HOW WILL CLIMATE CHANGE AFFECT THE WADDEN SEA AND WHAT ROLE CAN NATURE RESTORATION PLAY?

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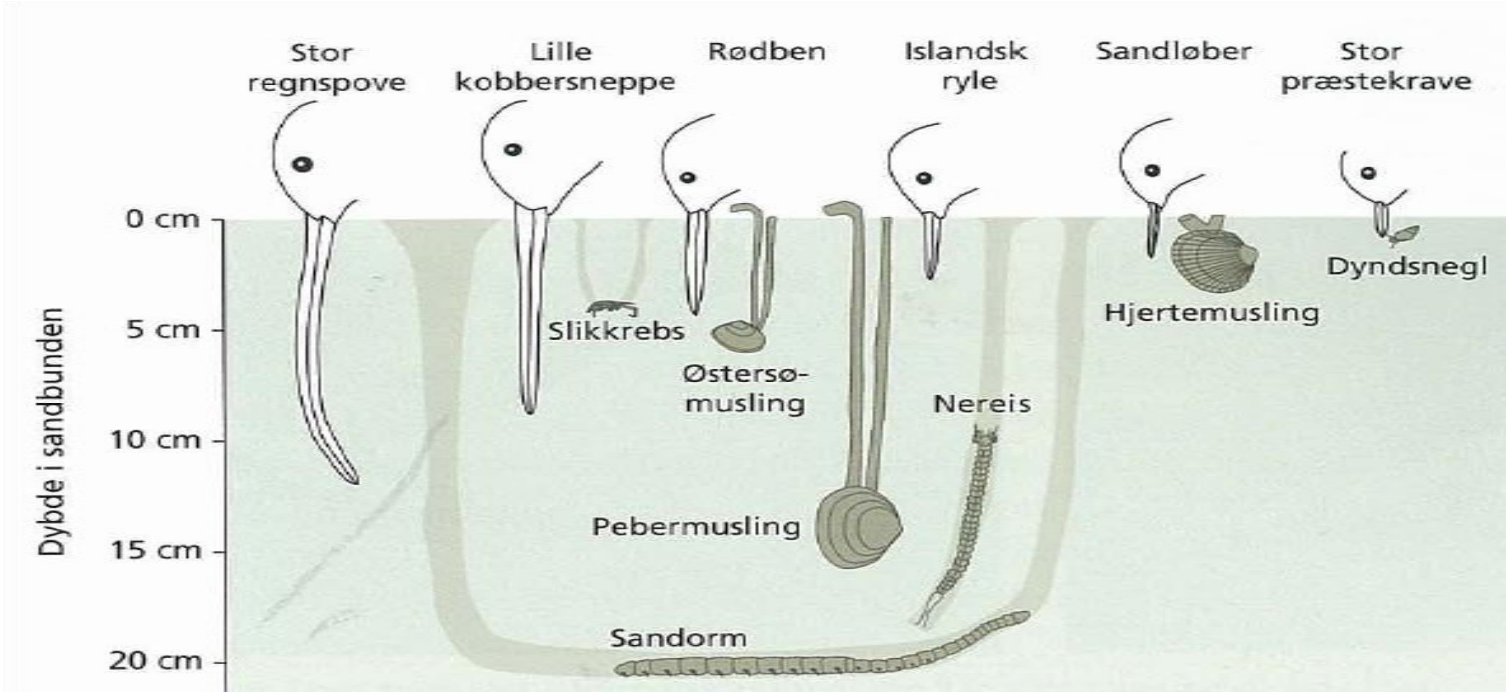
THIS TALK DEALS WITH SEDIMENTS

