# Benthic development in and around Princes Amalia Windpark

## soft substrate benthic fauna

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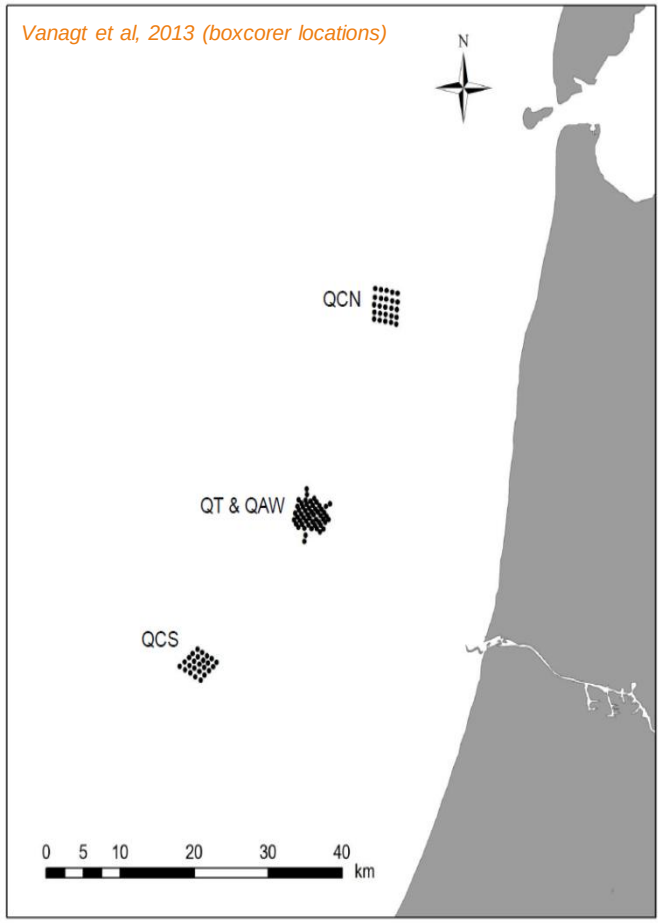
# History

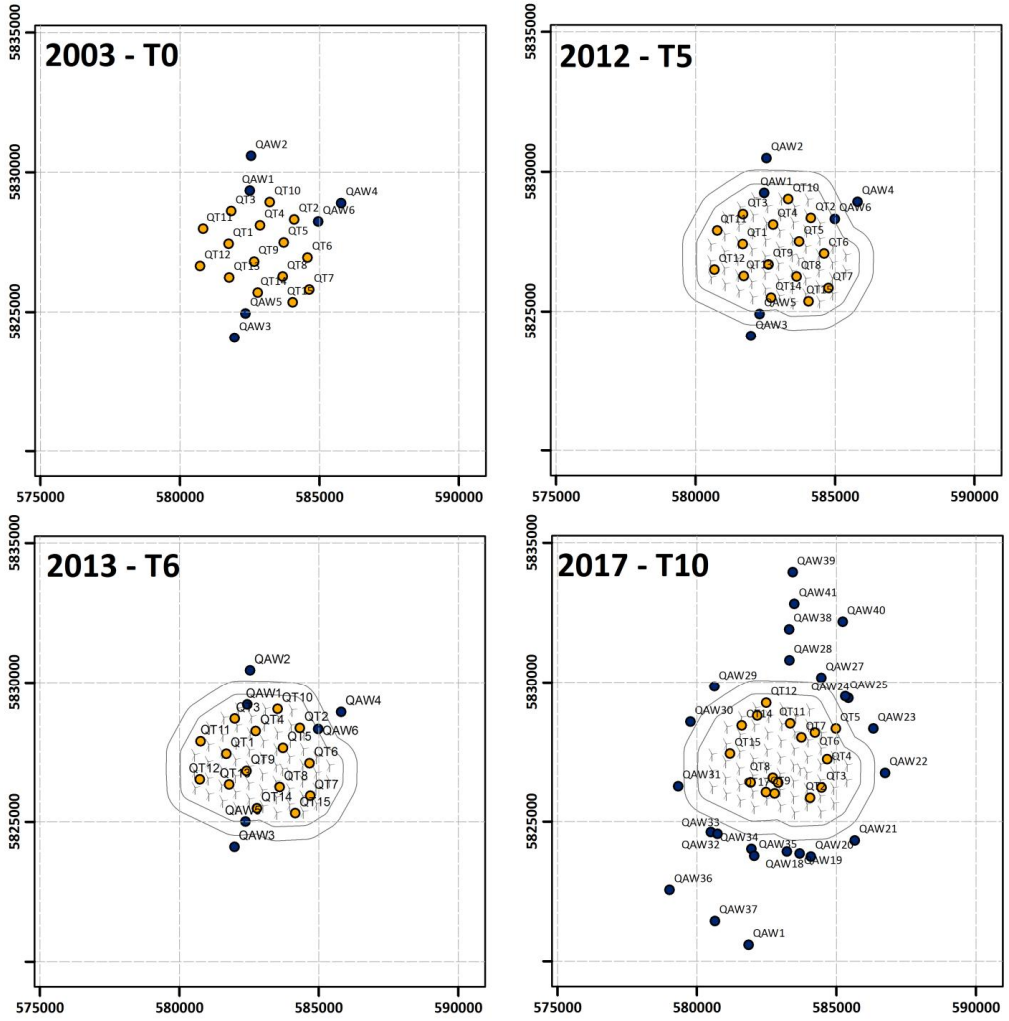
- Benthic dredge
- Focus on: larger infauna and epifauna
- Same dredge in all surveys (FWC)
- Sampling in spring
- 4 years of data (T-0, 5, 6, 10)
- Identification of species during the survey
- Fishes also counted and analysed (Sandeel)

| Year | Phase | Organisation |
|---|---|---|
| 2003 | T-0 | Hull University |
| 2012 | T-5 | eCOAST, Fieldwork Company |
| 2013 | T-6 | eCOAST, Fieldwork Company |
| 2017 | T-10 | Eurofins AquaSense, Fieldwork Company, eCOAST |

Is there a difference in the (larger) benthic community inside and outside of Princes Amalia windpark, 10 years after construction?

