BALANCE

Up-stream/Down-stream ordering of habitats along blue corridors

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Introduction

Benthic invertebrate communities show large gradients in species richness across the Baltic Sea with highest values in the Kattegat and Belt Sea area connecting to the Open Atlantic ocean. These patterns are shaped by variety of physical factors and the evolutionary history of the Baltic Sea, yet it is unknown to what extent the invertebrate communities are constraint by connectivity between population.

Questions?

Can the concept of blue corridors be applied to Invertebrate communities?

Does there exist any evidence that benthic invertebrate communities are shaped by Blue corridors?

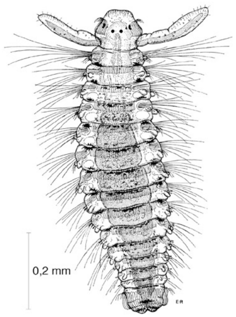
Can blue corridors be modelled to give quantitative estimates of population integrity within habitat and connectivity among habitats?

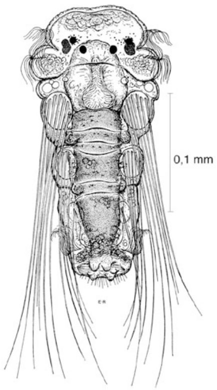
Larval dispersal and mortality constraint benthic communities

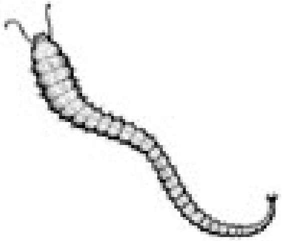
- The majority of benthic invertebrates have a planktonic life stage (Thorson 1950)

- The consequence is population losses due to mortality (temporal pattern) and dispersal over sterile areas (spatial pattern)

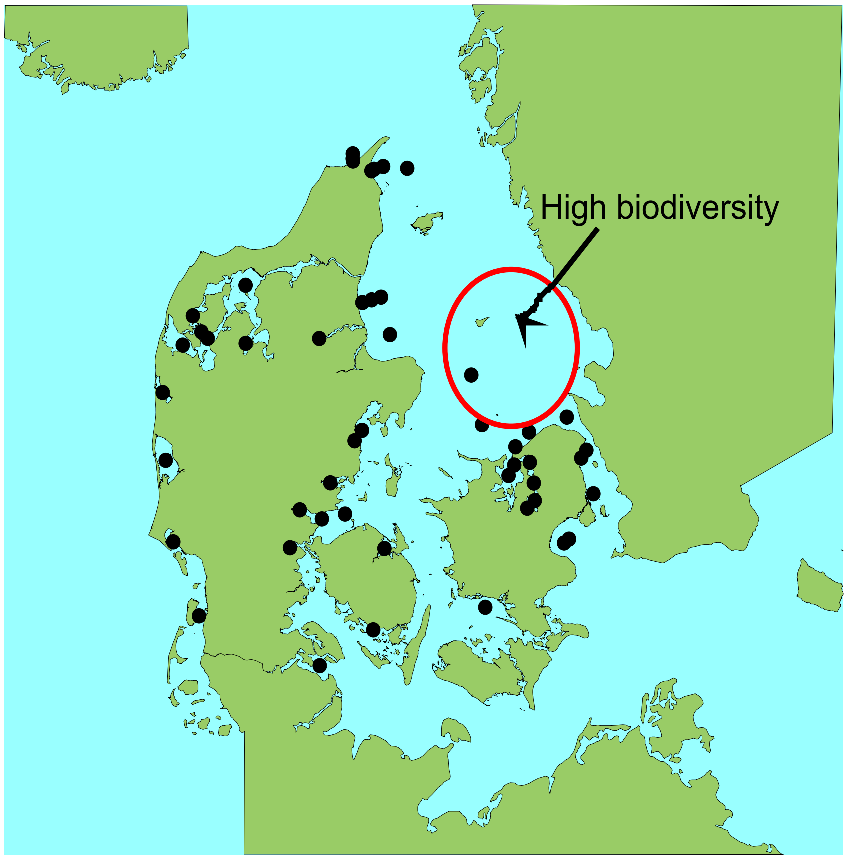
- Species living in habitats with low spatial coverage will experience high population losses due to dispersal over sterile areas – although some species have adapted life strategies to avoid dispersal.