The thinks you have under your feet when walking on tidal flats

- SHOWN ON A LARGER SCALE

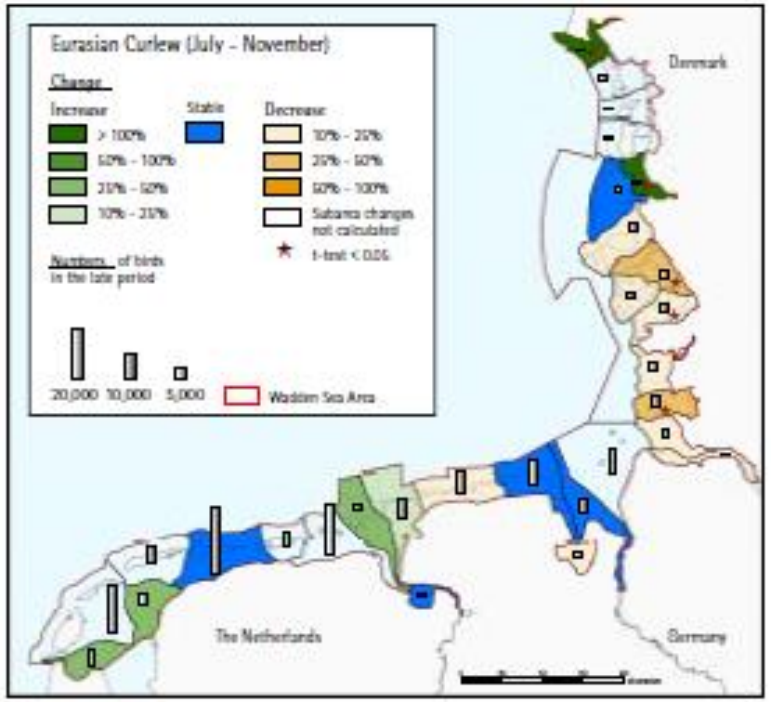
- SOMETHING ABOUT BIRDS



- AND SOMETHING ABOUT THE THREATS

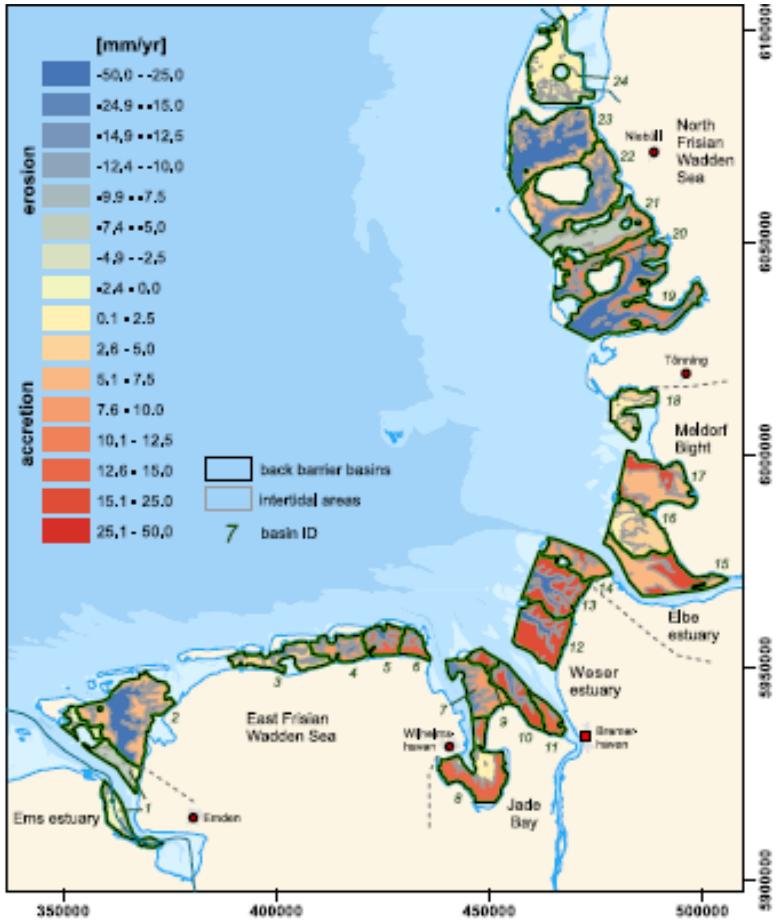
THE STUDY STARTED IN 2010

We found contrasting trends in the Wadden Sea, probably caused by the tidal amplitude and climate



