

TROPHOS

Higher trophic levels in the
southern North Sea



Partners and participants



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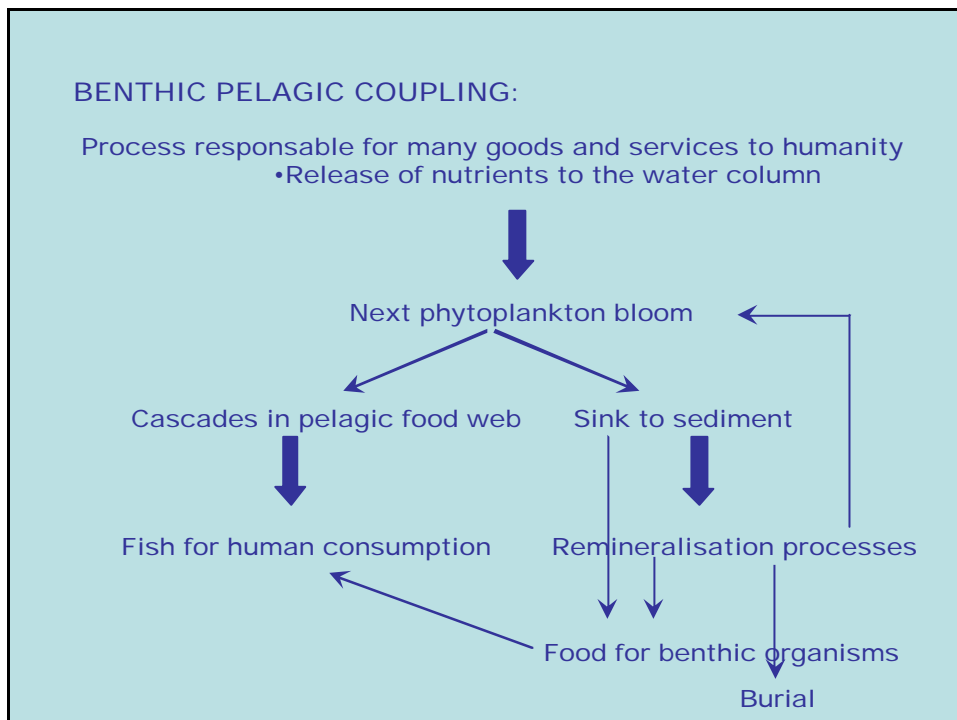
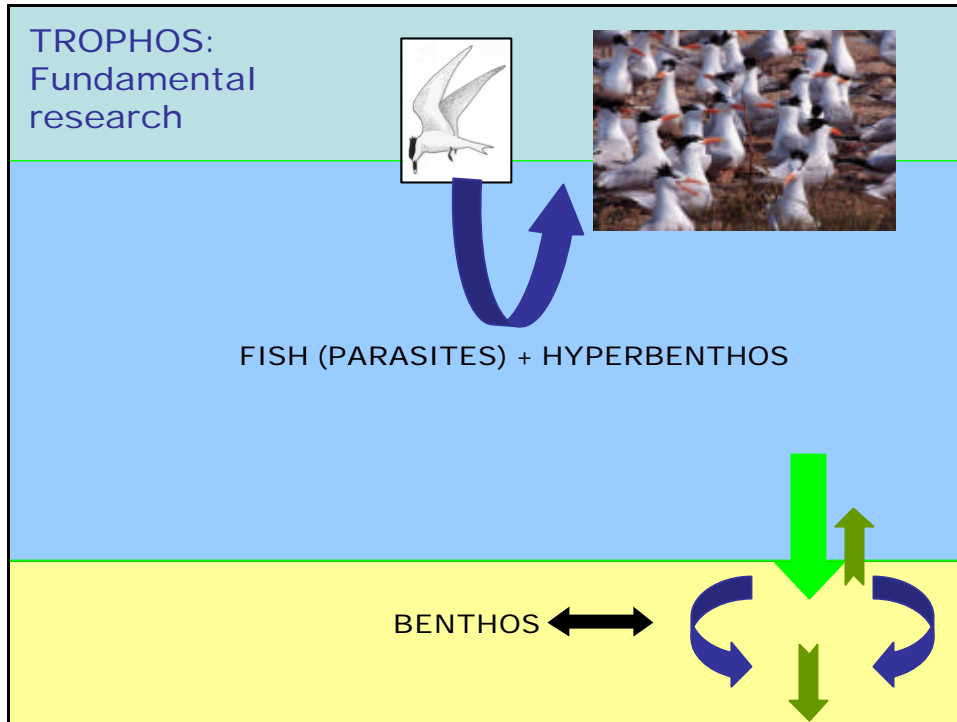
Filip Volckaert
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Maarten Larmuseau