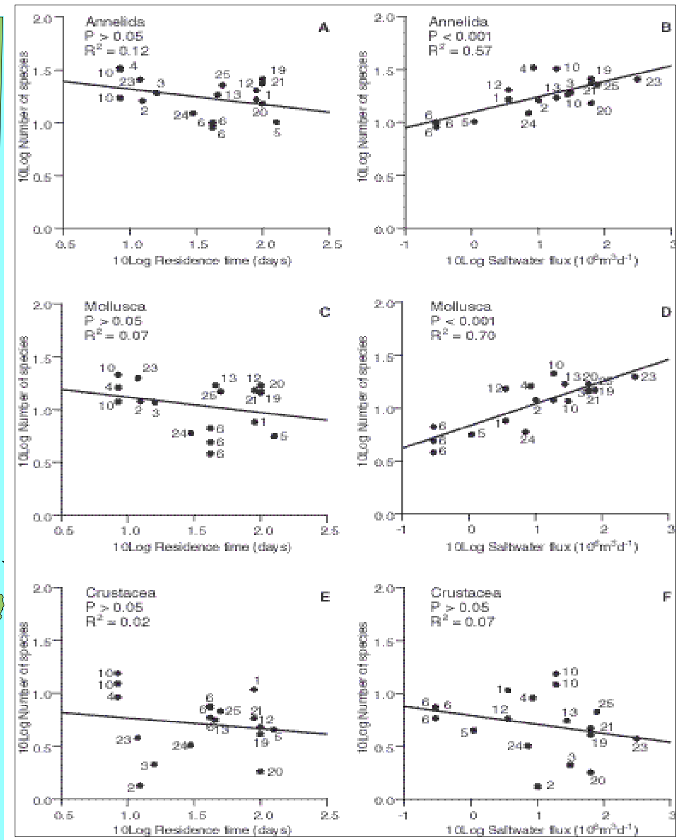






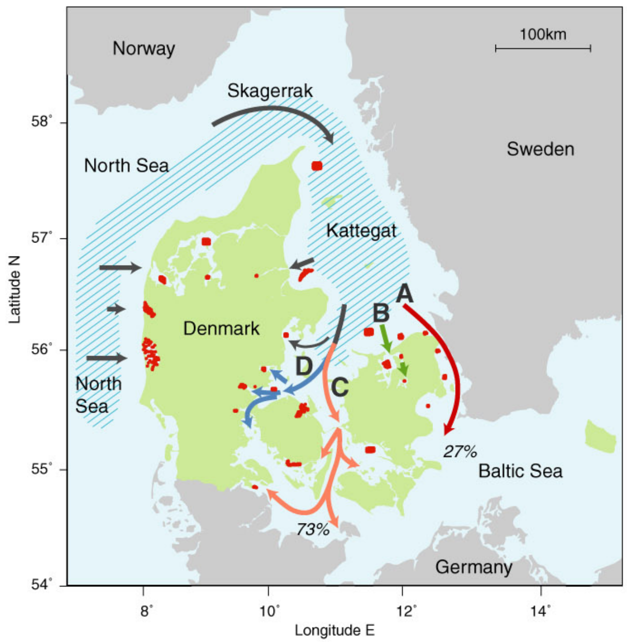
A bit of history

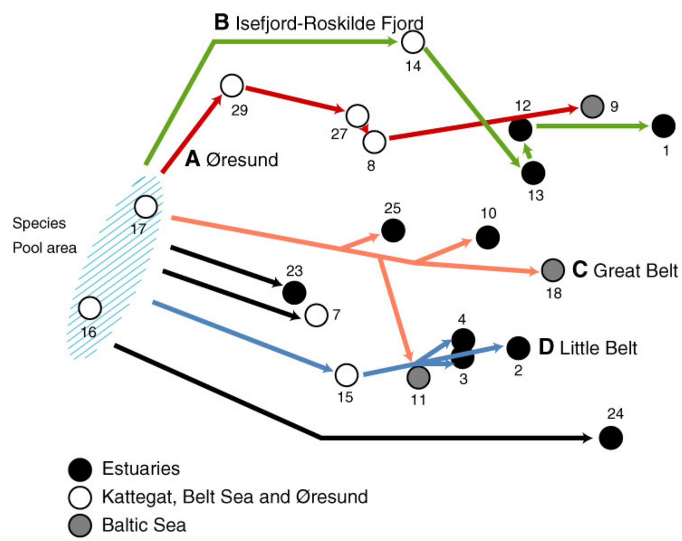




Josefson & Hansen 2004

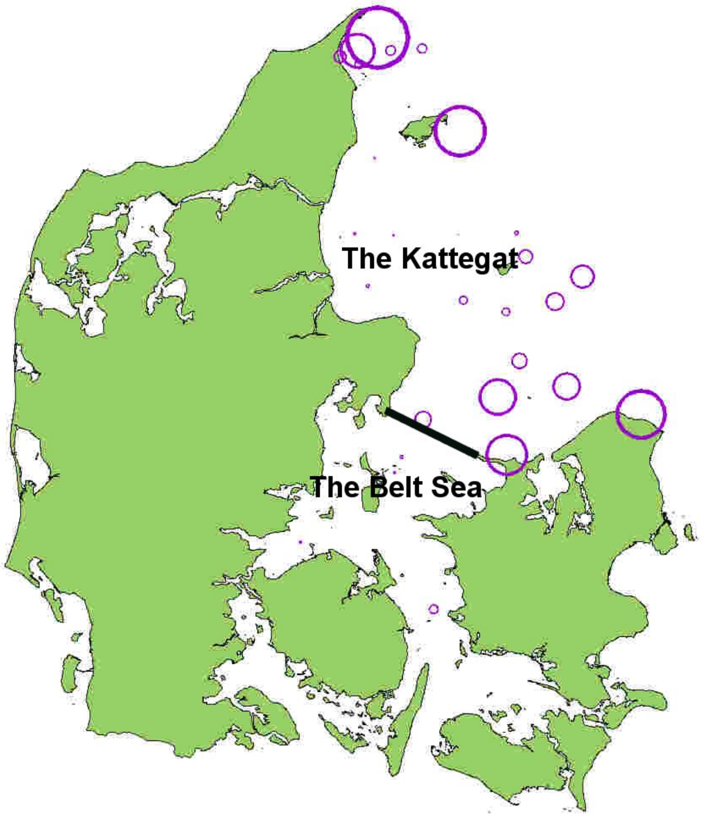
Species similarity of dispersing species

