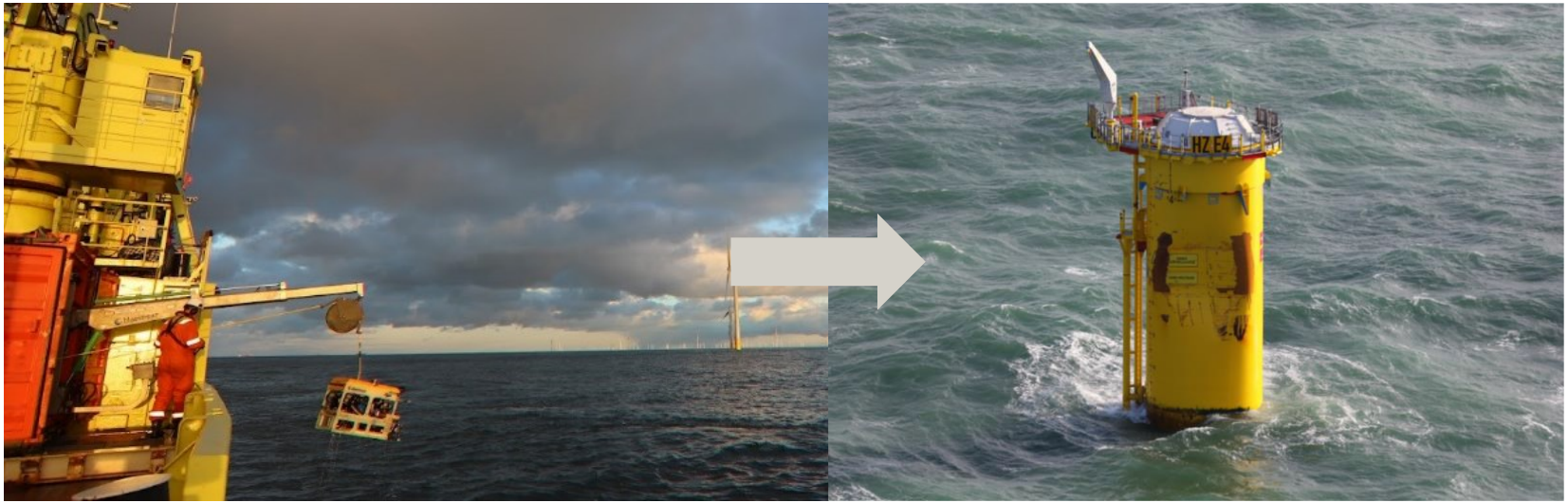
Marine growth sampling tool evaluation

Evaluation of the performance of an ROV-mounted tool for sampling marine growth on offshore energy structures

Joop Coolen, Jan-Jelle Huizinga, Kennisdag Wozep – MONS 25 maart 2025



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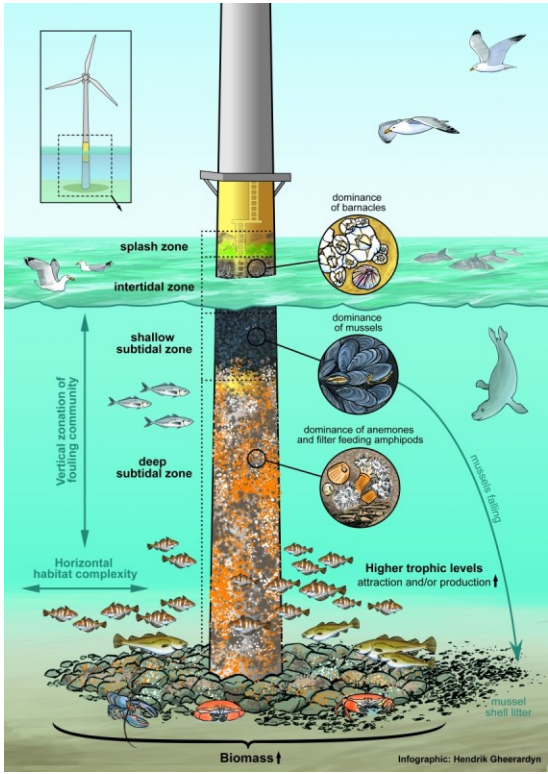
Supported by: WOZEP DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME VATTENFALL

