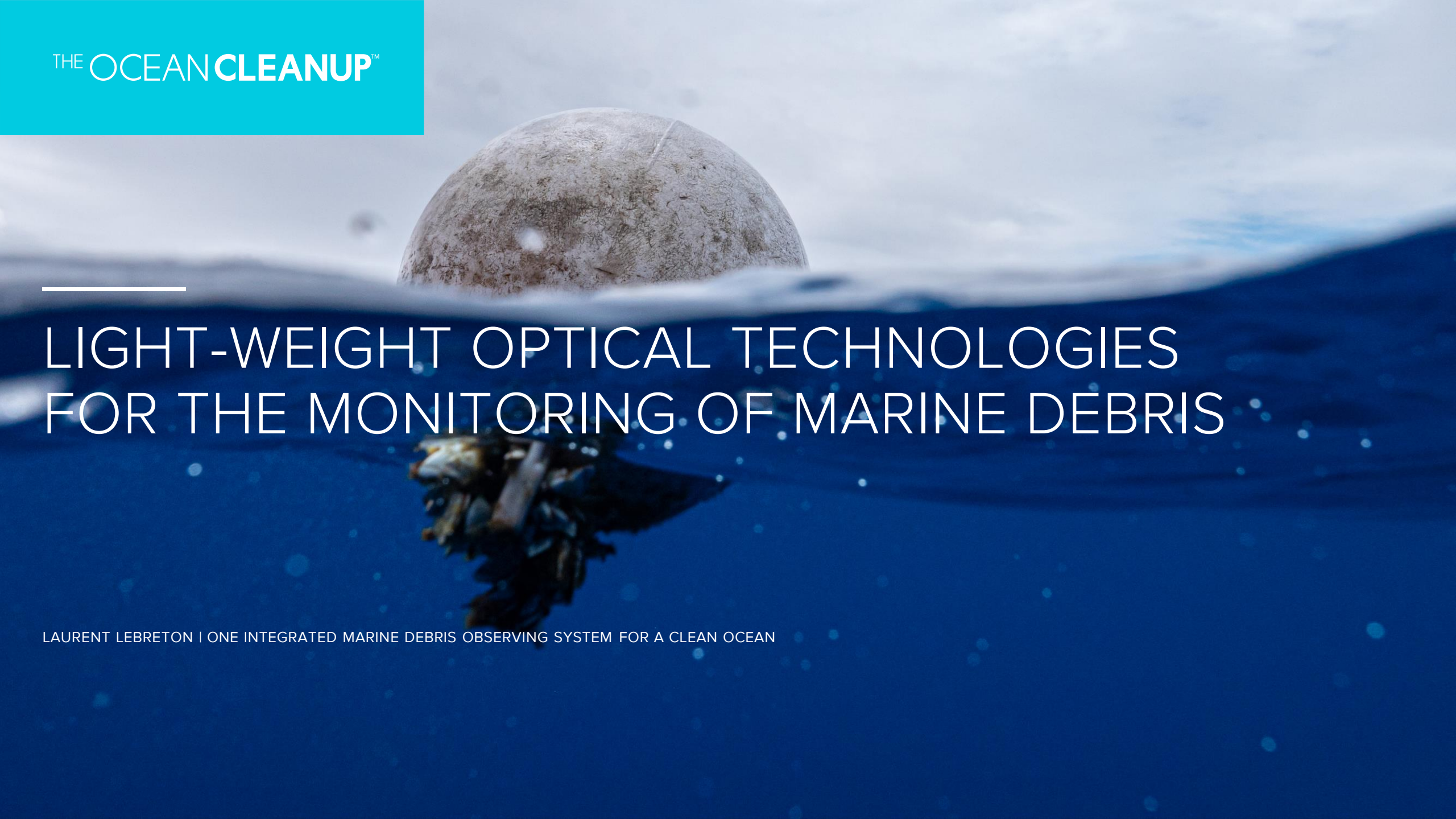
THE OCEAN CLEANUP™

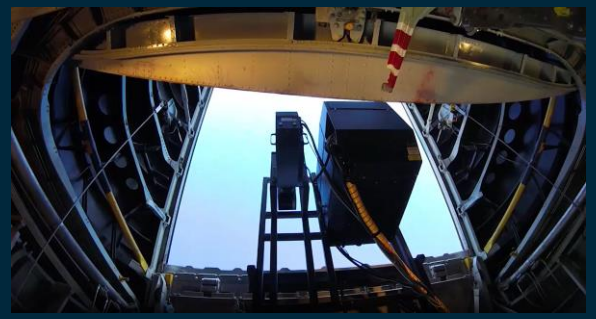


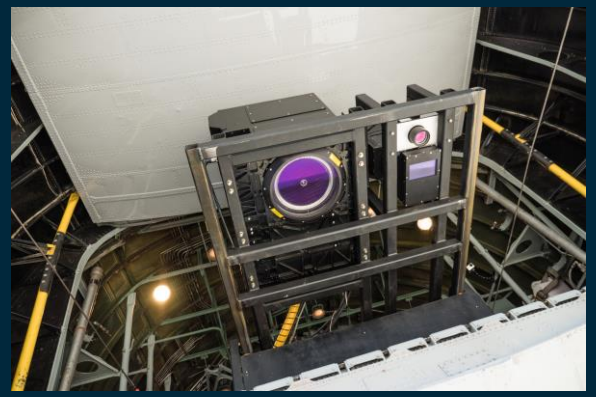
LIGHT-WEIGHT OPTICAL TECHNOLOGIES FOR THE MONITORING OF MARINE DEBRIS

