

50th European Marine Biology Symposium

**Top-down or bottom-up**  
The role of birds in the  
Wadden Sea food web

Horn, S., Asmus, R., Enners, L., Garthe, S., Schwemmer, P., Asmus, H.



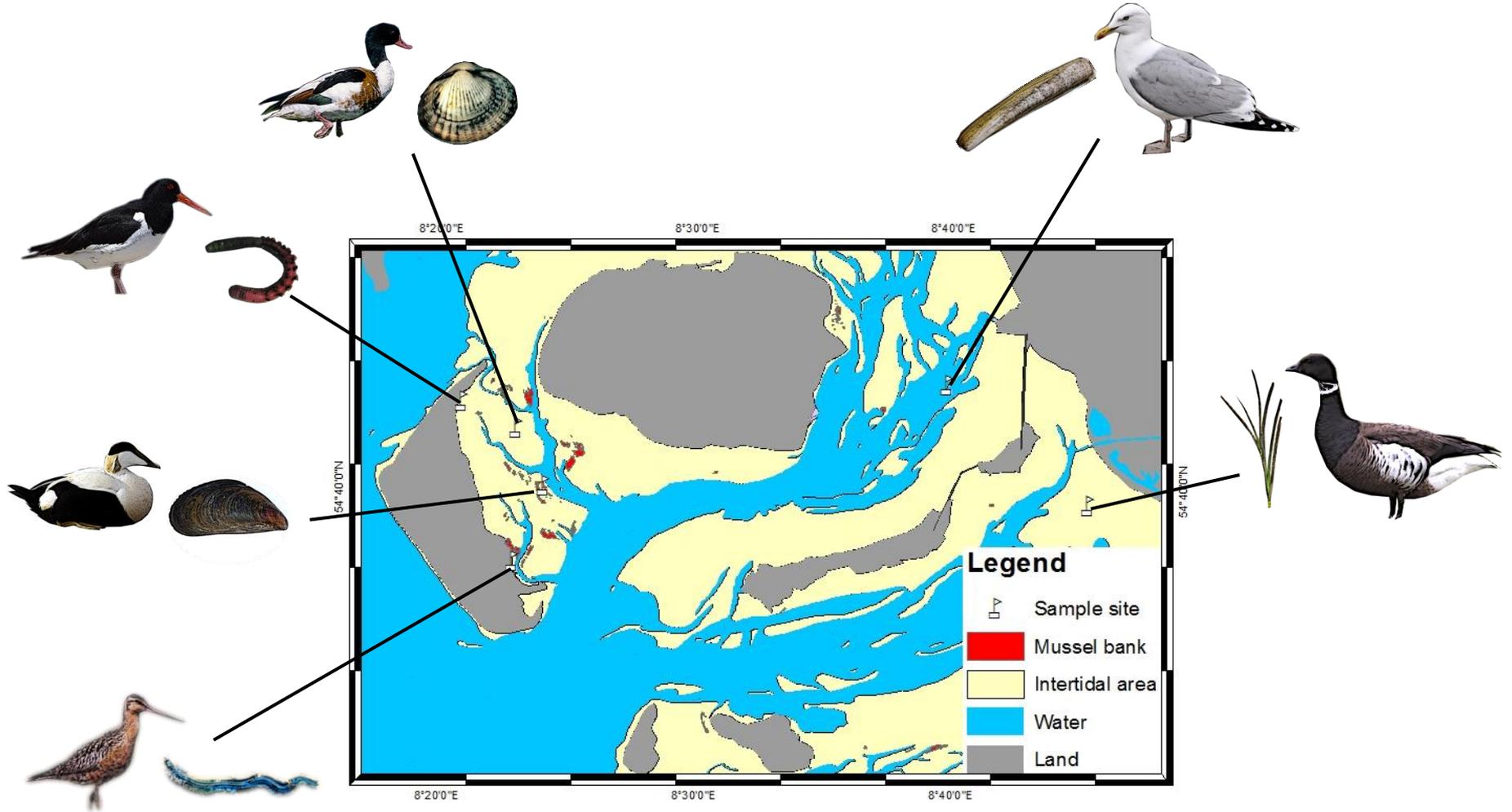
# Introduction



1. Which area is most important?