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Marc Vandewalle
Wouter Courtens
Eckhart Kuijken

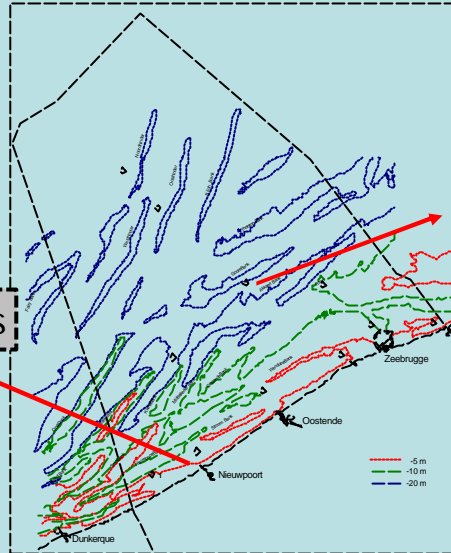


TROPHOS: BENTHIC PELAGIC COUPLING

Both stations:

- monthly sampled Oct. 2002 – Oct. 2003
- very detailed: Feb., April and Oct.

St. 115bis



St. 330

TROPHOS: BENTHIC PELAGIC COUPLING

Station 115bis

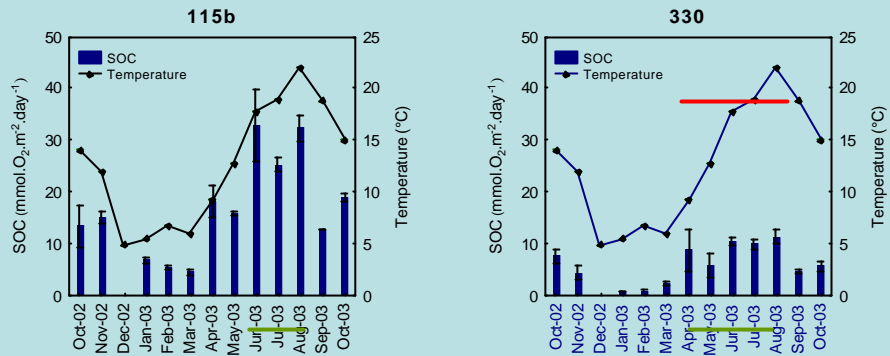
- MGS: 185 μ m; mud%: 4%
- oxygen stressed
- diffusion/bioturbation
- macrobenthos: *high* diversity and density
- great ecological importance

Station 330

- MGS: 329 μ m; no mud
- oxygen always present
- physically forced
- macrobenthos: *low* diversity and density
- no special importance

TROPHOS: BENTHIC PELAGIC COUPLING

Oxygen consumption: proxy for remineralisation



BUT! underestimated!

- x 1.4 (1)
- x 3 during bloom (2)

(1) Janssens, Huettel & Witte L&O (2005); (2) Ehrenhauss & Huettel, JSR (2004)

TROPHOS: BENTHIC PELAGIC COUPLING

Process studies: reveal timing of intense activities



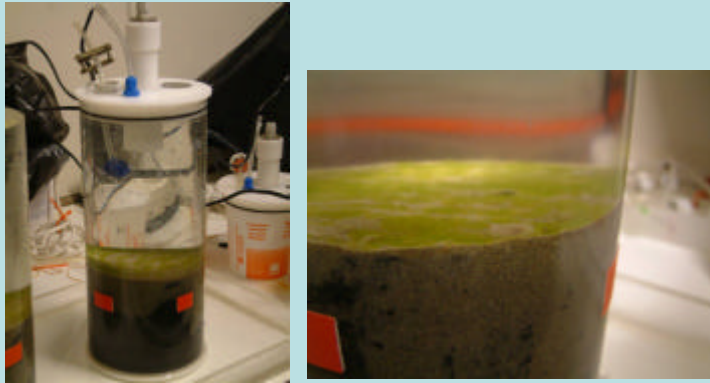
Process studies:

