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CAN PULSE TRAWLING REDUCE THE MECHANICAL IMPACT ON THE BENTHIC ECOSYSTEM IN THE BOTTOM TRAWL FISHERY FOR SOLE?

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Abstract

In the beam trawl fishery for sole in the North Sea, the twin beam trawl has dominated the fishery since the 1960s. Beam trawlers used heavy gear with tickler chains to chase sole out of the sea bed. The fishery is criticised for the mortality imposed on benthic invertebrates, the adverse effects on the sediment structure and on the high energy consumption. Since 2010, a number of vessels has switched to the economic more profitable pulse trawling technique which uses electrical stimuli to immobilise the target species. Because electric fishing is illegal in the EU, the pulse trawlers operate under a temporary derogation pending a decision on the sustainability of the innovative technique. Here we analyse VMS and landing and effort data of a subset of the Dutch fishing fleet that have switched from tradition beam trawling to pulse trawling. We compare the changes in fishing effort since 2009, compare the spatial distribution of both gear types and estimate the change in the footprint (areal extent of fishing activities) and trawling intensities profile by habitat type. Using recently developed impact methods, we estimate the impact of both fishing gears in terms of the change in benthic biomass, the shift in the longevity composition of the benthic community and the resuspension of sediment.

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Presentation story line

1. Title slide: results of BENTHIS Case Study

2. Beam trawls replaced otter trawls to fish soles as it allowed the use of multiple tickler chains to chase soles out of the sea floor

   Beam trawls heavily criticised for their adverse impact on sea bed and the benthic ecosystem

   Beam trawling requires powerful engines --> high fuel consumption

3. Technological innovation to replace mechanical by electrical stimulation

4. Pulse trawls cause cramp response

5. Comparison gear characteristics. Pulse trawls much lighter, less bottom contact, lower towing speed. Expectation of reduced impact (CO_2 emission, benthic impact, improved selectivity (more sole, less discards)

6. Transition in Dutch fleet from tickler (to sumwing) to pulse

   Of 84 licences, 75 licenses used in sole, 4 licenses shrimp fishery)

7. We studied the mechanical/physical effects: type of mechanical effects

8. Study mechanical impact (2 field experiments: tickler chain and pulse trawl disturbance with commercial gears; reference site)
   Disturbance seabed: multibeam, SPI, boxcore
   Resuspension of sediments:
   Benthic mortality: BACI
   Feeding response (stomach analysis)

   Sediment resuspension:
   Omdat het resultaat hiervan complex is door verschil in silt fraction tussen pulse en beam rawl site, en omdat de boomkor een erg licht net gebruikte (enkel gebreid) met minder weerstand is de uitkomst niet representatief voor de boomkorvloot. Zou het daarom liever weglaten.

9. Multibeam resultaten.

10. Multibeam resultaten: geeft schatting van de verandering in diepte trawl track = verlies /verplaatsing van sediment.

11. Penetration SPI geeft de dikte van de verstoorde laag.

12. Resultaten penetratiediepte

13. BACI: Catch composition

14. BACI mortality: no significant change in density of benthos between T0 and T1. Large variability. Power analysis shows that you need many more samples to obtain a significant reduction for the pulse site than for the beam trawl site, supporting lower mortality pulse trawl.

15. BENTHIS: meta-analysis shows mortality related to penetration of the gear (Hiddink et al 2017). X% Lower penetration pulse gear --> x% lower mortality

16. Effects bottom trawling on food for flatfish Results stomach analysis.

17. Results Hiddink et al (2016) J Appl Ecol. Conditie en biomass ratio prey/plaice heeft dome-shaped met piek bij intermediate trawling intensities.

18. Conclusions:
    x% reduction in footprint;
    x% reduction CO_2 emissions;
    x% reduction in penetration;

shift in distribution (softer habitat)
x% decrease in impact indicator (PD2)
effect on feeding
Consequences for feeding of benthivorous flatfish
higher catch efficiency (presentation Poos)