Artificial reef effect: biofouling on wind turbines

- Offshore wind offers hard substrate habitat
- Foundations colonised by many species
- OWEZ & PAWP fouling inventoried >10 y. ago
- Dominated by mussels, amphipods & anemones
- Large variation between locations
- Wozep intends to continue the monitoring



Degraer, S., Carey, D., Coolen, J. W. P., Hutchison, Z., Kerckhof, F., Rumes, B., & Vanaverbeke, J. (2020). Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure and Functioning: A Synthesis. *Oceanography*, *33*(4), 48–57. https://doi.org/10.5670/oceanog.2020.405

Sampling wind turbines: challenges & solution

- Data on marine growth communities is increasingly important
- Samples from marine growth and scour protection taken by divers
- Problem 1: At many NL locations, diving not possible or feasible
- Solution: ROV tool for sampling marine growth & scour protection
- Problem 2: No quantitative tool existed on the market
- Solution: Bluestream & WMR developed a tool for marine growth sampling

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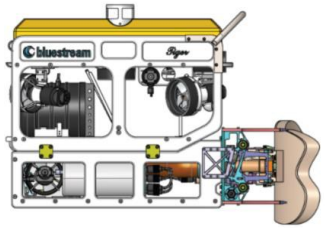
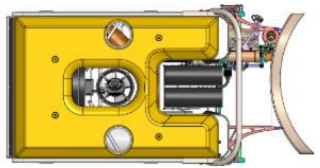
Tool development so far

- 2021: First concept marine growth sampling tool formulated
- 2022: Engineering design created
  Version 1 built
  Tested in Bluestream facility
- 2023: Version 2 built based on V1 with alterations
  Tested in Bluestream facility
- Nov 2023: Test in Hollandse Kust Zuid OWF
- 2024: Test samples were evaluated
  Report delivered to Wozep in January 2025





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Coolen, J. W. P., Babeth van der Weide, B., Bittner, O., Peck, N., Kornau, L., Keur, M., Foekema, E., Ibanez-Erquiaga, B., & Huizinga, J.-J. (2025). Marine growth sampling tool evaluation - Evaluation of the performance of an ROV-mounted tool for sampling marine growth on offshore energy structures. Wageningen University & Research report C068/24B. https://doi.org/10.18174/678892

MGS-tool

ROV

TOOL

Test aims

- Test the general performance of the MGST in offshore conditions
- Evaluate the feasible depth range
- Test 3 different scraper types (2 plastic, 1 steel type)
- Afterwards:
    - Analyse **species composition** of samples in laboratory
    - Analyse presence of **coating particles** in samples
    - Compare MGST samples to existing diver samples

Field report summary

- Test conducted at Vattenfall HKZ foundation in November 2023
- From research & survey vessel Zirfaea
- 2 days on location during ~22 hours
- 21 acceptable samples taken (4 samples rejected: total 25 samples)
- Samples successfully taken at depths between 4,5 and 20 meters
- Samples at depths <4,5 m failed due to wave action → ROV moved


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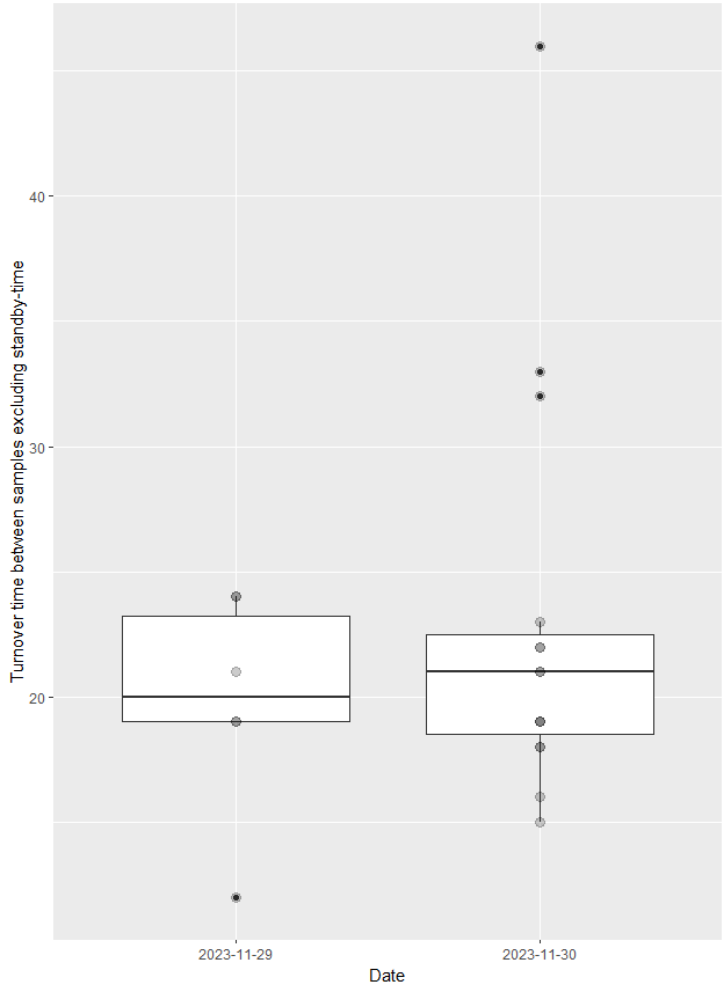
Results: Field test