- reveal vulnerable periods of benthic ecosystem
- Sediment dependent



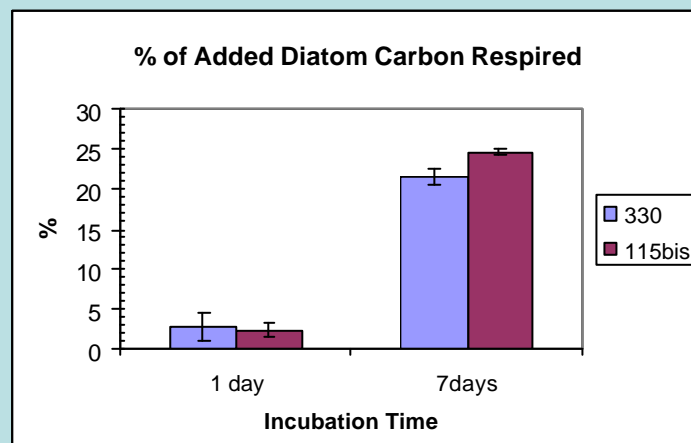
Important added value for decision makers

TROPHOS: BENTHIC PELAGIC COUPLING: EXPERIMENTS



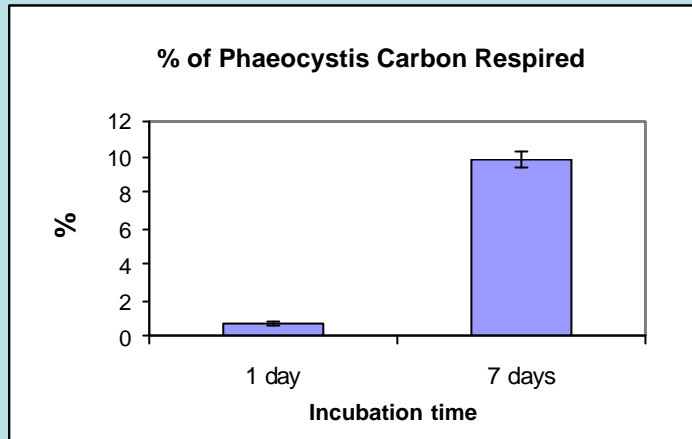
intact sediment cores + labeled *Skeletonema* or *Phaeocystis*

TROPHOS: BENTHIC PELAGIC COUPLING: EXPERIMENTS



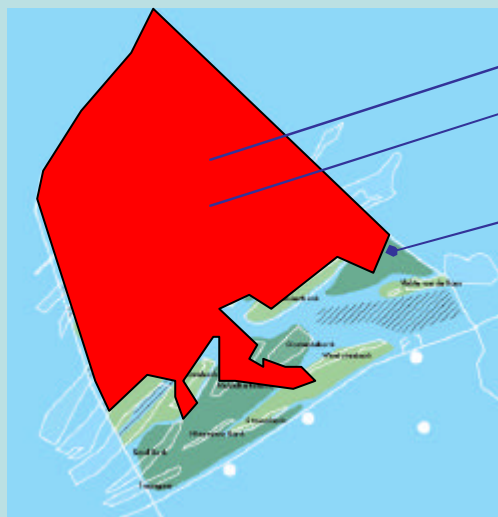
- Different communities (densities and diversity):
NO effect on short term total mineralisation

TROPHOS: BENTHIC PELAGIC COUPLING: EXPERIMENTS



Decaying *Phaeocystis* colonies remineralised in benthic ecosystem!