# Survey design




QT = Inside OWP (T = turbines)

QAW = Outside OWP (AW = Adjacent waters)

# Survey design changes in 2017

2017: changed survey design

- North and South reference areas cancelled
  - Other anthropogenic and environmental factors
  - Data not comparable
- More sampling locations were added in the adjacent waters (QAW)
- The buffer zone was cleared
- Environment was taken into account (depth, sand ridges, etc.)

# Data preparation

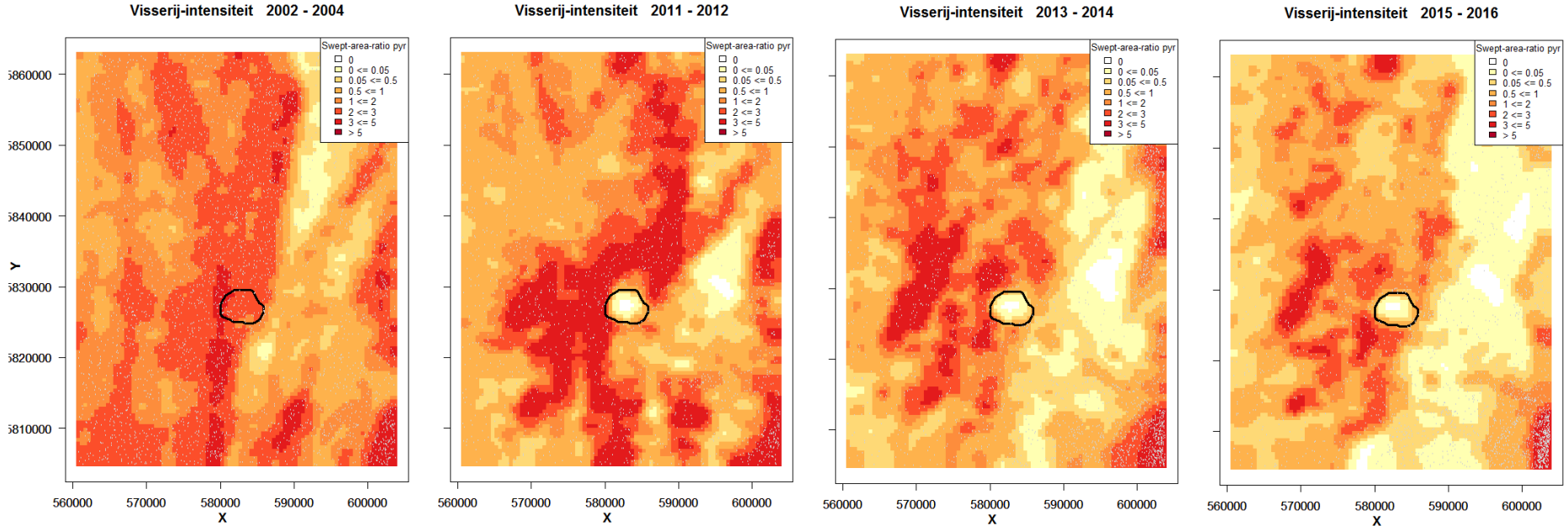
2 datasets:

1. WOZEP benthic dredge survey 2017
2. Historical data from repository WOZEP

- Issues in historical dataset:
  - Coordinates,
  - transect length and sampled surface
  - Missing environmental data (depth, sediment characteristics, etc.)
- Clean-up in ecological data
- Fishing intensity from Wageningen Marine Research (Machiels, 2017)
- All ecological data and Environmental data linked
- New dataset created for WOZEP repository (cf. WOZEP format)

# Fishing intensity

- Wageningen Marine Research (Machiels, 2017)
- VMS position of fishery vessels
- Fishery intensity data per sample (no of days since last fishing, no. of VMS pings in proximity, etc.)