- MGST performed well
- No visual damage to coating observed
- Mean time for a sample = 22 minutes



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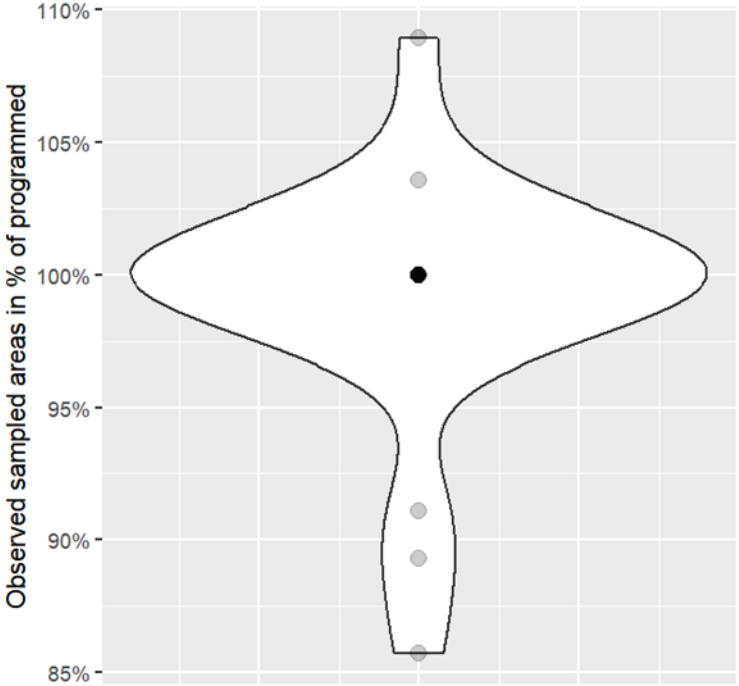
Results: Field test

- Planned sampling area was 560 cm^2
- Actual area varied 480 – 610 cm^2
- 16 samples exactly 560 cm^2
- Average deviation was 1%



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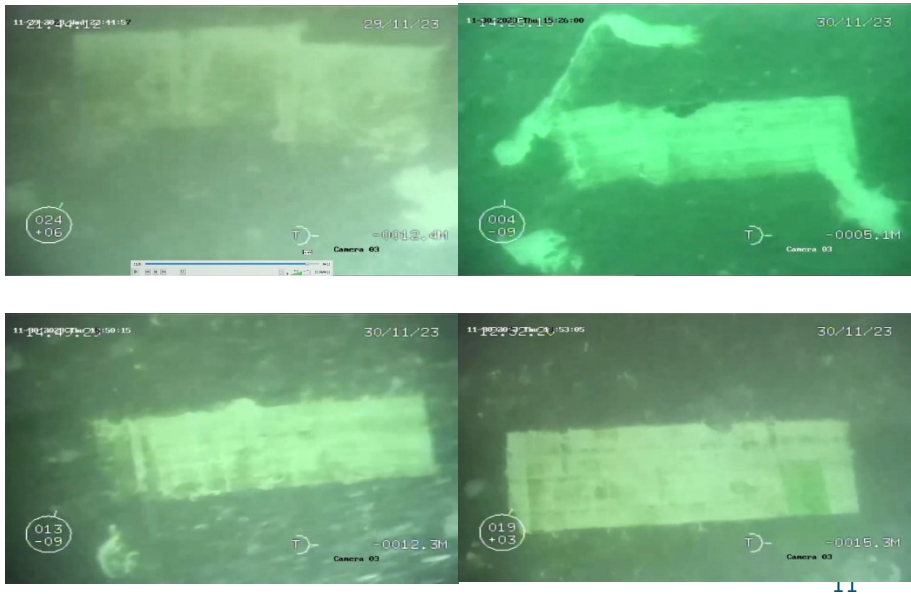
Results: Video analysis

