hence, it is more important to reduce plastic production from the source.

NGO's Efforts to Tackle Marine Debris Problem in Korea

Dr Sunwook Hong & Dr Jongmyong Lee, Researcher, Our Sea of East Asia Network (OSEAN)

55. Dr Hong introduced the non-profit organization OSEAN that aims to educate and raise awareness, research, and cooperate at national level to achieve a clean and safe ocean. Through research, OSEAN aims to reduce the impacts of marine debris in Korea and help create policies that will combat marine debris in the Asia Pacific region.

56. Styrofoam buoys were found to be the major cause of micro-plastics (1 – 5mm) and meso-plastics (5 – 25mm) in Korea. According to the research conducted by Dr Shim from KIOST, the density of Styrofoam buoy with EPS, a harmful chemical, had the highest density among micro-plastic density reports. Understanding that Styrofoam buoys were priority, OSEAN conducted panel sessions, policy development and adoption of best practices.

57. Some of the causes of Styrofoam buoy debris were 1) unintended loss of buoys in use 2) intended discard of buoy after use 3) difficulties in collecting and recycling. Based on each cause, Dr Hong commented that strategies were formed and potential action plans will be implemented to government policies.

58. Impacts of marine debris on wildlife were also researched by OSEAN. Based on the research, 93.3% of ingestion and entanglement were by birds. To educate the public about the harmful impacts of marine debris on the wildlife, two action plans were conducted. First, a book that included pictures and facts about wildlife and marine debris was introduced to both children and parents. Also, OSEAN collaborated with a television program to capture angler's littering in Korea and praise citizens that practiced marine friendly fishing.

59. Dr Hong also introduced webinar and biannual publications that represented international cooperation among Asia-Pacific researchers. In wrap-up, Dr Hong hoped that the overall situation of marine debris will continue to decrease in Korea.

Marine Debris Monitoring Methodologies

Dr Sunwook Hong & Dr Jongmyong Lee, OSEAN

60. Dr Lee introduced that marine debris monitoring methodology is important as it is used to improve policies to protect and prevent marine debris. Average citizen can participate in using quantitative assessment on nationwide beach survey through submitting their collected data. With the assessment by researchers and quantitative assessment by citizens, it can be used to determine the pollution level and source identification.

61. Between March 2008 to December 2009, NGOs and volunteers monitored 20 beaches bimonthly to study the weight, number of items and volume of debris found on beaches. During this process, photos were also taken to ensure correct documentation of samples. In Korea, Styrofoam and plastic covered the largest percentage of approximately 70% in all categories. Moreover, fishing activities were the main source of debris.

62. There are two types of source identification method – International Coastal Cleanup (ICC) method and scoring method. The ICC is the world's largest volunteer action that encourages participation and at the same time raises awareness about marine debris problems. Using the datacard from the Ocean Conservancy, volunteers can submit the data on debris collected and this data will be uploaded onto Ocean Conservancy's database for everyone's access.

63. Another type of assessment is the beach debris rapid assessment often used with mobile applications Japan introduced the best practice in this area using the "Litter

Pollution Index." This assessment is based on visual scoring and recording the distribution of debris along the coastal line. Through this method, hot spots can be managed and allows cost-efficient cleanup to proceed. Unlike the ICC method, this method requires training workshops that educates and trains volunteers on applications and fieldworks. In response to a question made by one of the participants, Dr Lee stated that the two methods gave similar results.

64. Dr Lee commented that there are loopholes in the Korean legislatives to monitor commercial fishing. However, there are efforts being made to change and improve the current monitoring system.

65. Based on the lecture, Dr Lee explained that participants will have the opportunity to use the ICC method during the field exercise at Yeosu Beach.

Field exercise - Monitoring Yeosu Beach

Dr Sunwook Hong & Dr Jongmyong Lee, OSEAN

66. Yeosu Beach is approximately 30 minutes from the Yeosu Expo venue. This exercise aimed at introducing methods to record trash found on beach that aligns with the method by the Ocean Conservancy. Participants were divided into 5 groups to collect and record the type of debris. Team leaders were in charge of distinguishing and tallying total number of debris.

67. After 30 minutes of exercise, a total of approximately 2.3kg of marine debris was found on the beach. The most common debris found was cigarette butts and firework sticks. Dr Hong commented that the reason for the frequency in firework sticks in the beach can be attributed to the increase of selling fireworks near the beaches. As there is no light at night, people are less inclined to throw away trash into trash bins.

68. The collected data was sent off to the Ocean Conservancy. Dr Hong sent the results of the sample collected on the next day. In total 423 cigarette butts, 96 food wrappers, 64 plastic caps, 33 straws, 41 ropes and 165 firework sticks were found. Among these items, 214 tiny trashes with less than 2.5 centimeters in size were collected.



14 June 2017 (Day 3)

KOEM's Efforts to Combat Marine Litter

Ms Jin Sung Mock, Assistant Manager of Marine Debris Management Team, Korea Marine Environment Management Corporation (KOEM)

69. Ms Mock introduced herself as a member of the Marine Debris Management Team and the Marine Litter Management Center. She started the lecture by introducing the 2nd National Marine Litter Management Plan and KOEM's efforts to work based on this plan. This plan focused on creating a safe and productive sea without marine debris through four key strategies: 1) concentrated management of sources of marine debris 2) establishment of marine debris management infrastructure 3) strengthening public-orientated waste collection project 4) promotion of customized education. Ms Mock explained that through the four strategies, advanced marine litter management system was constructed.

70. Ms Mock emphasized that information is important as it enhances efficiency and effectiveness when applying policies and creating action plans. Over five years, the marine litter information system has been designed, established and maintained by the Marine Litter Management (MALI) Center. As a result, information became available to the public to increase public awareness about marine debris.

71. Further explanation was given about the foundation of the MALI center. Ms Mock explained the significance of the center as it provides systematized information management that supports policy making and task development related to marine debris. MALI center has four business areas
    - Research monitoring
    - Policy support
    - International cooperation
    - Information management

At the moment, information collection from local government is being focused.

72. The objective of the MALI center is to “establish organization for consistent and systematic promotion of marine litter management policies through information management and policy advising.” The center is managed by KOEM with close collaboration with the Ministry of Oceans and Fisheries, advisory panel, NGOs, and related institutes. Although the center is still at a beginning stage, Ms Mock commented that everyone is working hard to become a global leader to combat marine debris.