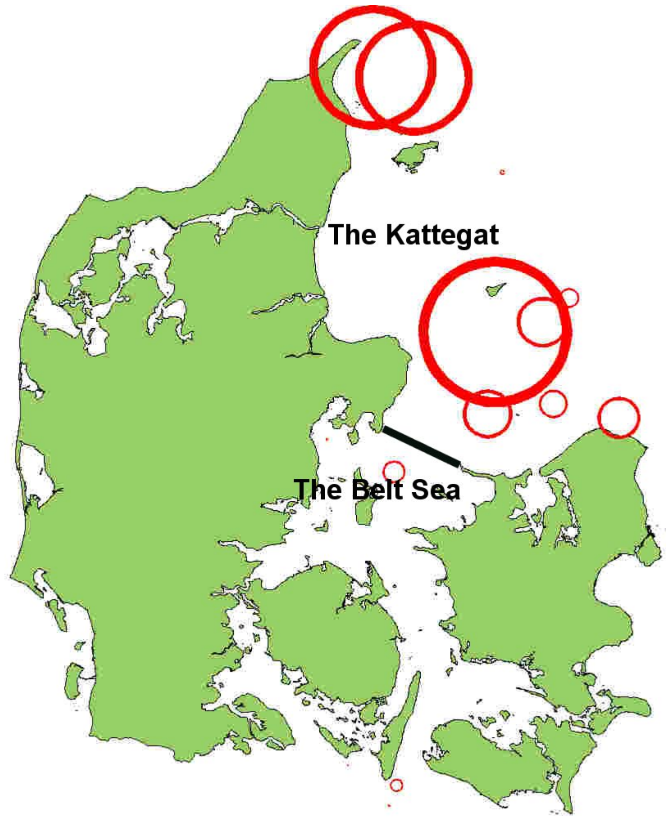




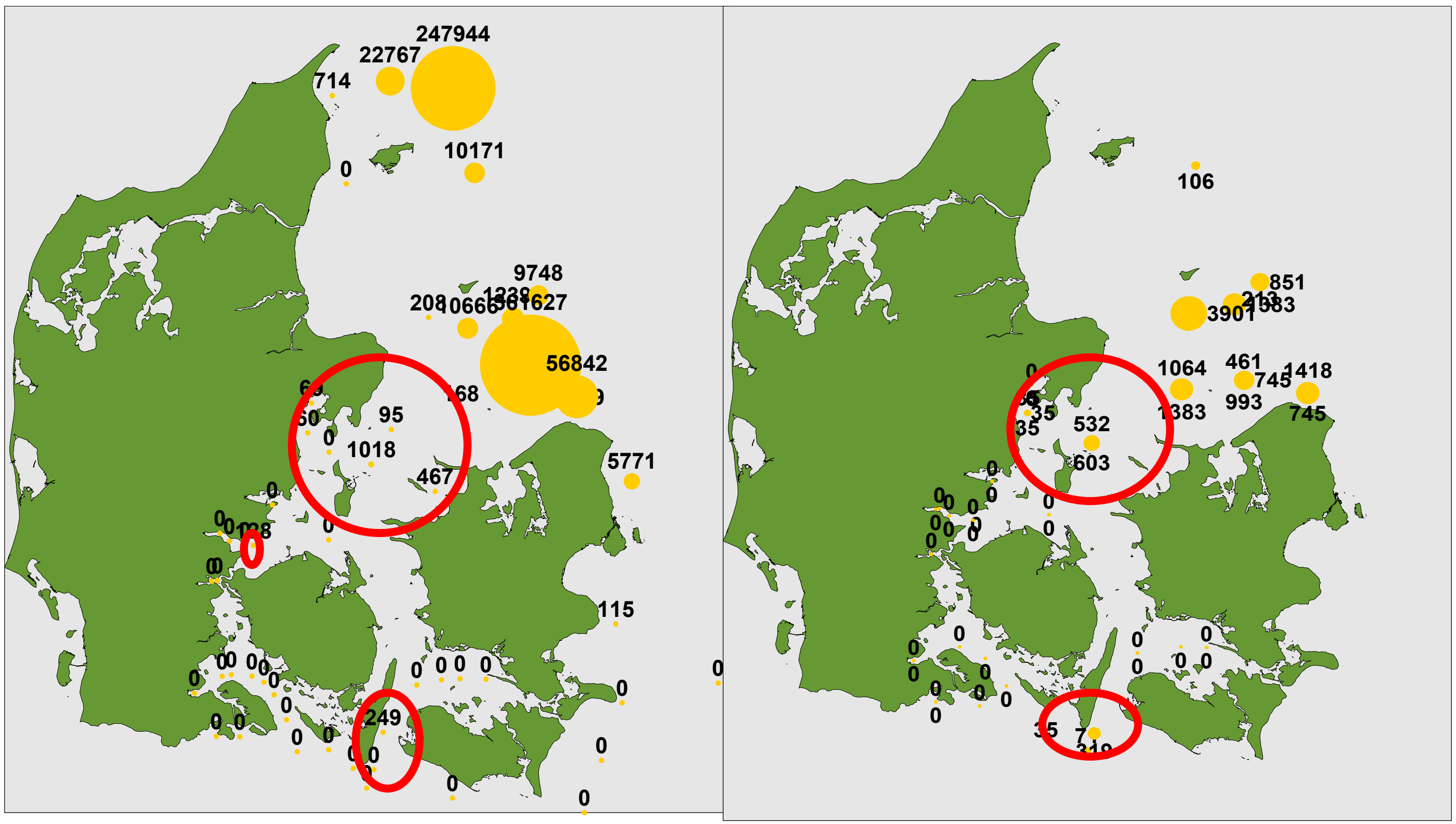
Josefson & Hansen (2004) J Global Ecol Biogeogr 13

Distribution of adult Echinoderms

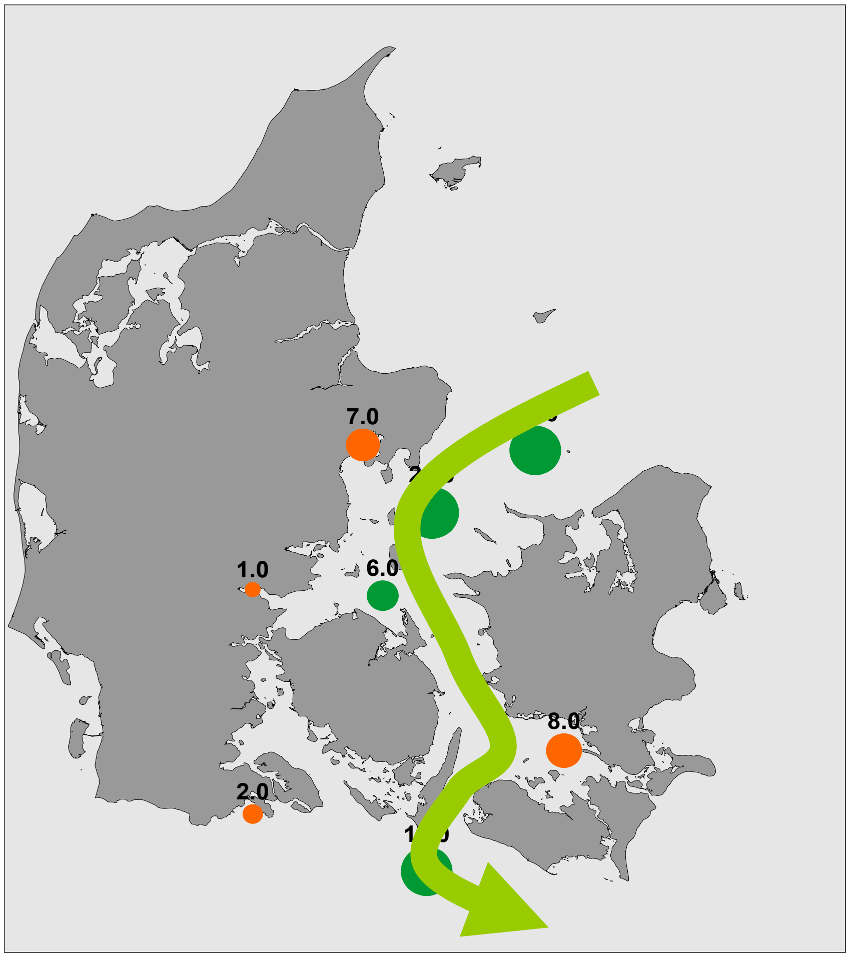


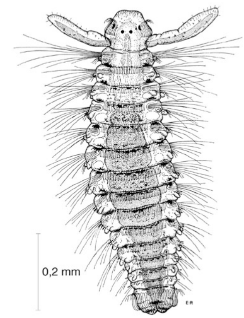


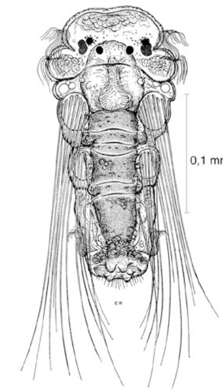
Distribution of larvae and postlarvae of Echinoderms