2. How do birds impact food webs?
3. Can birds be used as indicators?

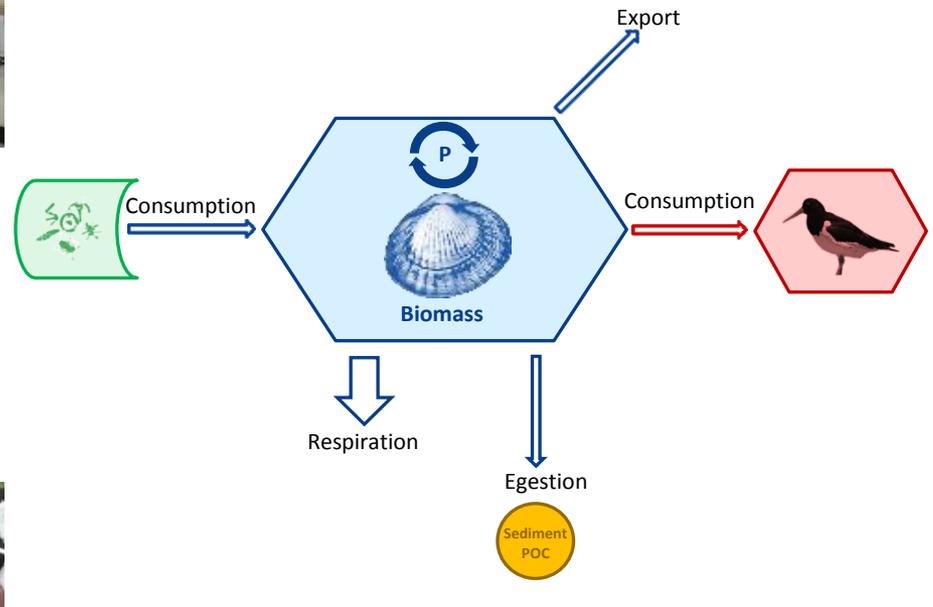
# Material and Methods

## Sample sites

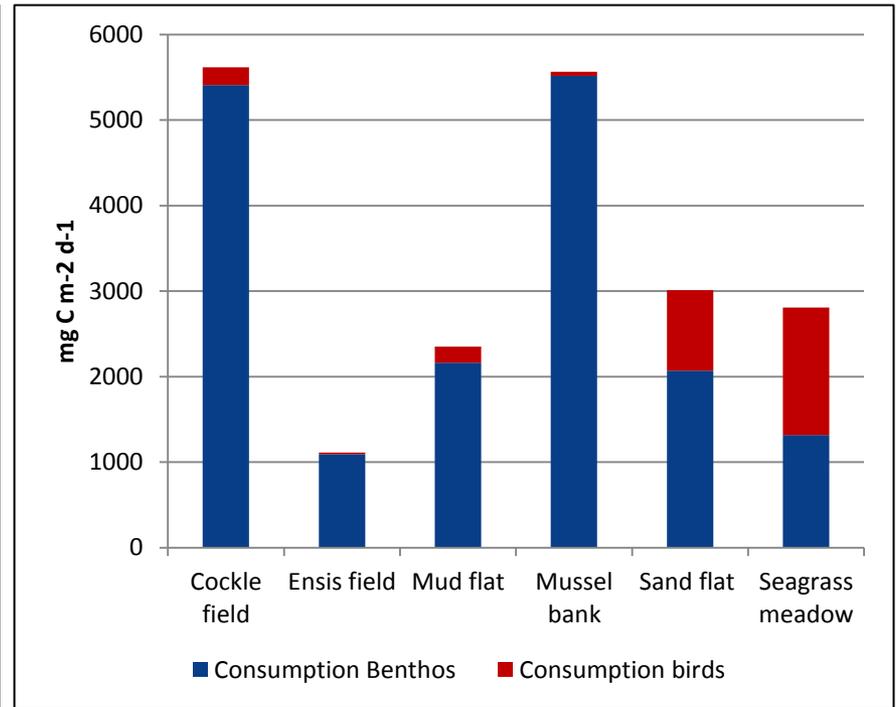
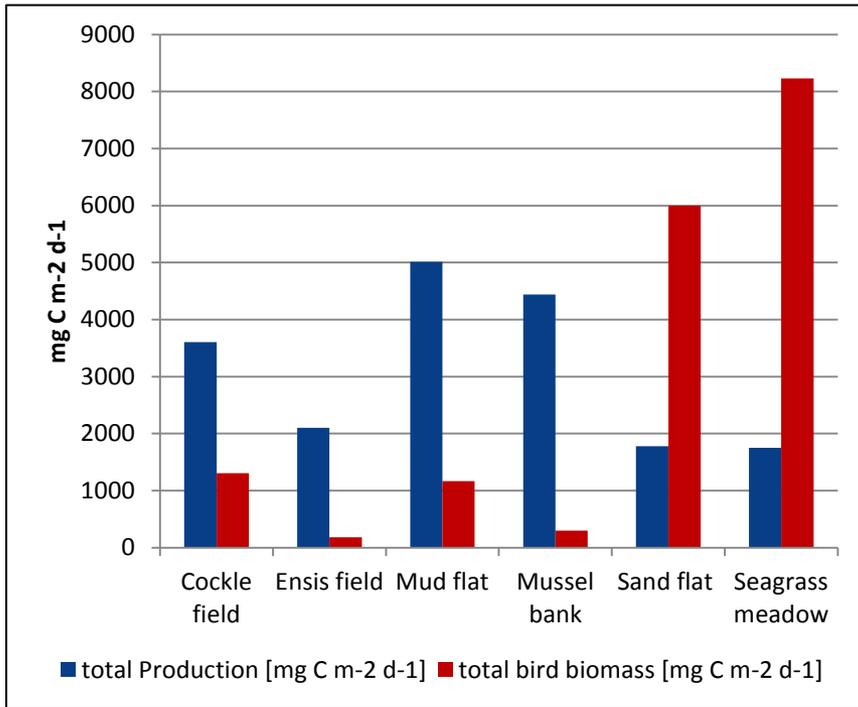