THEN WE WAITED FOR TEN YEARS -

UNTIL CHANGES IN GEOMORPHOLOGY OF THE GERMAN SECTION WAS PUBLISHED



Blue colors: Erosion of sediments

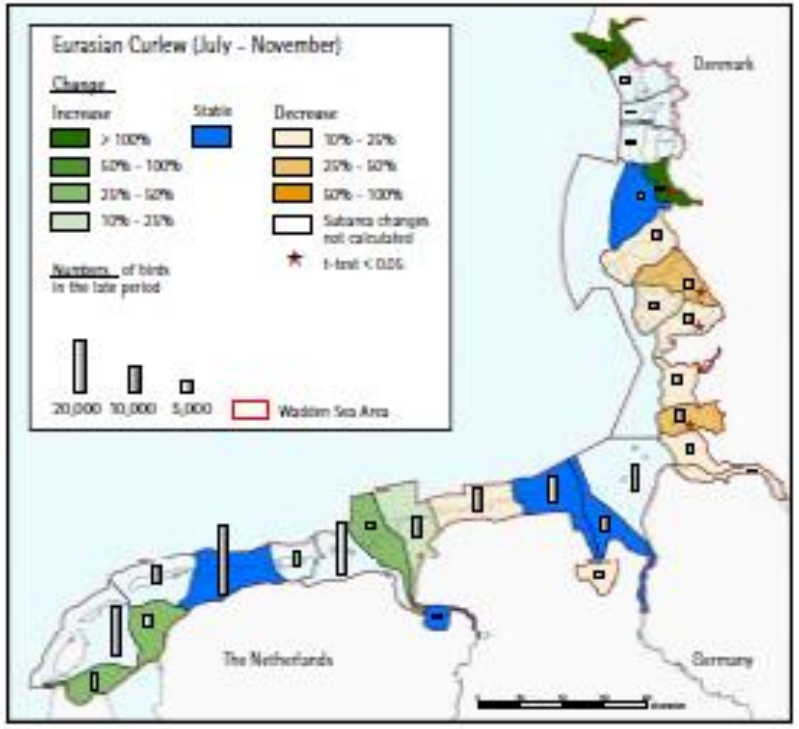
Cream color: Stable sediments

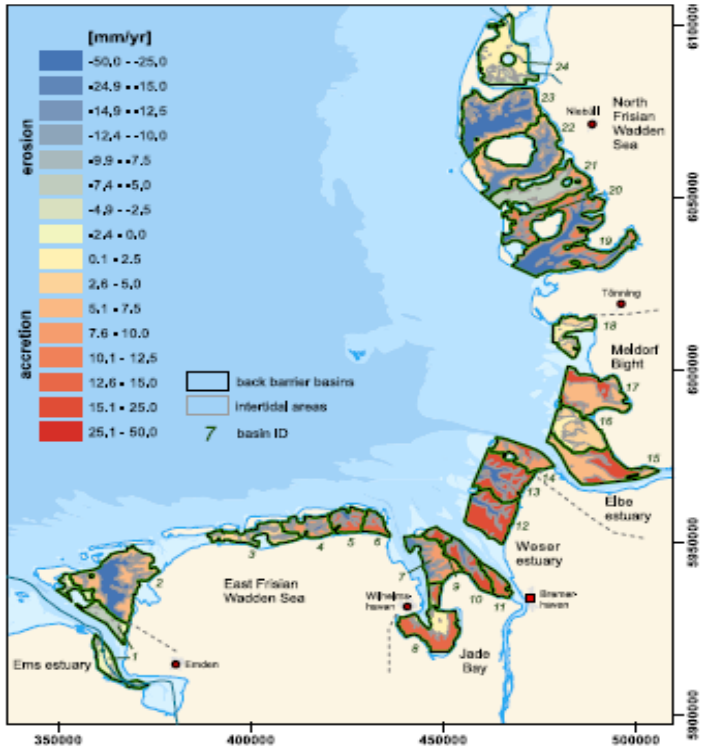
Brown color: Accretion-erosion of sediments

Benninghoff and Winter 2019

CHANGES IN WADER NUMBERS AND GEOMORPHOLOGY WERE ANALYZED

Data from the 'Joint Monitoring of Migratory Birds in the Wadden Sea' 1987-2019 was used





