Evaluating drones and novel imaging technology for mapping and monitoring of aquatic environments (DRONING)

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What? –objectives

Explore and evaluate flying drones and novel imaging technology for mapping and monitoring of costal marine habitats

- Mapping of marine habitats, i.e. **distribution patterns of eelgrass, seaweeds and sediments** in shallow waters
- Detecting **abundance of the invasive species**; e.g. Pacific Oyster (*Magallana gigas*)
- Quantifying **seaweed biomass and C deposits** in beach zones
- Quantifying **marine litter/plastics** in the beach zone

Why? - need for improved mapping and monitoring tools

- ❑ Eelgrass and seaweed vegetation are **essential to coastal ecology**, as feeding and **nursery grounds** for fish and important for **CO_2 uptake and C sequestration**
- ❑ The invasive Pacific Oyster have increased dramatically in number and distribution recently, but quantitative abundance and spreading pattern is unknown
- ❑ Marine litter/plastic has a tremendous impact on coastal systems and its distribution is widely unknown
- ➢ Current methods for mapping costal habitats are **labor intensive** and inefficient to quantify changes and dynamics
- ➢ Drone-based imagery can assess shallow water regions with **high spatial** (cm's) and **temporal** (hours) **resolution,** and **provide cost-effective surveys applications**




How? – drones and imaging techniques

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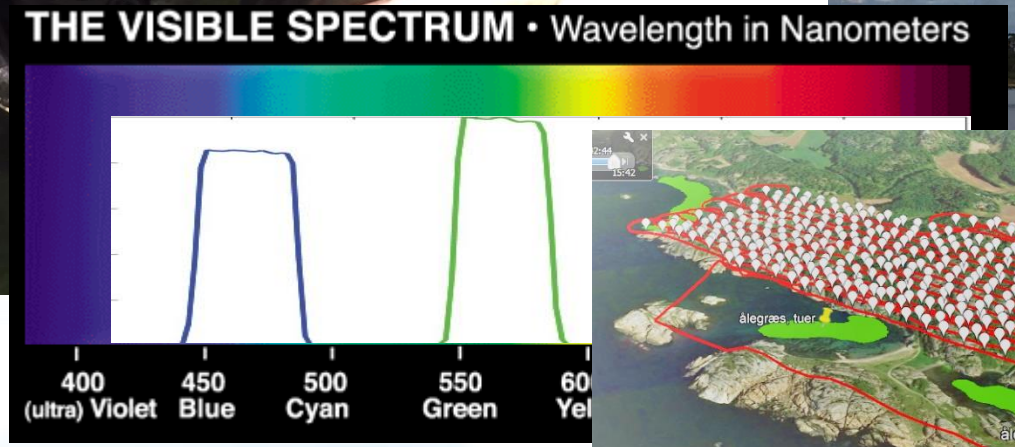
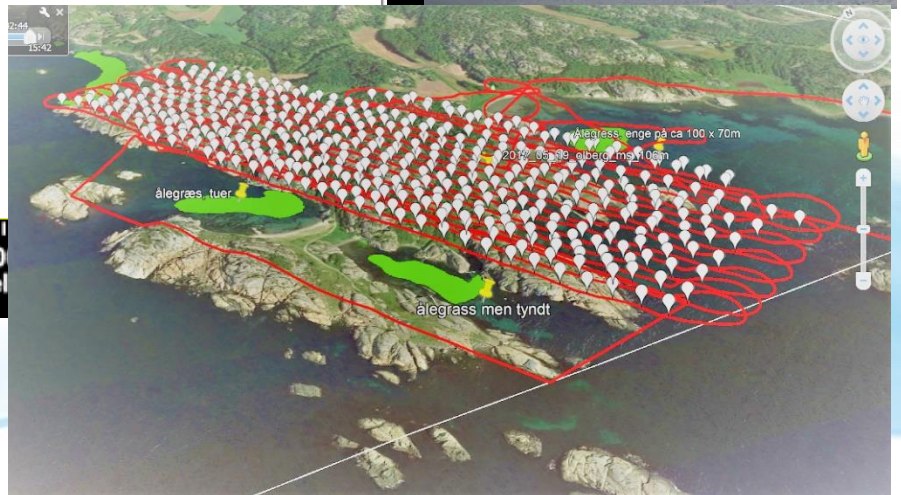
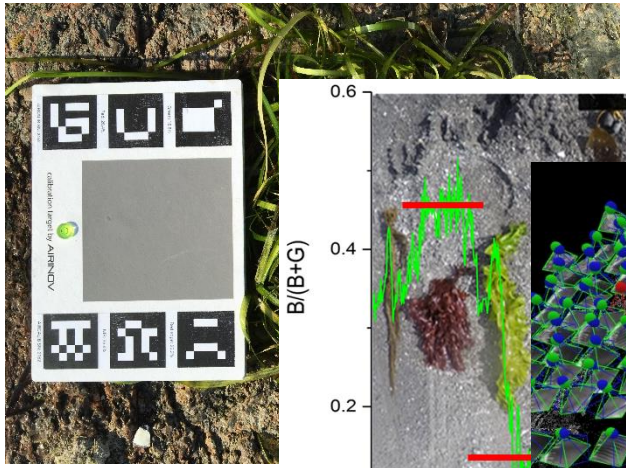
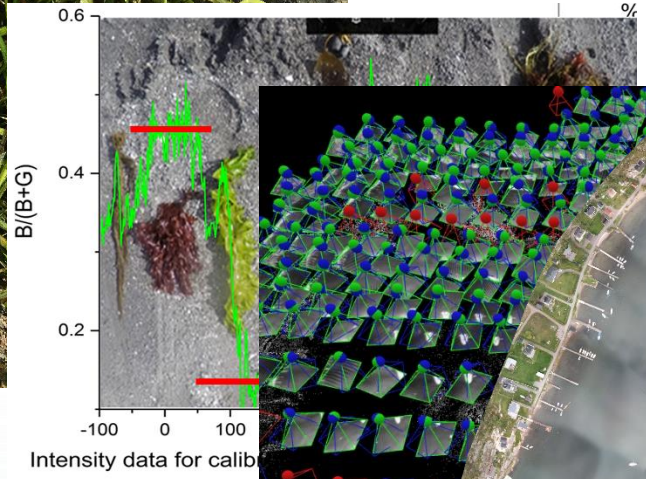
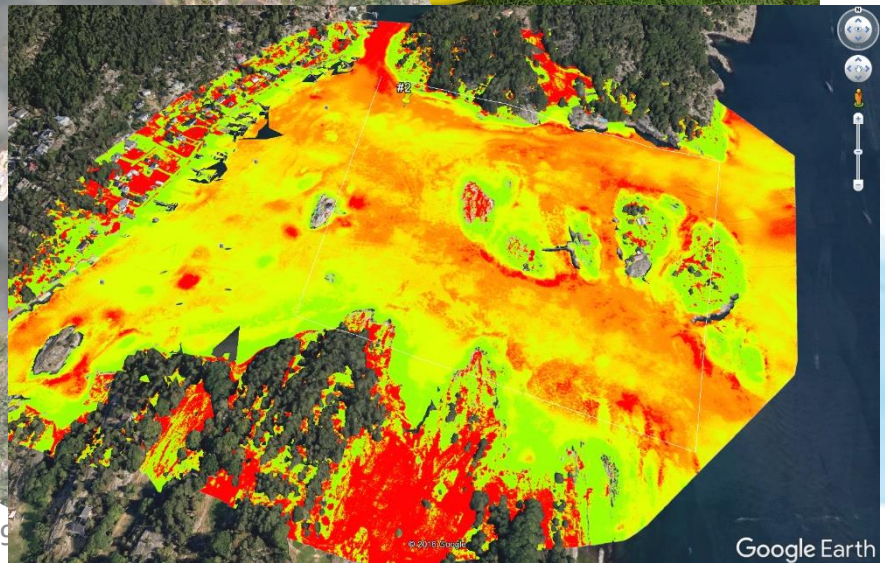