LAURENT LEBRETON | ONE INTEGRATED MARINE DEBRIS OBSERVING SYSTEM FOR A CLEAN OCEAN

2016 AERIAL EXPEDITION

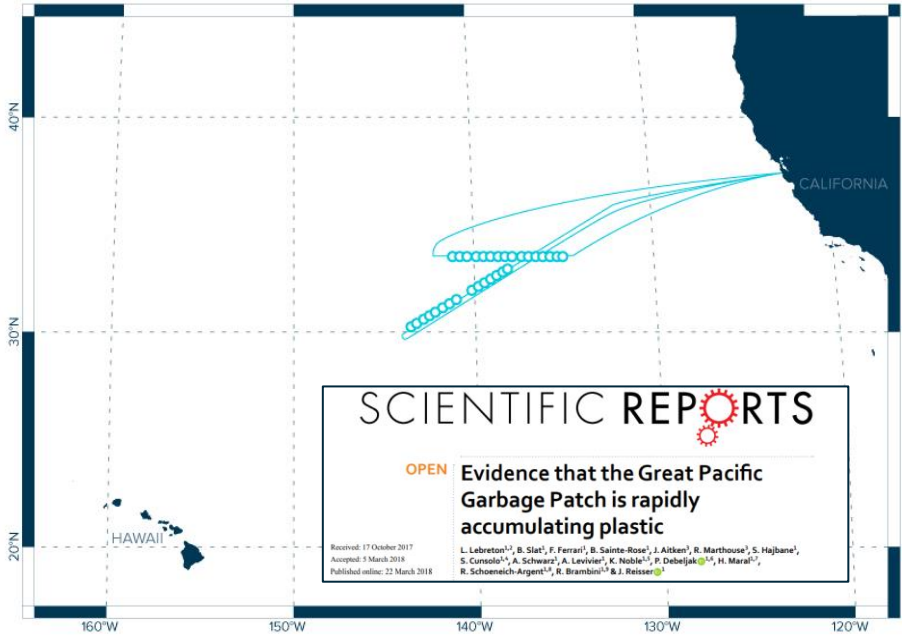
Observations of marine debris in the North Pacific subtropical gyre using RGB and SWIR cameras as well as LIDAR.



