Same Risk Area Case-study for Kattegat and Øresund. Appendix 3: Connectivity analysis—Additional results

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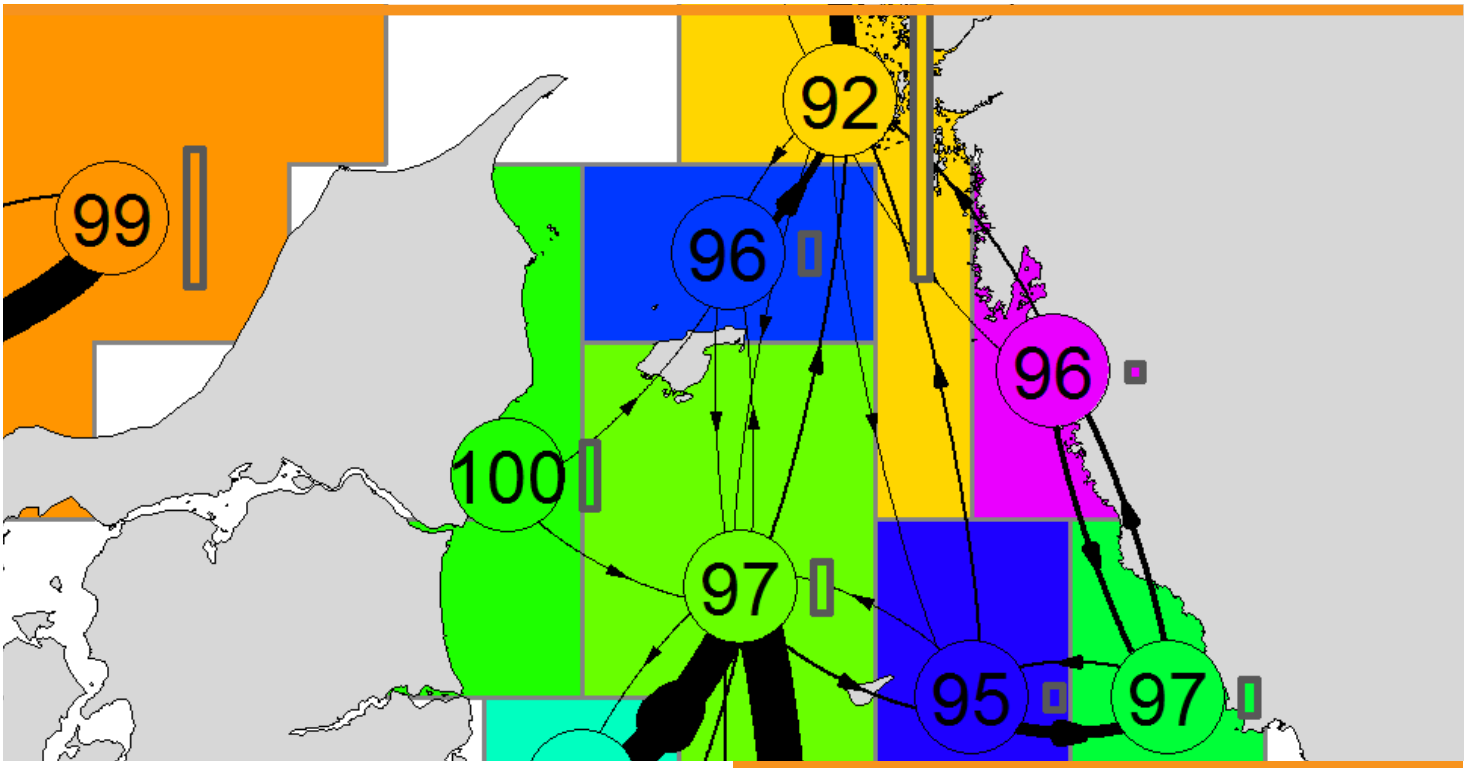
Appendix 3: Connectivity analysis—Additional results



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By Flemming Thorbjørn Hansen
and Asbjørn Christensen

DTU Aqua
National Institute of Aquatic Resources

Same Risk Area Case-study for Kattegat and Øresund
Appendix 3: Connectivity analysis—Additional results

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Flemming Thorbjørn Hansen and Asbjørn Christensen

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Contents

1 Introduction

This appendix 3 is an appendix to the report: ”SRA Case Study for Kattegat and Øresund”. The appendix presents result from the connectivity analyses carried out for 23 marine invasive species for the Kattegat and Øresund region. The additional results presented here are supplementary to the results presented in the main report and appendix 2. These supplementary results include:

- Hydrographic regions delineation for each species for each year 2005, 2010 and 2012, based on larval dispersal simulations using 200 000 agents as the initial number of agents per simulation. These are included to show how connectivity may vary between years.

- Hydrographic regions delineation for each species for each year 2005, 2010 and 2012, based on larval dispersal simulations using 50 000 agents as the initial number of agents per simulation. These are included to evaluate how robust the connectivity analyses are to the number of agents included in the larval dispersal modelling.

- Hydrographic regions delineation for each species for the year 2005 based on larval dispersal simulations using 200,000 agents as the initial number of agents per simulation, and assuming a more shallow drift depth interval of 0 - 15 m, compared to the depth range of 0 - 40 m applied in the other larval dispersal simulations. These are included to evaluate how assumptions on drift depth may affect the results.

All hydrographic regions delineations are done assuming a multiple generations dispersal (or stepping stone dispersal) using the number of expected generations during a 5 year period and a between generations survival rate of 10 % per generation.