- Sampled area shape as planned (rectangle) in 14 samples
- 7 samples with (some) deviation

- Deviation by ROV movement →

- Deviation by species presence →



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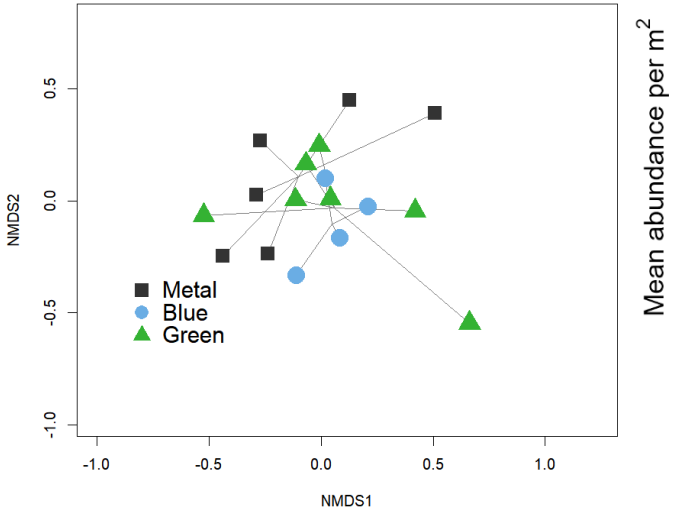
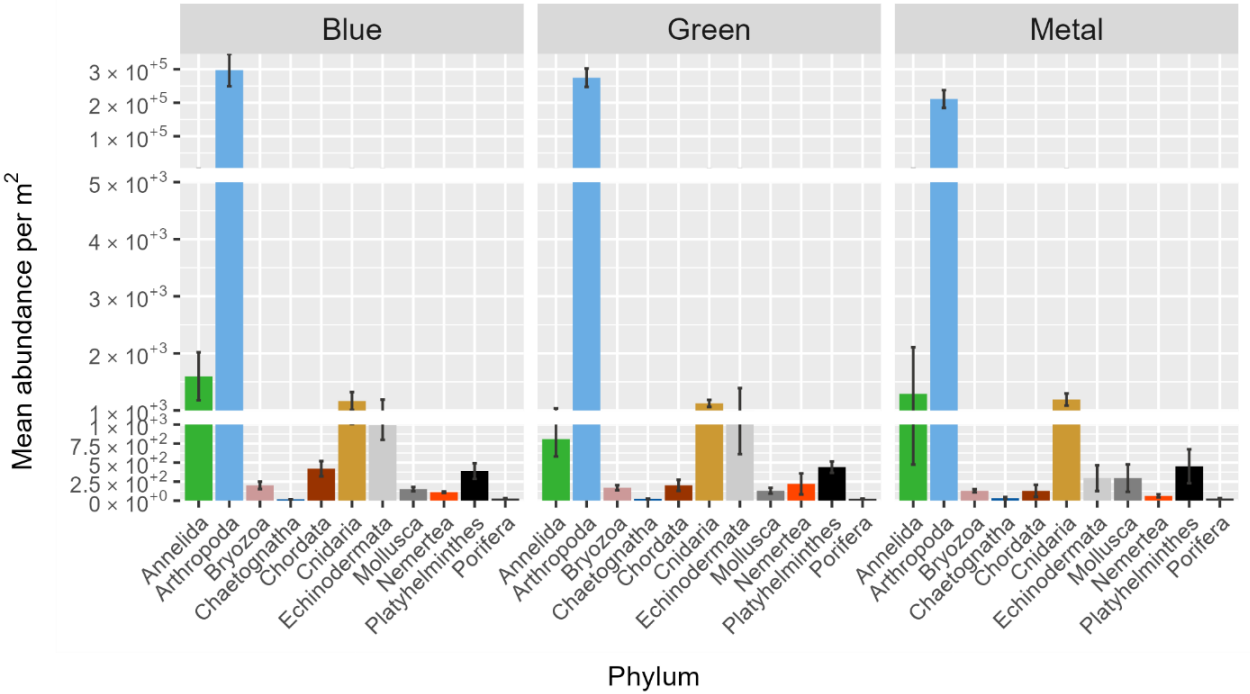
Results: taxonomic labwork