Ecological valuation map of the BCS



Low ecological value

Ecological value

High ecological value

Based on distribution maps of macrobenthos

GLOBAL CONTRIBUTION TO FUNCTIONING of MARINE ECOSYSTEM Of BCS: HIGH ecological value

Source: Een Zee van Ruimte

TROPHOS: BENTHIC PELAGIC COUPLING: CONCLUSIONS

Process studies:

Timing of intense activities
Differences between sediments

NO CLEAR LINK BETWEEN DIVERSITY AND PROCESS RATES



"Value" of an area cannot be judged from distribution maps only

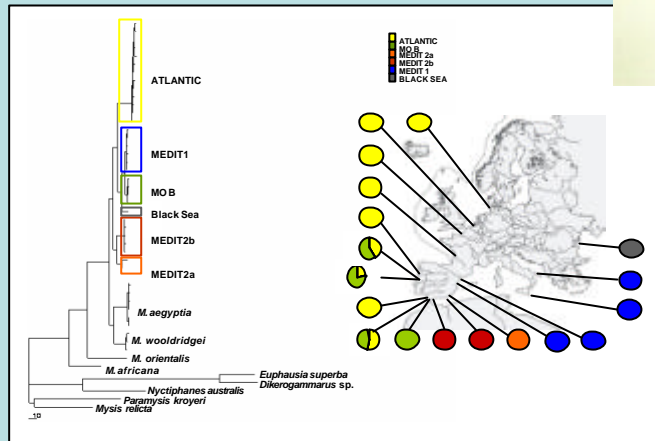
➔ Urgent need for understanding the driving forces
facilitating remineralisation processes in coastal
Areas (macrobenthic Activities)