# Material and Methods

## Benthos and Bird data

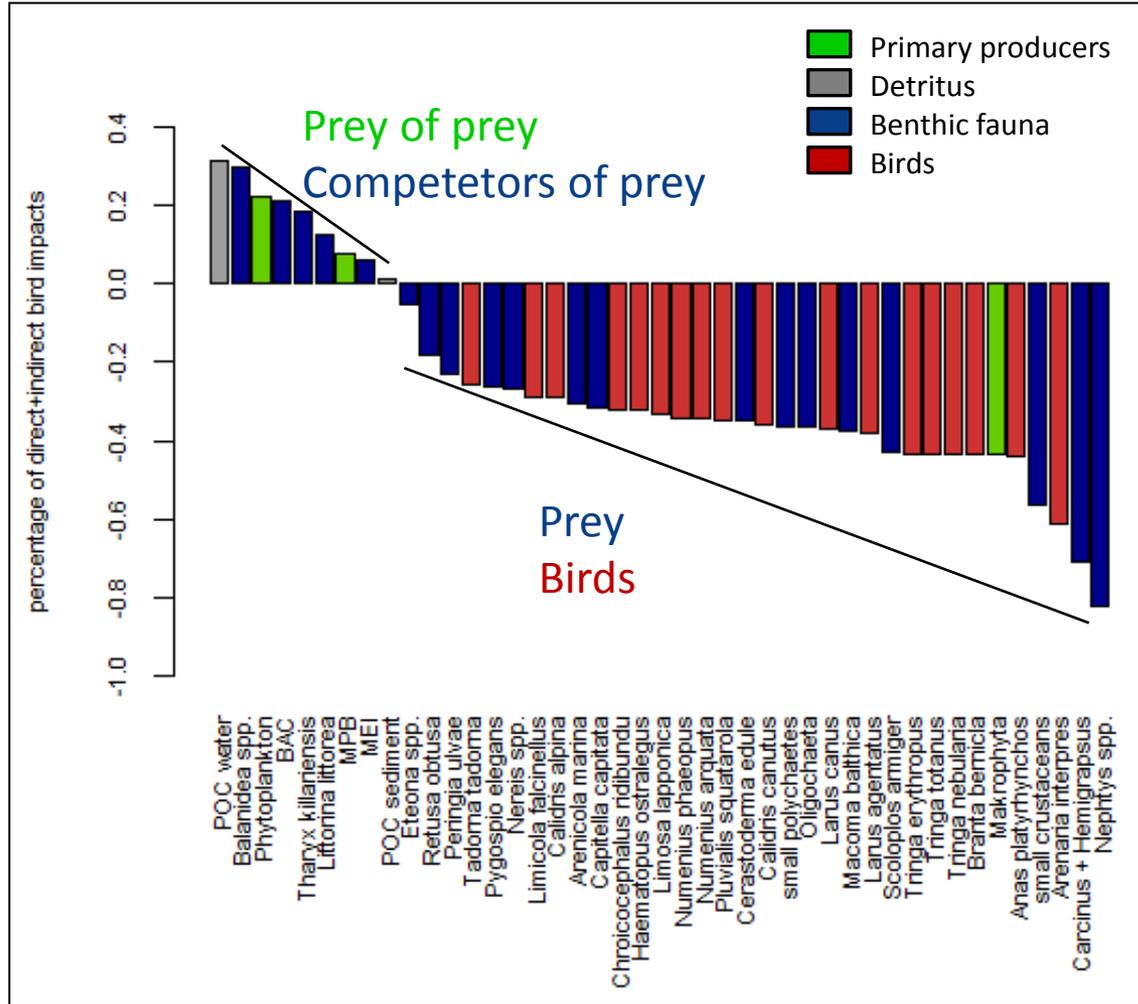


## Production and consumption