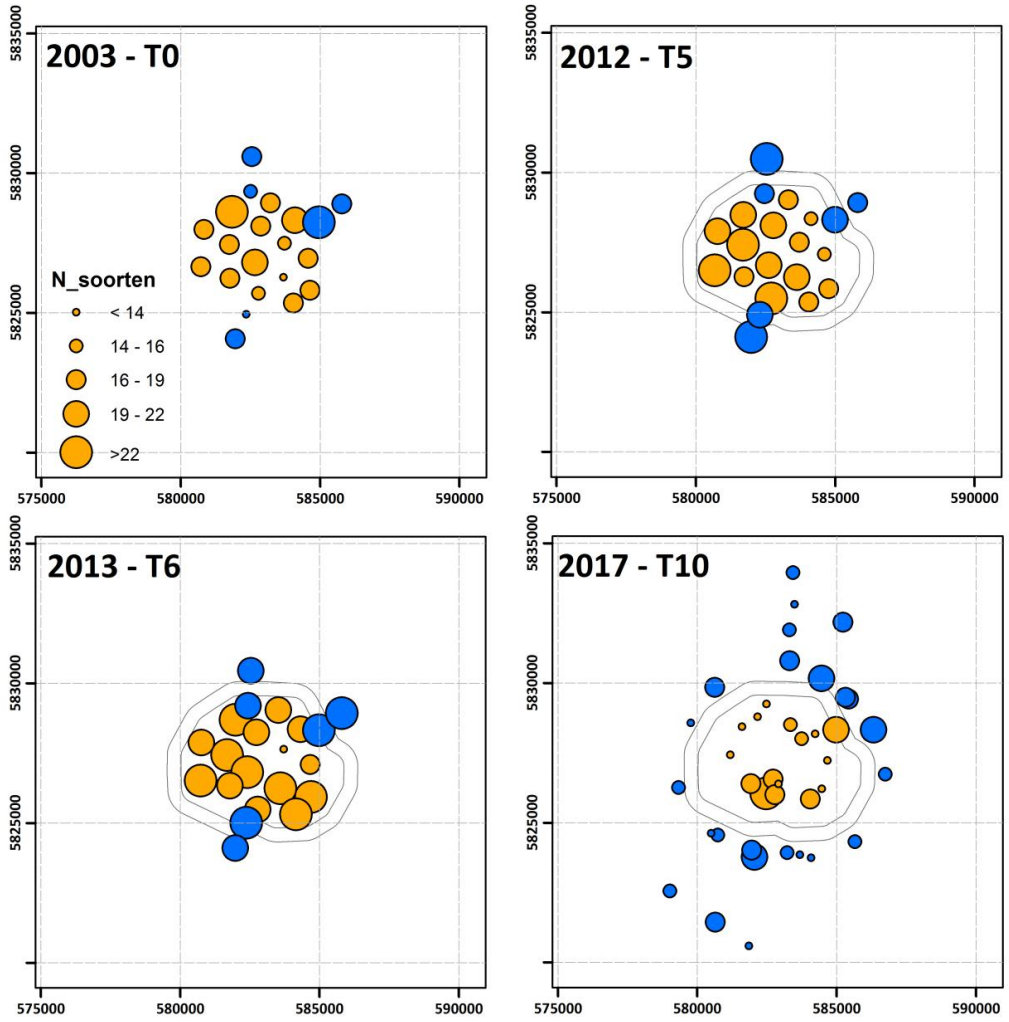


# Results

Univariate analysis

Multivariate analysis

# Number of species