IT LOOKED SIMPLE, BUT MORE VARIABLES WERE INVOLVED

1. Regime shift in the North Sea and the Wadden Sea in 1988/89

2. Changes in geomorphology in the German sector

3. Changes in sea level rise in the German Bight

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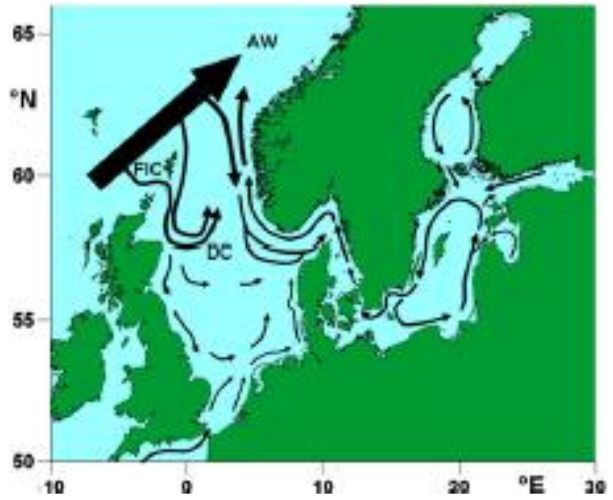
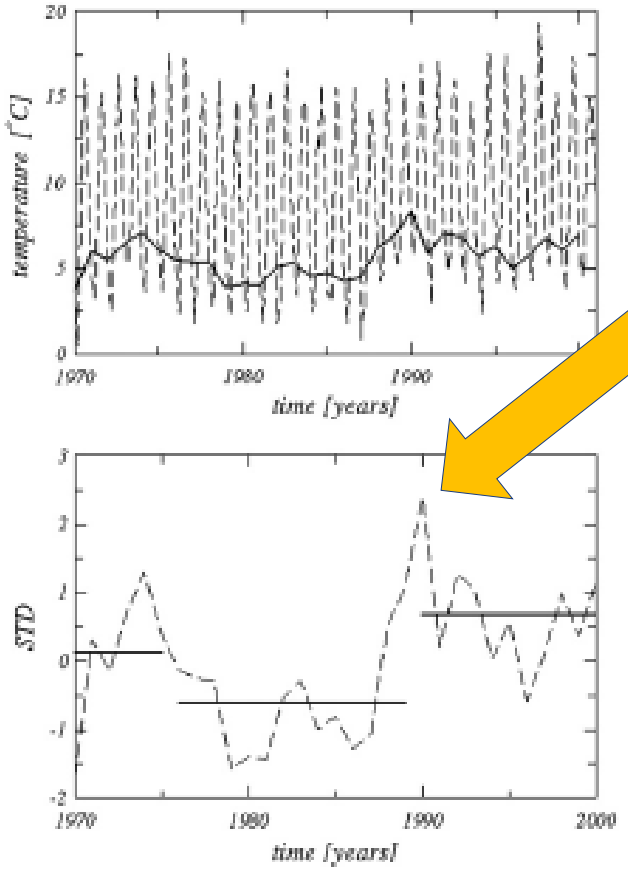
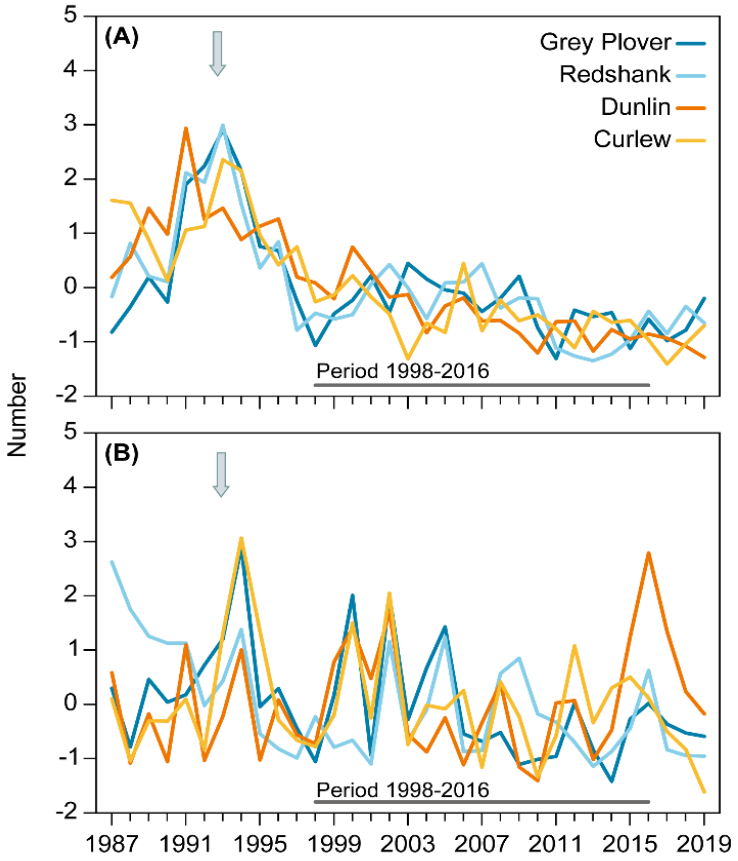
1. REGIME SHIFT