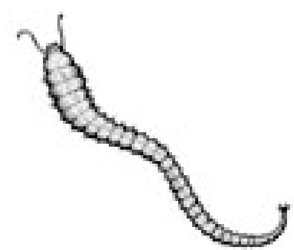


Species richness of polychaet larvae



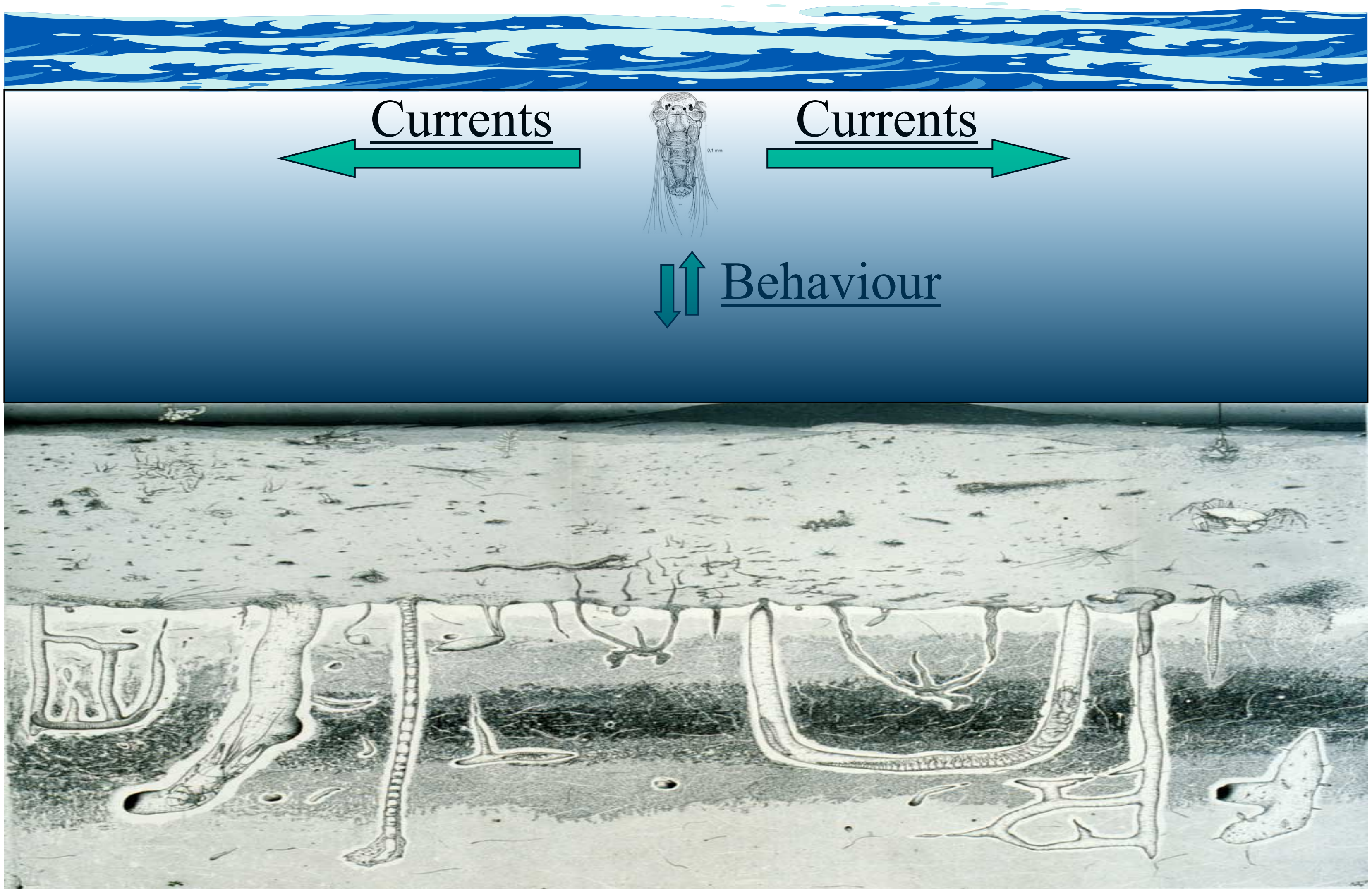






Modelling larval dispersal along blue corridors!

A blue corridor can be considered as a channel or a route of particular importance for the population exchange between locations and of importance for the maintenance biogeographical patterns of species and communities. Blue corridors are shaped either by biological mechanisms thus describing the possible route, or the route of choice of migrating motile organisms or the corridors can be shaped by physical factors when biota is transported passively by currents. In the context of planktonic dispersal, passive transport, blue corridors should refer to biogeographical patterns of benthic organisms established by non-random routes of dispersal.


Currents
Currents
Behaviour

Larval dispersal and mortality constraint benthic communities

- Typical larval mortality in the plankton of 0,15-0,23 d-1 (Rumrill 1990, Hansen 1999)

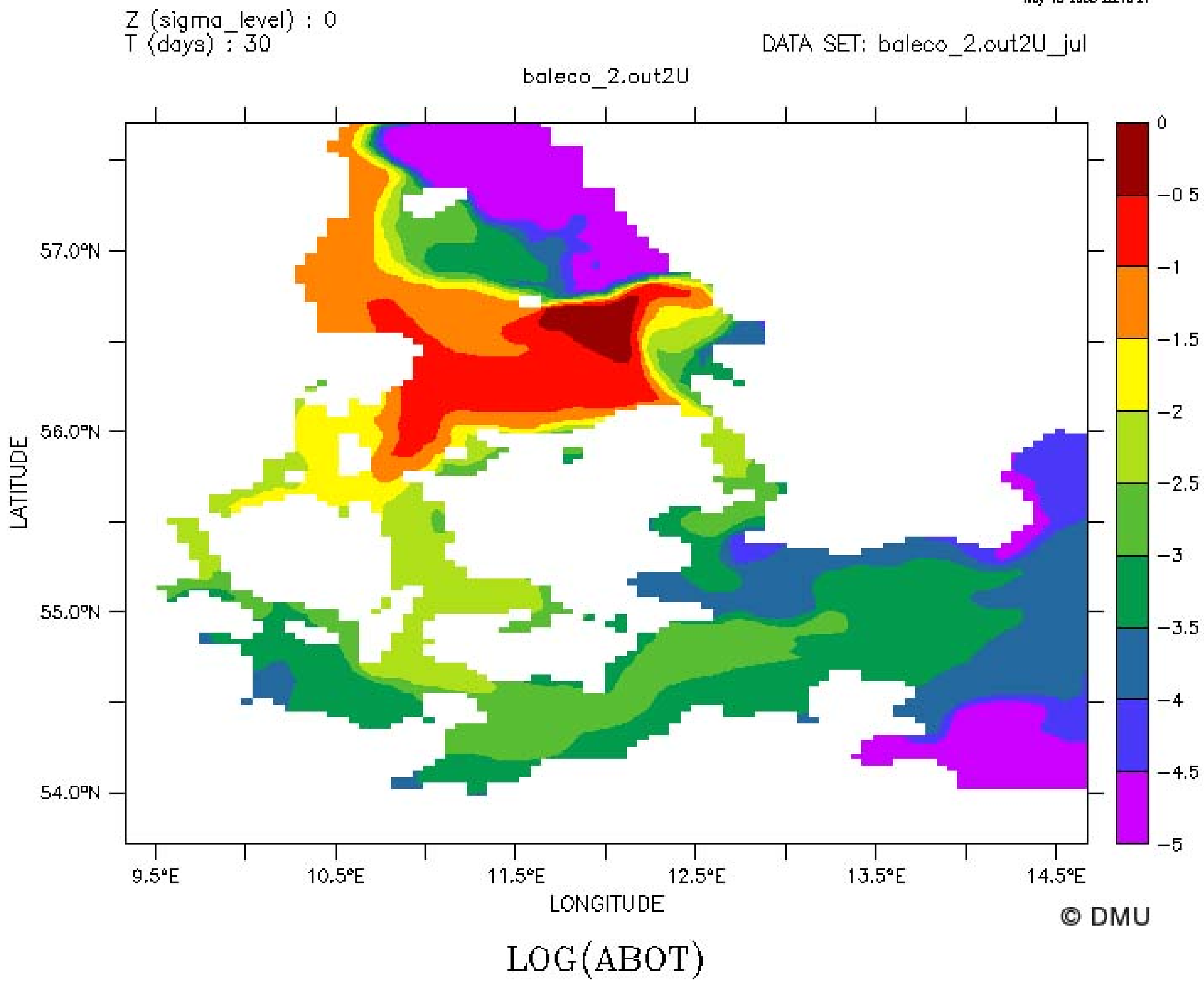
- Input to the water column estimated to be 20000 m-2 d-1 (Pedersen et al. in press)