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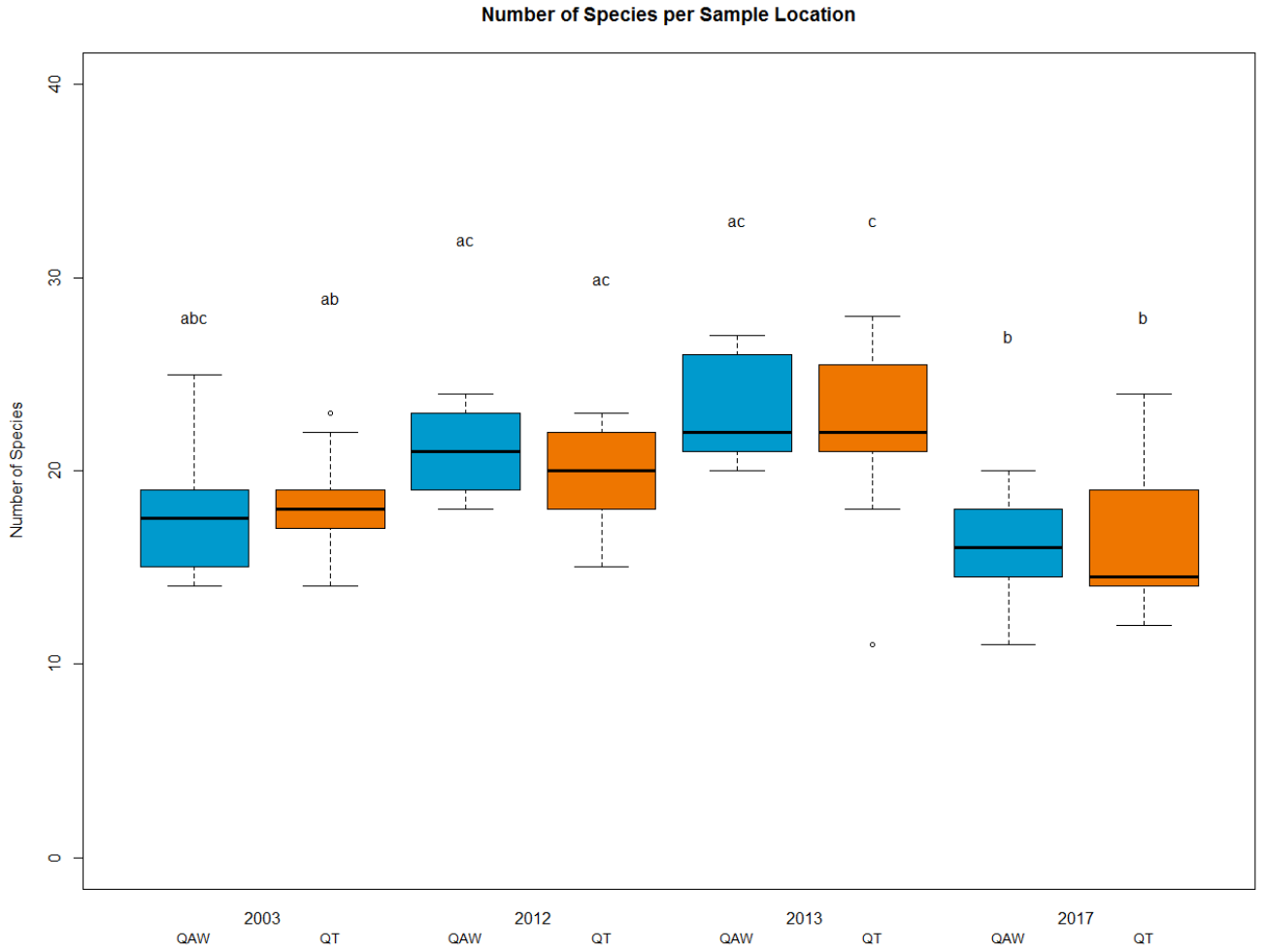
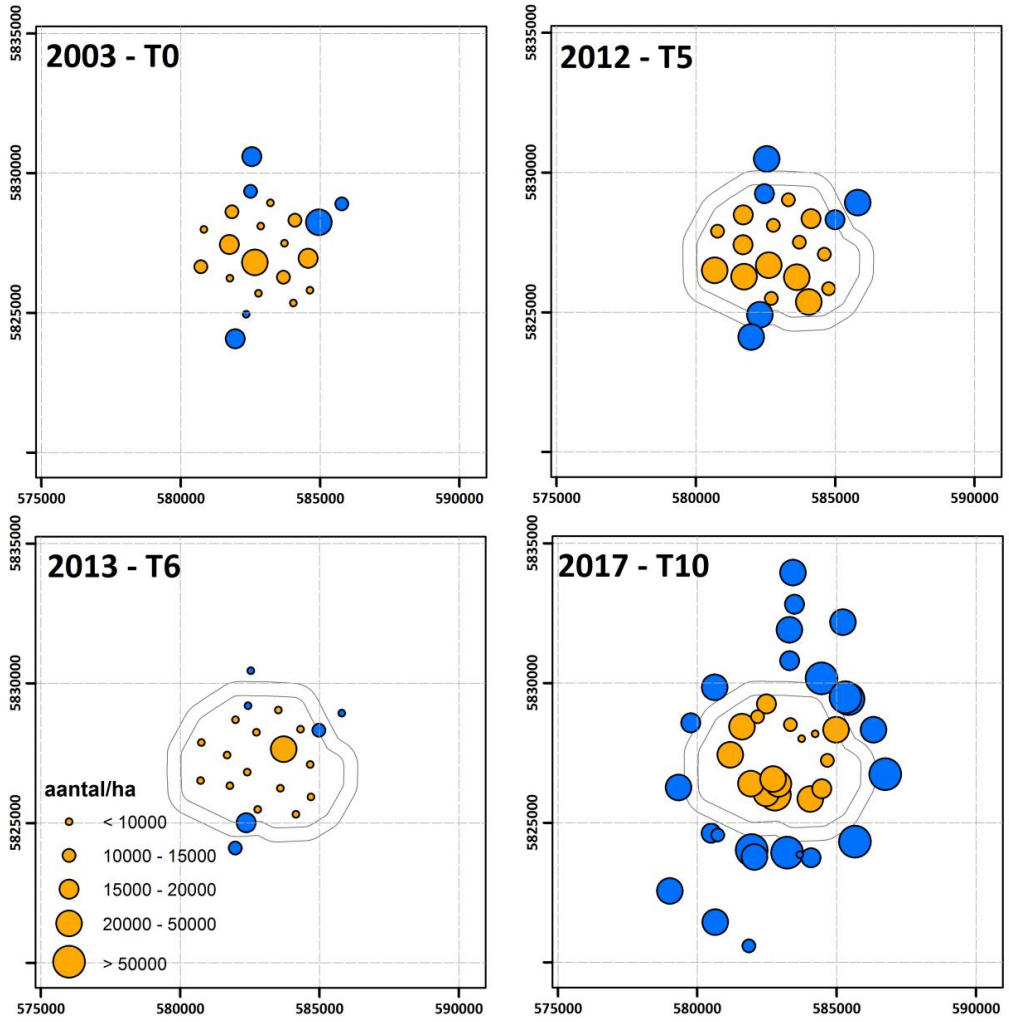