Mapping distribution patterns of eelgrass, seaweeds and sediments in shallow waters bays and inlets



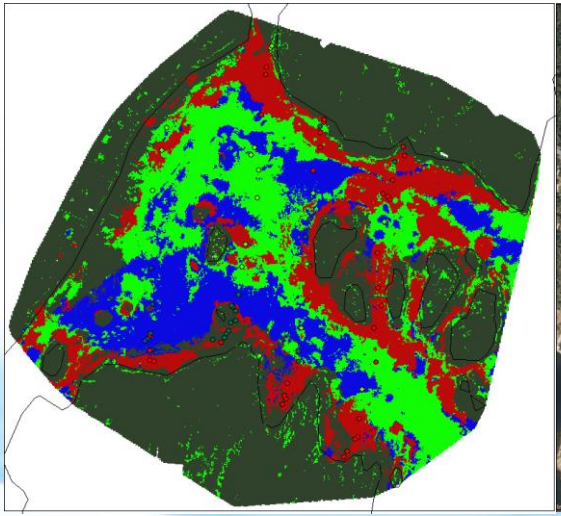


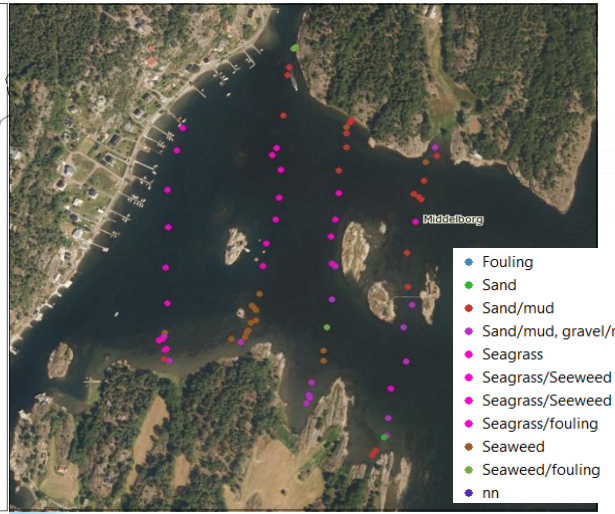


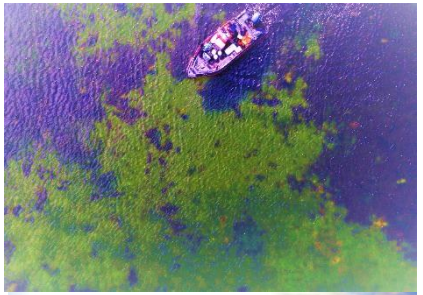
Mapping distribution patterns of eelgrass, seaweeds and sediments in shallow waters bays and inlets

- Drone images data were validated against ‘ground truth’ distribution mapping, applying traditional techniques using geo-reference underwater recordings from small boats

Middelborg	2m calculation window			5m calculation window		
	0-2m depth	0-3m depth	All depths	0-2m depth	0-3m depth	All depths
MS-NDAI	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MS-NDVI	0.311	0.159	<0.001	0.003	<0.001	<0.001
MS-RedEdge	0.522	0.429	0.007	0.166	0.079	<0.001
RGB-ChlA	0.447	0.753	0.002	0.283	0.705	0.001