Warm water from the Golf Stream flowed into the North Sea and affected the Wadden Sea in 1988/89

REGIME SHIFT AFFECT BIRD NUMBERS THREE YEARS LATER



Number of four waders species in tidal basin no. 10 (A) and no. 23 (B)

Arrows indicate 1992

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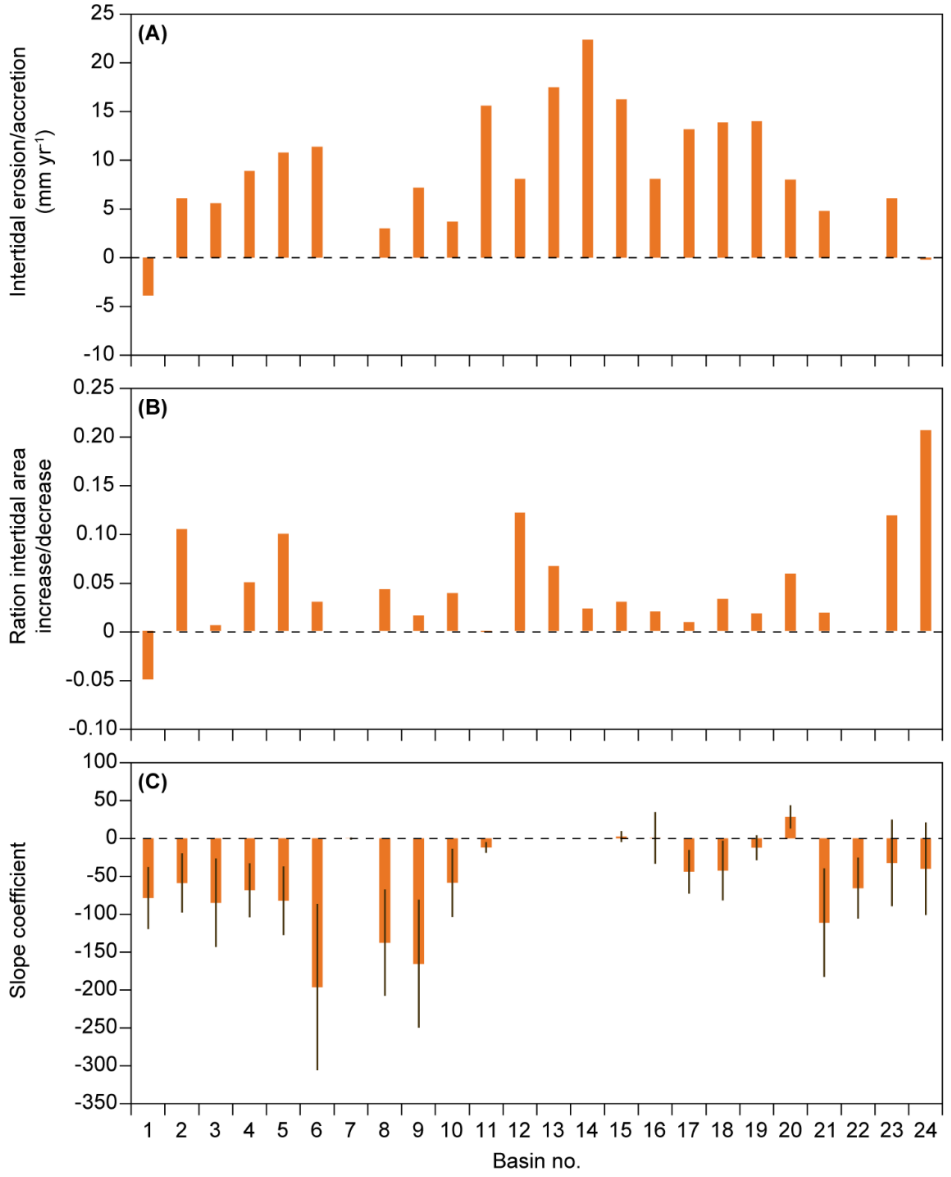
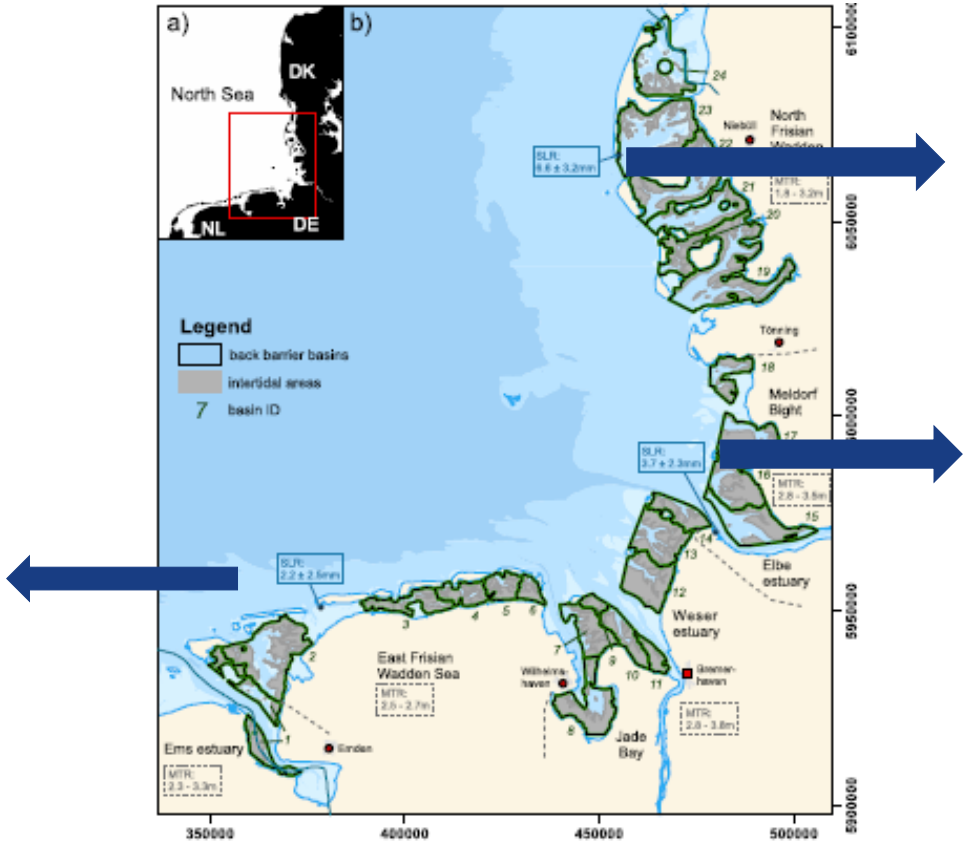
2. GEOMORPHOLOGY AND BIRD NUMBERS