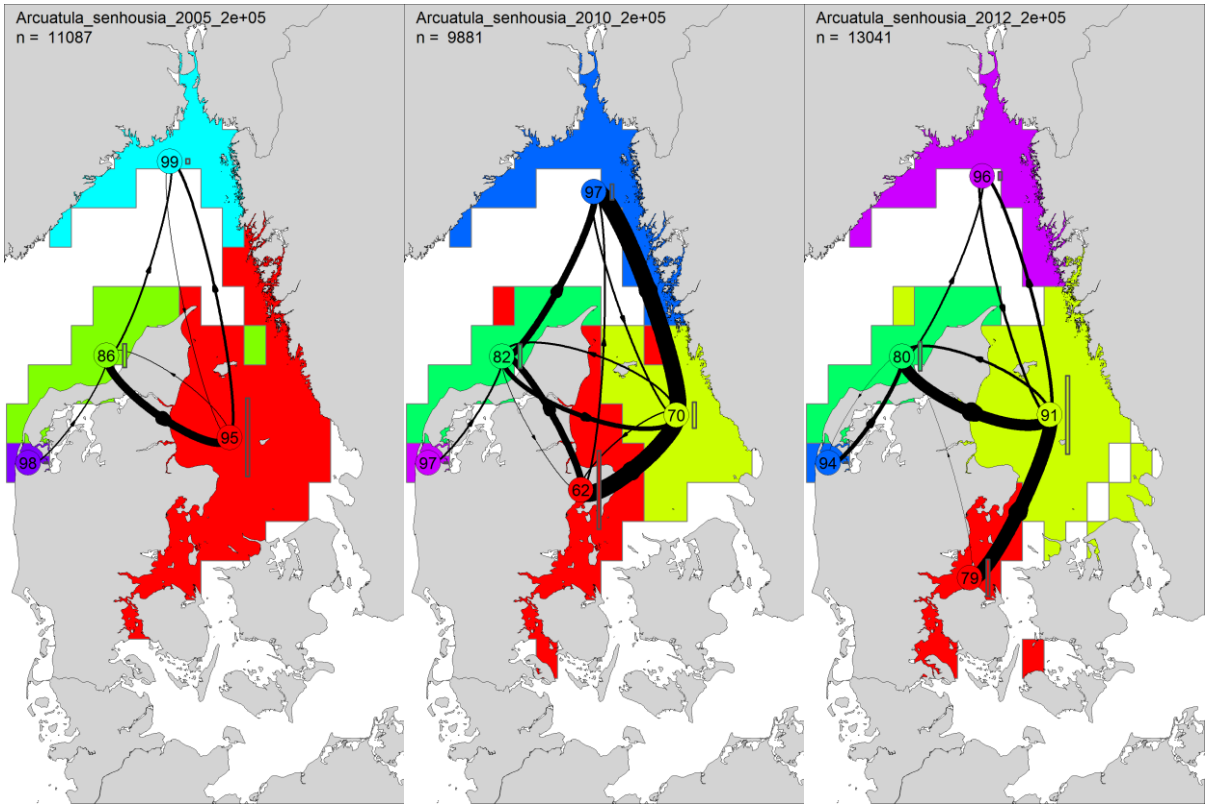
In addition to the hydrographic regions delineations, the appendix include downstream and upstream dispersal probability maps for each species for 7 of the major harbours of Kattegat and Øresund: Frederikshavn, Grenå, Gothenburg, Varberg, Helsingør, Helsingborg and Copenhagen. Dispersal probability maps are presented for both single generation dispersal and multiple generation dispersal within a 5-year period.

For details on the applied methodology and on how to read and interpret the hydrographic regions maps and dispersal probability maps, see the main report and/or appendix 2.

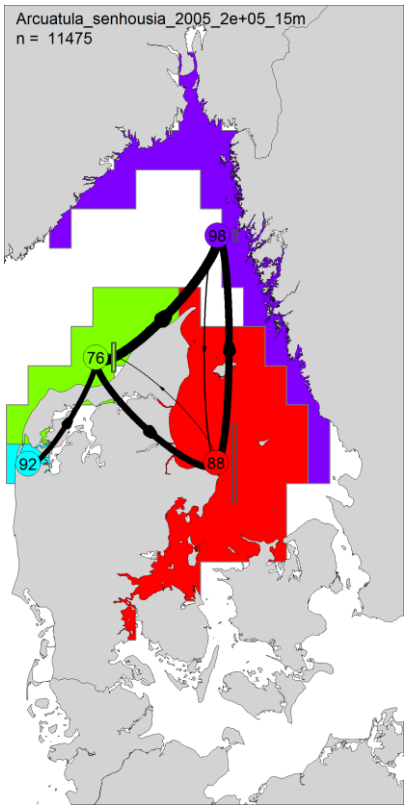
2 Arcuatula senhousia

2.1 Hydrographic regions

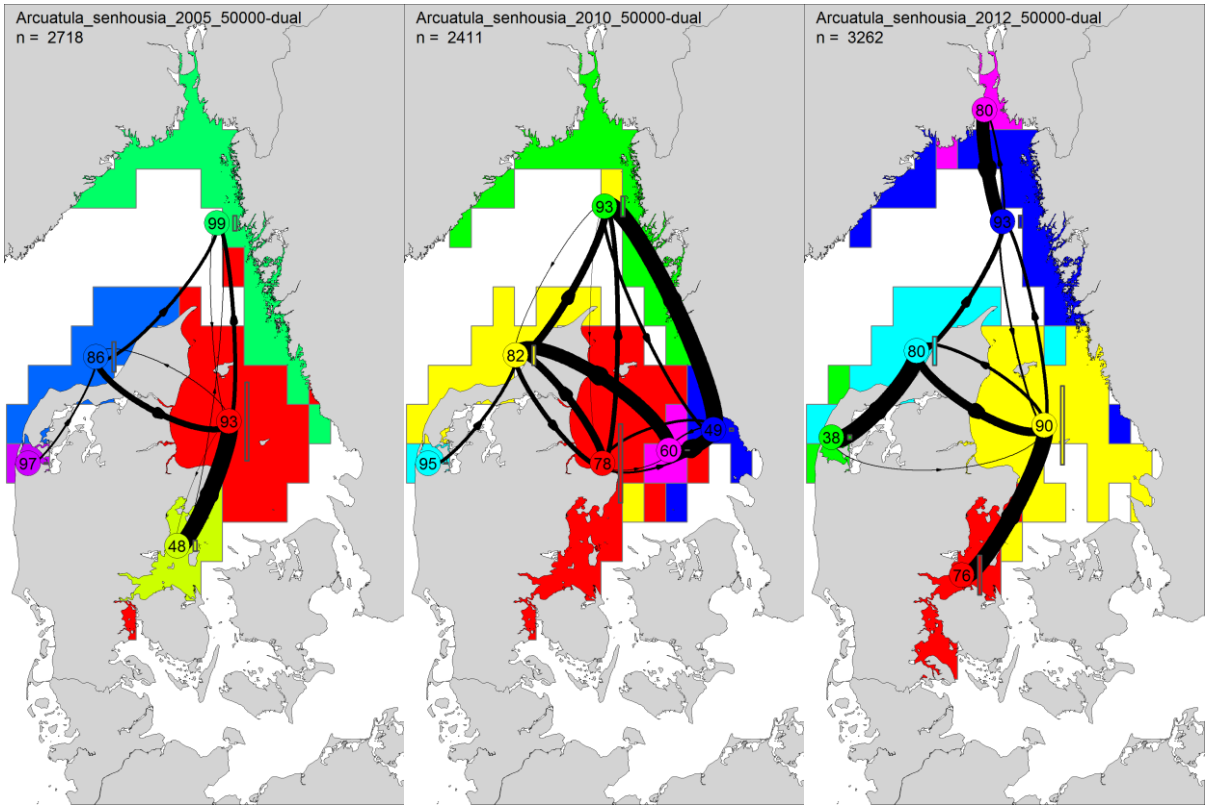
2.1.1 200 000 agents



2.1.2 200 000 agents (0-15 m)