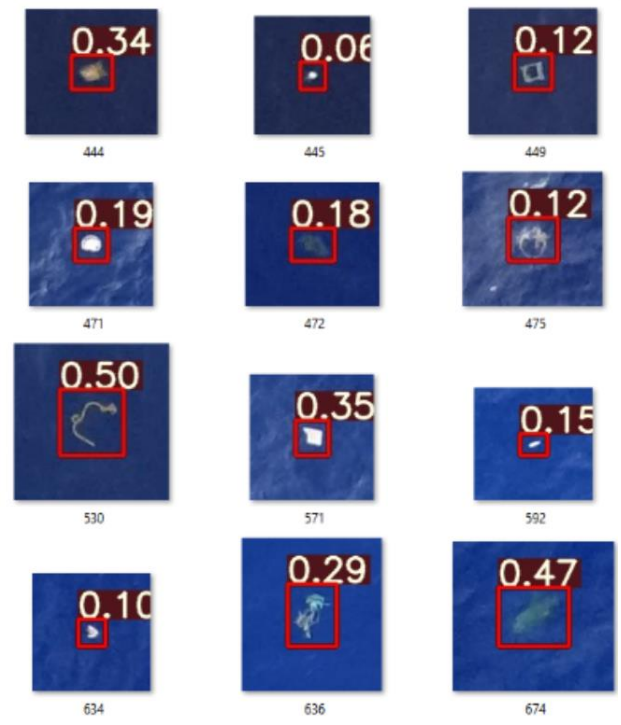


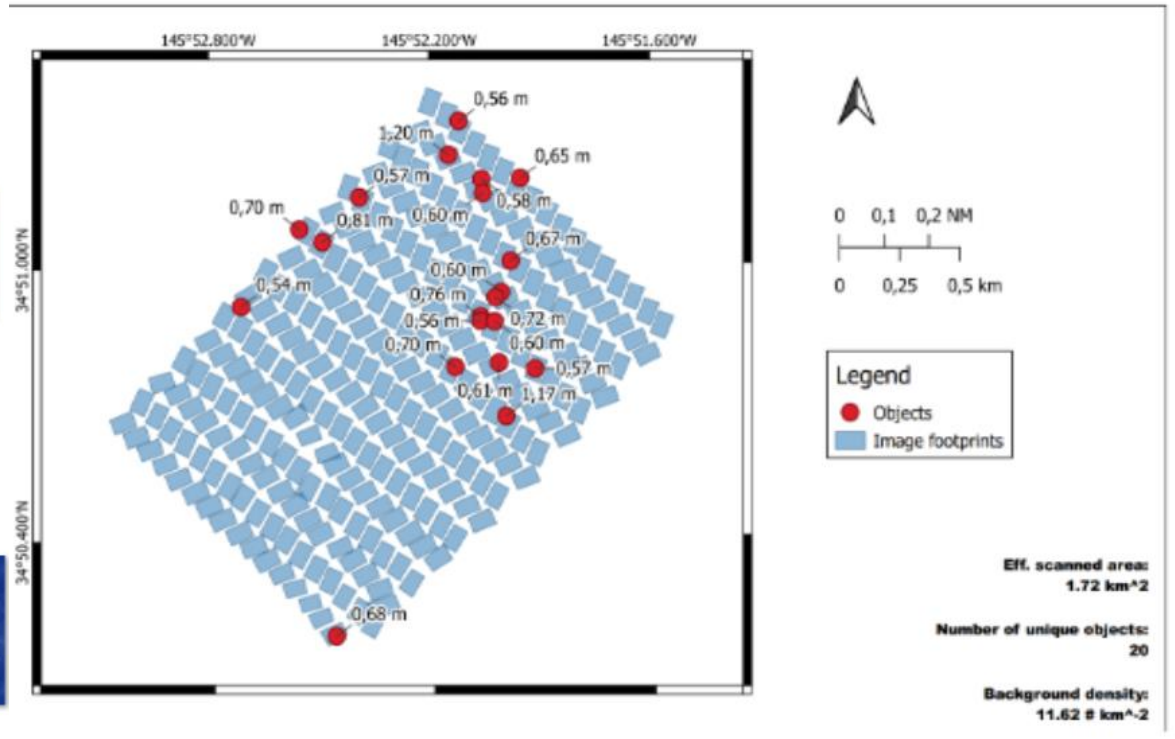
MARINE DEBRIS DETECTION

N = 7,298 aerial images of the sea surface were recorded during two reconnaissance flights above the accumulation zone.



Tagging of debris was initially performed by observers. Labelled imagery was then used to train an image reconnaissance algorithm.

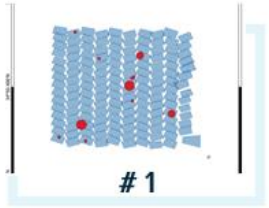


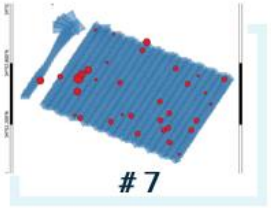


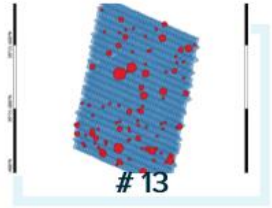
UNMANNED AERIAL VEHICLES

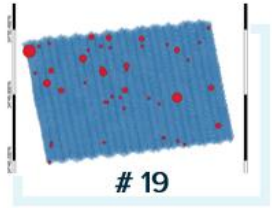
Advances in UAV technology allows for offshore deployments for the capture of aerial imagery.

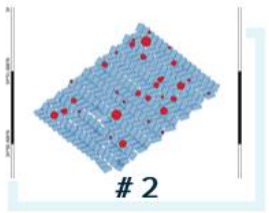
Amphibious fixed wing UAVs can produce several square kilometers of high-resolution imagery during one flight.

