

CUREing Ocean Plastic in Pandemic Times

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Rachel E. Simmons
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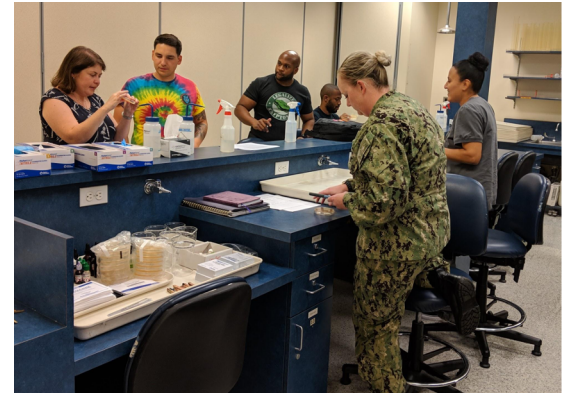
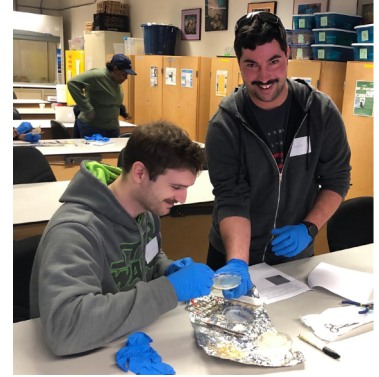


ASBMB 2021



National University- veteran-funded, non-profit, non-traditional

- 28% Hispanic, 10% African-American, 10% Asian
- Mean age 32, many veterans & active duty
- Accelerated courses (1-2 month)
- Goal: increase participation in STEM
- CURE!



Origins: Plastics @ SEA Expedition 2010

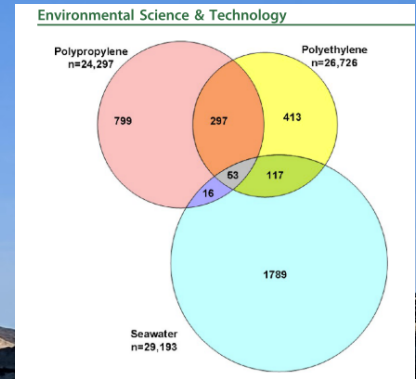
- Quantified microplastic particles and described microbial populations
- Focus on floating plastic (polyethylene and polypropylene)
- High proportion of the genus *Vibrio*
- Documentary “Into the gyre”

Zettler et al, 2013. *Environ. Sci. Technol.* 2013, 47, 13, 7137–7146



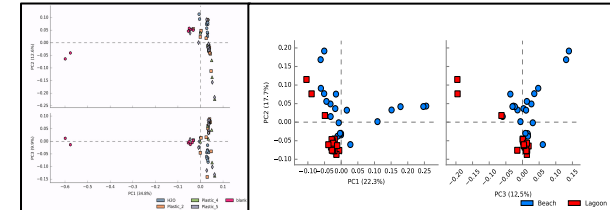
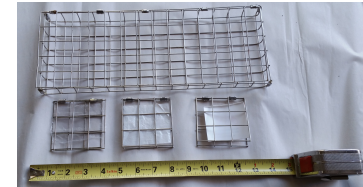
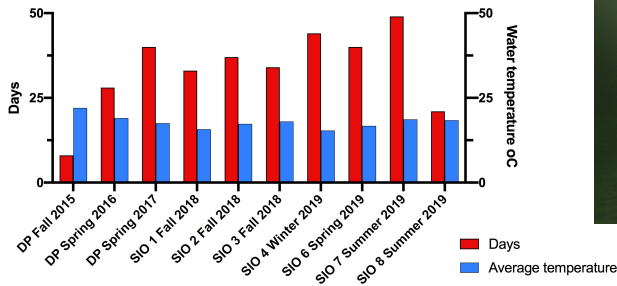
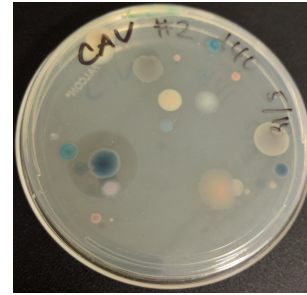
						
PETE	HDPE	PVC	LDPE	PP	PS	OTHER
polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics, including acrylic, polycarbonate, polyethylene fibers, nylon, fiberglass
soft drink bottles, mineral water, fruit juice containers and cooking oil	milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps	trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff	crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings	furniture, consumer, luggage, toys as well as bumpers, lining and external borders of the cars	toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups	an example of one type is a polycarbonate used for CD production and baby feeding bottles
						

Emelia DeForce, chief scientist Plastics @ SEA



Microbial colonization of floating plastic in coastal waters

- Idea: incorporate studies of early colonization of plastic in coastal waters into coursework (CURE: Course-based Undergraduate Research Experience)
- Metagenomic sequencing
- Culture on generic and ChromAgar Vibrio media
- Collaboration with SIO