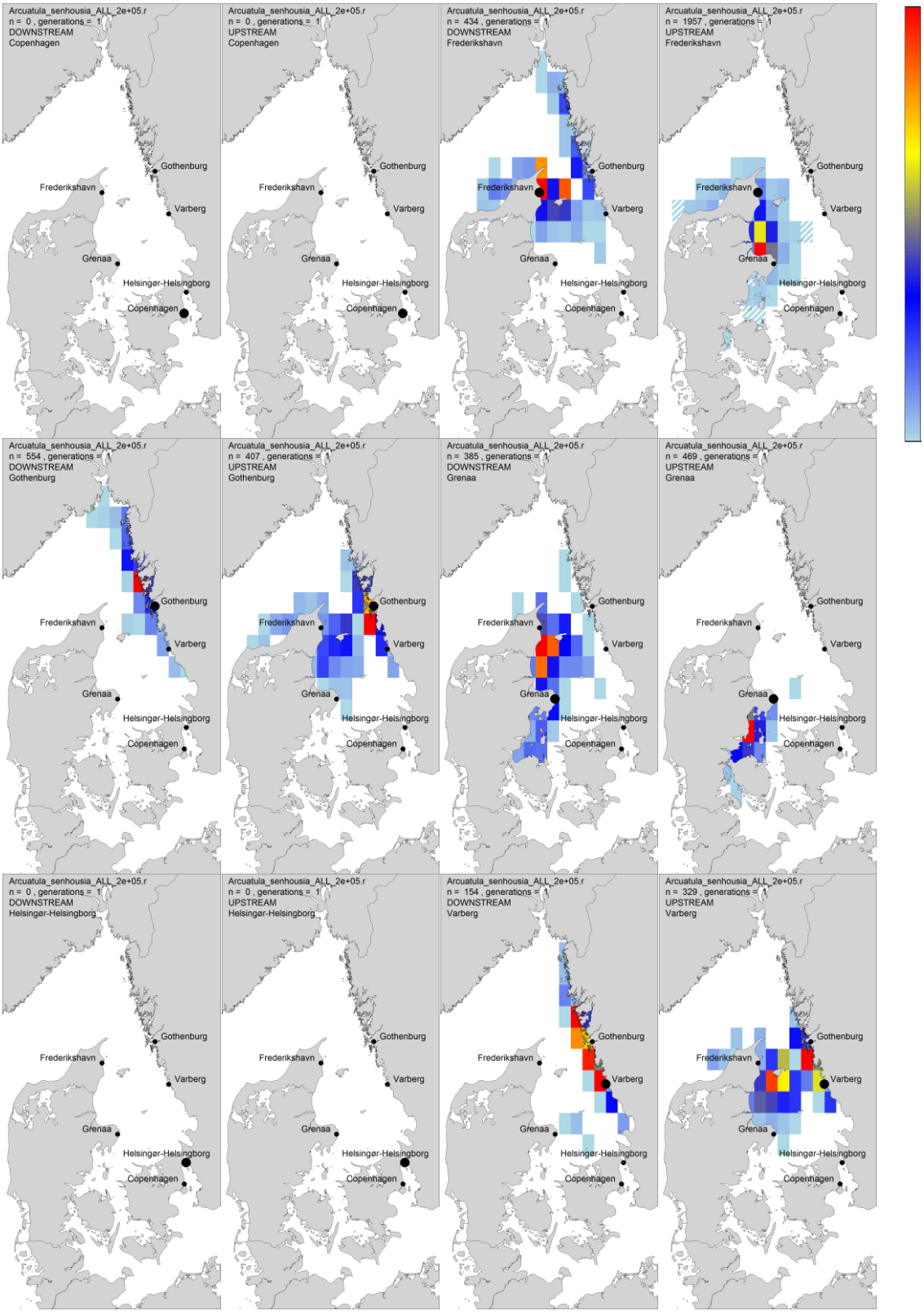


2.1.3 50 000 agents

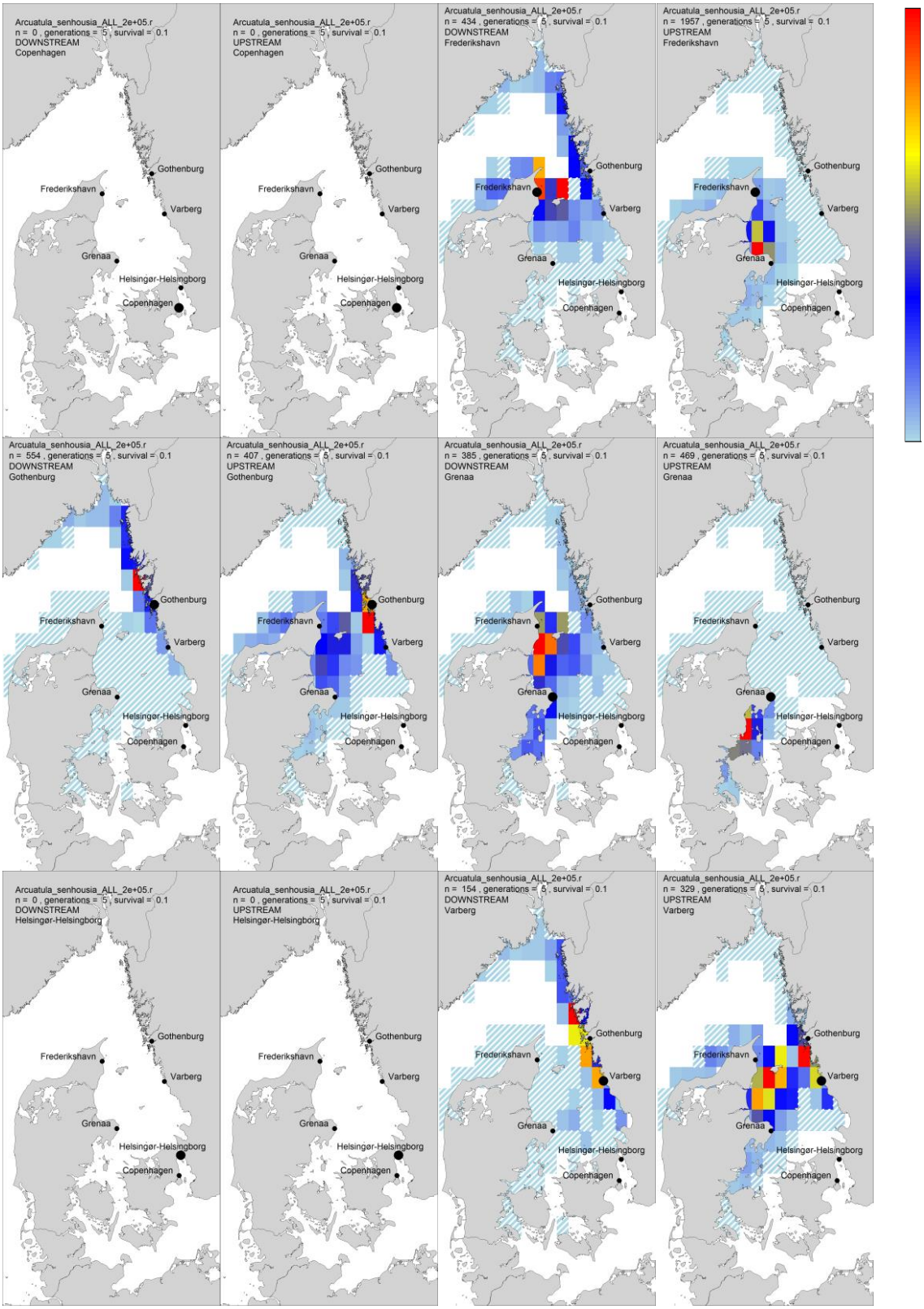


2.2 Dispersal probability plots