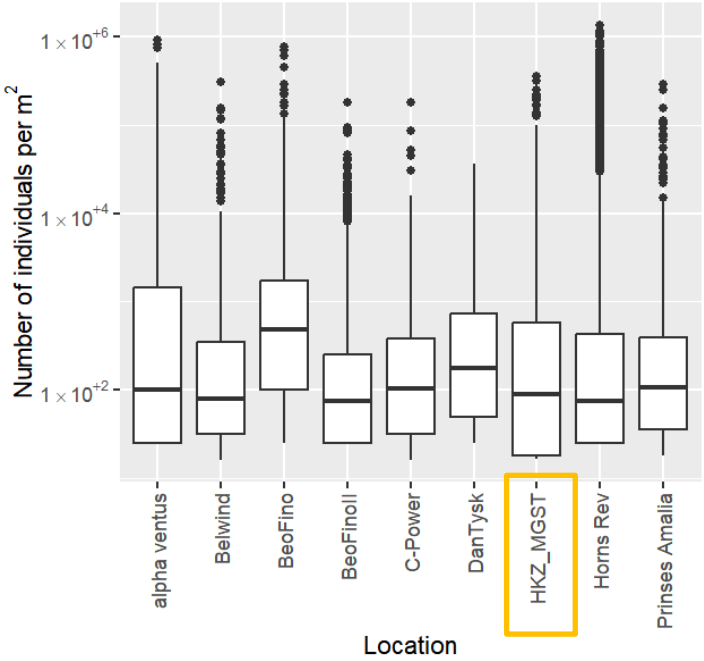
- Some non-significant difference between knife types (high variation)

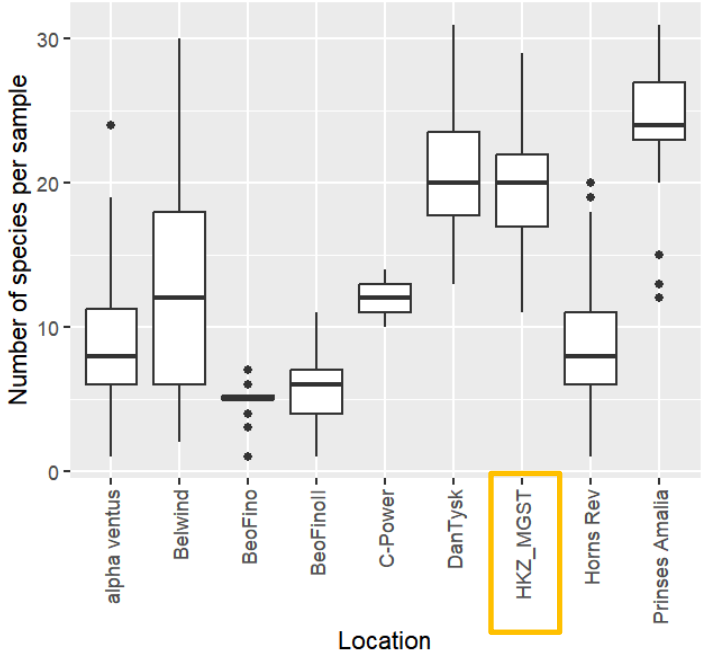




Results: comparison to existing data

- MGST data in range of data from other wind farms (NL, BE, DE, DK)





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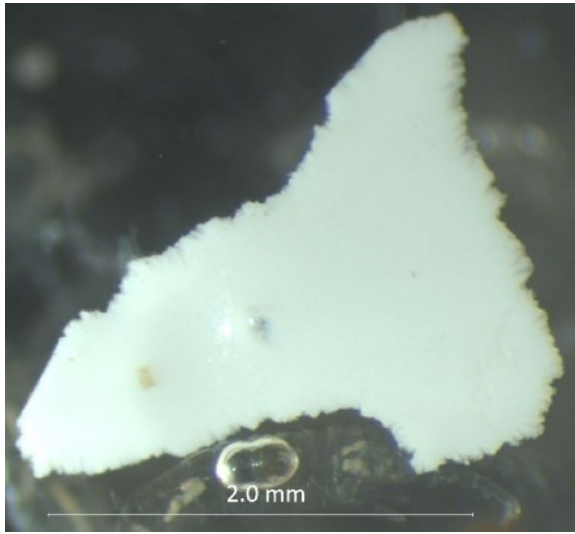
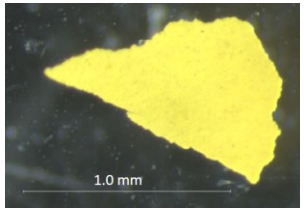
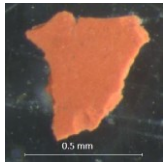
Results: coating labwork