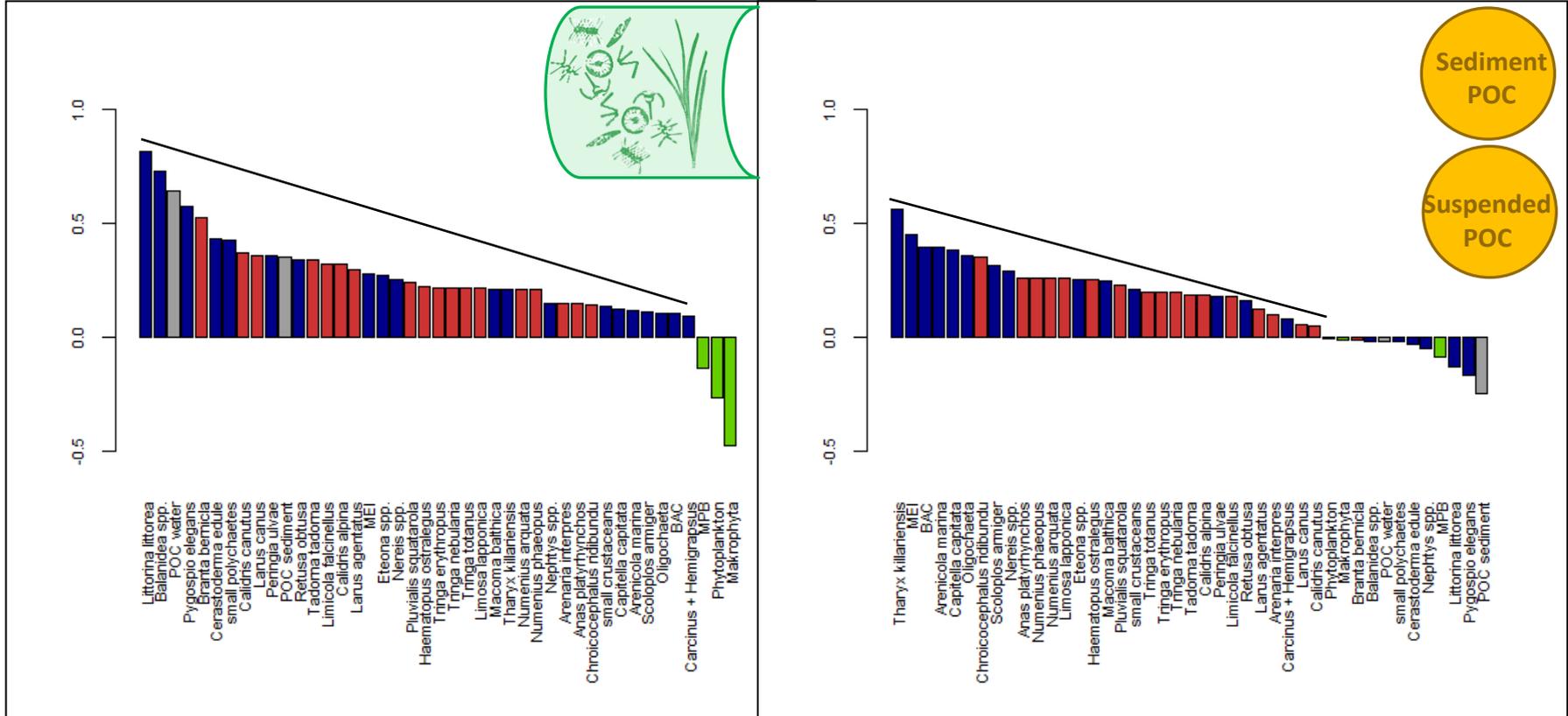
Highest bird occurrence and consumption on seagrass meadow and sand flat