The education part: CURE (NSF-HSI grant, 2018)

- *CUREing Microbes on Ocean Plastics* => a collaboration between two different types of institutions:
 - NU – mostly undergraduate, teaching, many minority and non-traditional students
 - SIO at UC San Diego – public, research-focused institution, less diverse
- Implemented in NU courses
 - Majors and non-majors general biology
 - Upper-division biology courses: molecular biology and bioinformatics
- Active participation of SIO graduate students & postdocs



Jeff Bowman,
prof at SIO



Elements of the original CURE

- Modular design from scientific method to bioinformatics analysis (course dependent). Complexity of laboratory work depends on the course
- Always includes a field trip to SIO: deployment/collection, tour of the pier, interactions with graduate students and faculty (NU & SIO)=> make science & scientists “real”
- Retrospective post survey & focus groups
- Longitudinal monitoring, institutional indicators (graduation, retention etc.)



March 2020...

- NU migrated all classes online (hoping for reopening after July)
- SIO pier visits very limited, large groups not allowed



Onsite vs online (non-majors)

Onsite

- Students watch & discuss the Into the gyre documentary
- Field trip (8 am- 12pm):
 - Pier visit
 - Lecture on plastic pollution
 - Lecture on experimental design
 - Processing of samples
 - Q&A with NU/SIO researchers & students
- Observation of samples

Purpose of Q&A: humanizing scientists, career advice, discussion about how to solve plastic pollution

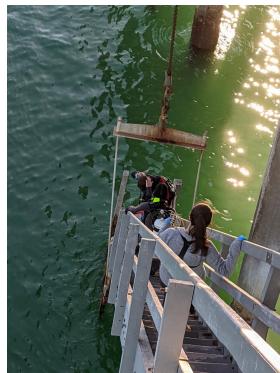
Online

- Students watch & discuss the Into the gyre documentary
- Students watch the plastic pollution & experimental design lectures + quiz
- Students watch videos of previous field trip plus any footage of an ongoing one
- Social media postings & padlet
- Live Q&A with NU/SIO researchers & students

Content embedded into LMS

Emelia DeForce 2019-2020 Lecture

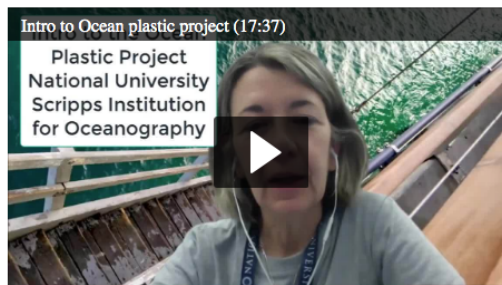
You watched the Into the Gyre Documentary last week, where you learned about the Plastics at Sea expedition and their results, and some ideas about how to combat it. You can watch the recording (which was recorded at Scripps Oceanography in 2019) [here](#).
 The quiz, focus on the following: types of plastic resins, which float and which do not, in what organisms have microplastics been



Dr. Ana Barral intro lecture on the National University ocean plastic project

In this recorded lecture, dr B provides a brief history of how the project started at NU and how is the project done. Please pay at!

Slides:  [SIO spiel.ocean.plastic.2020.pdf](#)  



Week Two Discussion

Enabled: Statistics Tracking

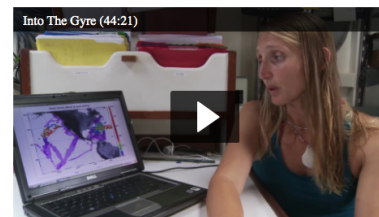
Plastic pollution in the ocean is a well-known fact, and most of us are familiar with pictures of

Please watch the documentary "Into the gyre." Fun fact: Dr. Emelia DeForce, one of the scientists.

- What is a common misconception about "garbage patches" in the ocean?
- What are your thoughts about plastic pollution in the ocean, and what can we do to p

Your posting is due Friday 2/12. Then comment on 2 other students' postings, responding di

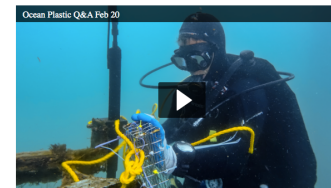
Please note that you have to post in order to see other students' postings.

Ocean plastic Q&A recording and info

Posted on: Saturday, February 20, 2021 1:23:11 PM PST

Hello all,

Please find the recording for today's panel on ocean plastic research [here](#).