Changes of tidal flats:

(A) Accretion-erosion
(B) Intertidal flat area
(C) Number of waders
(slope coefficient of trend lines)



3. SEA LEVEL RISE



Wang et al. (2013)

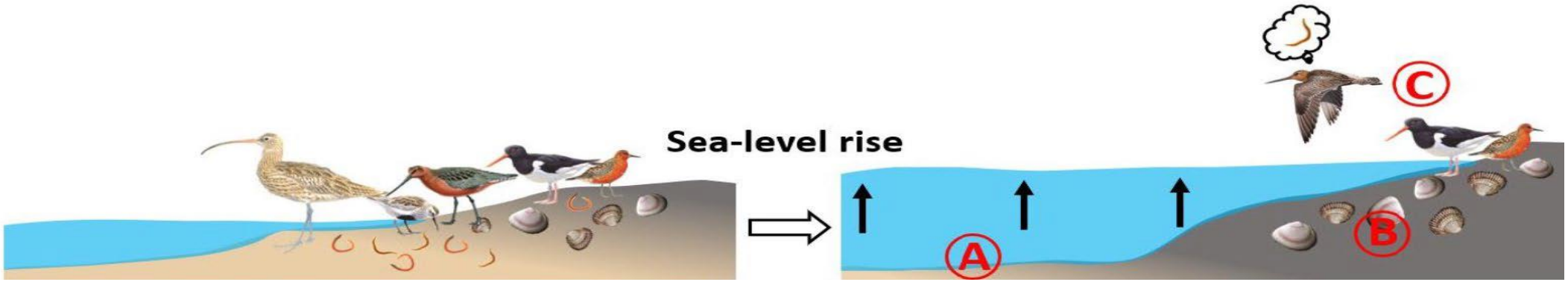
THE FINAL MODEL

Variables, period 1987-2019	F	df	p	Estimate
Changes of tidal flat size, km^2	7.79	1	**0.0061**	6.7714
Changes of accretion-erosion, mm yr^{-1}	8.68	1	**0.0039**	0.1582
Sea level rise, mm	11.13	1	**0.0011**	0.3418