Public Advertisement Campaign for Reduction of Marine Debris

Ms Jin Sung Mock, KOEM

73. Ms Mock continued to give further information about the MALI center and its public advertisement campaign. The focus of the public campaign aligns with the one of the strategies in the National Marine Litter Management Plan “promotion of customized education” to raise awareness about marine debris.

74. In 2014, a campaign was aired on a public television channel during special air time. Ms Mock showed a video of the campaign that gave the following message; ‘The oceans are precious inheritance that must be protected for the future generation’. In 2015, a more creative message was transmitted to the public asking how much people believed the ocean is worth using an image of a barcode used in stores. The campaign further explained that value cannot be placed on the ocean.

75. Ms Mock explains that KOEM plans to create a campaign every year. There have been advertisement contests held for the public to increase participation and also raise awareness about marine debris. Through these activities, KOEM hopes to create a pleasant, safe, and productive sea without marine debris.

Marine Debris Project of Korea – Sri Lanka

Dr KyungShin Kim, Researcher, Korea Maritime Institute (KMI)

76. Dr Kim introduced the capacity building project in Sri Lanka to manage marine debris that occurred from 2015 to 2017. The capacity building consisted of four activities – research, policy making, education and creating facilities.

77. In Sri Lanka, 1.59 million tons of plastic enters the ocean on an annual basis

creating serious problems for the Sri Lankan government. Even though a National plan was drafted in 2014, financial limitations and the lack of scientific research on marine debris became obstacles for the Sri Lankan government. Therefore, the Sri Lankan government suggested cooperation with organizations from Korea (KMI, Ocean Research Institute, Marine Tech Engineering and Consultants), the Sri Lanka Marine Environmental Protection Agency and university students to solve their marine debris problem. Dr Kim commented that although the project was based on only one region, Negombo, he hoped that the Sri Lanka government will move towards creating a national plan for marine debris.

78. The research process consisted of surveying three locations – Negombo Harbor; Coral reefs; Mt Lavinia Beach. Based on the analysis of each location, strategy and tools were constructed. A bi-monthly survey was conducted at the mouth of Maha Oya River as plastics tended to travel to ocean through this river. In the beginning, diving survey was impossible due to severe pollution in the water that caused poor visibility. For Negombo, iron debris took up the largest portion with a total of 37 tons. Other debris consisted of batteries, fishing gear, cloth, plastic, tire, can, and bottle.

79. Based on the result and analysis of the data, education on students, fisherman and public officers were performed. Depending on the target, the type of information and method of education varied.

80. Dr Kim showed a video that was filmed underwater for coral reefs and sunken ship survey. The video showed evidence of sunken ship, ghost fishing, and marine debris ranging from plastics to metal. Fish nets were tangled around coral reefs which required cutting of nets to remove portions of marine debris.

Research of Micro-Plastics in Chinese Marine Environment

Dr Yanan Di, Professor, Zhejiang University

81. Dr Di announced that the production of plastic has increased rapidly over the last 60 years. China has shown similar increase in pattern of plastic production. Over 24.8% of plastic is produced in China and the production level of plastic production continues to increase in China.

82. Dr Di further explained the concept of micro-plastics by categorizing into secondary and primary micro-plastics. Primary micro-plastic is from direct use, commonly known as micro-beads in cosmetics. On the other hand, secondary micro-plastics

are fragments from larger plastic materials that have been broken up into smaller fragments due to the combination of mechanical forces and photochemical processes. Dr Di described the difficulty in micro-plastic study as unlike macro-plastic debris, micro-plastic requires trained staff and particular equipments to identify. Other factors such as size of micro-plastic and shape also needs to be considered when analyzing.

83. There have been various researches conducted on micro-plastic however there are difficulties in comparing the data due to the difference in the unit system. Dr Di explained that there is a need for a standard monitoring unit system to be able to compare data globally. Another difficulty faced with studying micro-plastic is that it is easily influenced by water system. For instance, in different seasons the patterns of currents can change the distribution of micro-plastics.

84. China has started studying micro-plastics from the early stages. Dr Yi commented that China has published numerous papers based on micro-plastics distribution, accumulation and negative impacts. Furthermore, China has also conducted research connecting human activity to micro-plastic concentration. Specifically, Dr Yi's research focuses on using mussels to evaluate the level of environmental stress experienced by micro-plastics. Also, there have been researches on determining the level of micro-plastics that create most damage and on methods to extract micro-plastic from tissue.

85. Dr Di explained that all kinds of organisms can ingest micro-plastic. These micro-plastics can interact with big molecules, such as protein, creating serious damages. At sub cellular or cellular level, the evidence of micro-plastic is not visible however, based on the damage created at individual or population level, it may be possible to infer the damages created by micro-plastic.

86. Finally, Dr Di commented that there has been rapid development in micro-plastic studies and hopes that further research will be conducted to determine the level of damages on human health.

Updates and Practices on Reducing Marine Debris Pollution by Chinese Taipei

Ms Hsin-Chen Sung, Senior Technical Specialist, Chinese Taipei Environmental Protection Administration

87. Ms Sung started by expressing her appreciation for being invited to this APEC event.

In Chinese Taipei, fishing nets have been the greatest marine pollutants that affect marine life and ecology. Ms Sung showed a video from Penghu County where turtles and whales have been harmed from plastics and fishing nets. To reduce marine debris, beach cleaning programs have been conducted since 1998.

88. To improve regulations and implement practices on marine protection, preliminary investigation has been conducted. Surveys were carried out in ports, estuaries, and coral reef area. The result showed that iron, aluminum cans, fishing nets and plastic bags were common debris found in seabed. Ms Sung commented that depending on the condition of water, the level of debris accumulated in the area differed.

89. Based on the investigation, action plan for source reduction and cleaning process have been implemented. For source reduction, consumers were made to purchase plastic bags and restrictions on any product with micro-plastics were restricted. Strict regulations on fishing vessels were implemented to prevent using and dumping of waste that could become marine debris. For the cleaning process, both professional cleaning teams and volunteers participated in cleaning up coral reefs littered with debris. Ms Sung showed a video of divers using scissors to cut fishing nets covering the surface of coral reefs.