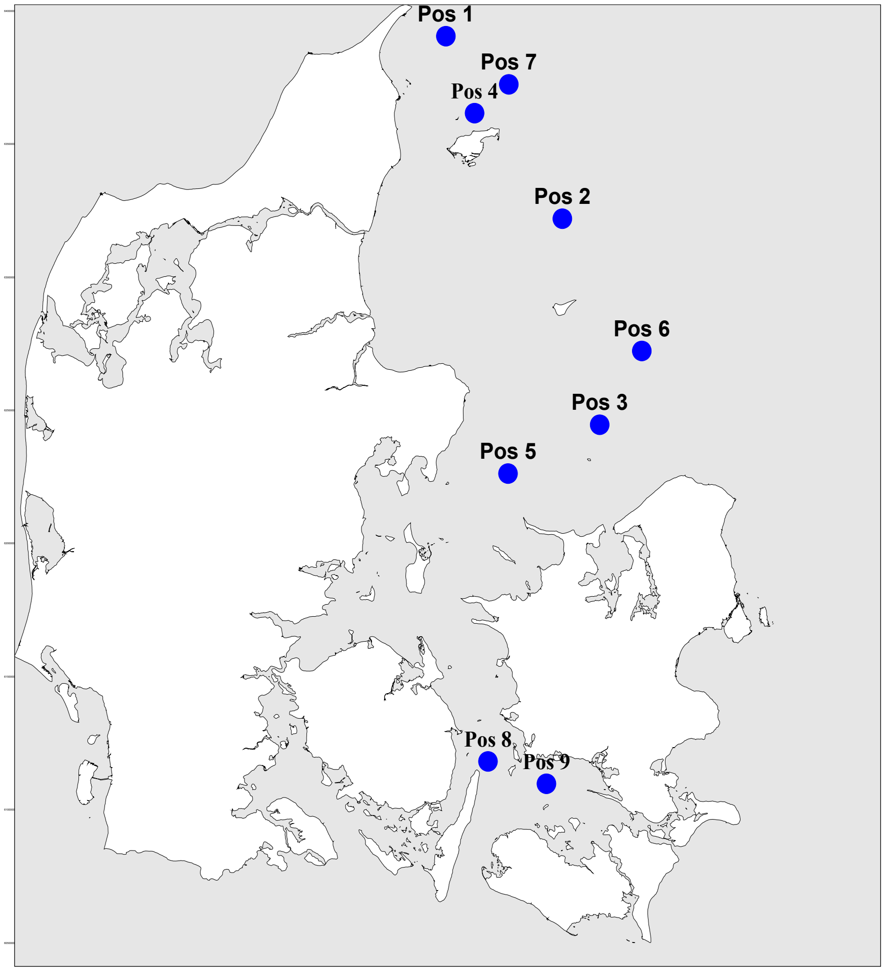
- Average duration of the planktonic life stage of 2- 6 weeks

- Input of recruits to the bottom from the water column of ~ 40 m-2 d-1 (Pedersen et al in press)

$$c = \int_{t=0}^{t=p} x_0 e^{-\alpha t}$$

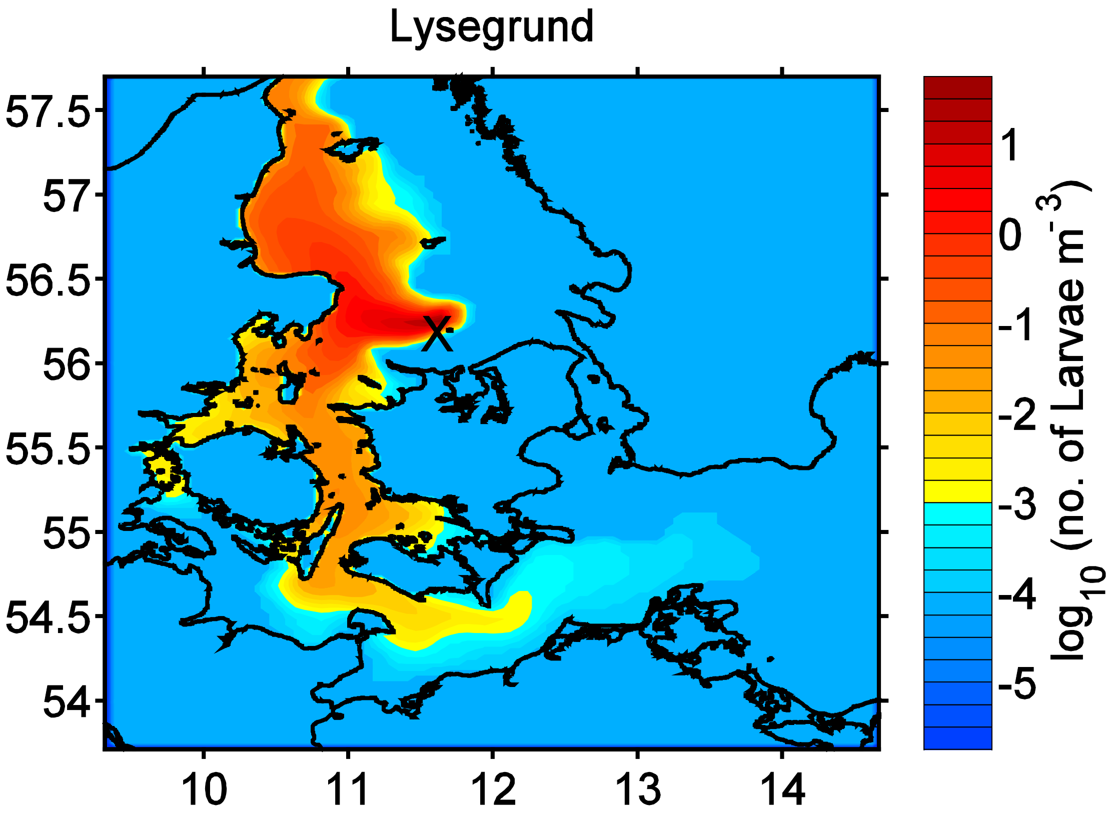
Tracer spreading from southern Kattegat in July 2003