Additional info

- to sign up for focus groups, go here: <https://www.signupgenius.com/go/10c0d4dae82ca4fccf8-nucure>
- There will be a survey related to the experience (videos, content, Q&A) arriving to your email starting tomorrow
- Both activities provide you with EC points. As they are anonymous, for the survey please email your instructor
- Here is the link to the padlet where we have added information and video links: <https://padlet.com/abargal>

Thank you again! Feel free to reach out with questions related to the project, undergraduate research etc.

dr B.abarral@nu.edu

Padlet: bulletin board, intro, information etc.

Ocean Plastic Q&A Feb 20, 2021

Made to share information and hear from you!

Welcome to the OP padlet!

This is a place to post information and questions ahead of the 2/20 Q&A, and also to share resources. Anybody can post- just click on the pink + sign on the lower right corner- you can type, upload pictures/documents/videos, share links etc. You can also comment and 'like' previous postings. We'll be monitoring this space before and during the Q&A. For questions, you can 1) add a posting with your question, or 2) comment on a previous posting with your question. We'll start a few possible topics.

How can science skills help my career?

Most of you are not science majors, however, many of the skills learned in science courses may be valuable for your career. Please comment with specific questions or ideas.

Research at NU & SIO

If you are curious/interested about the scientific research at NU & SIO, we'd be happy to answer your questions!

Plastic pollution solutions

Want to learn more about ways you can help preventing plastic pollution? Please comment with questions or ideas.

What you can do

A student shared this project by her daughter to collect plastic from the ocean- what a wonderful mission!

The Bowman Lab at SIO

Check out our collaborator Jeff Bowman's group website.

Intro dr B

Hi, I am a prof of biology at NU, also the program lead of the AS Human Biology program. Love nature, the beach, and of course science and research. You can find me on Twitter & IG @Bio_prof.

Deployment/collection Feb 18, 2021

(hot of the presses, apologies for video glitches)

Sat 2/20 Q&A program (10-11.30 am PT)

Panelists
From NU: Profs Ana Barral, Rachel Simmons, Ken Dery; students Allison Leask & Andrea Price
From SIO: Emelia DeForce (also Thermo-Fisher), drs Avishek Dutta, Jesse Miller, grad student Matt Heiron
External evaluators: Kurt Steuck and Leah Campbell
Program
• Introductions
• Ocean plastic project
• Science skills and careers
• Breakout rooms
• Info on surveys and focus groups for EC

Recycling codes for plastics

Which ones float and which ones sink

Which plastics float and which sink in seawater?

Intro Allison

Hi everyone! I am currently a student at NU working with Dr. Barral on the ocean plastics project.

Intro Avishek

I am a postdoctoral researcher at SIO. My research interest is in environmental microbiology and bioinformatics. I like travelling and exploring new places.

Intro Dr. S.

Hi there! I am a biology prof at NU I'm into genetics, programming, and tabletop RPGs. Find me on Twitter @sciencetible

Deployment/collection

This reel is from a November deployment/collection at the SIO pier

Intro to Emelia

Hi Everyone! Great to be a part of this very interactive course! I am a microbiologist currently working at Thermo Fisher Scientific, the company working on kits for covid testing. I've worked for 15 years on trying to better understand plastics in the ocean. So excited to meet you all!

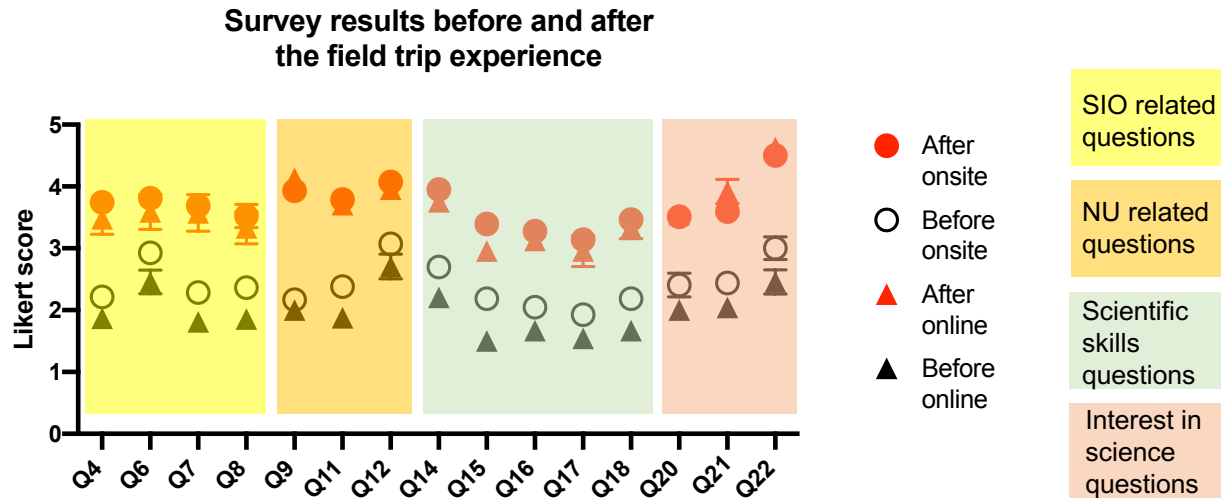
Pre-covid times!