Dispersal of marine fishes and invertebrates

1. The BCS harbours a diverse fauna

1.1. Cryptic speciation is common on the Eastern Atlantic shelf

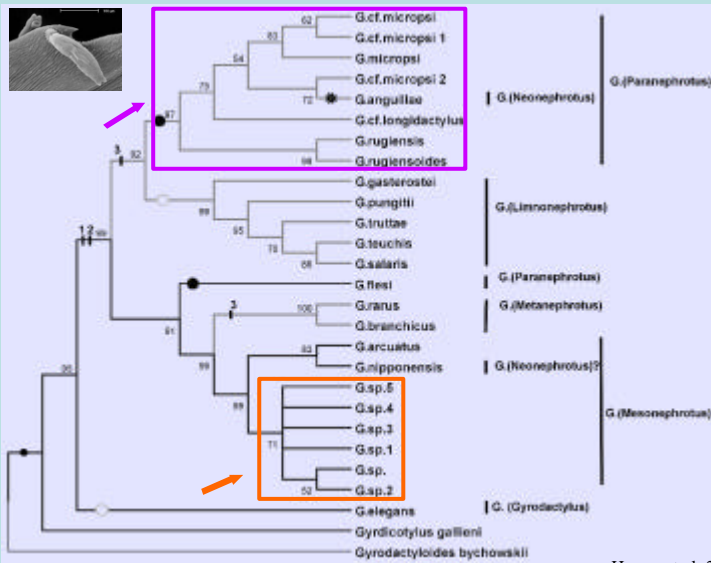
6 cryptic lineages



Remerie et al. 2006 Mar Biol
Remerie et al., in prep

1. The BCS harbours a diverse fauna

1.2. Cryptic speciation is common: the flatworm *Gyrodactylus* parasitic on *Pomatoschistus* gobies



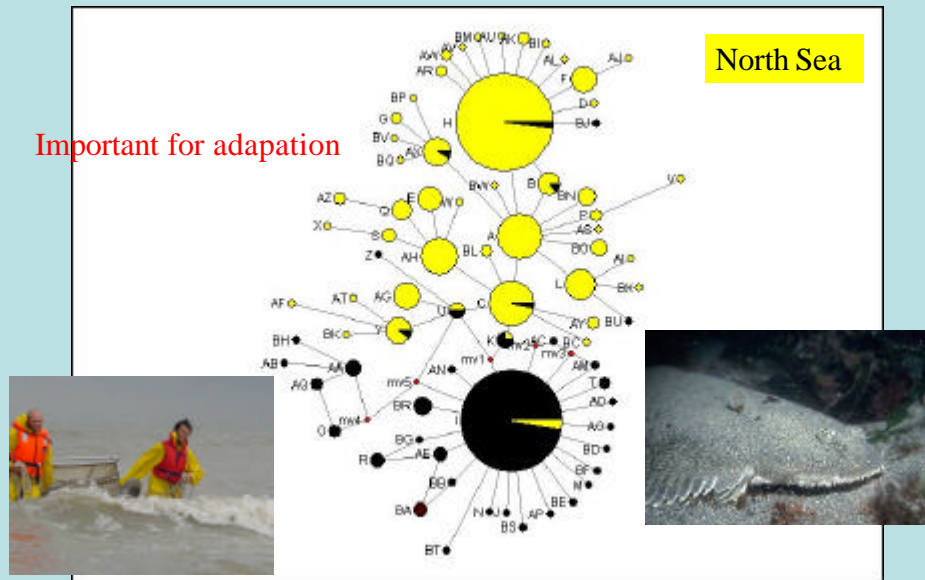
Fin Group

Gill group

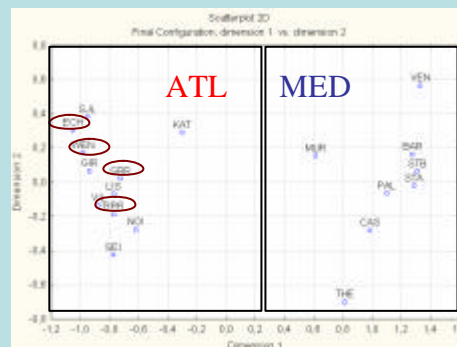
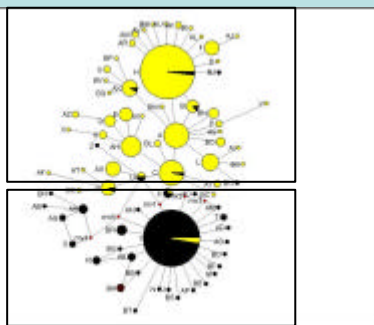
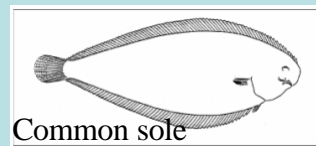
Huvse et al. 2004 MPE

2. Populations on the BCS have a high genetic diversity

Important for adaptation



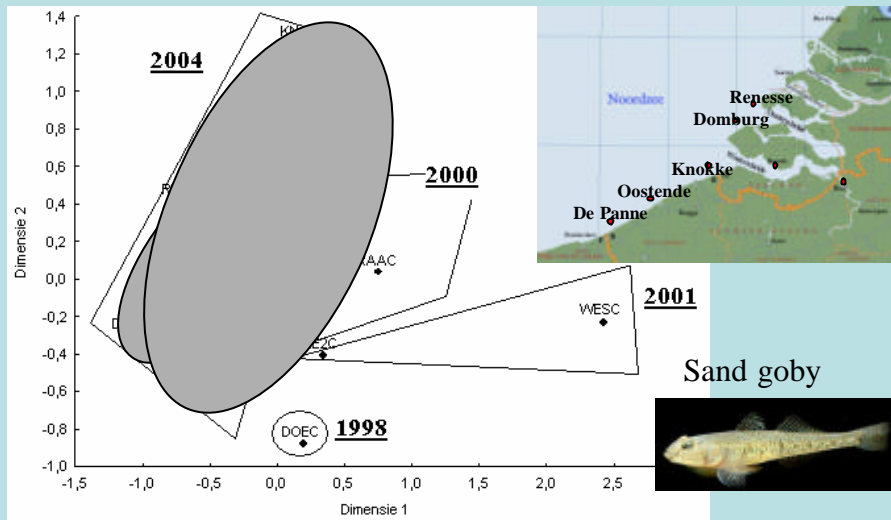
3.1. Populations on the BCS are structured in space



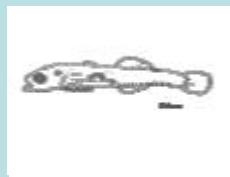
Draisma, Hellemans & Volckaert, in prep.