Pos 1
Pos 7
Pos 4
Pos 2
Pos 6
Pos 3
Pos 5
Pos 8
Pos 9

Larvae plumes in the Kattegat and the Belt Sea



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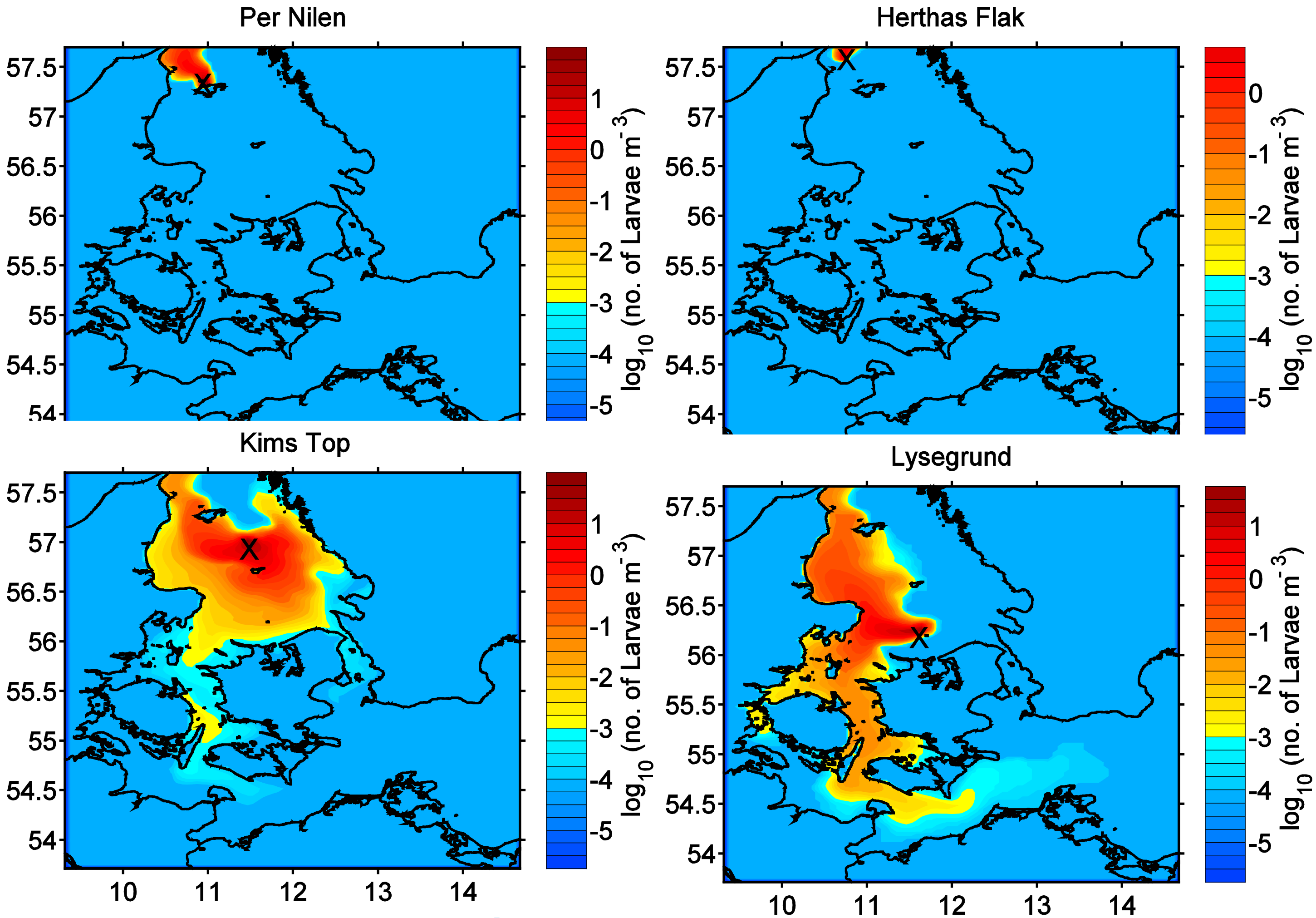
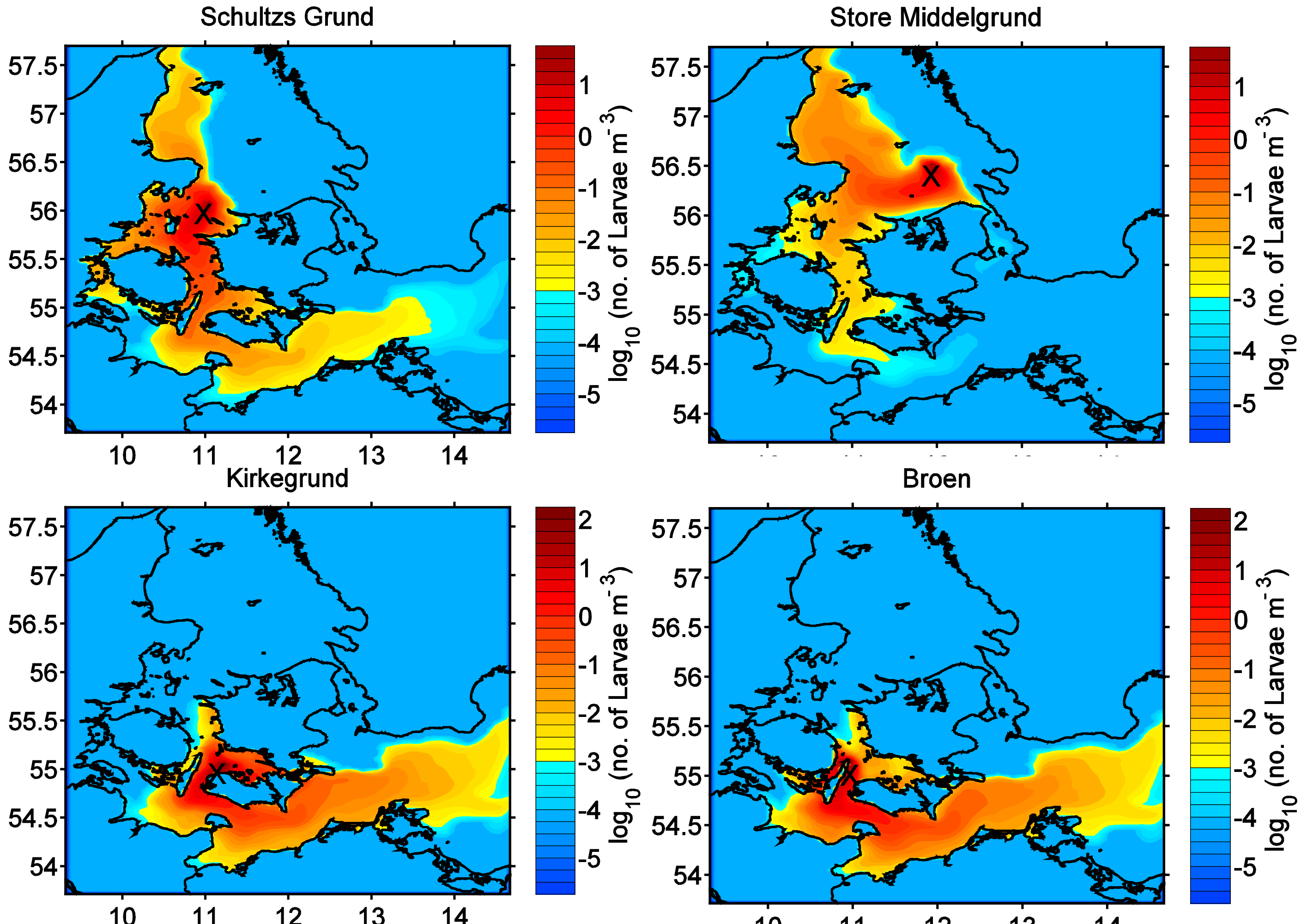
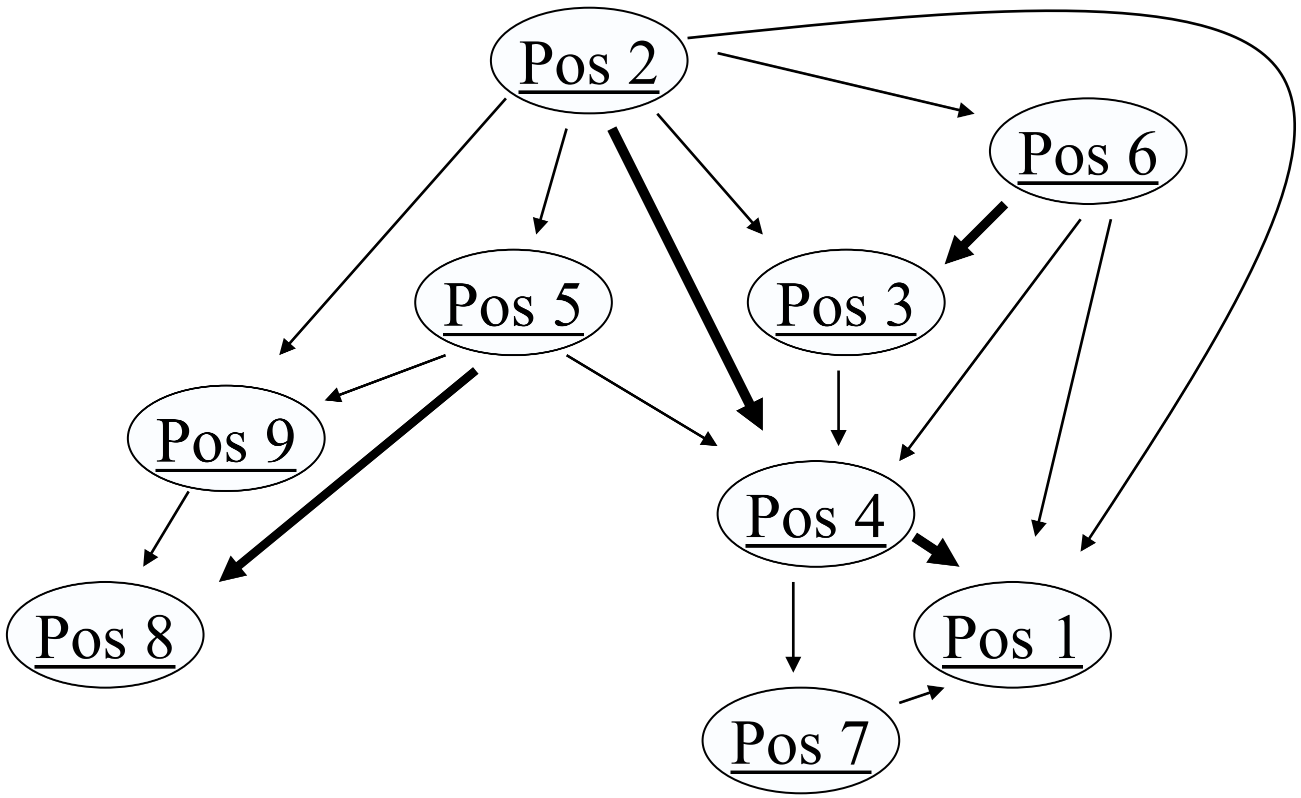