90. Ms Sung concluded the presentation mentioning that although Chinese Taipei is not a UN member, there are efforts made to protect the marine environment. She hoped that there will be more opportunities such as this one to communicate and share experiences and expertise.

15 June 2017 (Day 4)

Introduction of KIOST: Micro-Plastic in the Marine Environments – Emerging Containment of Concern

Dr Won Joon Shim, Researcher, Korea Institute of Ocean Science and Technology (KIOST)

91. Dr Shim started the session by showing an introductory video of KIOST. KIOST started in the 1970s to study the sea. The organization created ISABU project that aims at oceanic exploration by looking towards the future of ocean; reviving the sea; searching for marine resources; protecting the ocean; and making ocean a safer place. A second video was played that showed the development of marine

ecosystem health and risk assessment. Through the successful lab created at KIOST, marine pathogens that have not been introduced before are being found. Dr Shin emphasized this is especially important in the field of marine debris and micro-plastic in the marine environment.

92. Dr Shim explained that we are presently living in the plastic era. The production and use of plastic has drastically increased over the decade. According to the Ocean Conservancy, 2.5 billion metric tons of solid waste is produced all around the world and 275 million metric tons is plastic waste. Among that, every year 8 million metric tons of plastic goes into the ocean. The main polluter, depending on the economic growth, is expected to be Asia.

93. The damage caused by marine plastic debris vary from biological and ecological effects; aesthetical effects and socioeconomic impact; effects on fisheries such as “ghost fishing” by derelict fishing gear; and navigational hazard.

94. Dr Shim has focused his research into micro-plastic and has defined micro-plastic as in size of 1um to 5mm. Dr Shim has emphasized that when defining micro-plastic, understanding that “synthetic polymer can be divided into organic and inorganic” is crucial. Over the years, plastic has increased in numbers, toxicity, detection difficulty, cleanup difficulty and targeting of organisms. On the other hand, the volume of the plastic has decreased, as has the velocity of settling and entanglement.

95. The weathering condition of plastic in the marine environment is especially high in beaches where solar UV, oxygen and high temperature is available. Research conducted on EPS buoy shows that when exposed to sunlight, there is high production of nanoplastics. Dr Shim provided results from research that fragmentation of plastic by UV exposure and mechanical abrasion can produce over 1000 fragments over 1 year exposure. 97% of the fragments are less than 50 micrometer which is practically unable to detect. These plastics are found to have been ingested by marine organisms from Korean coastal waters, such as oyster, mussel and lugworm.

96. Previously, when considering the cost and benefit of the Styrofoam buoy, the benefit outweighed the cost. However, from the findings of the research, the cost of using Styrofoam buoy is heavier and as such changes are expected to be made. These changes are 1) replacement of EPS to alternative buoys, government supporting 70% of price, 2) increase in recovery rate of used buoy from 10% to 50%, 3) regulating

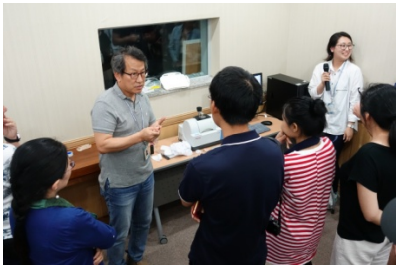
the use of harmful chemicals on buoy, and developing alternative buoy.

Demonstration of Micro-Plastic Analysis inside Laboratory

Dr Won Joon Shim, KIOST

97. The method in which Dr Shim has conducted micro-plastic research is through sieving and separating sediments based on density. The leftover sample is analyzed using FT-IR microscope that is able to detect different variation of each fragment. The machine uses infra-red to understand polymer. When infra-red is beamed at the polymer, the polymer will absorb the light and vibrate leaving a unique vibrating pattern. The spectrum is like a “finger print” that will allow understanding of each fragment’s origin.

98. Depending where the research is conducted, on beach or in water, the result can differ. Conducting on beach can lead to bias as collection is usually conducted in limited area with less variety. However, conducting in water allows sample to always be random due to continuous mixing by water.



Technical Tour 1 – Micro-Plastic Lab in KIOST, Geoje Island Tour

Dr Won Joon Shim, KIOST

99. The participants visited the HeungNam Beach, Geoje Island which is approximately 20 minutes from KIOST. HeungNam beach at first sight had large pile of plastic debris. Styrofoam was especially visible on the beach. For 1 hour, participants had the opportunity to participate in collecting samples to understand the methodology used by Dr Shim’s research.

100. The sample was collected from area of 0.5m by 0.5m; with depth of 5cm. Samples were sieved to leave only debris. Participants were divided into three groups with two researchers acting as instructors. Within each group, participants were paired up to have an opportunity in collecting sample from each line. On each line, four square

areas were sampled. On the collected sample, 1) date 2) station name 3) line was recorded. With the collected samples, further sorting is expected to be conducted in the lab to study only the plastic debris. FT-IR will be used at the last stage to determine the origin and the nature of the samples.



16 June 2017 (Day 5)

Global Programme of Action (GPA) for the Protection of Marine Environment from Land-Based Activities – Global Partnership on Marine Litter

Mr Aaron Vuola, Associate Programme Officer, United Nations Environmental Programme (UNEP)

101. Mr Vuola introduced the Global Programme of Action (GPA) that aims to prevent the degradation of the marine environment from land-based activities. In developing countries, untreated waste is discharged into the waterways causing coastal waters to become polluted with plastics and other debris. Mr Vuola emphasized that marine debris is a global problem that requires global efforts. GPA is the only intergovernmental mechanism that deals with freshwater, coastal and marine environments

102. GPA focuses on three partnerships – Global Partnerships on Nutrient Management (GPNM); Global Partnership on Marine Litter (GPML); Global Wastewater Initiative (GW^2I). Each partnership focuses on different areas of work to help economies reach their target related to Sustainable Development Goal.

103. There has been a launch of global campaign on marine litter called #Clean Seas that aims to improve plastic management, reduction in plastic production and helping plastic to re-enter product life cycle. More than 25 economies have joined the campaign with different level of commitments. Mr Vuola also introduced the Massive Open Online Course (MOOC) on marine litter and urged participation.