Quantifying marine litter/plastics in the beach zone

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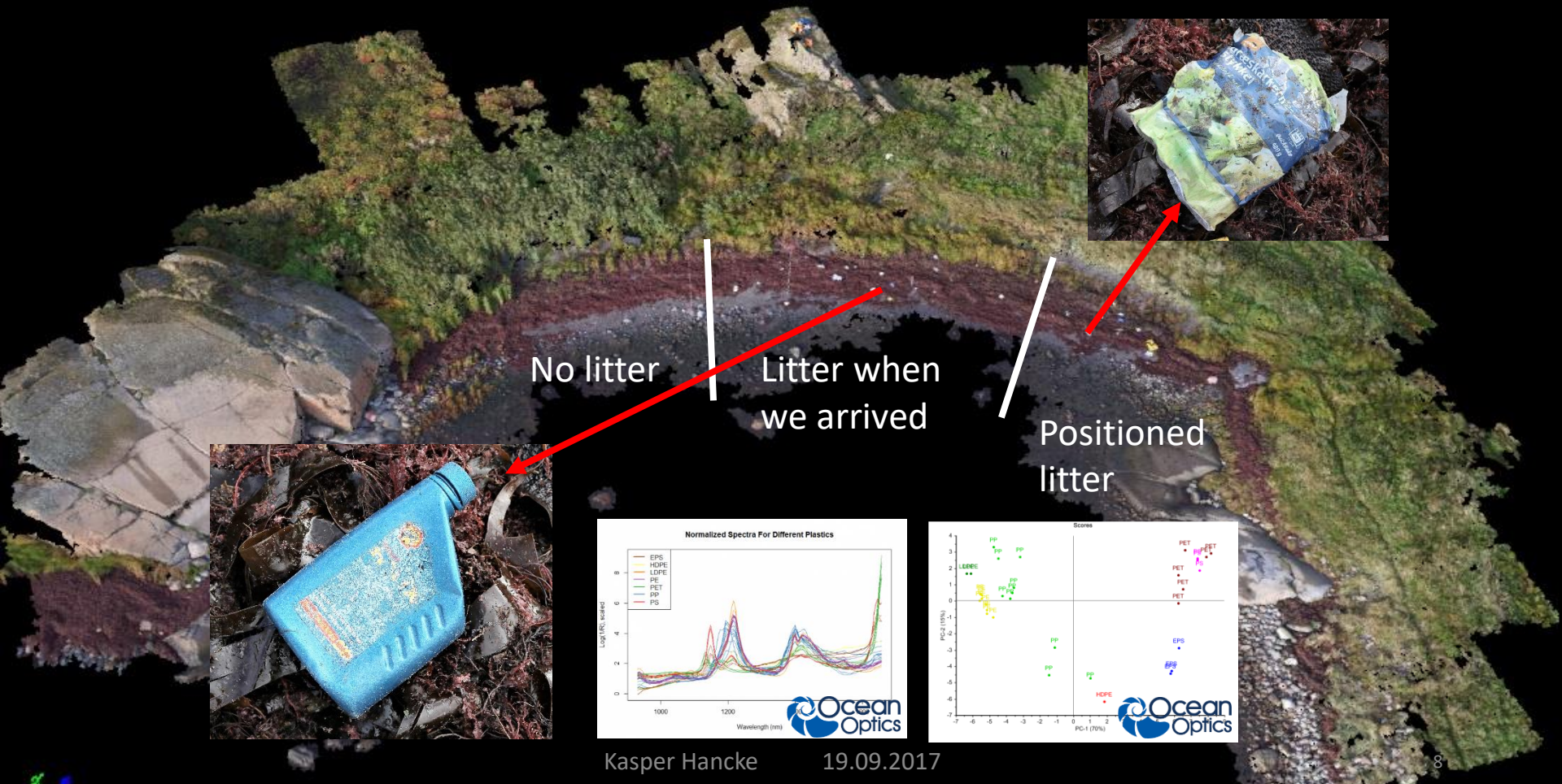
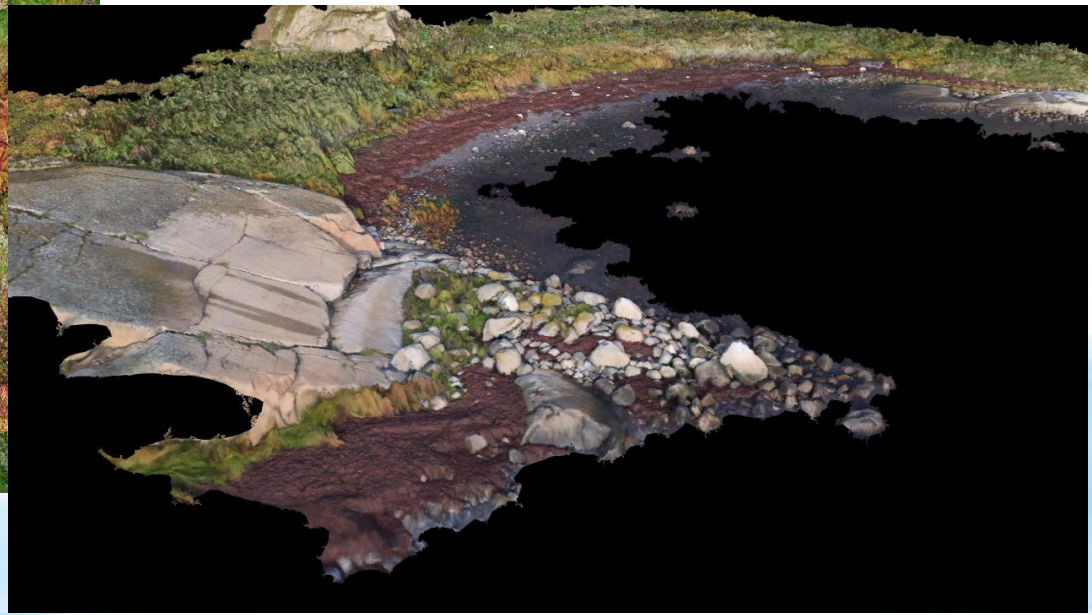