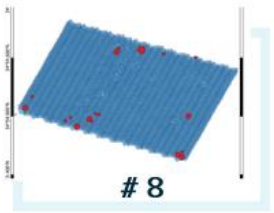


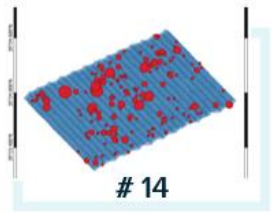


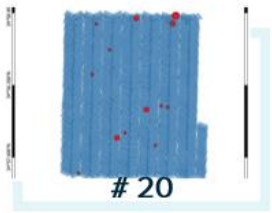


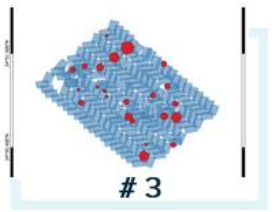


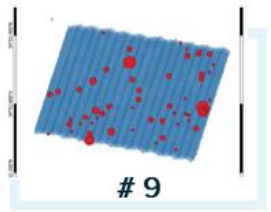


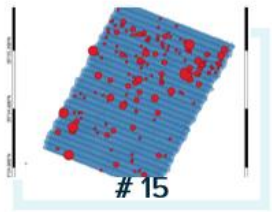


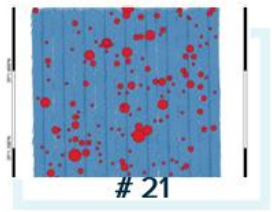


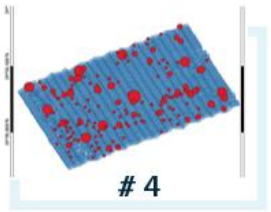


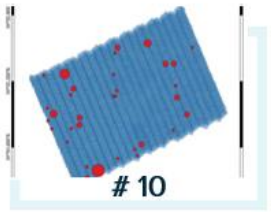


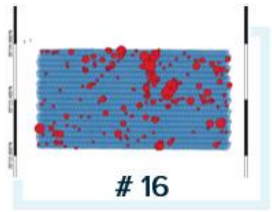


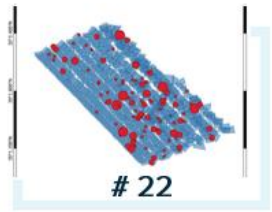


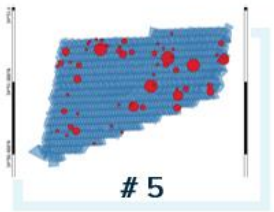


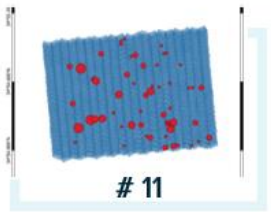


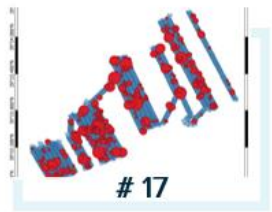


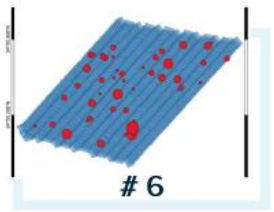


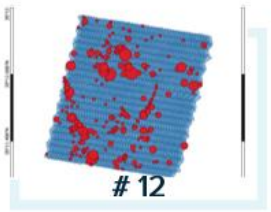


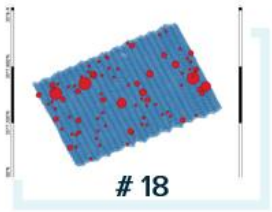












UNMANNED AERIAL VEHICLES

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Amphibious fixed wing UAVs can produce several square kilometers of high-resolution imagery during one flight.

One recent mission overview:

Total flight	**22 flights**
Total airtime	**26.85 hours**
Photos taken	**21,185**
Total area scanned	**95 km^2**
# debris detected (>50 cm)	**2,419**
Min. concentration	**3 #km^2**
Max. concentration	**78 #/km^2**

DETECTION IN RIVERS

The same principle can be applied in different environments such as rivers with fixed cameras installed on bridges.