- Coating found in 10 out of 21 samples
- 3 colours of coating observed →
- Max individual particle size 2,6 mm^2
- Average total particle size per sample 0,64 mm^2







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Discussion

- No clear damaged fauna seen in samples
- Some variation in sampled area

  BUT: Diver samples do not register actual sampled area!
- No coating damage observed visually
- Coating particles in sample below 0,005% of sampled area

Discussion

- MGST performed well within testing limitations
- Weather (wave action) is limiting factor for shallow sampling
- Next steps planned in new project RODRIGO:
    - Perform more tests at different structures & fauna communities
    - Explore potential to use stronger magnets
    - Compare MGST directly to diver samples

Thank you

Thanks to Wozep for funding the test and Vattenfall for facilitating it.

Download the report here:
https://edepot.wur.nl/678892

Contact details:

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New project: RODRIGO

- Funded by KIA-LWV, Ørsted, TenneT & Ecowende
- Currently open to additional partners
- Starts in June 2025, duration 4 years
- WP1: further test the MGST at other structures and communities
- WP2: perform diver vs MGST sampling test in 1 wind farm
- WP3: start development of scour protection sampling tool
- Interested to know more? Contact Joop via joop.coolen@wur.nl

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Some backup / discussion slides not presented

Laboratory methods

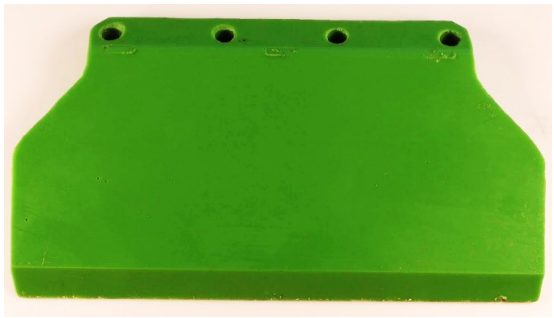
- Extract fauna from samples
- Identify species, count and weigh them
- Dissolve organic & calcareous matter in left-over
- Count and measure size of coating particles in left-over
- View ROV video footage to identify presence of species

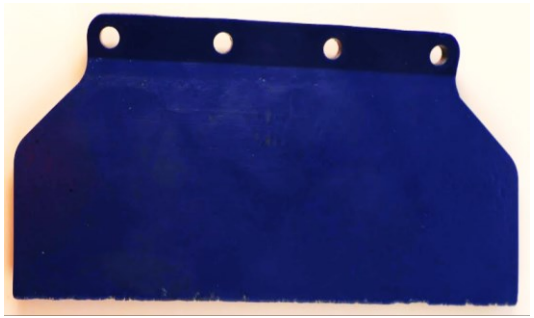
Lab report summary

- All 21 acceptable / good quality samples processed
- Lab analists remarked high numbers of copepod plankton
- No significant damage to species in sample

Results: Field test

- 3 types of scrapers all took similar samples
- Softer plastic scrapers damaged faster than steel scraper
- No scraper type showed visual damage to coating
- No clear difference in fauna removal percentage





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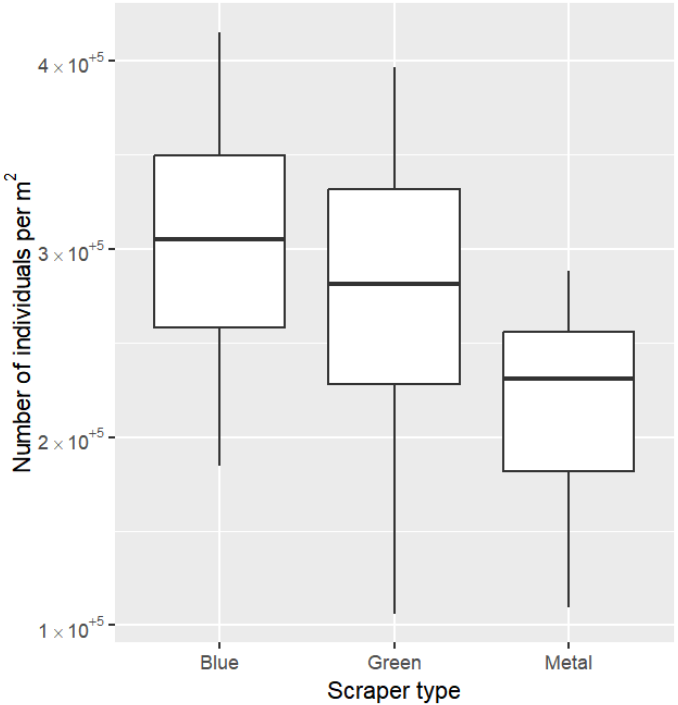