3.2. Populations on the BCS are structured in time

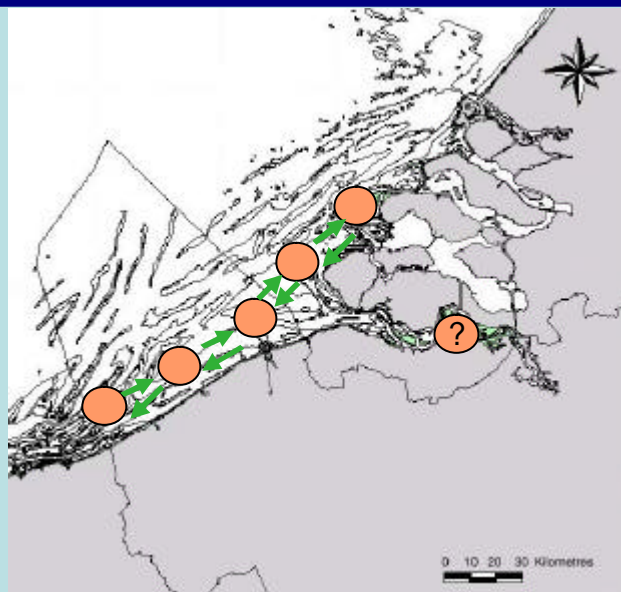
→ temporally unstable population structure



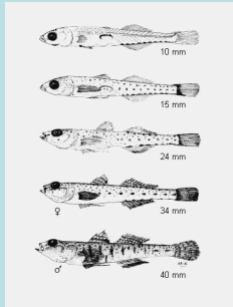
Post spawning: larval dispersal in early summer