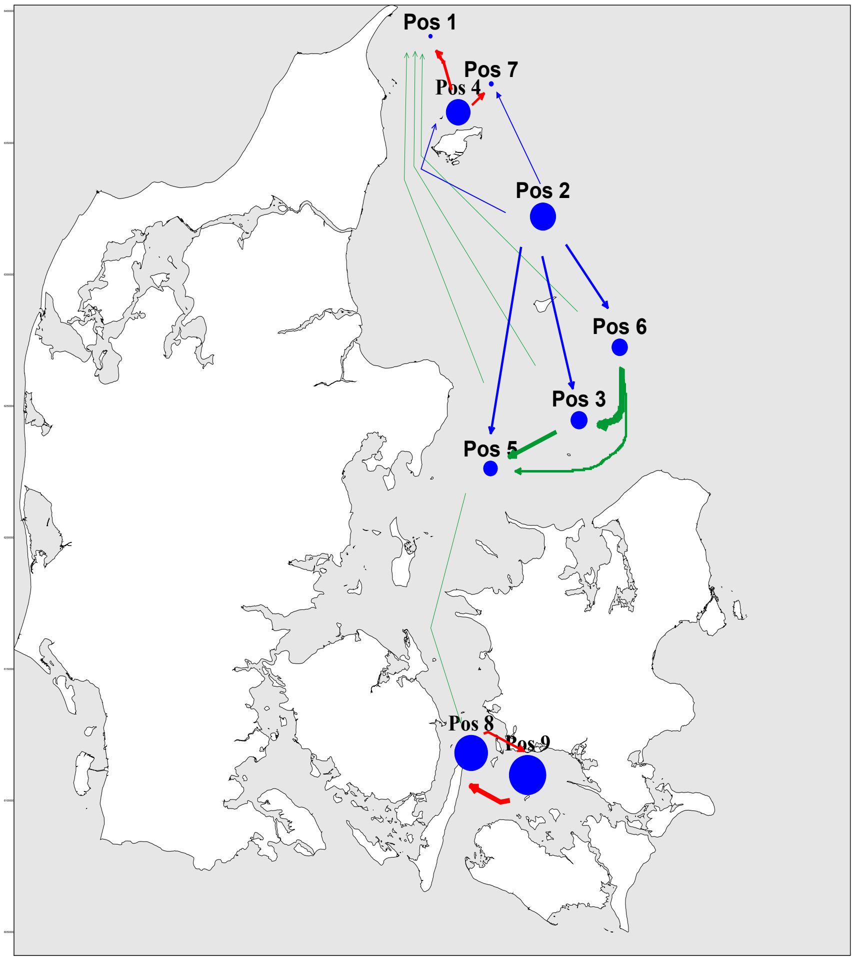
Larvae plumes in the Kattegat and the Belt Sea