2.2.1 Single generation



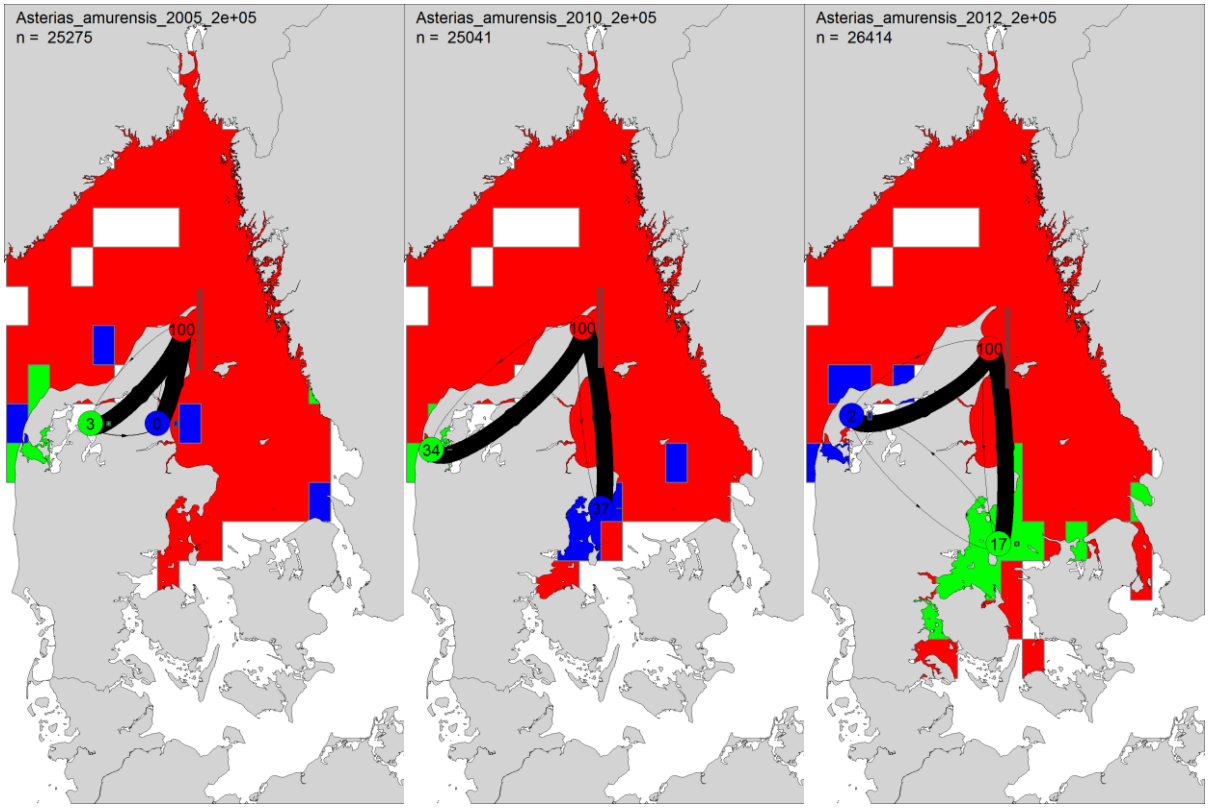
2.2.2 Multiple generations



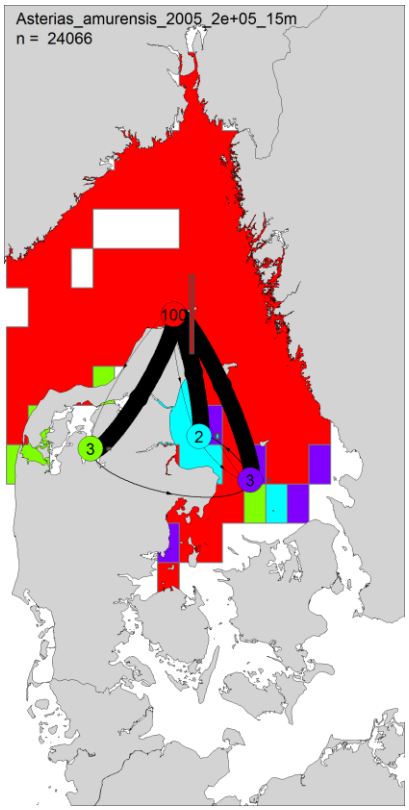