# Abundance (no individuals / 10000 $m^2$)



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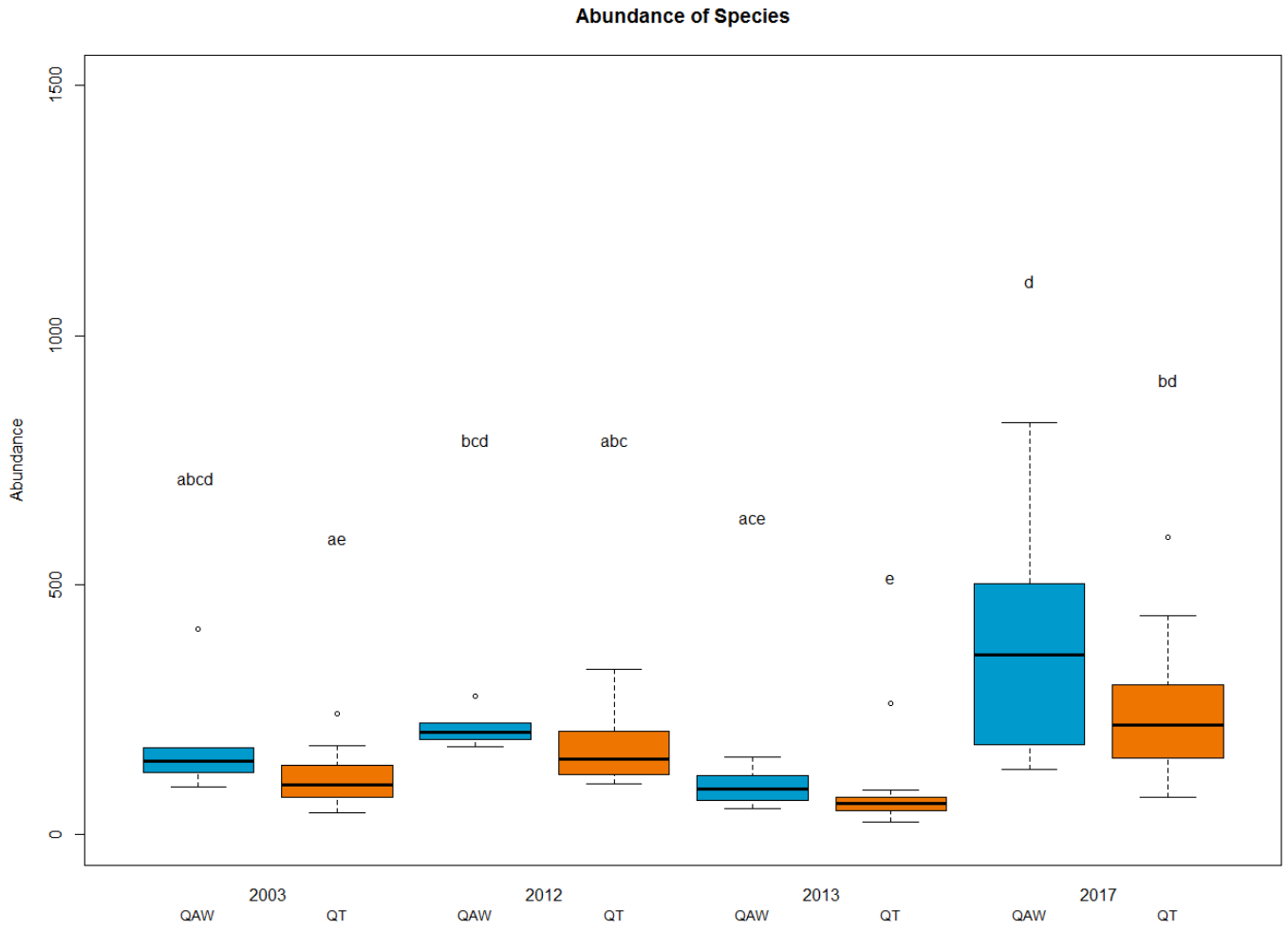
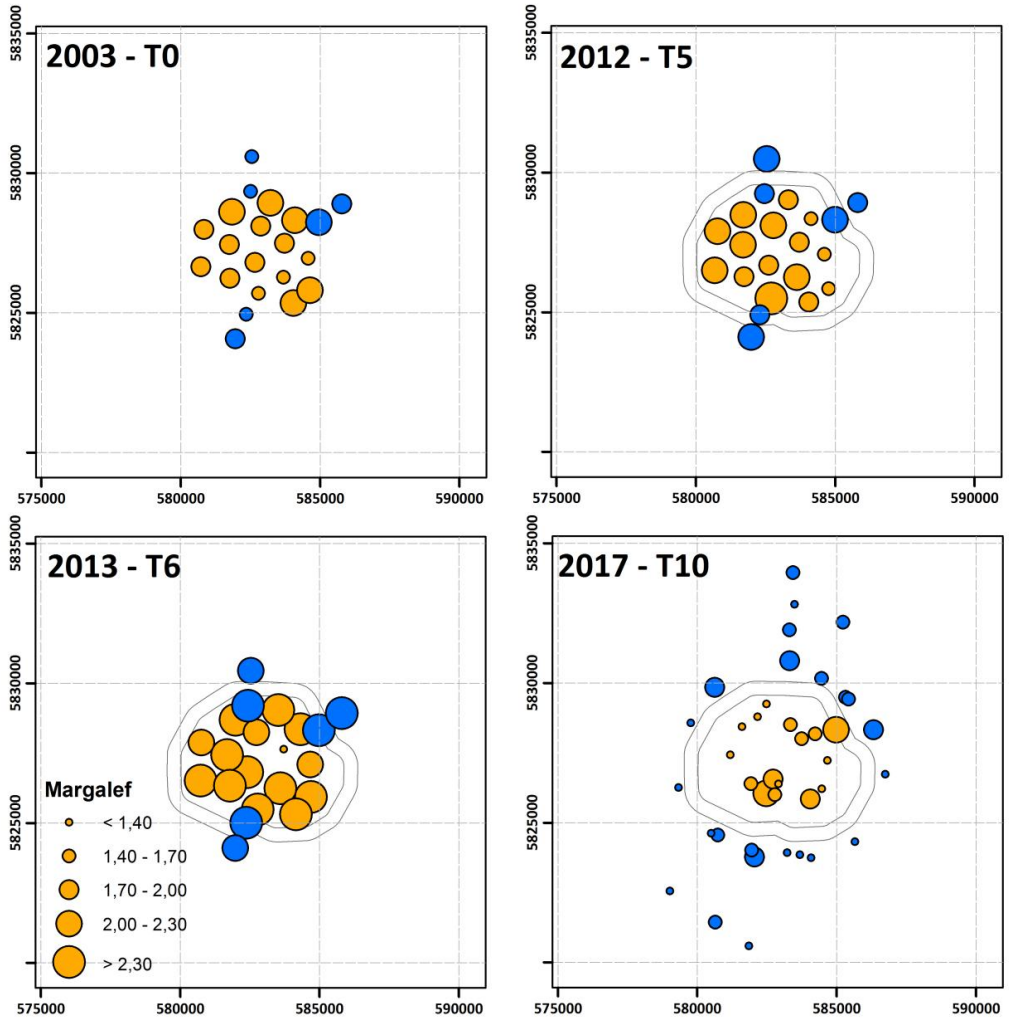