UNEP Regional Seas Programme and their Activities on Marine Debris

Mr Aaron Vuola, UNEP

104. Mr Vuola presented the Regional Seas Programme to the participants by first giving a background history. There are 18 regional seas conventions and actions plans comprised of more than 143 countries for the programme. Through intergovernmental meetings, the programme creates action plans and protocols under convention.

105. Limitations of the programme such as existence of few binding instruments and even the few binding ones rarely in effect or differ in the level of scope was explained. Mr Vuola commented that there are efforts being made to reduce the existing gaps in the action plans yet these also vary in approaches and methodologies. Furthermore, Mr Vuola stated that binding instrument might not be the best solution as non-binding or voluntary mechanisms may have faster effect in addressing marine litter issues.

NOWPAP Regional Action Plan on Marine Litter (RAP MALI)

Dr Ning Liu, Programme Officer, Northwest Pacific Action Plan (NOWPAP)

106. Dr Liu gave a brief history about NOWPAP and the structure of the organization. On 2008, NOWPAP Regional Action Plan on Marine Litter was agreed by member economies – China; Korea; Japan; Russia. There have been reports from technical experts and policy specialists published dealing with the state and emerging issues related to marine and coastal environment.

107. Dr Liu explained different departments within NOWPAP that deals with different areas. For instance, POMRAC deals with pollution monitoring; MERRAC of marine environment emergency preparedness and response; DINRAC of data and information; CEARAC of monitoring and assessment of coastal areas.

108. Finally, Dr Liu stated that marine litter issue should be looked from two aspects – 1) managing waste land-based and sea-based 2) changing attitude and behavior of people. Each member of NOWPAP has made unique efforts pertaining to each economy's situation.

Monitoring of Marine Litter in Russia

Mr Nikolay Kozlovskii, Staff Member, NOWPAP POMRAC Secretariat

109. Mr Kozlovskii explained that Russia conducts marine litter monitoring within the North West Pacific. Through the monitoring, it became evident that two types of current were responsible for transporting litter to beach in Far Eastern Russia. Like other economies, plastic was the major pollutant found in the beaches.

110. For various survey of sample, Mr Kozlovskii showed pictures taken for each step during the analysis stage. Furthermore, he showed different types of waste found in the samples. Mr Kozlovskii commented that data collection during winter and late autumn were limited due to sporadic sampling.

111. Mr Kozlovskii shared some of the findings from the preliminary survey
    - The size of plastic particles often ranged from 1mm to 5mm.
    - Primary micro-plastics were often found in inhabited localities whereas secondary micro-plastics were found along remote coasts. Some of the micro-plastics found were from fibers, films, EPS fragments, and micro-beads.

Marine Litter Management System in Russia

Mr Nikolay Kozlovskii, Staff Member, NOWPAP POMRAC Secretariat

112. In Russia, marine litter originates from sea-based and land-based. Therefore, national activities specific to ports, coasts and river banks, and land have been planned to minimize marine litter.

113. The port reception facilities have helped to collect debris to reduce dumping of litter at sea. The wastes collected at these facilities are either recycled or land-filled depending on the nature of the waste. Over the years, the amount of floating debris collected have decreased in all the major ports within the far eastern region in Russia. For coast and river bank debris, cleanup activities from volunteers and students have been promoted.

114. At St Petersburg central wastewater treatment plan, there have been efforts to examine the effectiveness of wastewater treatment plan to effectively remove micro-plastic before it is released to the ocean. Mr Kozlovskii commented that the report based on the results is expected to be published in late 2017.

115. Finally, Mr Kozlovskii expressed his sincere appreciation for being invited to the APEC Yeosu workshop and hopes to participate in other future workshops to share and collaborate with different economies.

Technical Tour 2: Clean-Up Vessels and Port Reception Facilities by KOEM Yeosu Branch

116. Participants visited the clean-up vessels in Yeosu. Previously, the clean-up vessels were operated by the Ministry of Oceans and Fisheries (MOF). In 1998, KOEM took over and has since operated the vessels with the support of MOF. The clean-up vessels focus on cleaning marine debris and creating a safe environment for ships. There are approximately 20 vessels at 12 branches operated by KOEM. These muti-purpose vessels can be used for oil spill response as well as to clean marine debris. Often, two vessels are joined together to collect garbage in the middle.

117. Next, participants visited the Yeosu Branch which operates a waste treatment center. Treatment centers in Korea are operated by both public and private business but often centers run by the government charge lower commission and are built where private businesses are not available. Participants were instructed about the procedures and the regulations the center operates. The training officer gave a tour on the various sections of the facility explaining the purpose of each machinery. Through the tour, participants gained an insight on the process waste collected go through treatment.



17 June 2017 (Day 6)

IV. Economy Presentations

One or two representatives from each economy gave a presentation about the 1) current status and problems of marine debris 2) legal and legislative framework 3) future directions

and plans 4) recommendations to APEC.

Chile

Ms Maria Macarena Maldifassi Gatica, Marine Debris Management, Education and Awareness Program, Directorate General of the Maritime Territory and Merchant Marine (DGTM)/ Marine Pollution and Climate Change Department; Mr Cristian Entrique Brito Martinez, Environmental Risk Coordinator, Ministry of Environment

118. Ms Maldifassi Gatica started the presentation by explaining relevant authorities that deal with marine debris. With the collaboration of the Ministry of Environment and Ministry of Foreign Affairs, policies, laws and sanctioning of international conventions occur in Chile. When the laws and policies have been created, it is the role of the Maritime Authority and Superintendent of Environment to create guidelines and help with the enforcement of the laws.

119. Chile has various legal frameworks that are either local or international. The legal frameworks seek to prevent environment damage, including marine pollution, and protect people from the harms of pollutions. Some of the legal frameworks that are applied in Chile are the London Convention and Protocol, Solid Waste Management Policy, and their constitution which states that people have the right to live in an environment free of contaminants.

120. The sources of marine debris in Chile are divided into land-based and ocean-based sources. Commonly found ocean-based sources are fishing vessels and cargo ships. On the other hand, land-based sources are from poor waste management practices, extreme natural events or waste left by people on beaches.

