U.S. Department of State Interagency Marine Debris Coordinating Committee Public Session Presentation

Disability Accessibility User Guide

Below is the script and notes from each slide in this presentation. This presentation was given on December 15, 2020 at a public session of the IMDCC:

1. Slide 1
    a. “Good morning, thank you IMDCC for this opportunity to give this presentation today on Satellite Monitoring of Floating Plastics Marine Debris. To just briefly introduce myself, my name is Grayson Shor and I serve in the State Department’s Office of Ocean and Polar Affairs on the Marine Debris Team. My office is tasked with leading and coordinating U.S. Government activities *overseas* to address sea-based sources of marine debris.”
    b. ”The goal of this presentation is to briefly introduce a 21st century way of filling a critical gap in understanding of a growing global problem as a means to enable data-driven, *smarter* policymaking. This problem, has to do with marine debris, particularly plastics.”
    c. Note: "remote sensing" is a more accurate term here than "satellite monitoring” for this type of analysis.
2. Slide 2
    a. “By the numbers, the plastic marine debris crisis is shocking. Recent estimates predict that, under a Business as Usual scenario, by 2040 plastic pollution entering the ocean will triple from about 11 million Mt in 2016 to 29 million Mt per year. For reference, 10 million Mt is equivalent in weight to over 100 aircraft carriers (1 Nimitz Class = 99k metric tons).” [Source: Report: https://www.pewtrusts.org/en/research-and-analysis/articles/2020/07/23/breaking-the-plastic-wave-top-findings]
    b. “The impact on our marine environment and the livelihoods of those who depend on the ocean is immense. In 2015 alone, it was calculated that marine debris cost APEC economies over $11 billion.”
    c. “The COVID pandemic has exacerbated this crisis in ways not yet fully comprehendible.
    d. …Hospitals in Wuhan, China produced more than 240 tons of single-use plastic-based medical waste (such as disposable face masks, gloves, and gowns) per day at the peak of the pandemic, 6 times more than the daily average before the pandemic occurred. If the increases observed in Wuhan hold true elsewhere, the United States could generate an entire year's worth of medical waste in 2 months.” [Source: https://science.sciencemag.org/content/369/6509/1314#:~:text=Hospitals%20in%20Wuhan%2C%20the%20center,the%20pandemic%20occurred%20(5)]
3. Slide 3
    a. “If you are attending this IMDCC meeting today you probably don’t need a backgrounder on the ubiquity of plastic and the ***plastic*** marine debris crisis

impacting the polar regions and everywhere in between. In a sense, the flow of plastics into our oceans is the largest continuous oil spill in history.

b. "The United States and the international community have ramped up our efforts to study and address this issue, especially in recent years. Often such multilateral bodies as those listed on my slide, and domestic organizations, focus on asking four major questions [read slide]."
c. "Despite progress in understanding the multiple dimensions of marine plastic pollution over the decades, most of our knowledge remains quite limited and based on theoretical estimates rather than observed data. In order to address plastic pollution and its impacts there is a need for better data on the main sources of plastic waste, its distribution and abundance on land and at sea, as well as data on the transport and fate of plastic once it enters the environment."
d. "Without the ability to measure this problem how can we manage it? Without scalable and regular ways to M&E our efforts, how can we be sure we are making effective investments?"
e. "Currently governments across the globe, including the U.S., are spending millions of dollars a year on this issue. For example, Just a few weeks ago the U.S. International Development Finance Corporation (DFC) announced a new $2.5 billion 'Ocean Plastics Initiative' aimed at curbing the flow of plastic into the marine environment. The value of understanding this issue and and ways to measure our efforts is increasingly apparent.
f. "You might be wondering what the role is of the State Department in such a technical project. Well, the role of State is to communicate the needs identified by our missions and the representation of the U.S. in various multilateral bodies to the domestic technical agencies. We coordinate action amongst the interagency to solve this issue in the international context. The benefit for the U.S. is to lead on an evolving and important crisis, to project the American brand, research, and innovations – State works hard to ensure this happens."
g. https://www.dfc.gov/media/press-releases/dfc-announces-new-25-billion-ocean-plastics-initiative

4. Slide 4
   a. "In summary…
   b. Problem = most information available about plastic pollution is based on theoretical estimates rather than observed data." (large uncertainties and frequent inconsistencies)
   c. Proposed Solution = develop a scalable and sharable system for accurately identifying floating plastic marine debris in the open ocean using satellite imagery and geospatial analytical tools. This would be accomplished by initially focusing geographically on the North Pacific Gyre and topically on macro-plastics.
   d. How = geospatial tools allow for uniform assessments over a large area at regular frequencies.
   e. Benefit = Generating such data not only advances the state of the scientific knowledge about plastic pollution, it also helps inform and measure effectiveness of policy interventions, regulations, and related responses."

f. Note: Understanding plastic pollution and its impacts from a systems perspective requires reliable and scalable ways of collecting data about the terrestrial sources, geographical distribution, abundance, and pathways of plastic waste in the environment.