3 Asterias amurensis

3.1 Hydrographic regions

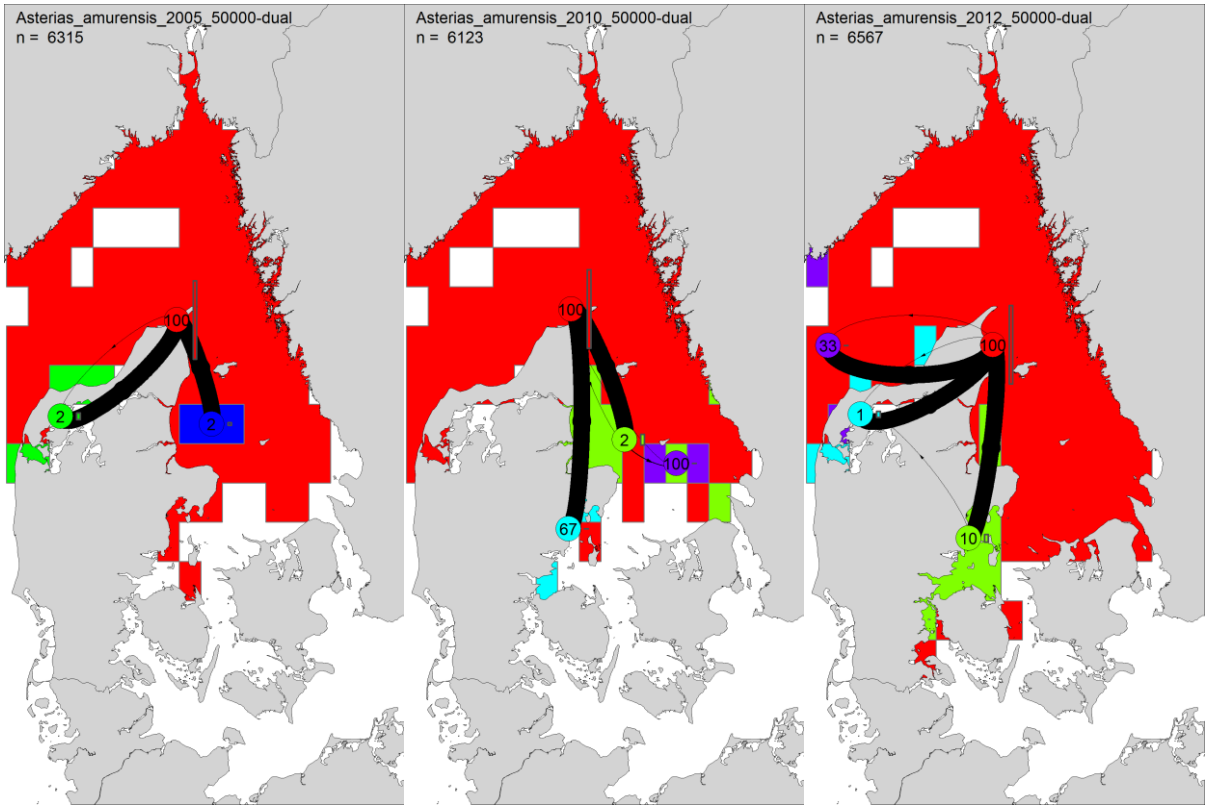
3.1.1 200 000 agents



3.1.2 200 000 agents (0-15 m)