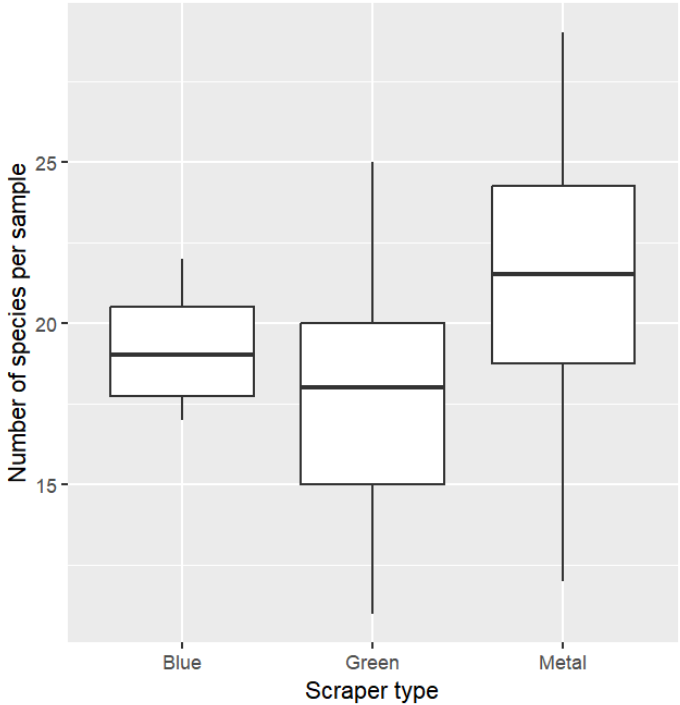

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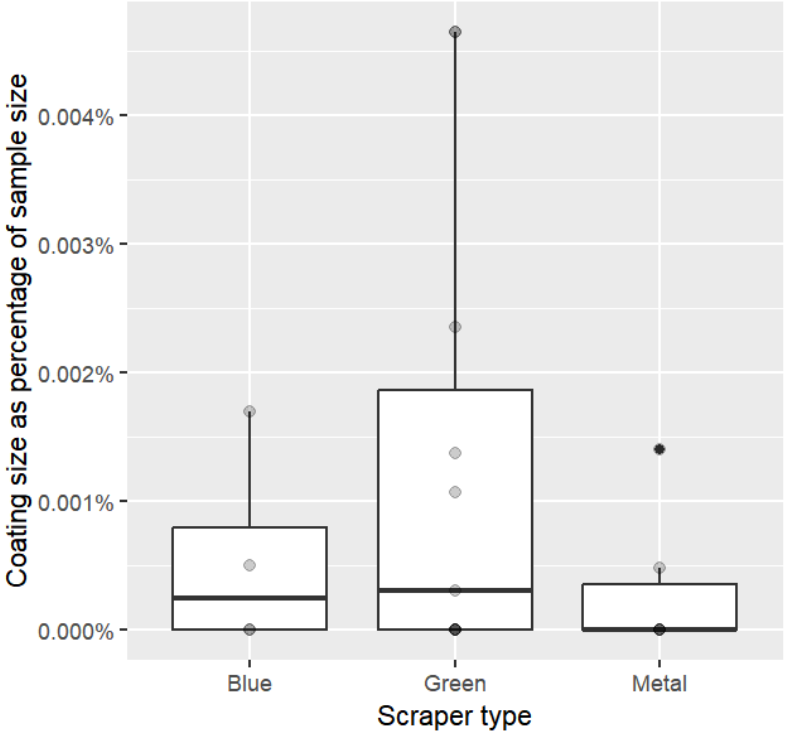
Results: coating labwork

- No clear difference between scrapers
- 0 – 0,0046% total coating particles compared to sampled area



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