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Earth and Space Science

RESEARCH ARTICLE
10.1029/2019EA000960

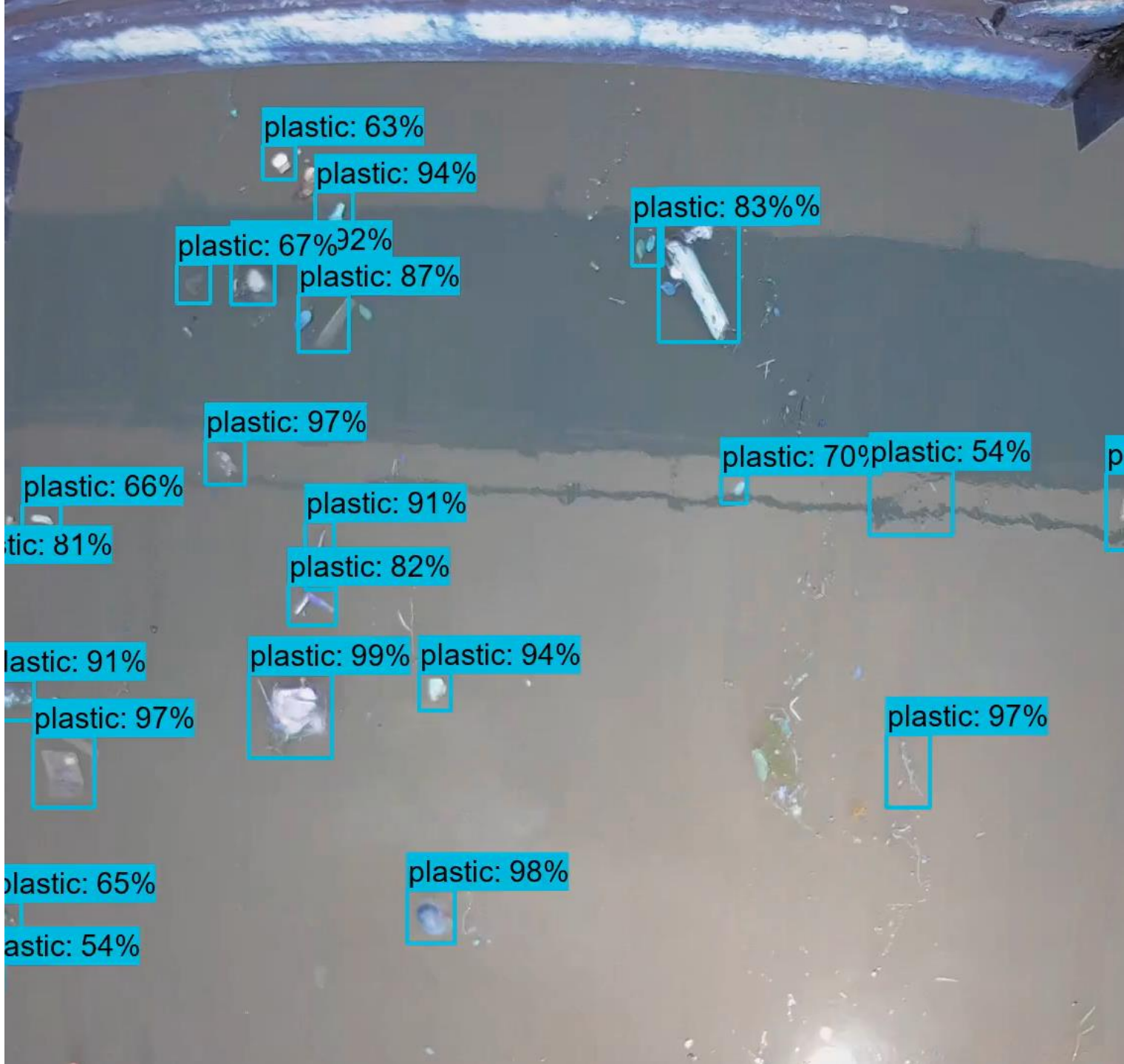
Key Points:

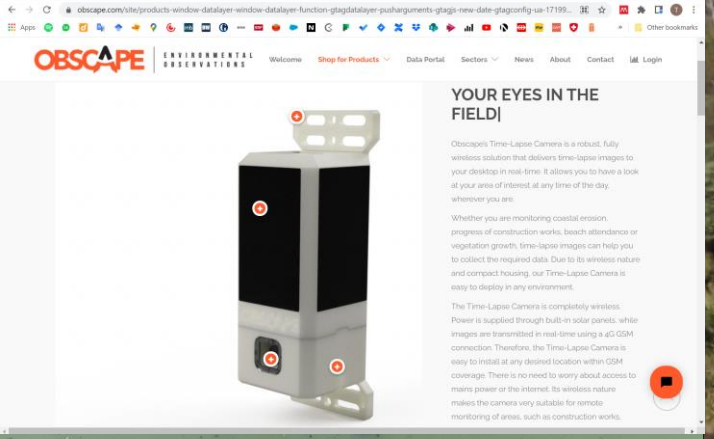
- The proposed automated monitoring method locates river plastic on images reliably
- The method generalizes reasonably well to new locations and would benefit from a larger data set
- Automated method counts agree reasonably with manual methods