## Impact analysis: Seagrass meadow



Birds induce important direct and indirect impacts within a food web

# Impact analysis: Seagrass meadow

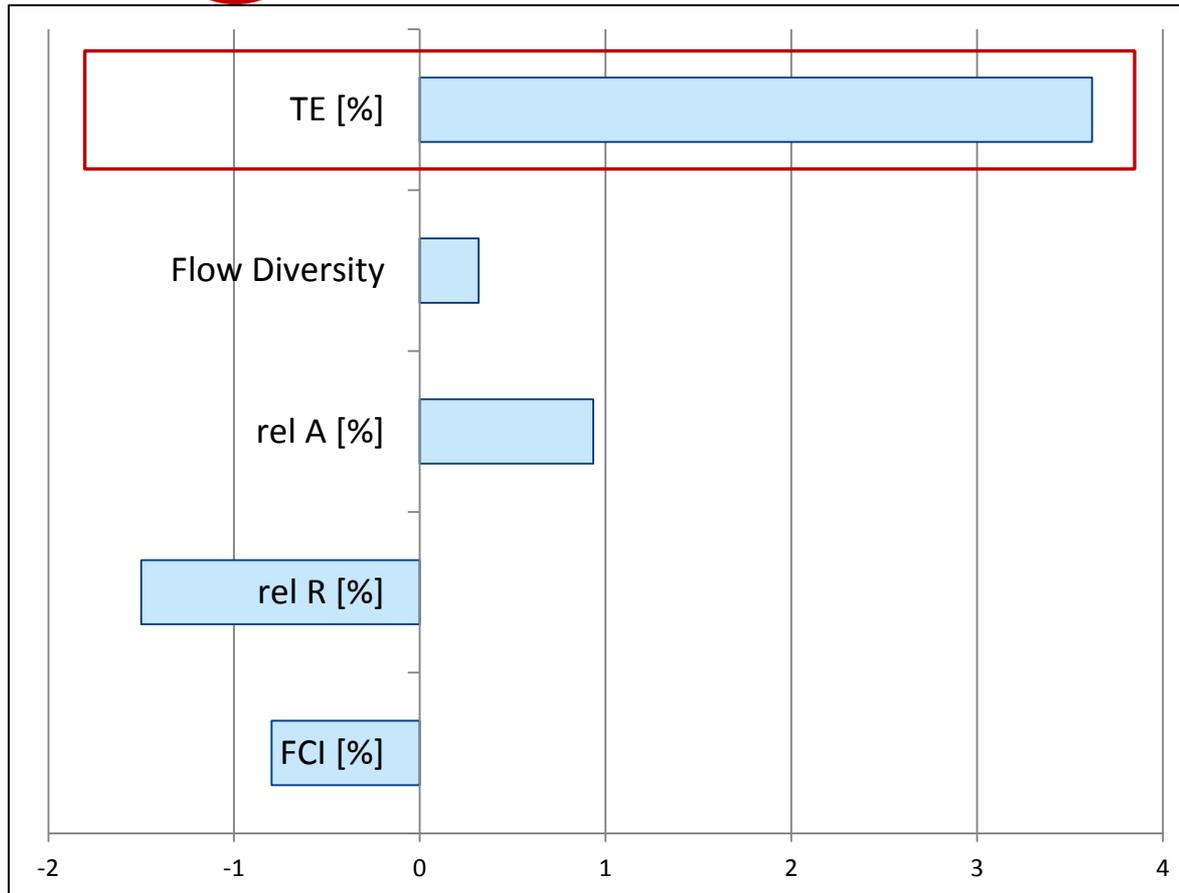


- Primary producers
- Detritus
- Benthic fauna
- Birds



# Results

## System attributes



TE: Trophic efficiency

Flow Diversity: Number of interactions and evenness of flows

Rel A: Organisation, productivity, maturity

Rel R: Resilience

FCI: Cycling

Birds increase efficiency, organisation and maturity of food webs, but decrease resilience and cycling