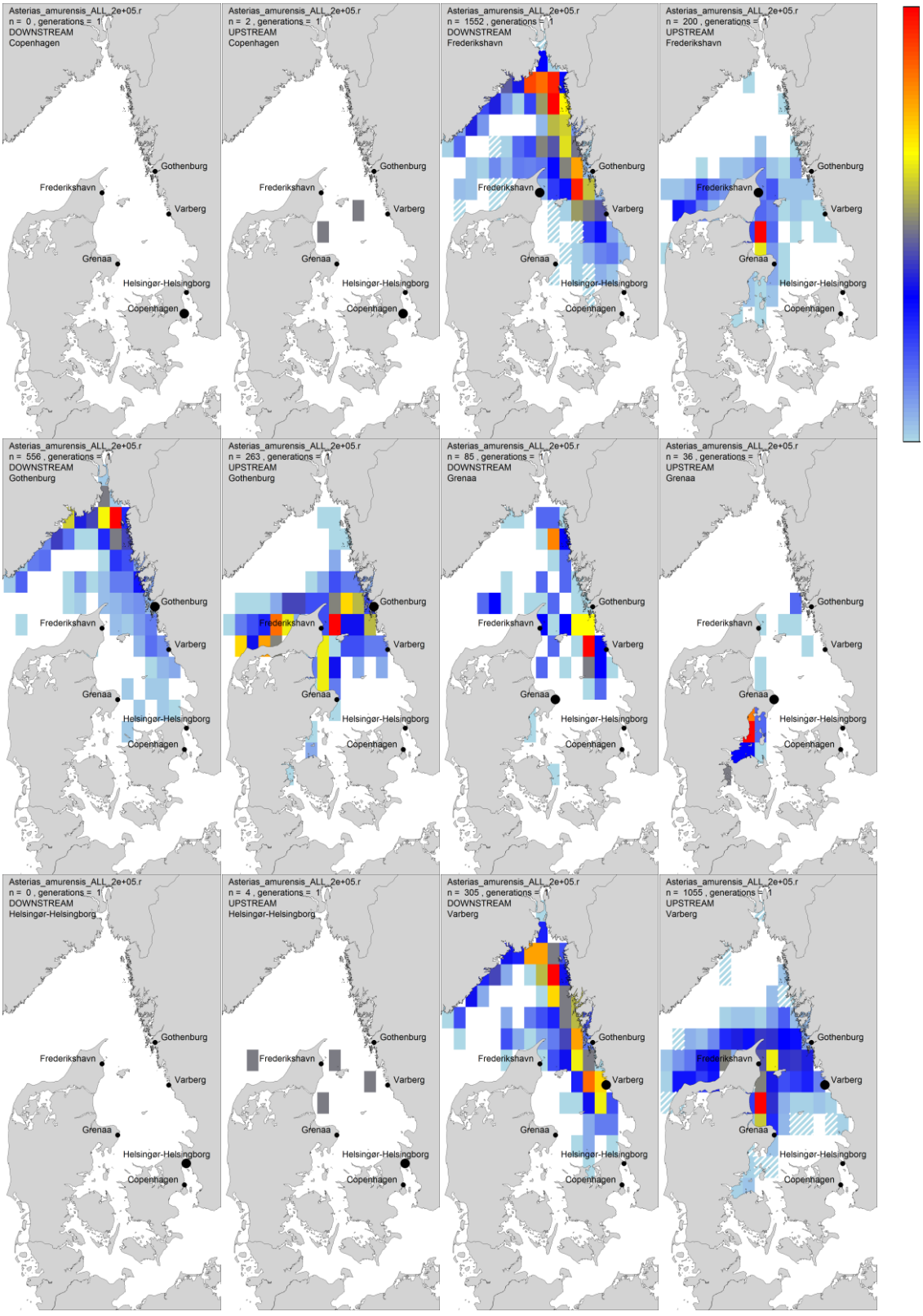


3.1.3 50 000 agents

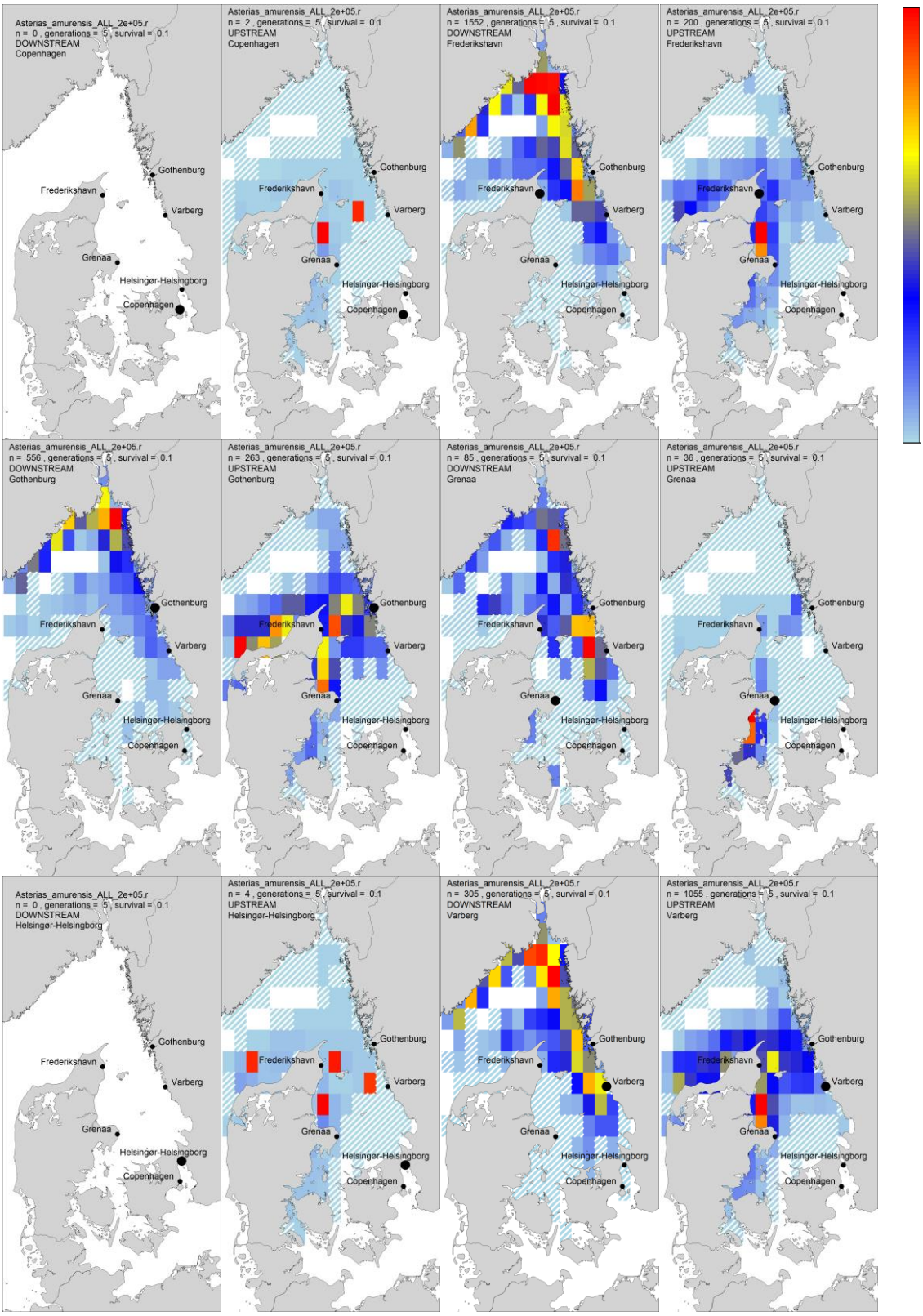


3.2 Dispersal probability plots

3.2.1 Single generation



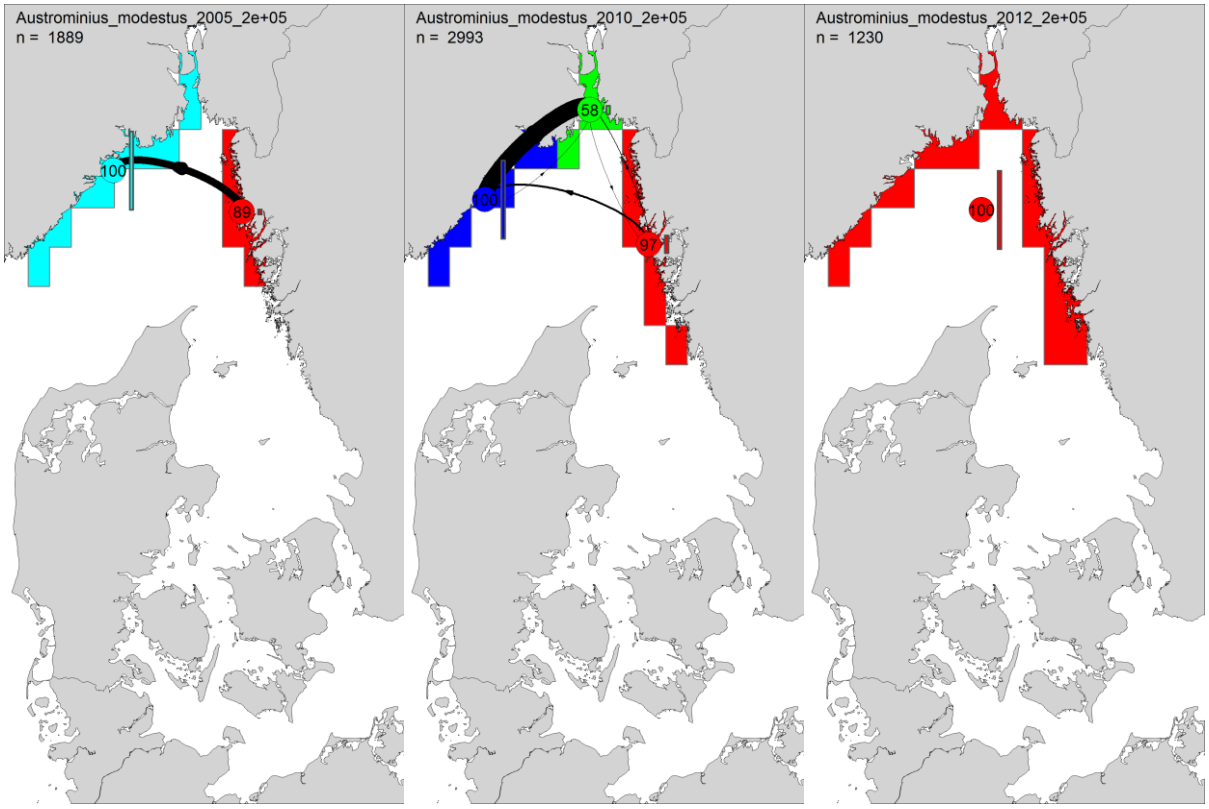