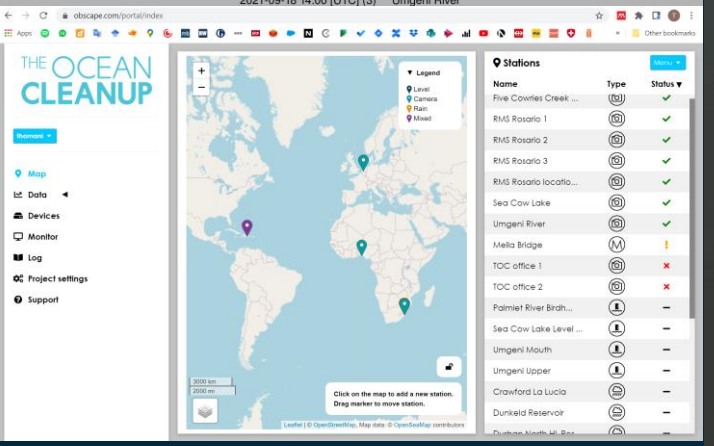
Automated River Plastic Monitoring Using Deep Learning and Cameras

Colin van Lieshout[1,2,3], Kees van Oeveren[1], Tim van Emmerik[1,4], and Eric Postma[2,5]

[1]The Ocean Cleanup, Rotterdam, The Netherlands, [2]Jheronimus Academy of Data Science, 's-Hertogenbosch, The Netherlands, [3]Soda science, 's-Hertogenbosch, The Netherlands, [4]Hydrology and Quantitative Water Management Group, Wageningen University, Wageningen, The Netherlands, [5]Cognitive Science and AI, Tilburg University, Tilburg, The Netherlands







IMDOS FOR A CLEAN OCEAN

DETECTION IN RIVERS

Off-the-shelf solar powered solution:

Camera and level gauge telemetry module.
Preferred settings:

Image burst:	**3 images**
Sampling interval:	**15 minutes**
Communication interval:	**15 minutes**
Image dimensions:	**4056x3130 pixels**
Operational time:	**automatically**
Frame rate:	**4 FPS**

VESSEL MOUNTED CAMERAS

Cameras can be deployed on vessels to detect marine debris. The challenges are different from rivers (e.g. camera orientation)