121. Mr Brito Martinez has stated that the Chilean government has made efforts to prevent waste on land and in ocean. Mr Brito Martinez introduced the idea that a waste is also a resource and therefore has economic value. Therefore, people need to make efforts to develop new practices and turn to new materials.

122. By mentioning Extended Producer Responsibility (EPR), Mr Brito Martinez explained that through putting more responsibility on the producer, the amount of waste produced can be reduced and recycling can increase. At the moment, only six products are being regulated in Chile. These include lubricant oils, electric and electronic devices, vehicle batteries, containers and packaging, tires, and batteries.

Producers of these categories are bound by law to recycle a certain percentage of their products. Yet limitation exists in that only six products are being regulated at the moment.

123. Another important institutional framework is the Pollutant Release and Transfer Registry (RETC), which catalogs potentially harmful substances that may be released or transferred to the environment. This database is important as it can provide systematized information for the prevention and control of pollution. For the mining industry in Chile, they must register updated information about the products and waste discharged into the environment or atmosphere.

124. Ms Maldifassi Gatica shared that in Chile, there are large number of volunteers that participate in beach cleanup activities. Over the years, the number of volunteers participating in the cleanup has increased. In 2016, with the partnership with the Ocean Conservancy, participants were able to clean up in total of 21,000 kilometers, 100 beaches, approximately 92 kilograms of trash cleaned with the help of over 10,000 volunteers.

125. Ms Maldifassi Gatica explained that although the Maritime Authority is developing an educational project with schools in 10 Regional Navy Authorities throughout the country that focuses on marine debris awareness and cleanups, the issue remains that often marine debris is related to the small scale activities that are associated with livelihood aquaculture. For example, often Chilean people do not have the economic ability to purchase plastic buoys to support mussel culture and end up using Extruded Polystyrene foam (EPS).

126. Mr Brito Martinez believes that eco-design can help with increasing recycling and reducing waste production. This has been tested out with McDonalds in Chile where less packaging is used with more percentage of the packaging able to be recycled.

127. Overall, the Chilean participants expressed that they hope more programs will be created that will allow sharing of information and experiences related to marine debris. Furthermore, development of monitoring program within the pacific basin can help to establish management and control system. Other recommendations included continuing to raise awareness for impacts of marine debris and promoting best practices to reduce pollution.

China

Ms Xinzhen Lin, Director of International Cooperation Office/ Deputy Director of the Planning and Management Department, National Marine Environmental Monitoring Center, SOA

128. Ms Lin gave the background of State Oceanic Administration (SOA) sharing that SOA was founded in 1964 and now consists of 11 departments and more than 20 affiliated research institutes with approximately 30,000 staff members. The responsibilities of SOA consist of 1) ocean policy, laws and regulation 2) marine integrated management 3) marine environment protection 4) marine public service 5) protection and management of sea islands 6) marine science and technology development 7) ocean economic development 8) ocean international cooperation.

129. Ms Lin expressed concern that marine debris is already a global problem that affects all marine habitats in different parts of the world. China is already part of various conventions that acts to regulate and prevent marine pollution. Moreover, China has implemented laws that regulate environmental protection and prevention of damage from solid wastes, pollutants, and other forms of debris that may end up in the ocean.

130. In SOA, there are three stages in the marine debris institutional arrangement. First, research is conducted in the university and institutes, and shared to National Marine Environment Monitoring Center (NMEMC). SOA will participate directly in monitoring and assessing the situation. In this process, SOA and NMEMC will collaborate with local monitoring agency. Lastly, the Ministry of Environment and Protection will focus on controlling the waste originated from land sources. Ms Lin explained that the research conducted is different from research conducted by Professors at universities as the focus of the research is to provide information for decision makers in supporting their decision-making.

131. The monitoring program takes place once a year in the wet season for beach debris, floating debris and seafloor debris. This can take place in coastal recreational waters, harbors and ports, mariculture zones or marine protected zones. According to the monitoring program, plastic debris was found to be highest. In 2016, monitoring of micro-plastic was launched which showed that 76% of sample consisted of plastic. Yenzhen River had the largest accumulation of micro-plastic.

132. To conduct behavior change, public school activities, community activities and beach cleanup are continuously being prepared to educate and raise public awareness.

133. Ms Lin commented that the problems in China concerning marine debris are that there are gaps in knowledge and protocol. Without concrete guidelines, and lack of evidence collected from a wide range of areas, there are limitations in the prevention of marine debris. Furthermore, the management system, regulations and laws are still ambiguous that the processes are usually inefficient or ineffective. Cross-water mechanisms also need to be dealt with to gain a better ground in solving marine debris issues.

134. China has announced to support marine-friendly “blue economy.” This commitment aims to strengthen the marine ecological environment, enhance international cooperation, improve prevention capacities and develop a sustainable ocean economy. To achieve these goals, the National Soil Pollution Prevention Action Plan was released by the State Council on May 31, 2016. This focused on treating household sewage by creating a cleaning system and regulating agriculture products.

135. Yet there have also been cases of unsuccessful implementation such as the restriction on production, sale and use of plastic shopping bags. Even so, Ms Lin expressed continuous efforts made by State council through pushing new material development that may substitute plastic bags and showing steps to implement EPR system.

136. Ms Lin shared some of the future plans of SOA
    - Develop guideline for monitoring and assessing marine debris including plastics and micro-plastics
    - Identify transport and distribution pathways to develop sound system for debris removal and disposal.
    - Develop national marine debris action plan that aims to solve cross-sectional problems and make collaborate efforts to combat marine debris at national level
    - Pursue partnership with other countries and international organizations to fight together, and share experiences and practices.
    - Promote development of national laws, policies, and regulations to prevent and reduce based on the global framework.