5. Slide 5
   a. "For the remainder of my time I am going to give a quick overview of geospatial analysis in the context of our discussion. I'll then overview what we, my office and NOAA's National Environmental Satellite Data and Information Service (NESDIS), have done so far, and end with discussing what is next, or possible, for this field of analysis."
   b. "I want to thank NOAA/NESDIS, the Ocean Voyages Institute and Minderoo Foundation, and others for providing me with some of the graphics to use in this presentation."
6. Slide 6
   a. "The graphic here is a summary of data collected from various ships which have trawled these manta nets [1], and similar devices, behind their vessel to determine the density of suspended plastic waste in the ocean. The limitations of such research is that they cover a small area and they happen infrequently, thus only giving us a snapshot of what the situation is in a specific area at one point in time.
   b. "The world's oceans are equivalent in size to 36 U.S.s, such point source monitoring is like evaluating how much plastic is in Lake Tahoe a few times a year to infer how much plastic is in all the major water bodies of California."
   c. "[2] There is truly a diversity of monitoring options, we should opt to use them all."
   d. [3] "Satellite analysis solves some of these limitations I've mention. Satellite imagery *can* uniformly allow for an analysis of *floating* plastic marine debris across a large area on regular, sometimes daily, intervals. Incredibly, can also calculate historic levels of plastic pollution by analyzing imagery from the past.
   e. "Satellite monitoring is by no means a panacea but rather another tool in a monitoring toolkit. Three major limitations are: 1) satellites can only "see" *medium to large* floating plastics – such as fishing nets and accumulations of plastic bottles 2) satellites are expensive to build and, if we are using commercial imagery, it is also expensive to purchase images. 3) satellites with the high resolution necessary to be able to see largest aggregations of plastic marine debris often do not image large swaths of the ocean but rather predominantly focus their sensors on land masses – this currently limits the geographic area we can apply such geospatial analysis of ocean plastic marine debris."
   f. "This marine debris sub-field of ocean satellite monitoring is a very new one, therefore there isn't a dedicated sensor on a satellite fine tuned to such analysis as there is for other fields of research. That being said, we are in the process of learning what exactly is needed in the next generation of satellites to be able to greatly improve debris detection."

    g. Image
       Source: https://www.frontiersin.org/articles/10.3389/fmars.2019.00447/full , https://www.hakaimagazine.com/news/where-whales-and-plastic-meet/
    h. Monitoring the abundance of plastic debris in the marine environment (NCBI): https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2873010/
7. Slide 7
    a. "To just point out one other benefit of satellites, they allow us to view the world – and plastics – in ways our eyes cannot. For example, this is what can be seen using a near infrared sensor vs our eyes. Do you notice that certain types of plastics can be more easily grouped together?"
    b. Source: https://www.novuslight.com/spectral-imaging-ready-for-on-field-and-industrial-applications_N7527.html
8. Slide 8
    a. "The first such study to publish a successful effort to detect floating plastic marine debris was this summer, in a report by Dr. Biermann of the Plymouth Marine Laboratory."
    b. "The study's methodology allowed for aggregations of plastic particles to be distinguishable from naturally occurring floating materials, such as seaweed, driftwood and foam, with an average accuracy of 86% across 4 case study sites in *coastal waters*."
    c. Source: https://www.pml.ac.uk/News_and_media/News/First_successful_study_to_detect_marine_plastic_po
    d. Study: https://www.nature.com/articles/s41598-020-62298-z
    e. In April 2020, a paper from Plymouth Marine Laboratory and the University of the Aegean demonstrated that floating macro-plastics are detectable in optical data and distinguishable from natural sources of floating material based on their spectral signature (see Sentinel 2 bands used here). This verified that imagery analysis is technically possible. It is important to note this study focused primarily on coastal marine debris analysis, we intend to expand upon this study and utilize geospatial analysis to identify marine debris in the open ocean.
9. Slide 9
    a. "At the heart of Dr. Biermann's team's success was their ability to, 1) find plastics in a satellite image and, 2) identify the *spectral signature*, or 'fingerprint' of plastic *in a certain environment (coastal* waters)."
    b. "Just like a fingerprint, this signature is unique, everything absorbs and reflects light in different ways. The 'fingerprint' of plastic in certain coastal environments can be seen as the black line in this slide."
    c. "This is an important concept to understand, we'll be coming back to this later."
10. Slide 10
    a. "In short, my colleagues and I at the State Department and NOAA are trying to do what Dr. Biermann did in coastal waters but in the open ocean and on land."
11. Slide 11
    a. "The North Pacific Gyre, our focus area, is listed on this map in the red circle. We've chosen this as our initial study area as this is thought to have the

largest convergence of floating plastic marine debris on the planet, thus an ideal area to more easily find plastic pollution to test our methodology.“

   b. Source: https://www.bluebird-electric.net/oceanography/Plastic_Ocean_Pollution_Gyres_Garbage_Patches.htm