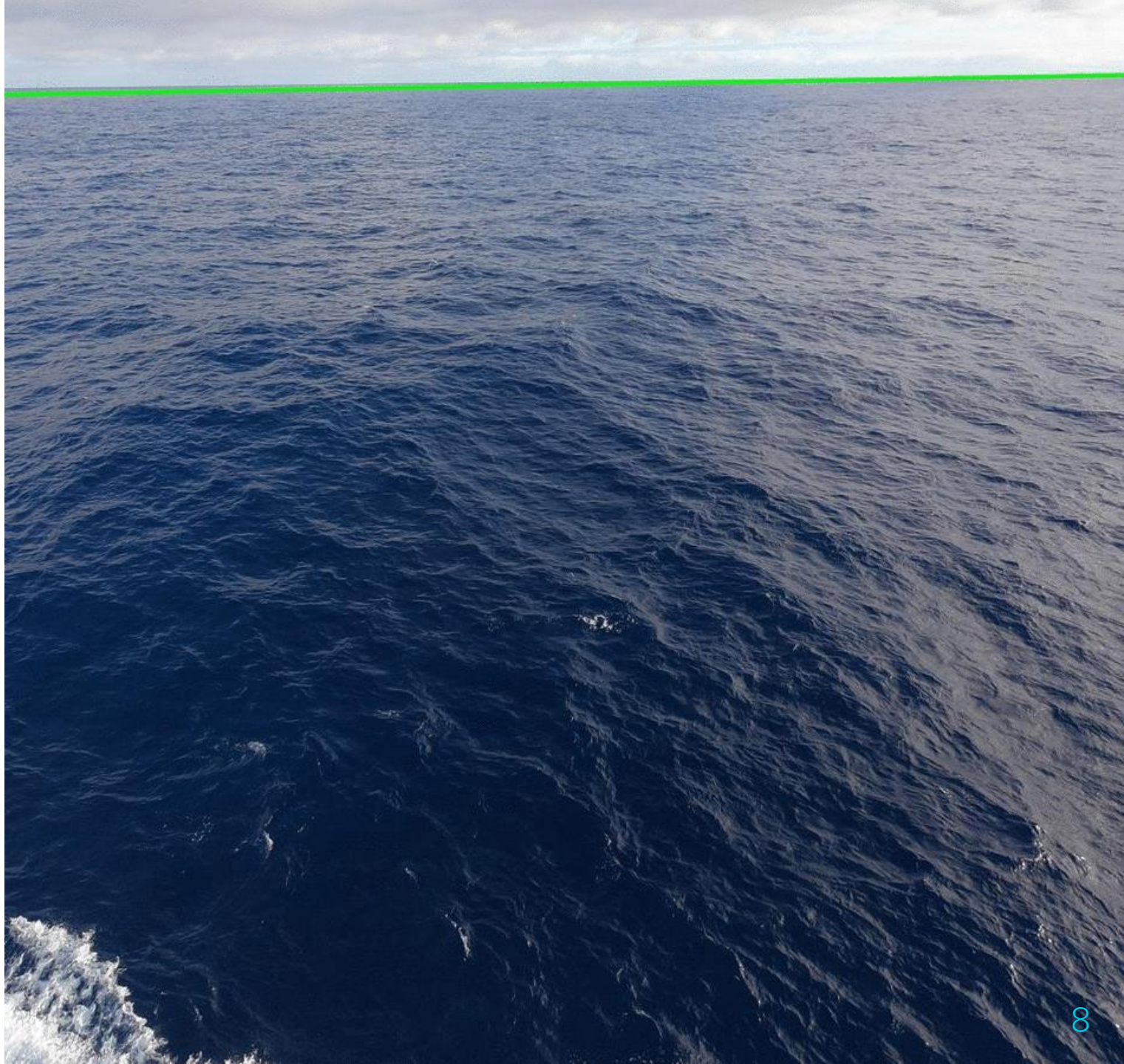
remote sensing

MDPI

Communication

Quantifying Floating Plastic Debris at Sea Using Vessel-Based Optical Data and Artificial Intelligence

Robin de Vries [1,*], Matthias Egger [1,2], Thomas Mani [1] and Laurent Lebreton [1,3]