Hong Kong, China

Mr Wai Chung Christopher Chan, Environmental Protection Officer, Environmental Protection Department

137. Mr Chan introduced Inter-departmental Working Group on clean shoreline which was coordinated by the Environment Bureau since November 2012. In this working group, there are eight departments participating as members. The purpose of this working group is to
    - Identify the source of marine refuse
    - To review existing measures to keep the shoreline clean
    - To formulate and implement measures to prevent and reduce marine refuse
    - To facilitate cleanup operations organized by community groups to help promote the environmental benefits of keeping our shorelines clean
138. In 2014, marine refuse study was conducted to examine the characteristics of refuse found in Hong Kong, China. The study focused on data collection, identification of source, and proposing methods to improve shoreline cleanup. Five rounds of surveys at 18 beaches and 9 other locations were conducted. Refuse were sorted, counted, weighed, classified and inspected to identify the sources and for further analysis on the characteristics of each refuse. Data was recorded on datacard that was based on UNEP/IOC Guidelines and International Coastal Cleanup (ICC) standard card. The datacard was different in that it had wider range of classification type including both natural and human causes. Through the 2014 reuse study, 80% of refuse was found to be from land-based activities with 95% from local sources. In addition, 70% of refuse were either plastic of foam plastics.
139. In order to combat marine debris, three prolonged strategies were created. First, reduction of overall waste generation from the source level. Second, removal of reuse from the marine environment. Third, to reduce the amount of refuse from entering the marine environment. This strategy was conducted with the use of campaigns that aimed at raising awareness and educating people about the problems associated with littering. Mr Chen showed a video that emphasized “what you bring, you must take away.” This campaign was broadcasted on television and radios. Websites were constructed to allow people to inquire about waste management and cleanup progress.
140. Mr Chen explained that over the years, there has been increased effort to cleanup beaches and coastline. Also there have been monitoring of 27 priority sites grading each site from grade 1 (clean) to grade 5 (poor). While 60% sites experienced improvement in cleanliness, often it was short lasting. Lap Sap Wan, Shek O is a site where cleanup was conducted over the course of one year. Unfortunately, after two months, the debris returned to the site suggesting that marine debris is actually

floating around the site on water. Hence, more effective method of cleaning the site would be removing the marine debris by boat.

141. Mr Chen commented that he looks forward to sharing Hong Kong, China's experience in combating marine debris with other economies in the future.

Indonesia

Mr Hendi Koeshandoko, Section Head of Pollution Prevention, Directorate General of Marine Spatial Management, Ministry of Marine Affairs and Fisheries (MMAF)

142. Mr Koeshandoko addressed the idea that plastic production and usage is leading to severity in marine debris problem. Through showing a picture of Kuta Beach, Bali littered with marine debris, Mr Koeshandoko portrayed the serious impact marine debris has on Indonesia. Indonesia is one of the largest contributors of plastic pollution. According to the World Bank Review, 75% reduction in plastic pollution in China, Indonesia, the Philippines, and Viet Nam could mean 45% reduction in plastic flowing into ocean globally.

143. In Indonesia, 30% of waste leakage into ocean is plastics and 80% of plastic leakage is from land-based source. Also, 38 million tons per year of waste is generated with 17 million tons per year accounted as uncollected waste. Among the waste, 45% of waste is disposed into waterways, parks or burned signifying that waste management in Indonesia is weak.

144. Mr Koeshandoko referred to a joint study between Hassanudin University and UC Davis in 2015 suggesting that the impact of marine plastic debris is affecting marine ecosystem. According to the research findings, 76 fish of 11 species were sampled with 28% of fish feeding on plastic debris in size of 0.1 to 1.6mm.

145. Indonesia plans to increase regulation on marine debris and create a community to increase awareness but also cooperation among ministry, local government and organizations are needed as well. Furthermore, Mr Koeshandoko believes that innovation in marine plastic debris processing is important as it can bring economic value to the economy. Mr Koeshandoko introduced a new technology in India by Dr R. Vasudevan that may be useful in solving marine debris problem. In India, plastic tar road technology was implemented on 25,000 kilometer road. By mixing plastic waste with bituminous mixes transforms waste into useful tar road.

146. The national plan of action for marine plastic debris prevention include
    - Reduce marine plastic debris in Indonesian water by reducing land-based, seas-based and coastal pollution
    - Prevent marine plastic debris
    - Increase research and innovation on marine plastic debris prevention
    - Law enforcement on waste into seas

    With each national plan, five stage strategies have been developed to fully utilize at different levels.

147. Mr Koeshandoko encouraged APEC economies to reduce plastic production and supported the use of substitute biodegradable plastic and production. Moreover, Indonesia hopes that there is greater cooperation to reduce transboundary marine debris and marine debris from sea transportation. Lastly, Mr Koeshandoko hopes that APEC can take initiative to develop international financial commitments or funds to support economies with marine debris prevention and management.

148. Mr Koeshandoko emphasized that marine debris is an international issue that requires global cooperation. Indonesia has taken steps to construct national action plan and hopes that other countries will participate in educating younger generation and raising awareness among people. Furthermore, he concluded stating that Indonesia is open to joint cooperation to research and track marine debris in the Indian Ocean.

Malaysia

Mr Mohd Redhvan Arif, Marine Park Officer, Department of Marine Park Malaysia (DMPM)

149. Mr Arif conveyed that marine debris poses environmental problems but also aesthetic problems in Malaysia. Sea-based source of marine debris is often from fishing vessels, fishing gears and shore fishing activities other than ships and oil platforms in Malaysia. As for land-based sources, tourism is a major contributor.

150. Unfortunately, Mr Arif explained that there is no specific legal framework for marine debris in Malaysia. Rather there are other guidelines, such as the 1974 Environmental Quality Act, or the 1985 Fisheries Act, that may pertain to marine debris. Local governments are in charge of regulating fully privatized waste management at the municipal level. Mr Arif expressed that there is greater need for reducing and recycling waste, with the use of conversion technologies in waste-to-

energy facilities.

151. According to Mr Arif, Malaysians are aware of the marine debris problem. Therefore, tourists and local people are encouraged to participate in beach clean-ups and eco-friendly activities. There have been cases of even underwater clean-up activities and no plastic bags or polystyrene containers.

152. Mr Arif suggested that there is greater need to understand the nature of marine debris. Whether the problem is a transboundary problem or a problem that needs to be dealt in national level is a question that needs to be answered. For Malaysia, there is a greater need for monitoring, researching and creating of systematic public awareness programmes and actions.

Mexico

Ms Adriana Cardenas Gonzalez, Deputy Director of Fisheries and Aquaculture, Environment and Natural Resources Ministry, SEMARNAT

153. Ms Cardenas Gonzalez explained that on average one person produces 1kg of waste per day in Mexico. 28% of waste is improperly managed and often the economic cost associated with environmental degradation by waste management is approximately 0.3% of GDP. Over the years, solid waste, plastic and organic wastes have all increased. Urban cities usually produce the largest amount of waste with 52% accounting for organic waste, 11% as plastic and 14% from paper and cardboard.