# Margaleff diversity index



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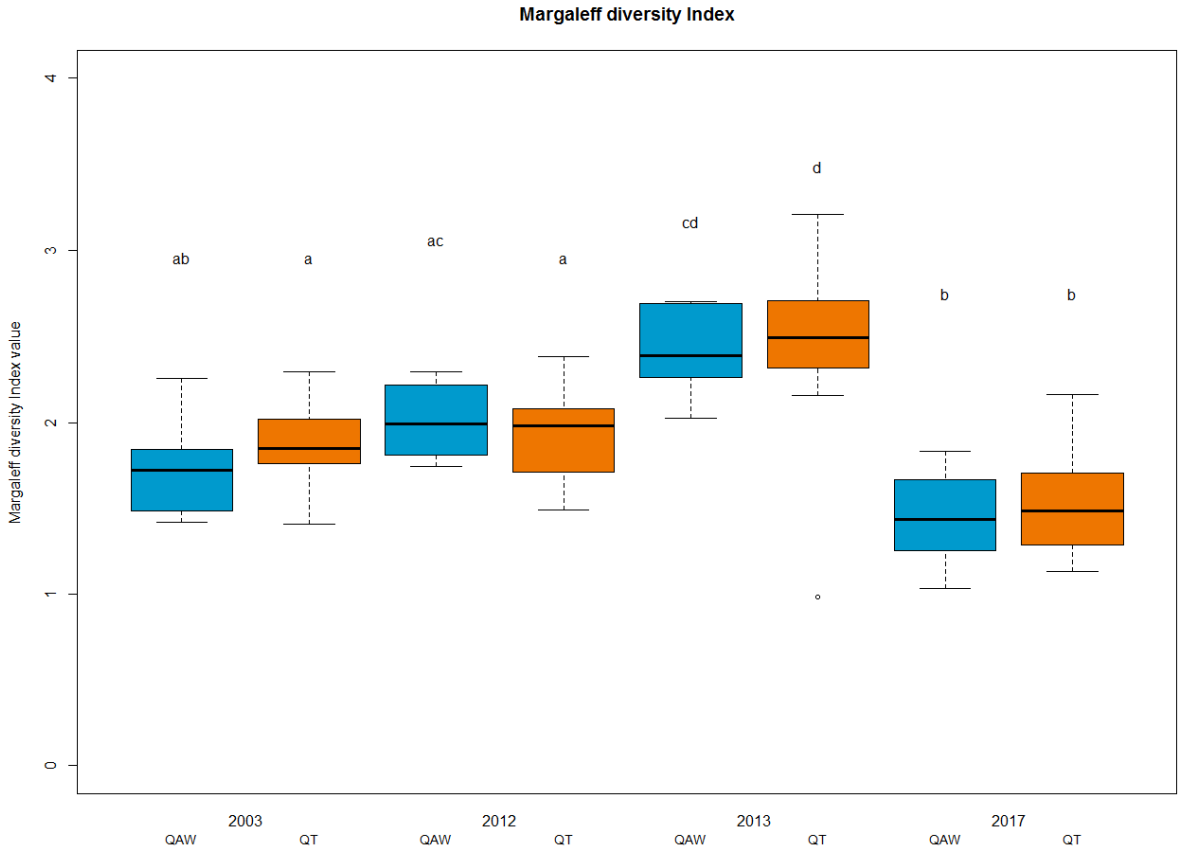
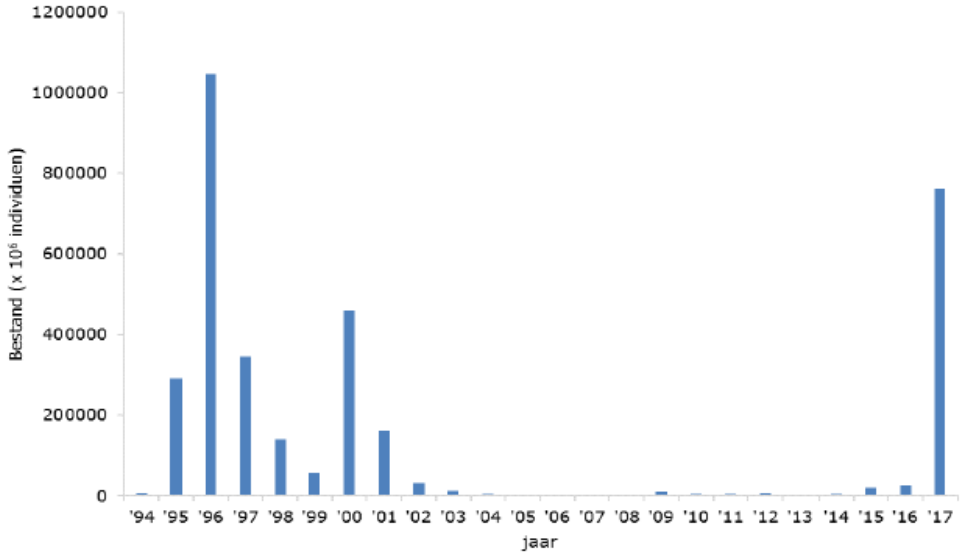