12. Slide 12
    a. “Since our work began earlier this we have thus far:
    b. Identified a pilot study region
    c. Increased our access to needed imagery and shared this with key partners
    d. We are in the process of developing a reliable methodology for floating plastic marine debris in the Gyre
    e. We are in the process of increasing the amount of in-field objects to improve and test our methodology
    f. We have yet to determine the best way to openly share these developed methodologies and data with the public in order to promote further data analysis and better informed marine debris policy.”
13. Slide 13
    a. “A major obstacle to validate and scale our work is a lack of in-field test objects with which to train our algorithm. In other words, we don’t constantly know where enough large plastic objects are in the Gyre.”
    b. “To overcome this we need to attach geo-locators, such as the two white buoys in this slide, to plastics items. We then can tack these plastics and find them in satellite imagery to analyze and identify their "fingerprint"."
    c. We have done this through the leadership of the CA-based NGO, Ocean Voyages Institute, which has been geo-tagging plastics for years and in 2019 conducted the largest open-ocean cleanup of plastics in history.”
    d. "OVI is in the process of recycling some of this plastic with partners, such as U.S.-based company ByFusion, into plastic cinder blocks"
    e. http://www.oceansplasticleanup.com/Cleaning_Up_Operations/Ocean_Voyages_Institute_Ghost_Fishing_Nets_Tons_Plastic.htm
    f. https://www.oceanvoyagesinstitute.org/
    g. https://www.byfusion.com/
14. Slide 14
    a. "Just to show you something fascinating. Here is what this fishing net looks like from space.”
15. Slide 15
    a. “Our goal is to geo-tag many more plastic objects. What you see here is a map showing the likelihood of debris accumulating in certain areas of the Gyre. This map was generated by our project partners at the University of Hawaii and is updated regularly. With this information, we know where to go when we want to geotag plastics."
    b. "We are always looking for volunteer vessels who want to geotag plastics for us. Reach out to me you'd like to participate.”
    c. Source: International Pacific Research Center, University of Hawaii at Manoa (http://iprc.soest.hawaii.edu/people/maximenko.php)

d. Further reading: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0242459

16. Slide 16
    a. ”The methodology we are developing and the data we are collecting can be applied in many ways. Here are just a few such examples…”
17. Slide 17
    a. [VIDEO SLIDE]
    b. “The application of Artificial Intelligence is yet another complementary tool to use to understand and measure plastic pollution. AI could be applied to satellite images to automatically identify and quantify plastic pollution or could be attached to in-fieldxq objects like boats, river overpasses, and trash aggregations devices to provide point source data on plastic waste flows and its composition. This could feed into a network of data points to give a live, large scale picture of what is truly happening in a certain area."
    c. "Imagine a world where we could actually measure the effectiveness of waste management policies in real time."
18. Slide 18
    a. [VIDEO SLIDE]
    b. “Such information can also be incorporated into data collected through, say, surveys of a local population's waste generation profile, to determine where such waste is going, its quantity, and the effectiveness of local plastic waste policies and regulations. Not to mention, the automation of identifying formal and informal waste sites.”
    c. Source: Systemiq
    d. TPA = waste/dump site
19. Slide 19
    a. “An example of applying geospatial analysis to tackle the plastic marine debris issue has been the efforts of the U.S.-based Global Ghost Gear Initiative (AKA "GGGI") and the Taiwan Fisheries Agency. GGGI has built a database, as you see here, where people can report the location of 'ALDFG'. This helps with determining where hot spots are, where action is needed or action is not working, and also gives us a large dataset of known net locations to train our plastic marine debris algorithm. We are in the process of working with GGGI to share data to support this effort.”
    b. “In Taiwan the Taiwan Fisheries Agency is working towards requiring fishermen to put a small geo-locator on their large fishing nets. The idea is that this will help keep fishermen accountable if they toss their nets at sea as well as help them collect lost nets.”
    c. Source: https://globalghostgearportal.net/dp/gearmap.php#
    d. Image Source: GGGI
20. Slide 20
    a. “My last example is a platform being developed by the Minderoo Foundation, called “Global Plastic Watch (GPW)”. GPW is a data-driven digital platform that

will enable near-real time global monitoring of the status and trends in plastic pollution on land and at sea."

   b. Source: https://www.nationalgeographic.org/media/drowning-plastic/

21. Slide 21
    a. “The initial study area of GPW is the island of Bali.”
22. Slide 22
    a. “GPW’s platform will detect and classify plastic waste and report it in a visually easy-to-understand way.”
23. Slide 23
    a. The platform will also help derive more accurate data on plastic waste's distribution and abundance on land, and..."
24. Slide 24
    a. "...pathways to the ocean."
25. Slide 25
    a. “...and do so at scale across Indonesia.”
26. Slide 26
    a. ”Thank you for your attention today, I hope you found this overview of our work interesting. I am happy to now answer any questions, or you can simply send me an email.”
    b. Grayson Shor: ShorG@state.gov