154. To gain a better understanding of marine debris problem in Mexico, Ms Cardenas Gonzalez used projects to further explain the severity of waste management. Project Limpia Guerrero was focused on researching three target areas from high density population to medium to small villages. Through observing the beach debris, it became clear that plastic bottles, plastic bottles and glass bottles accounted for largest amount of debris found on beaches.

155. Another example was given from studying the floating marine debris in water of the Mexican Central Pacific. This project focused on examining the sources, distribution and density of the floating marine debris found in nine research surveys. The results found from this research showed that major source of marine debris is from ocean-based often linked with fishing or commercial harbor activities. This result concurred with the worldwide trend reported from the Ocean Conservancy.

156. In Mexico, five ministries deal with marine debris – Ministry of Economy, Ministry of Energy, Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food, Ministry of Marine, and Ministry of Environment and Natural Resources. These ministries are in charge of creating regulations and policies that deal with waste management and managing the final deposition of waste. Often, local policies and regulations will be enacted that will improve the collection and recycling of waste.

157. Future directions in Mexico focuses on utilizing new technologies that helps to support new action plans, expanding infrastructure to properly manage with urban solid waste, creating value chain that will increase waste recycling, reusing and recovering waste energy. There are also plans to increase training programs that will help to raise awareness among consumers, producers and citizens about environmental and social impacts of waste.

158. Ms Cardenas Gonzalez addressed recommendation to APEC suggesting the need for regional level action plan that focuses on

    1) Efficient use of resources
    2) Low waste generation in production and consumption stage with increase in recovery of products and materials. This is also associated with production and consumption of durable and reusable products at an affordable cost.
    3) Need for share responsibility among producers, importers, exporters, marketers, consumers, and waste management companies and authorities
    4) Need for incentives to motivate markets into reducing waste production
    5) Legislative actions that promote implementation of measures to combat and reduce generation of marine waste.

Papua New Guinea

Mr. Joshua Robert Tamanabae, Observer Trainer, National Fisheries Authority Observer Programme

159. Mr Tamanabae started by asking participants to reflect upon their actions during the workshop and how that has affected the waste management. He introduced the mission statement of National Fisheries Authority (NFA) in Papua New Guinea as “effectively managing our fisheries and marine resources for sustainable and equitable benefits.” NFA aims to observe and regulate the development of Fisheries sector by taking into account fisheries science, environmental impact, social factors

and economic development.

160. There are two programmes run by NFA – observer programme (off-shore monitoring) and Port Moresby (POM) seascape programme (on-shore monitoring). The observer programme has observers monitor fishing vessels and collecting relevant data to report and manage compliance to regulations. On the other hand, POM seascape programme partners with local communities, government agencies and other stakeholders to alleviate marine environment degradation and pollution. POM seascape programme has initiated various programmes that aim to improve the waste management component.

161. Mr Tamanabae proposed three waste mitigation options based on POM seascape programme. First, use of drainage barrier device to catch marine debris from entering the sea at the drainage outlets to sea. Second, sea bins deployed to catch floating debris where trawl gears are unable to access small sea-areas, such as bridges and wharves. Lastly, use of marine debris trawls gear, which is a light metal frame with net sack that catches any debris found in ocean.

162. Mr Tamanabae suggests that there are problems within Papua New Guinea that makes marine debris a unique problem. Largely, the fact that there is no proper waste management system along coastal areas despite laws being in place makes solving marine debris difficult. Furthermore, there are communication barriers between line enforcement agencies which prevent efficient collaboration among different parties. There are also the problems of population increase, urban drifting, and lack of awareness towards marine waste management.

163. Mr Tamanabae emphasizes that current issue and situation must be taken into consideration. Rather than focusing on broad scope, establishment of long-term plan that specifies course of actions would be a more appropriate approach.

Peru

Ms Sara Regina Purca Cuicapusa, Researcher, Instituto del Mar del Peru (IMARPE)

164. Ms Purca Cuicapusa showed a picture of Costa Azul beach, Peru where port activities, recreational and urban debris littered the beach. Over the years, amount of marine debris has increased in Peru creating concern among people. While NGOs and volunteers have participated in cleaning up the beach each year, it is not

enough to maintain a clean beach.

165. In Peru, between July 2014 and August 2016, macro and micro plastic were sampled in four beaches using the KIOST methodology sampling protocol. On each beach, more than 100m of the beach were sampled. Through the research, it was found that Peru has the second highest micro-plastic among APEC economies based on comparison with other economies. Although Ms Purca Cuicapusa stated that there is a difference with other economies as there was lack of fiber found and most of debris was hard plastic fragments.

166. Ms Purca Cuicapusa explained that the Environment Ministry is currently in charge of overseeing marine debris problem. In Peru, Ministry of Production is expected to oversee marine debris problem in the future as it acts as the Ministry of Oceans and Fisheries of other economies. Industry and Transport Ministry and NGOs are also important institutions for marine debris problem in Peru. Ms Purca Cuicapusa mentioned that research about status of micro-plastics; toxicity and effects will be researched leading to formation of strategy in Peruvian society.

167. Lastly, Ms Purca Cuicapusa shared her suggestion towards marine debris issue. First, technical training on marine debris can help in better preparing for the future. Second, there should be more monitoring and networking of marine debris among APEC economies. Lastly, increase in frequency of marine debris workshop among APEC economies to discuss the advances and results found can further help in preparing and preventing marine debris pollution.

The Philippines

Mr Marcelino Jr Rivera, Chief of Water Quality Management Section, Environmental Management Bureau

168. Mr Rivera introduced top ten marine debris items collected in the Philippines with number one as food wrappers then cigarette butts; straw; plastic bags; and bottle caps. Over the years, the number of food wrappers and containers continue to increase and account for largest portion in marine debris.

169. Mr Rivera explained that there are several issues pertaining to marine debris in the Philippines. First, there is no single agency that has specific mandate on marine debris prevention and control. As such, there is weak enforcement on anti-littering.