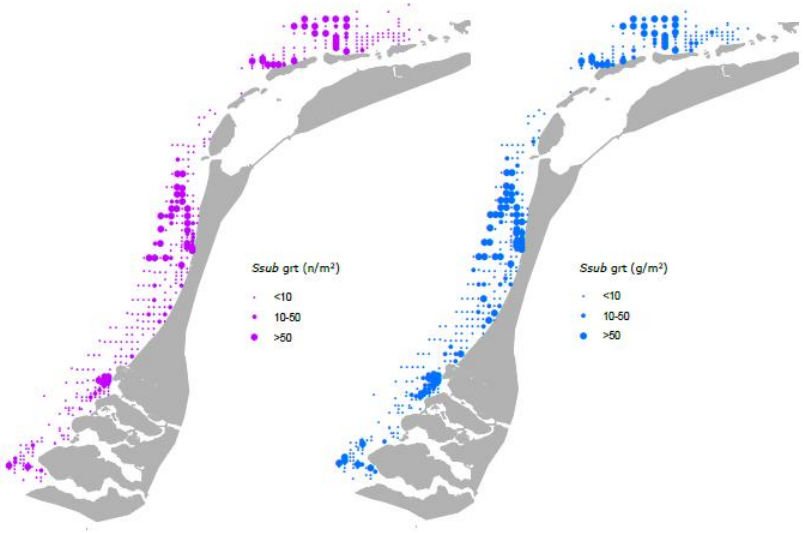
# *Spisula subtruncata* in 2017

WOT shellfish survey

Troost et al, 2017

High numbers of *Spisula*



# Environmental variables

- Relations of univariate species parameters with environmental variables were tested:
  - Depth (2003, 2012, 2013, 2017)
  - Fishing intensity (2003, 2012, 2013, 2017)
  - Organic matter (2012, 2013, 2017)
  - Sediment grain size (D50) (2012, 2013, 2017)

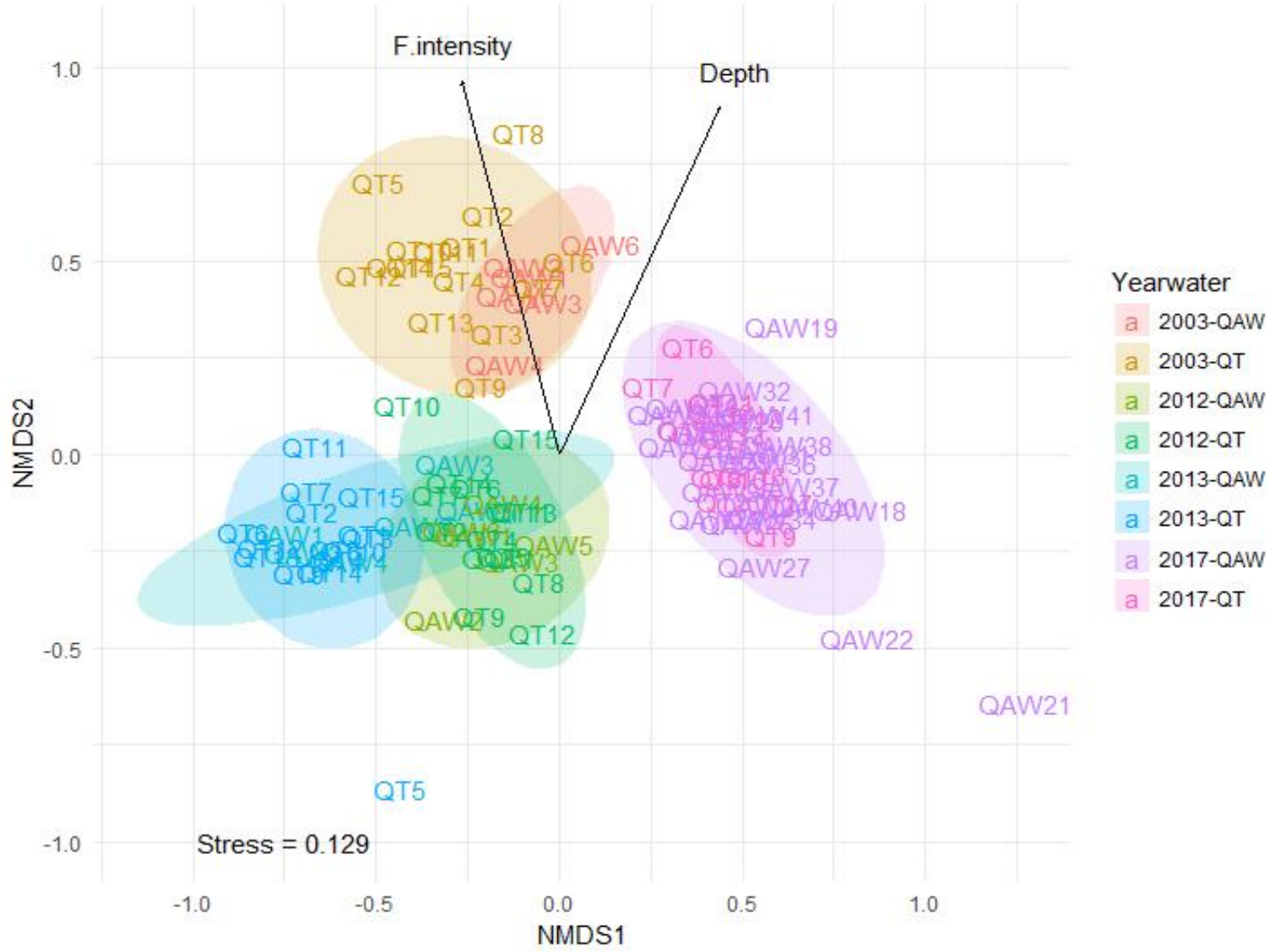
- Relations were small: when including all environmentral variables, a max. of 28% of the variation in the species parameters was explained.