3.2.2 Multiple generations



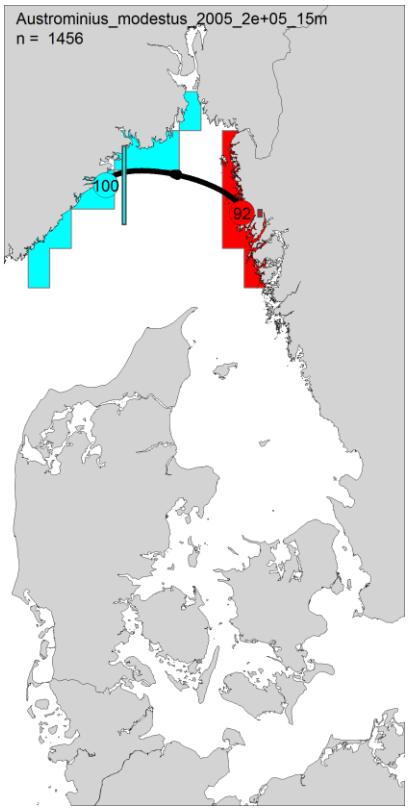
4 Austrominius modestus

4.1 Hydrographic regions

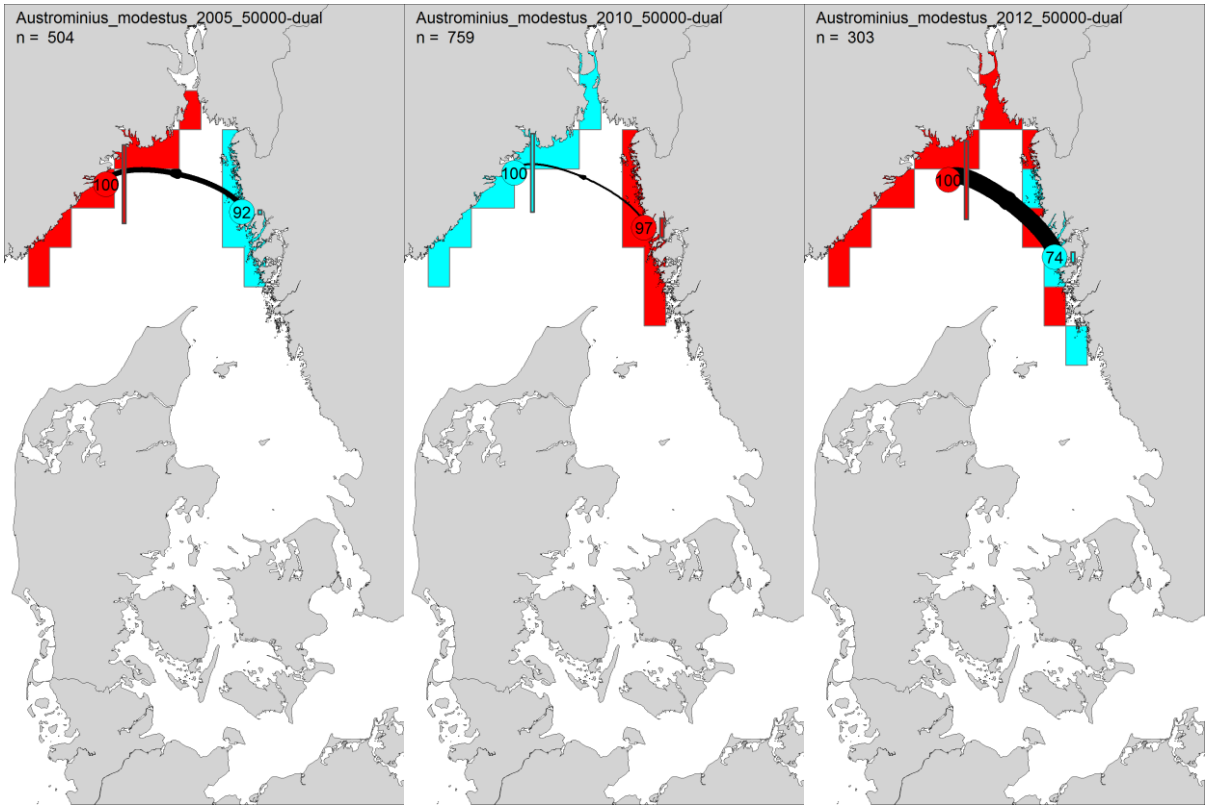
4.1.1 200 000 agents



4.1.2 200 000 agents (0-15 m)