(Accretion-erosion) * (Sea level rise)	18.1	1	**0.0003**	-0.0395

HOW CAN WE MITIGATE THESE CHANGES

1. On a regional scale these changes are difficult be mitigate
2. However, on a local scale there are some options

The problem we are facing:



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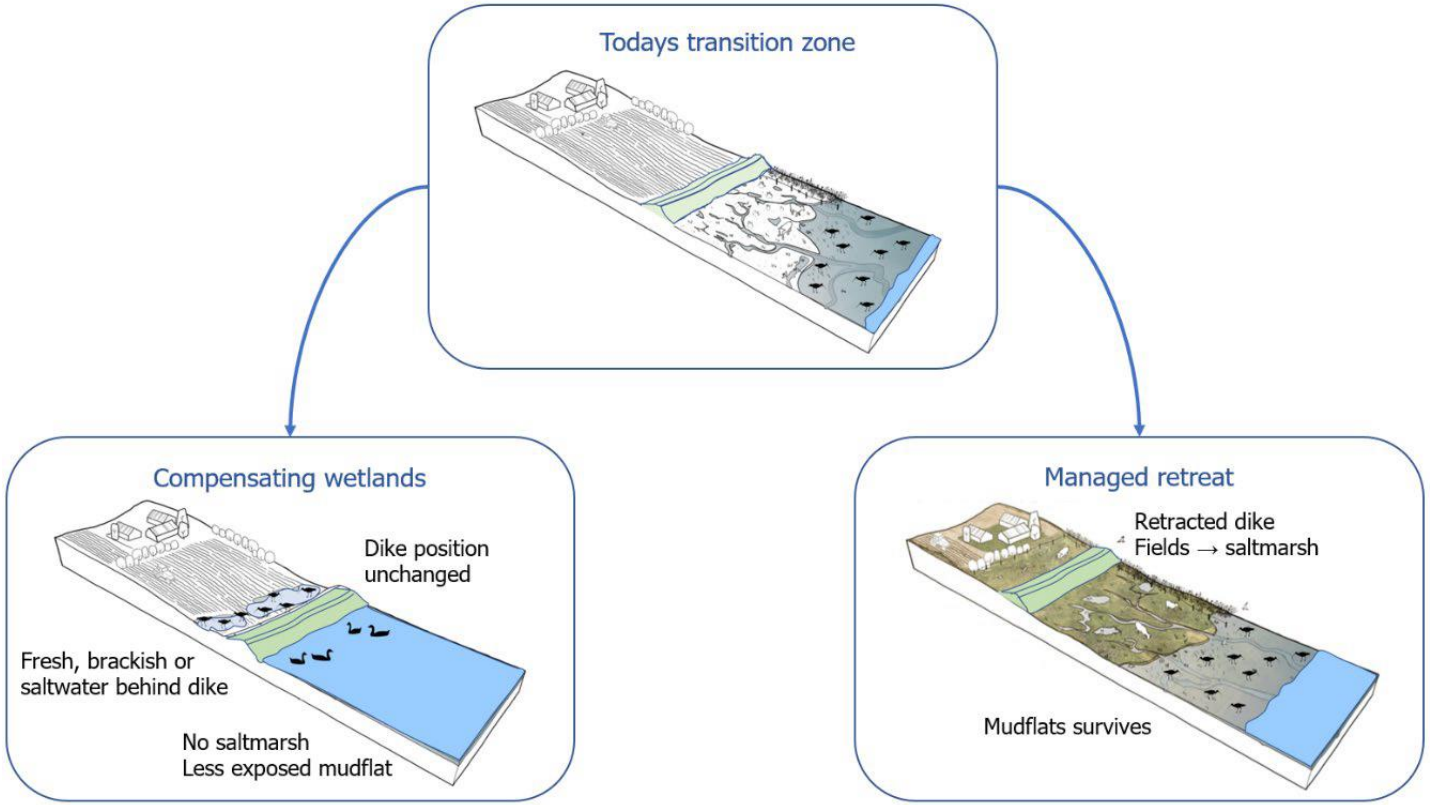
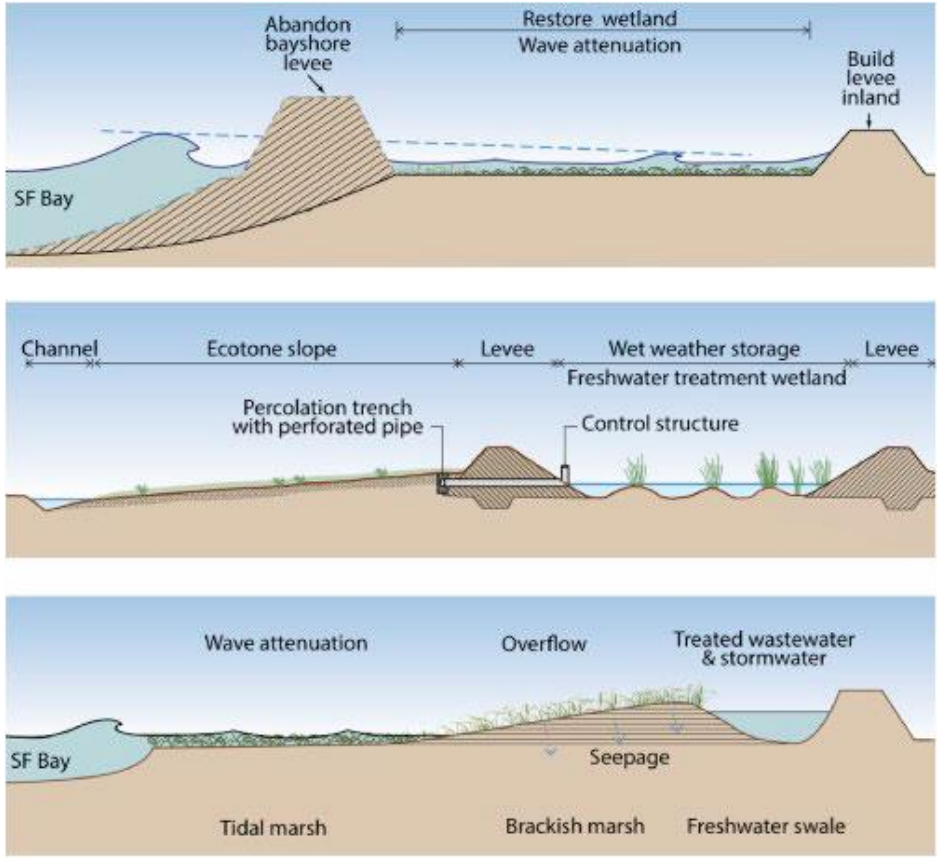
THERE ARE SOME OPTIONS

