

MOTIVATION

- Net trawling and numerical distribution models alone paint a crude portrait of the aquatic plastics pollution, causing a demand for `sustainable, affordable, innovative` monitoring strategies to further advance scientific evidence-based knowledge (Garaba et al., 2018).
- Remote sensing from airborne (aircrafts, drones) and satellite platforms has the potential to provide this much needed supplementary geo-spatial and temporal coverage to better `detect, track, quantify, classify` aquatic plastics.

METHODOLOGY

- Very high (~0.02 m) drone orthophotos were used to improve geo-referencing of high (10 m, resampled) geo-spatial resolution satellite imagery.
- DJI Matrice 210 and S900 hexacopter drones were equipped with SLANTRANGE multispectral, FLIR thermal and Sony A5100 RGB imagers.
- Satellite images were retrieved from PlanetScope, Sentinel-1, Sentinel-2, TanDEM-X and WorldView-3.
- C-130 Hercules aircraft with ITRES SASI-600 imager (1.2 x 0.5 m, 100 wavebands, 950-2450 nm) and 16 MP Optech CS-4800i RGB camera (0.1 x 0.1 m).
- Targets were floating plastic bottles, bags, ghost nets and ocean cleanup pipe.

AEGEAN SEA - GREECE

- Floating plastics were identified in high geo-spatial Sentinel-1 radar and Sentinel-2A multispectral images (Fig. 1 & Fig. 2).

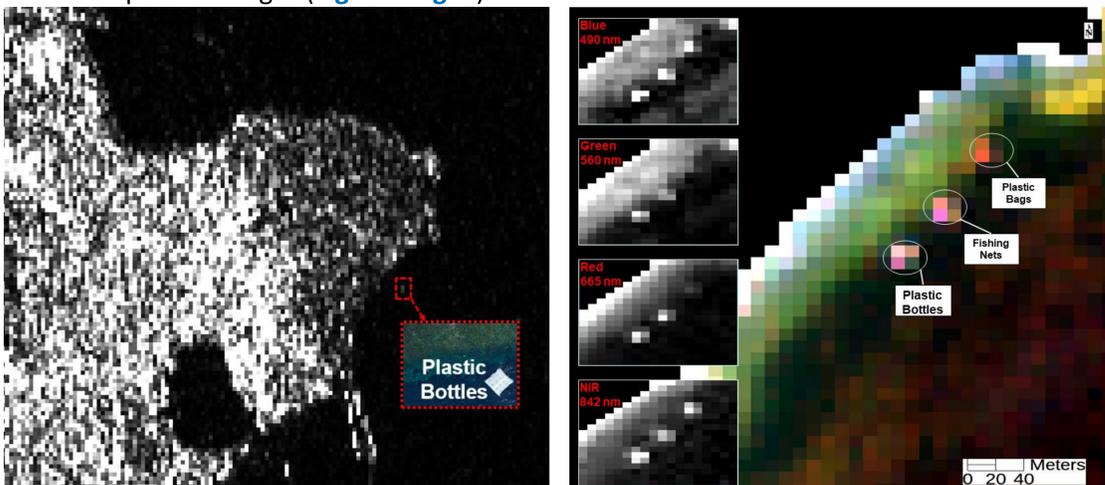


Fig. 1 Sentinel-1 SAR VV polarized greyscale image showing detection of the plastic bottles target (left). Sentinel-2A detected all three artificial floating targets on 07 June 2018 over Greek waters (Topouzelis et al., 2019).

- Spectral analysis of Level-1C data showed plastic targets had higher reflectance compared to surrounding seawater (Fig. 2).
- Level-2 products from Sen2Cor and ACOLITE algorithms showed similar results, but unbiased percentage differences less than 65 % were determined.