Quantifying seaweed biomass and C deposits in beach zones

Deposits of seaweed biomass the day after a storm



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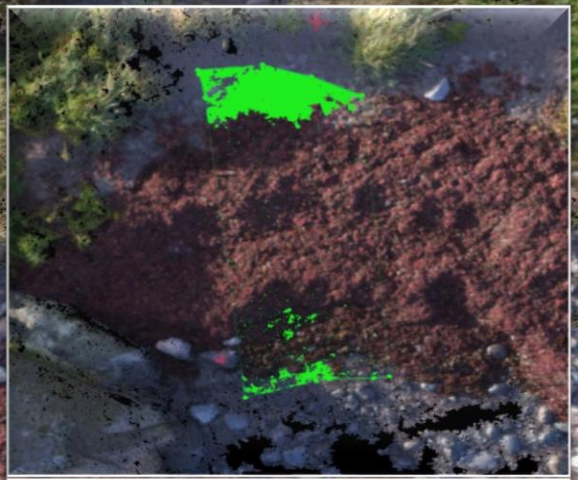

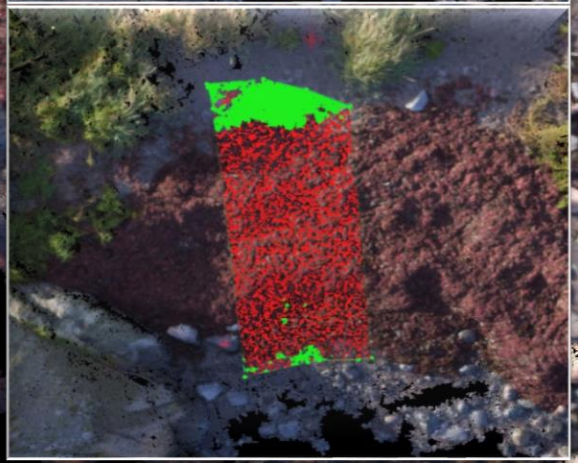

Length: 5.40 cm
Arv. Height: 24.5 cm
Volume: 1.32 m^3 per meter beach
Volume in picture: 15.8 m^3

Preliminary results and conclusions

- Spectral imagery from drones can be applied to map vegetation coverage in shallow water ecosystems
  - Specific Normalized Index algorithms need further development and improvements for accurate estimate and separation between habitat types
- Biotic and abiotic mass and structures can be quantified and tracked in space and time
  - e.g. seaweed and sediment deposits in the beach/river zone across seasons and years
- Marine litter/plastics can be observed
  - Identification and quantification are possible with future developments
- Too early to conclude on detection of Pacific Oyster distribution


Thank you,
any questions?