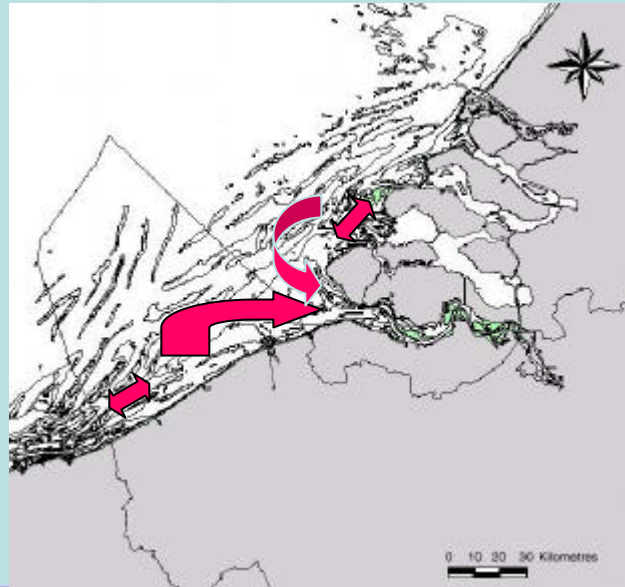
Gene flow during pelagic stage



Estuarine migration in late summer



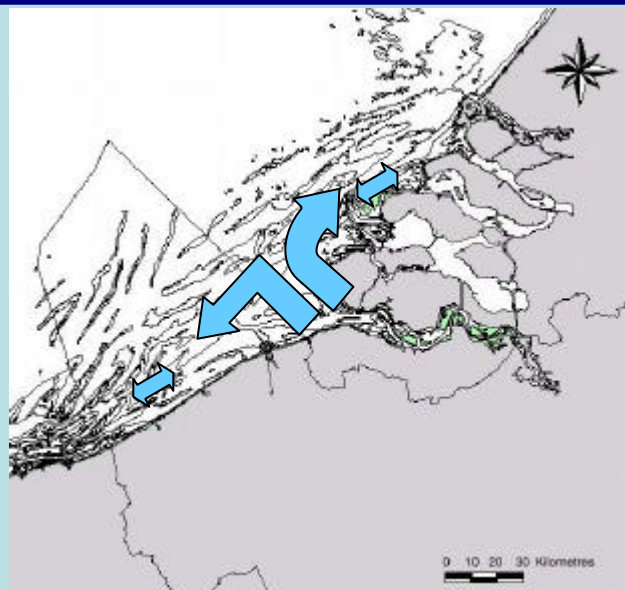
Estuaries:
Role of nursery



Winter migration

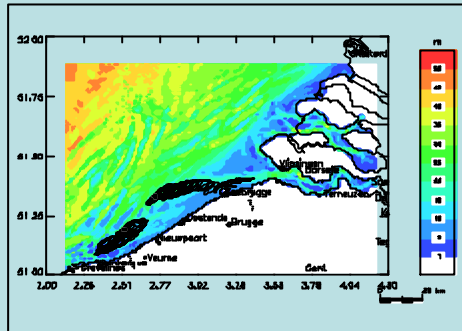


Next generation:
temporal and
spatial
differentiation

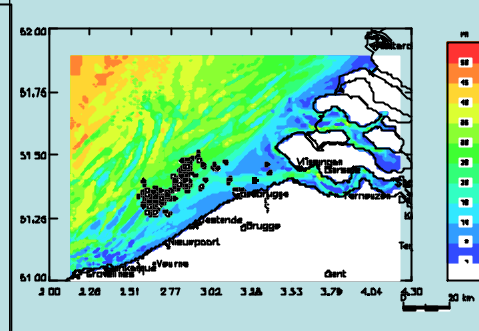


Significance of dispersal

? Modeling as research tool



Particle tracks of larvae released at two points. No vertical migration implemented.



Particle tracks for 200 larvae, released at the black dot. No vertical migration implemented.

The significance of evolution

- Genetic biological diversity is considerable
- Genome harbours potential for local adaptation (response to *ecosystem shifts*)
- Importance of population variation in space and time for fisheries management
- Large sized Marine Protected Areas for nature conservation

CONCLUSIONS:

- Genetical biodiversity is considerable
- Genome harbours potential for local adaptation (response to ecosystem shifts)
- importance of population variation in space and time for fisheries management

PERSPECTIVES

- Evaluation of adaptive potential for marine organisms
- Large size Marine Protected Areas for nature conservation

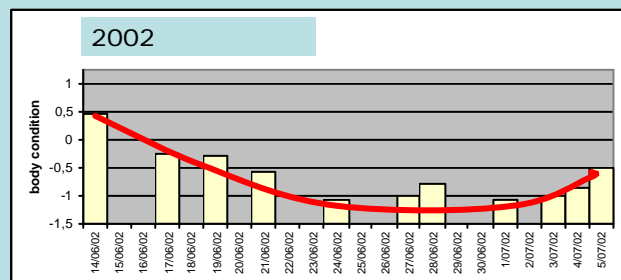
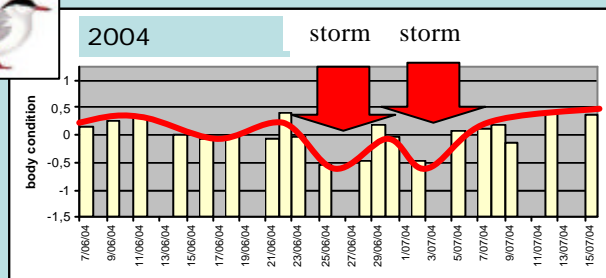
Seabirds as indicators of the food web



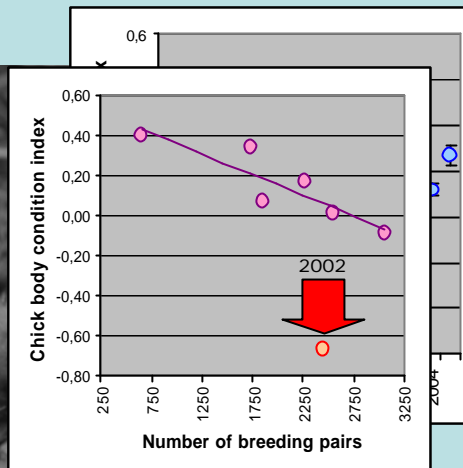
Reproductive parameters as an indicator of food availability