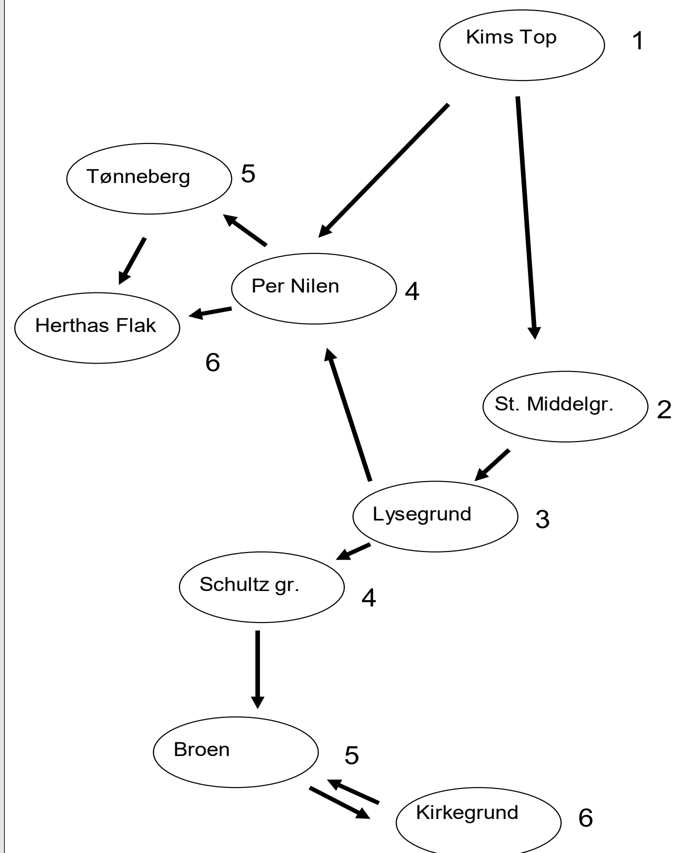


	Pos1	Pos2	Pos3	Pos4	Pos5	Pos6	Pos7	Pos8	Pos9
Pos1	5.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pos2	0.0045	82.4	0.0181	0.276	0.0035	0.186	0.0001	0.0013	0.0006
Pos3	0.0017	0.0003	50.1	0.0503	0.305	0.0	0.0	0.0425	0.0177
Pos4	1.77	0.0	0.0	77.1	0.0	0.0	0.0	0.0	0.0
Pos5	0.0001	0.0	0.0	0.0069	41.7	0.0	0.0	0.241	0.0765
Pos6	0.0005	0.0001	1.35	0.0158	0.0834	47.8	0.0	0.0061	0.0029
Pos7	1.43	0.0	0.0	0.0	0.0	0.0	7.49	0.0	0.0
Pos8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	109	0.0141
Pos9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0246	122

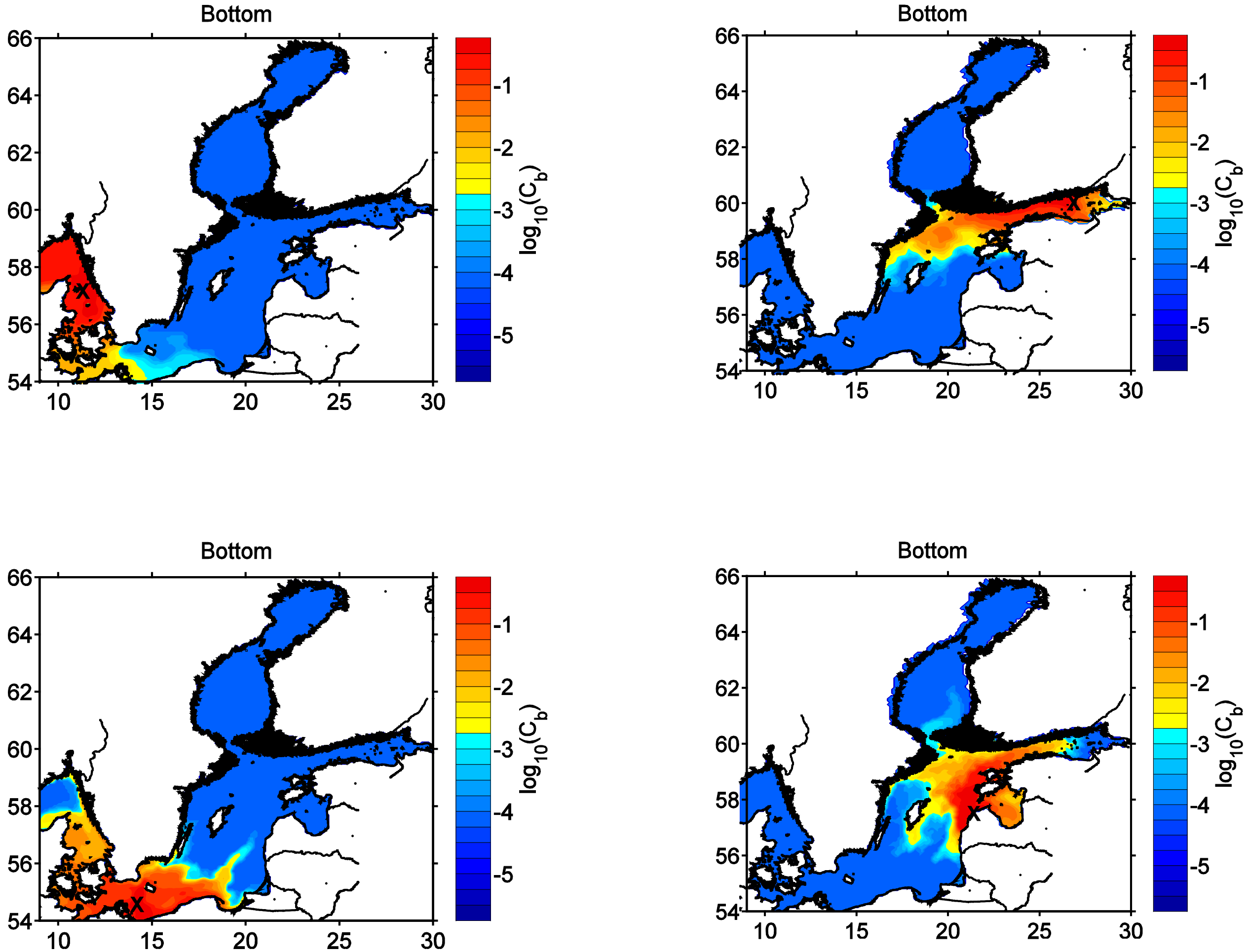
Rank order of sources and sinks




Pos 1
Pos 7
Pos 4
Pos 2
Pos 6
Pos 3
Pos 5
Pos 8
Pos 9


Kims Top
1
Tønneberg
5
Per Nilen
4
Herthas Flak
6
St. Middelgr.
2
Lysegrund
3
Schultz gr.
4
Broen
5
Kirkegrund
6

Larvae plumes in the Kattegat and the Belt Sea



Conclusions & perspectives

•Dispersal patterns of marine invertebrate larvae match the biogeography of postlarvae and adult bottom fauna and

•3-D modelling of blue corridors identify sources and sinks among habitats with respect to recruitment and suggests that there exists certain routes of particular importance

What to do next

•The modelling of concept of blue corridors can be applied everywhere. The limits are largely defined by the biological knowledge of larval behaviour and population dynamics and to a lesser extent of the spatial resolution of the models.

Perspectives

•The concept of blue corridors can provide a quantitative measure of connectivity between habitats and Up-stream and down-stream ordering of habitats may be a valuable tool to prioritise management and conservation of MPA.

•The model may also be used to explore adaptations in meroplankton communities

Acknowledgements

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Thank you for your attention