# Conclusions univariate analyses

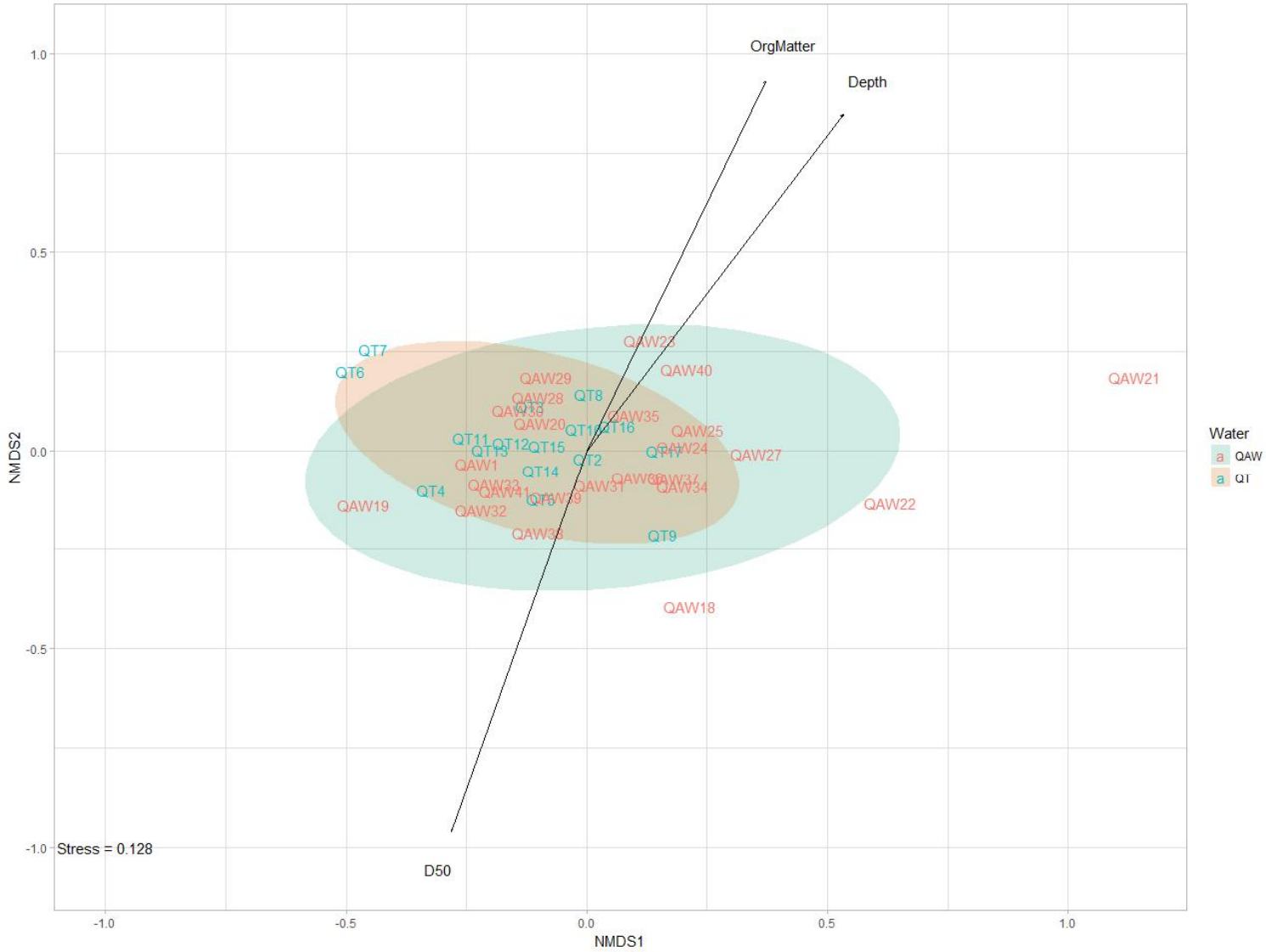
- Species diversity was rising 2003-2013 but was declined in 2017
- Abundance was variable from 2003-2013 and was increased in 2017

- Relations with measured environmental variables were small
- This indicates that other variables are responsible for the variation
  - Year to year variation (climate, etc.)

# Multivariate analyses: nMDS 2003-2017



# Multivariate analyses: nMDS 2017



# Correlations environmental variables

| $r^2$ values and significance (*) | | | |
|---|---|---|---|
| | 2003-2017 | 2012-2017 | 2017 |
| Year | 0.67*** | 0,81*** | |
| Depth | 0.20*** | 0.31*** | 0.35*** |
| Fishing intensity | 0.39*** | 0.01 | 0.03 |
| D50 | | 0.13*** | 0.23** |
| Organic matter | | 0.06* | 0.27*** |

# Conclusions multivariate analyses

- Clear temporal differences in species composition
- Differences between QT and QAW are very small

- Correlation of fishing intensity with species composition driven by 2003
  - No effect from fishing intensity when 2003 is excluded from analyses (but still strong difference in fishing intensity within and outside windpark)

- Other environmental variables showed only small relations with species compostion.

# Overall conclusions

- Strong temporal effects in both univariate parameters and species composition
- Measured environmental variables were less important
  - Year to year variation overrides other effects!
  - No clear effect of closing the OWP on larger soft substrate benthic fauna

- 2017 is a “strange” year:
  - 2017 very high in abundance and relatively low in species
  - 2017 some stations (21, 22, outside the park) had enormous density and biomass (Bivalve *Spisula subtruncata* and Gastropod *Euspira nitida*)

# Discussion

- Experimental design was changed.
  - Reference areas not representative (other environmental and factors)
  - Imbalance in datasets

- Only larger species investigated → Extra species trait analysis might give more insight?
- Is 10 years long enough to capture recovery?

# Questions?

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