Year	Clutch size	Hatching success	Fledging success	Breeding success
1997	2.4	78	50	1.2
1998	2.5	77	61	1.2
1999	2.5	78	67	1.3
2000	2.3	91	37	0.8
2001	2.3	80	74	1.4
2002	2.2	79	8	0.1
2003	2.6	87	74	1.7
2004	2.1	81	38	0.7
2005	2.0	80	36	0.6

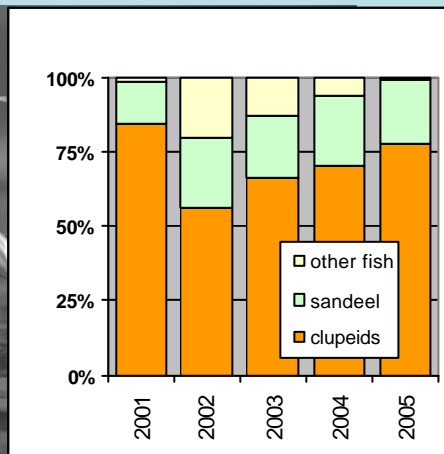
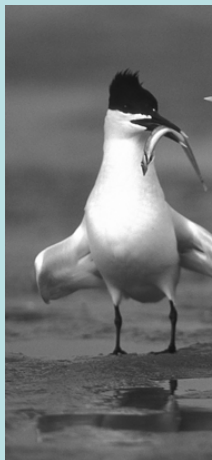
Chick body mass as an indicator of food availability



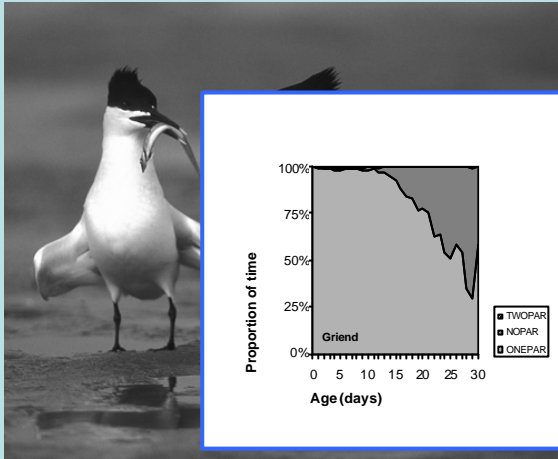
Chick body mass as an indicator of food availability



Food specialists as indicators of the food web



Food specialists as indicators of the food web



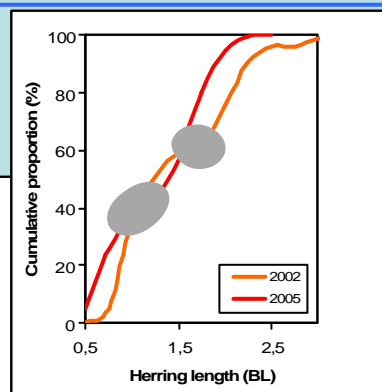
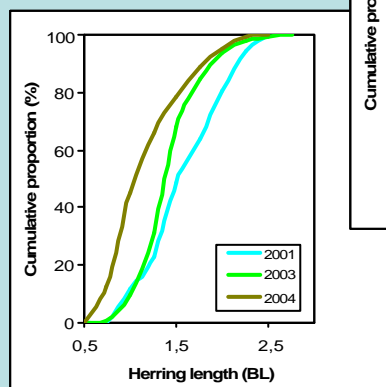
Sandwich Terns enjoy an easy living at Zeebrugge



Anomalies in the chicks' diet as an indicator of food availability

Year	Clutch size	Fledging success (%)
2001	1.1	70
2002	1.1	43
2003	1.3	66
2004	1.5	52
2005	1.2	28

Anomalies in the chicks' diet as an indicator of food availability



TROPHOS: SEABIRDS: CONCLUSIONS

- strong variations in breeding parameters of terns
- apparent link with food availability
- useful indicators of the food web

TROPHOS: SEABIRDS: NEW QUESTIONS

- poor knowledge of the underlying food web
- what determines observed changes
- validation of changes