One of our first SIO field trips

More about Jeff Bowman

If you found prof Bowman's life story interesting, here is some more information. You can also check out his lab website polarmicrobes.org

Survey results for non-majors online (n=24) versus onsite (n=43)



- Paired and unpaired t-tests w/ Bonferroni correction
- “After” (both onsite & online) significantly higher than “before”
- “Before online” significantly lower than “before onsite”
- No significant difference in “after” between online and onsite

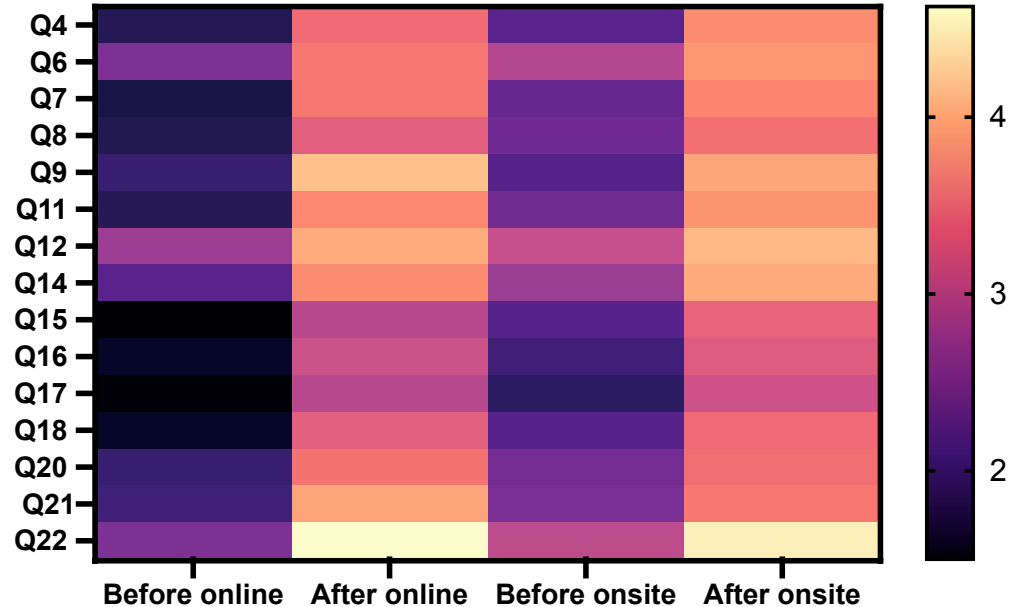
Survey questions

SIO	Q4	Rate your knowledge about the Scripps Institution of Oceanography (SIO)
	Q6	Rate your knowledge about the SIO research projects
	Q7	Rate your knowledge about the methods used by SIO researchers
	Q8	Rate your knowledge about STEM careers
Research at NU	Q9	Rate your knowledge of the plastic research project at National University
	Q11	Rate your competence in laboratory skills
	Q12	Rate your competence in problem solving
Scientific skills (based on CLOs)	Q14	Rate your competence in applying the scientific method, including drawing testable hypotheses from observations and data
	Q15	Rate your competence in techniques such as PCR and gel electrophoresis
	Q16	Rate your competence in compound and dissecting microscopy, including fixing and staining of specimens
	Q17	Rate your competence in classifying organisms according to basic principles of taxonomy, including the use of a taxonomic key
	Q18	Rate your competence in explaining the structure of prokaryotic cells, as well as differences between major groups of prokaryotes
Interest in science	Q20	Rate your ability to think like a scientist
	Q21	Rate your interest in performing scientific research
	Q22	Rate your appreciation of scientific research

Survey results cont.

Highest gains:

- Q4: knowledge of SIO research
- Q9: knowledge of plastic research
- Q11: laboratory skills
- Q22: appreciation of science



Conclusions

- Online delivery had the same impact as measured by survey questions addressing students' knowledge and appreciation of science
- The scaffolding of the online version gave students more time for meaningful and deep engagement
- The number of students reached was much higher online
- Sign-up for focus groups was much higher compared to the onsite classes
- Focus group interviews showed a deep impact from the audiovisual materials and the live interactions
- Most expressed that they would have liked to do the experience in person

Acknowledgments

National University

- Co-PI Dr. Rachel Simmons
- Students Allison Leask & Andrea Price
- Instructors of the courses

SIO

- SIO Co-PI Dr. Jeff Bowman
- Dr. Emelia DeForce
- Dr. Avishek Dutta, Dr. Jesse Wilson, Matt Heron,

External evaluator

- Dr. Kurt Steuck

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Questions?



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