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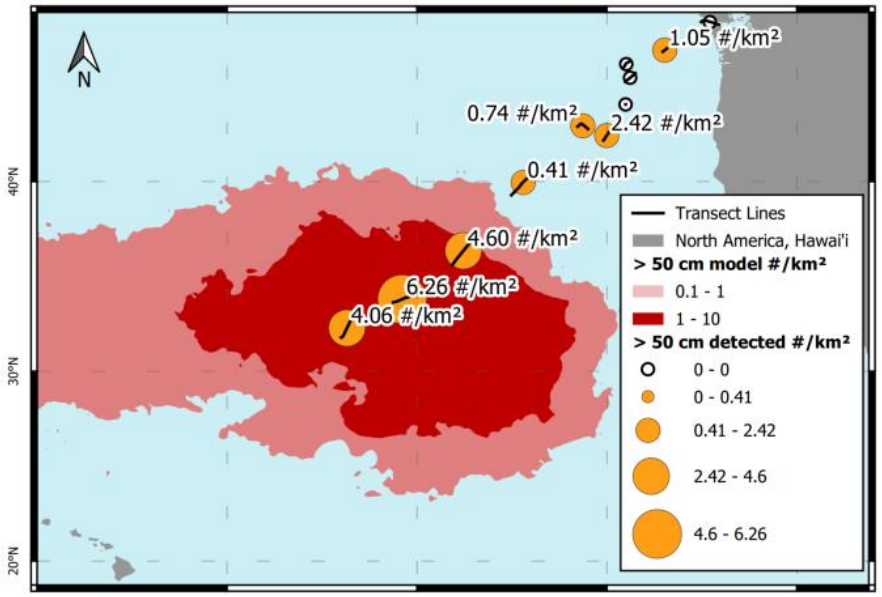
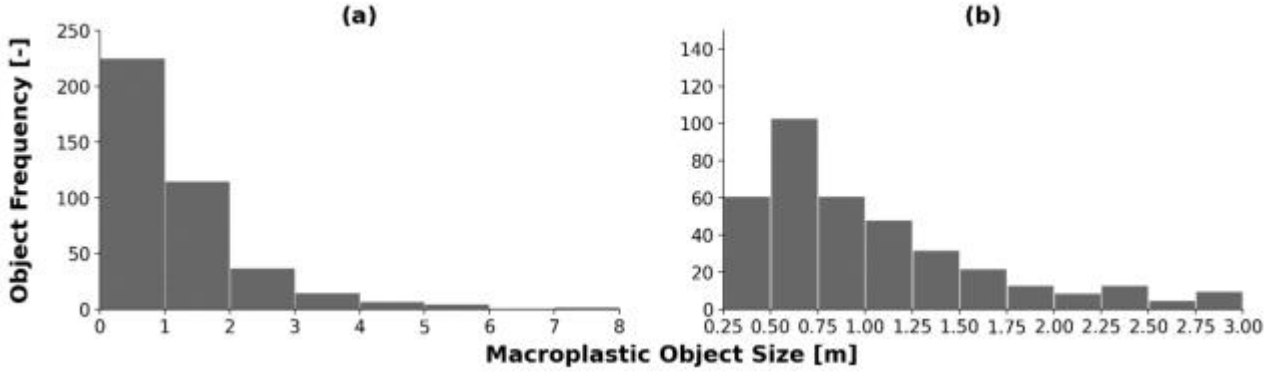
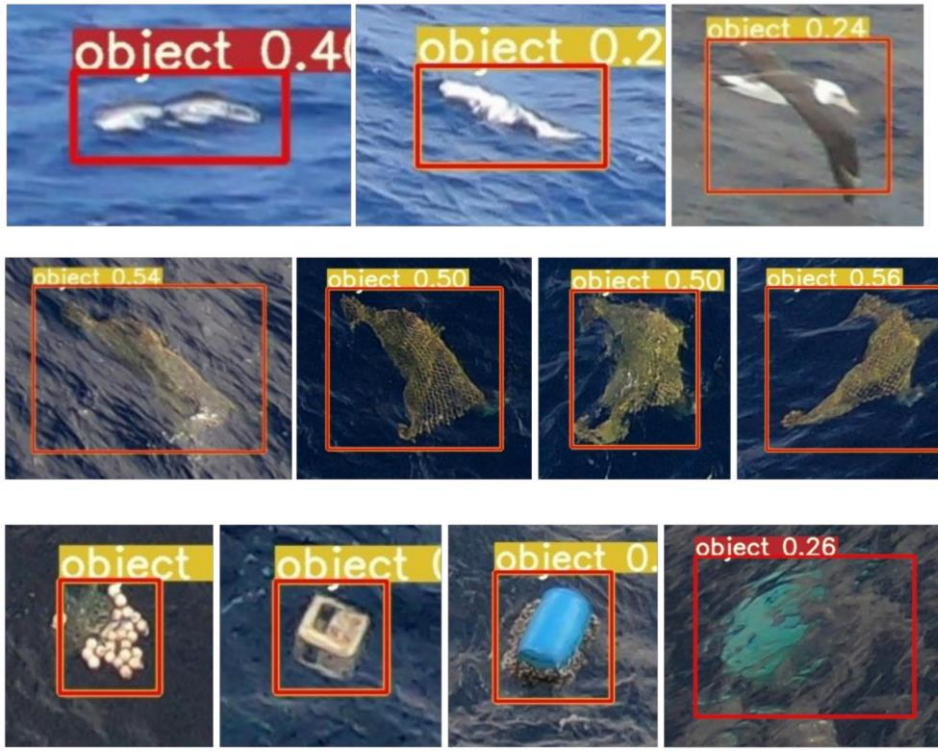
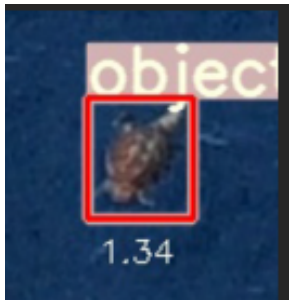


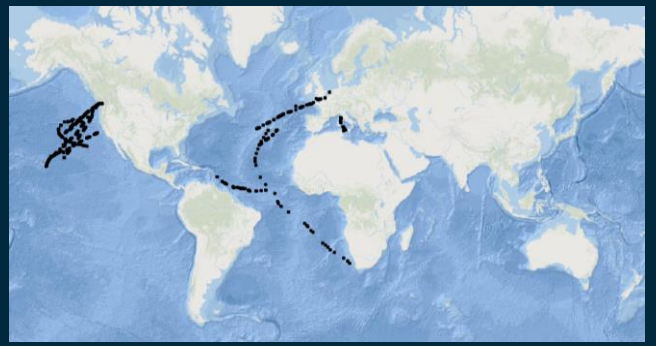






AUTOMATING & SCALING

Automated Debris Identification System (ADIS)



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