Create wetlands behind existent seawalls and/or withdraw seawalls and create saltmarshes and tidal flats in front



Redrawn from Ebbensgaard et al. 2022

- AND MORE TECHNICAL SOLUTIONS



Options for more resilient levees, habitats and shoreline protection. Top: moving the levee inland and buffering it with a wetland; middle, elements of Oro Loma experiment; bottom; profile of possible future shoreline gradient from fresh to salt water habitats. Source: ESA

Leo et al. 2019

A DANISH EXAMPLE

The Saltwater Lagoon in the Tønder Marsh

Established: 1984
Size: 250 ha

Salt water is pumped in from the Wadden Sea through a 800 m buried pipe

Max. numbers:
Dunlin: 55,000
Knot: 27,000
Golden Plover: 12,000

CONCLUSIONS

1. Decrease in wader numbers in the German Wadden Sea were initiated by a regime shift in the North Sea
2. Distribution of waders were driven by changes in geomorphology and sea level rise caused by climate change
3. Large-scale mitigating are difficult but possible. However, on local scales management of costal zones are possible.

THANKS TO HUNDREDS OF BIRD COUNTERS IN THE WADDEN SEA, TO THE JOINT MONITORING MIGRATORY BIRD GROUP, TO JOHN FRIKKE FOR FOTOS, AND TO YOU FOR LISTENING