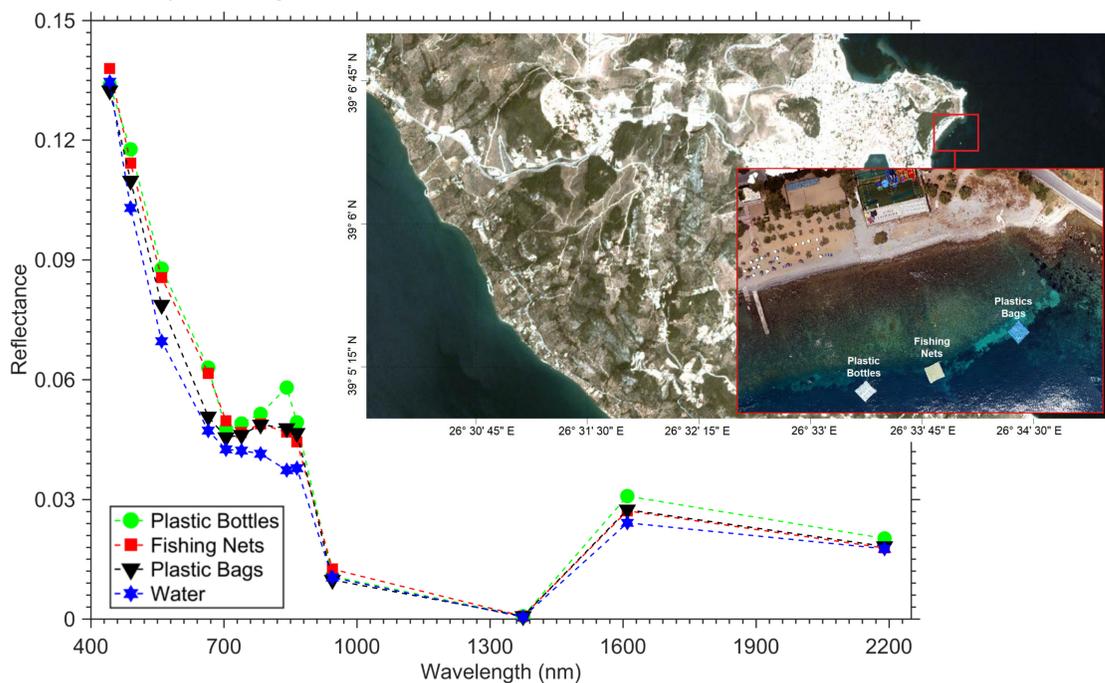


Fig. 2 Sentinel-2A Level-1C spectra of the artificial floating plastic targets in Greek waters (Topouzelis et al., 2019). Fig. 1 Artificial floating plastic targets captured by a Sony A5100 24.3-MP camera on a DJI S900 drone and Planet© Dove satellite on 07 June 2018 over Greece (Topouzelis et al., 2019).

GREAT PACIFIC GARBAGE PATCH

- System001 from The Ocean Cleanup was detected by WorldView-3 (Fig. 3) and from a DJI Matrice 210 drone (Fig. 4).



Fig. 3 WorldView-3 images of the cleaning System001 in the Great Pacific Garbage Patch.

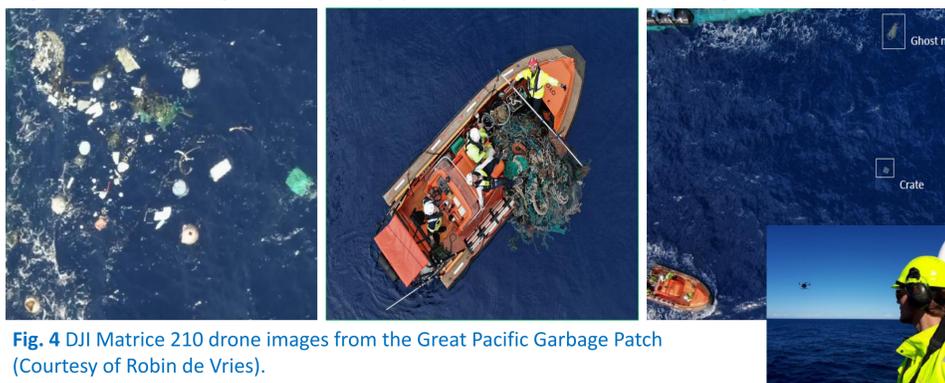


Fig. 4 DJI Matrice 210 drone images from the Great Pacific Garbage Patch (Courtesy of Robin de Vries).

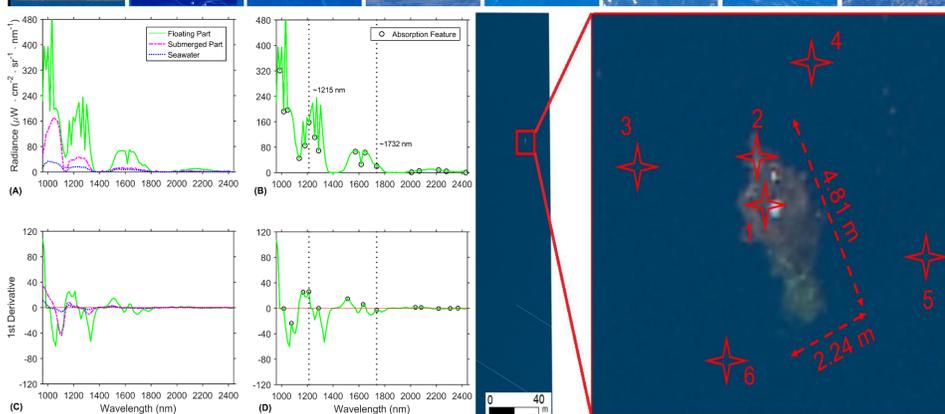
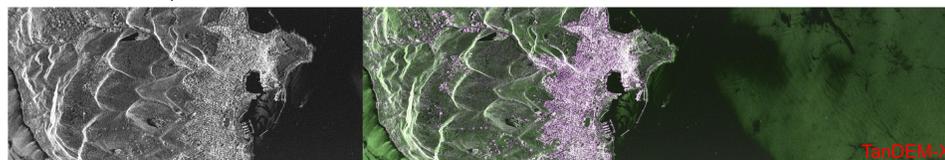


Fig. 5 RGB imagery of floating and submerged litter. At-sensor and derivative spectral data of ghost net with floating (1) and submerged (2) portion was studied with focus on 1215 and 1732 nm absorption features.

- Absorption features at 1215 nm and 1732 nm have potential applications in detecting and quantifying ocean plastics (Fig. 5).

FUTURE WORK

- Explore and develop algorithm for `detection, tracking, quantification, classification` of aquatic plastics using Sentinel-2, WorldView-3, PRISMA, Sentinel 1, Tandem-X.



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