Second, there is no funding support for marine debris management. As there is high cost to investing in technologies related to marine debris and lack of support from households to pay solid waste management, there are limitations related to developing marine debris management. Last, there is no systematic data gathering or researching effort focused on marine debris. Mr Rivera explained that often funding is tied to waste collection and disposal rather than educating and communicating about anti-littering.

170. There are future plans that are aimed at alleviating marine debris problem in the Philippines. For instance, banning plastic bags or charging plastic bag usage fee is a step that are in process of implementing. Also, increase in education about waste management in school curriculum at all levels will help to change behaviors from younger generation. Other directions that may be taken by the Philippines include emphasizing recycling and closing dumpsites.

171. Mr Rivera expressed the importance of technological trainings, support and assistance as it can help to take a leap in improving the management system for waste. Also, collaborating with members of APEC can help to strengthen information and practice sharing. Lastly, like many other countries have suggested, education and communication campaign to raise awareness about marine debris is important.

Thailand

Mr Phaothep Cherdsukjai, Practitioner level, Fisheries Biologist

172. Since 2014, Thailand recognized the severity of debris, both in land and marine, and has added marine debris into Thailand's national agenda. In 2016, plastic waste estimated at 51,000 tons was transferred through Thai waterways. Currently, Thailand is ranked sixth in generating plastic waste to marine environment. Mr Cherdsukjai shared Thailand's goal at escaping from the top ten countries of marine plastic polluters within the next five years.

173. In Thailand, Ministry of National Resources and Environment is responsible for land-based debris while Department of Marine and Coastal Resources (DMCR) oversee marine debris. Over the years, DMCR has organized various activities to clean up beach, underwater, estuaries and islands. Data collected by DMCR are submitted to the Ocean Conservancy to share data.

174. Recently, DMCR has conducted research at five river mouths, one island, one coral reef, and three beaches to study the type, source and amount of marine debris. The data collected from the research was used to develop measures, policies, and campaigns to relieve the marine debris problem in Thailand. However, in different locations, the source or type of marine debris differed. For instance, the main source of debris on the beach was Styrofoam and hard plastic from shoreline and recreational activity. On the other hand, in coral reef zone, main debris came from plastic and filament from fishing activities. Yet, all site's top three marine debris were composed of plastic bags, bottle caps and straws.

175. Thailand's government realized that decomposing of these plastics become micro-plastic that will further deepen the severity of the problem. Even at the moment, Thailand cosmetic brands use micro-beads that are a kind of micro-plastics.

176. This year, DMCR followed the method of NOAA guideline to set a preliminary study on micro-plastic contamination in sediments. Mr Cherdsukjai explained that samples from dry season have already been collected and samples for monsoon season is expected to be collected soon.

177. Thailand has produced a pollution management strategy for the next 20 years (2017 – 2036). The first phase aims to solve urgent and critical issue through creating waste management model in pilot areas. Potential action plans are divided into three parts – land-based sources; sea-based sources; and accumulated marine debris. Mr Cherdsukjai added that there are plans next year to launch campaign to stop plastic cover on water caps as every year 26 million pieces are produced. Also, Mr Cherdsukjai introduced that there are plans to create marine debris database and publication to educate people.

178. Mr Cherdsukjai suggested that international workshops at regional levels, with development and implementation of policy at regional levels can help Thailand to further prepare for marine debris. Workshops can also help in establishing partnerships at regional levels. Furthermore, Mr Cherdsukjai believes that getting more stakeholders involved in marine debris problem can help to raise awareness among people.

Viet Nam

Mr Le Trung Kien, Deputy Director, Department of Conservation and Aquatic Resources Development, Viet Nam Directorate of Fisheries

179. In 2014, Viet Nam had 23 million tons of debris where 14 million tons of debris was accounted from provinces in coastline. Among the debris, 2.4 million tons were marine debris. Through Viet Nam's development of plastic waste collecting system and landfill waste management, the volume of solid waste dumped into the waters has decreased. There have also been cleanup activities on coastal areas with the participation from local residents and tourists to raise awareness of environment protection.

180. Mr Kien explained that Viet Nam is also part of international conventions that aims to protect environment and manage policies. Viet Nam has participated in the UN Conference on Sustainable Development and other intergovernmental forums on protecting marine environment and reducing marine debris.

181. The future plans of Viet Nam include improving the management capacity and improving the policy-making mechanism regarding marine debris control. Other plans include developing technologies to effectively prevent and manage marine debris, increase awareness among manufacturers, distributors, consumers about marine debris and increase research capacity pertaining to impacts on marine life and human health.

182. Mr Kien made a recommendation to APEC regarding sharing of information and knowledge that pertains to transboundary issues of marine debris pollution. Adding on, Mr Kien hoped that there will be greater assistance to developing economies, such as Viet Nam, to help in constructing domestic legal legislatives that conforms to Basel Convention and MARPOL Convention.

V. CLOSING OF THE TRAINING PROGRAM

18 June 2017 (Day 7)

Course Program Evaluation and Discussion

181. Ms Chae gave a summary of the recommendation ideas suggested by each participant on the previous day.

182. After the completion of all the sessions, participants were given an evaluation sheets for submission to the APEC Secretariat. The participants filled the evaluation sheets and submitted them to the PO. Subsequently, the overall summary of some of the suggestions made by each participant in the previous day was discussed.

183. In general, participants were satisfied with the training program, including the lectures and the technical tours. Participants expressed gratitude for generous hospitality and excellent logistic arrangement extended by the organizers. However, some participants have commented more field exercise could have been improved. Overall, participants expressed desire to participate in the next phase of the workshop.

184. Ms Chae and Ms Su Yeon Kim, Deputy Director of Ministry of Oceans and Fisheries, distributed certification of completion to each participants.

185. KOEM expressed gratitude to participants for providing constructive inputs and enthusiasm which will be reflected into the planning of the next phase.

Closure of the Program

186. KOEM, declared the closure of the training program at 12:00 PM, 18 June 2017.

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V.PHOTOS FROM PROGRAM


14:00-14:30
14:30-15:00
15:00-18:00


Asia-Pacific Economic Cooperation
Ministry of Oceans and Fisheries
KOEM Korea Marine Environment Management Corporation
Capacity Building for Marine Debris Prevention and Management in the APEC Regio
12th - 18th June 2017, Yeosu, Republic of Korea