1. Which area is most important?

Sand flat and seagrass meadow

2. How do birds impact food webs?

Induce top-down cascade effect

Increase efficiency, organisation and maturity

Stable and organized food web less affected by disturbances

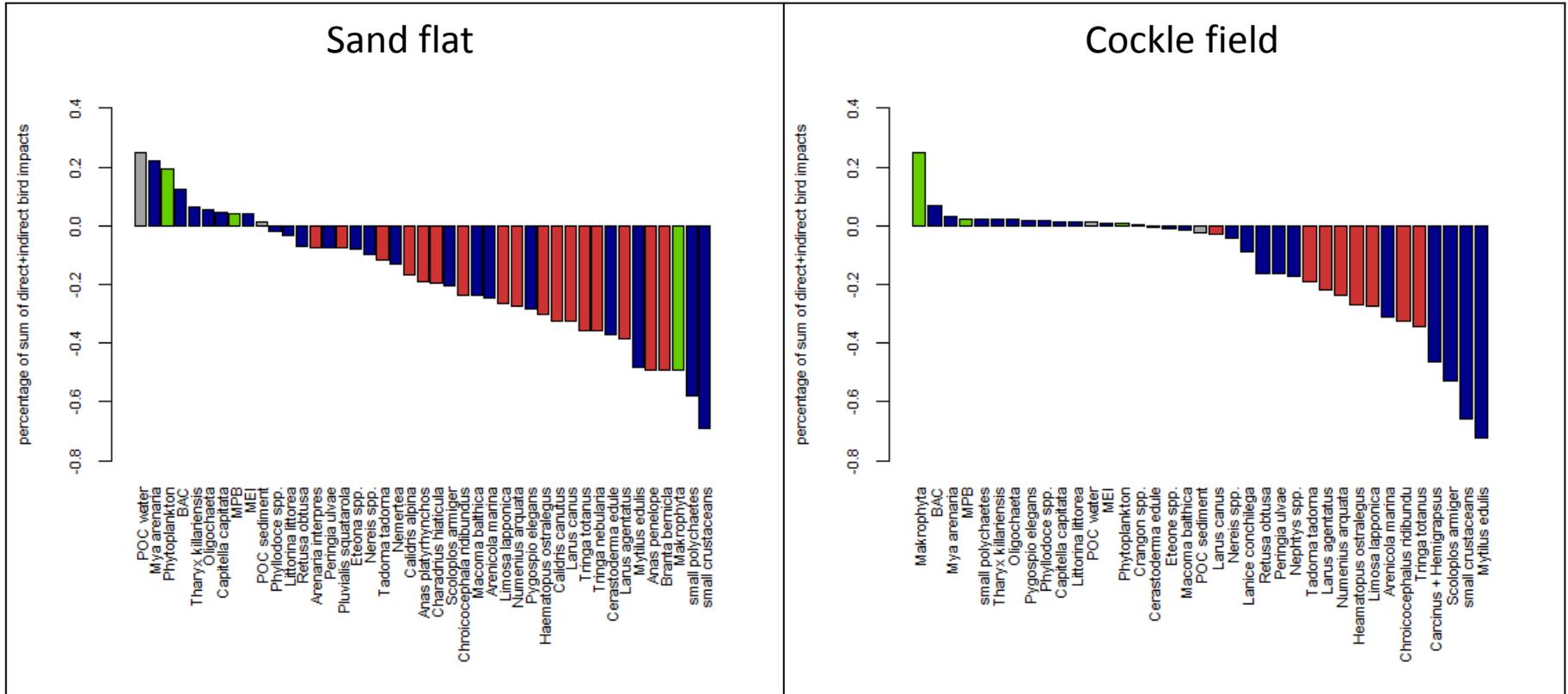
3. Can birds be used as indicators?

Birds can be indicators for a healthy food web

Thank you!



## Impact analysis: Sand flat and Cockle field



- Primary producers
- Detritus
- Benthic fauna
- Birds

## Impact analysis: Mixed trophic impact

Direct impact

$$[Q] = \begin{bmatrix} 0.0 & 1.0 & 1.0 \\ -0.667 & 0.0 & 0.0 \\ -0.333 & 0.0 & 0.0 \end{bmatrix}$$

Indirect impact

$$[Q]^2 = \begin{bmatrix} -1.0 & 0.0 & 0.0 \\ 0.0 & -0.667 & -0.667 \\ 0.0 & -0.333 & -0.333 \end{bmatrix}$$

Mixed impact

$$[M] = \begin{bmatrix} -0.500 & 0.500 & 0.500 \\ -0.333 & -0.333 & -0.333 \\ -0.167 & -0.167 & -0.167 \end{bmatrix}$$

