Studying effects of sand nourishments on fish and birds

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"The strong correlations of fish biomass with habitat destruction and top predators are more likely to reflect causality [...] then nutrient loadings."
Effect pathways on fish
Sediment preference of juvenile sole

Field study into effects of nourishments on fish

Research question: What are the medium-term (10-20 years) effects of sand nourishments on juvenile fish habitat?

Methods:

• Multiple surveys into the distribution and density of juvenile fish along spatial gradients in the shallow coastal zone.
• Statistical analysis to construct habitat models.
• Predicting the effects of nourishments on morphology and juvenile fish habitat quality.
Survey locations

- Location 1: Zuid-Holland
- Location 2: Noord-Holland
- Location 3: Texel
- Location 4: Ameland
  => 4 consecutive weeks from South to North
- Location 5: Schiermonnikoog in 2018
Transects: sampling

- Transects based on sediment
- Stratification based on depth
- Fish sampling:
  - 0-1 m: walking, seine net
  - 1-4 m: dinghy, 2 m beamtrawl
  - 4-10 m: vessel, 3 m beamtrawl + acoustics
- Benthos sampling each location
- Zooplankton, one sample per transect
- Continuous recording temp., salinity.
Missing hauls
Survey - Sediment
Survey – Underwater camera
One example result. On RNA:DNA ratios in fish

**Plaice**
- $R^2 = 0.0486$
- $p = 0.016$

**Dab**
- $R^2 = 0.239$
- $p = 1.5 \times 10^{-19}$

**Sole**
- $R^2 = 0.0250$
- $p = 0.13$

**Dab 0-group**
- $R^2 = 0.3$
- $p = 5.5 \times 10^{-10}$

**Sole 0-group**
- $R^2 = 0.0288$
- $p = 0.2$

**Salinity**

**Location**
Ebb-tidal deltas: fish-eaters’ paradises
Sand eel in the Ameland ebb-tidal delta

- Sand eel are staple food for birds and sea mammals and dependent on sediment characteristics.
- As part of the pilot project on nourishment of the Ameland ebb-tidal delta, we sampled for sand eel using a special dredge, at night.
Number of sand eels/ha: A) Lesser; B) Raitt's; C) Great; D) ratio.

Number of shellfish/ha: A) *Spisula*; B) *Limecola*; C) *Donax*; D) *Ensis*.
Sandwich terns

- Outer deltas are used extensively by Sandwich tern foraging on sand eels and herring/sprot during the breeding season.
- Research question: can sand nourishments affect the foraging possibilities of Sandwich tern?
- Research method: telemetry study to pinpoint the foraging locations in an ebb-tidal delta as precise as possible.
- 2018: pilot study on five birds.
2415
Exploring its premises
23-31 May 2018

Base AB3-080

Leeuwarden
Friesland

Google Earth
During chick feeding
28 May - 7 June 2018
Further work on terns

- Next year (hopefully) fifteen Sandwich terns can be followed.
- This year’s pilot showed that the combination of temperature and accelerometer data can pinpoint the location of foraging dives.
Conclusions

- Various effect pathways of sand nourishments on fish and birds exist, but unravelling these from other effects is not an easy task.
- Fish and bird species are mobile and show large resource flexibility. Effects of sand nourishments may appear rather through medium to long-term cumulative burden than through short-term direct effects.