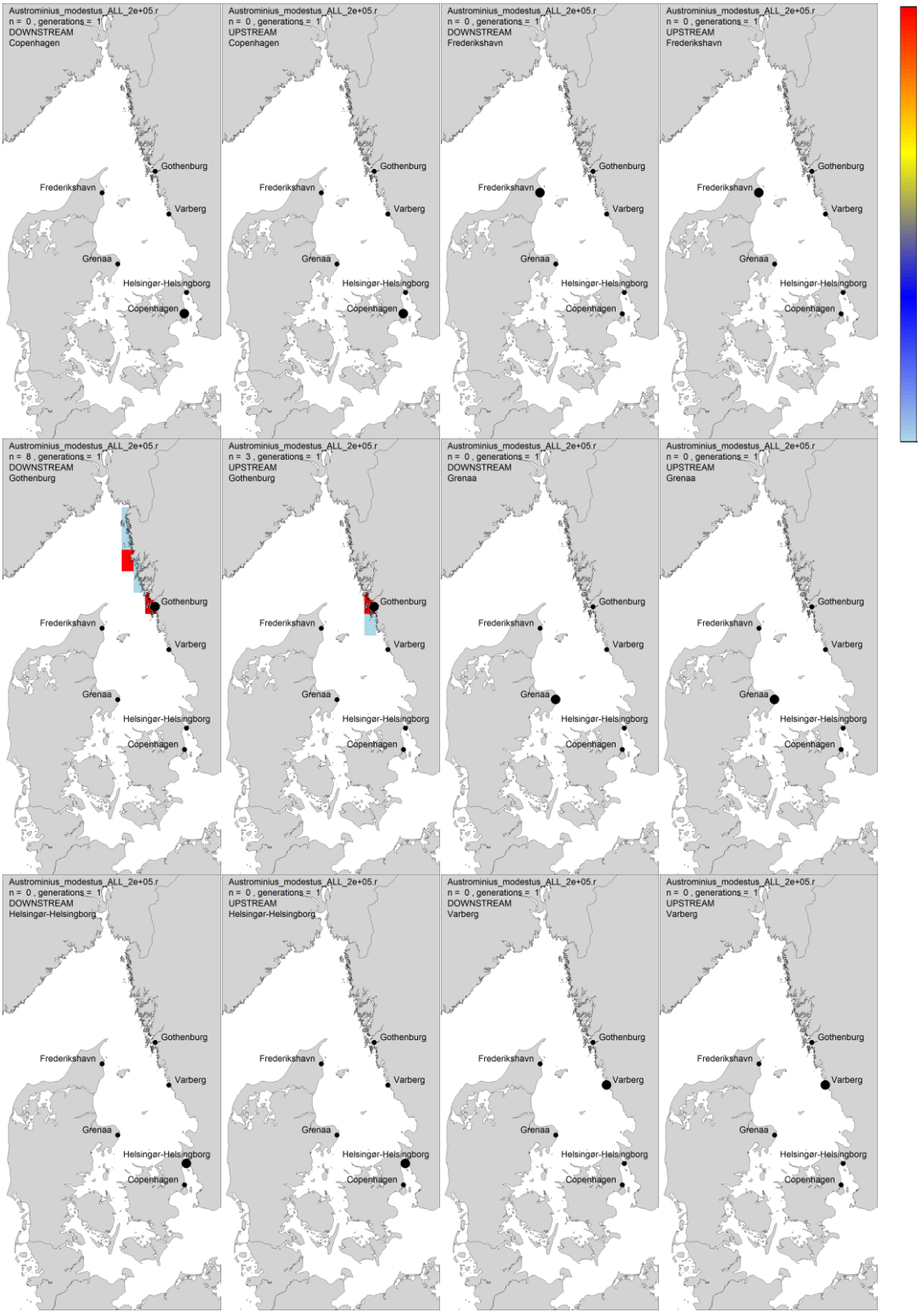


4.1.3 50 000 agents

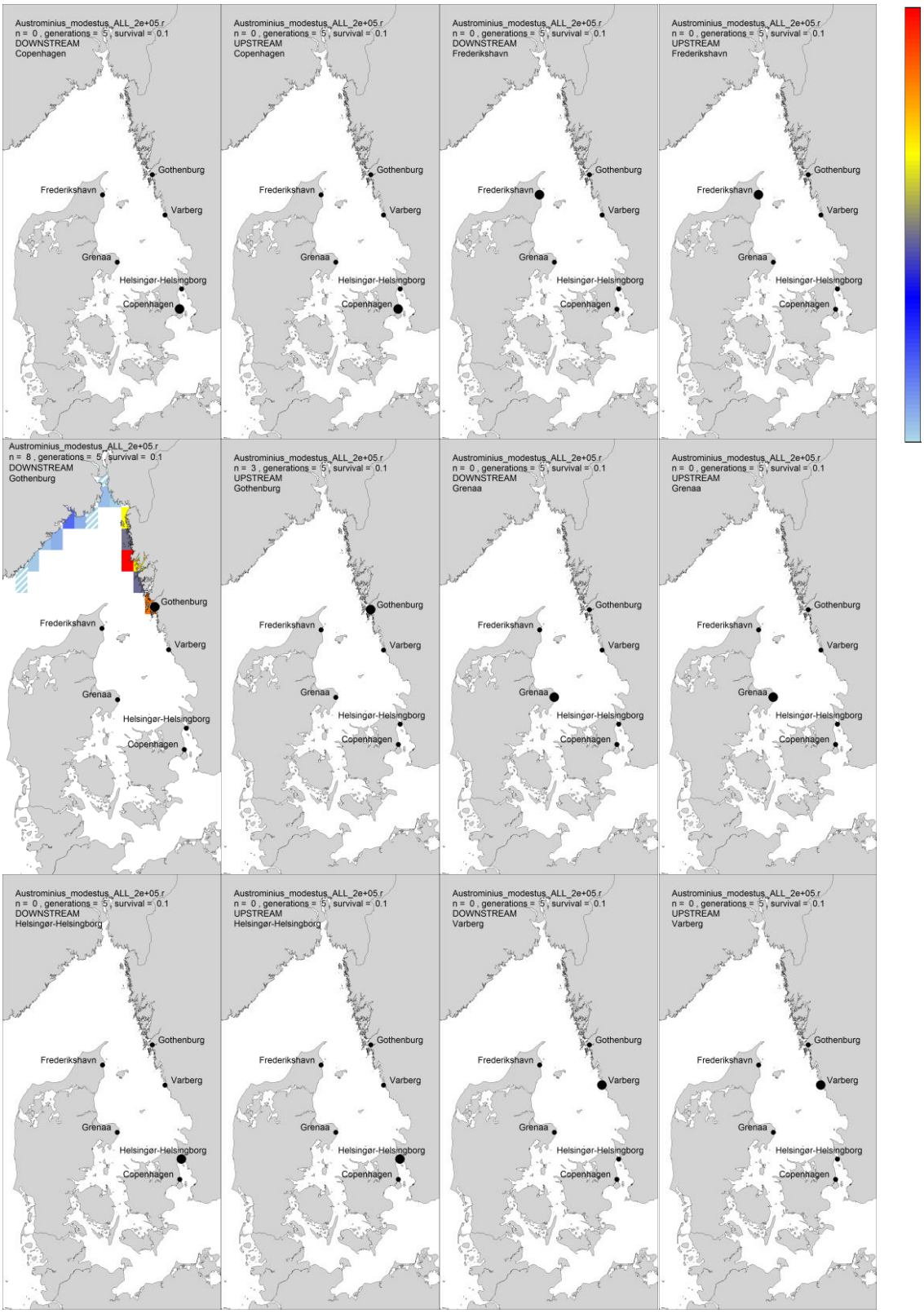


4.2 Dispersal probability plots

4.2.1 Single generation



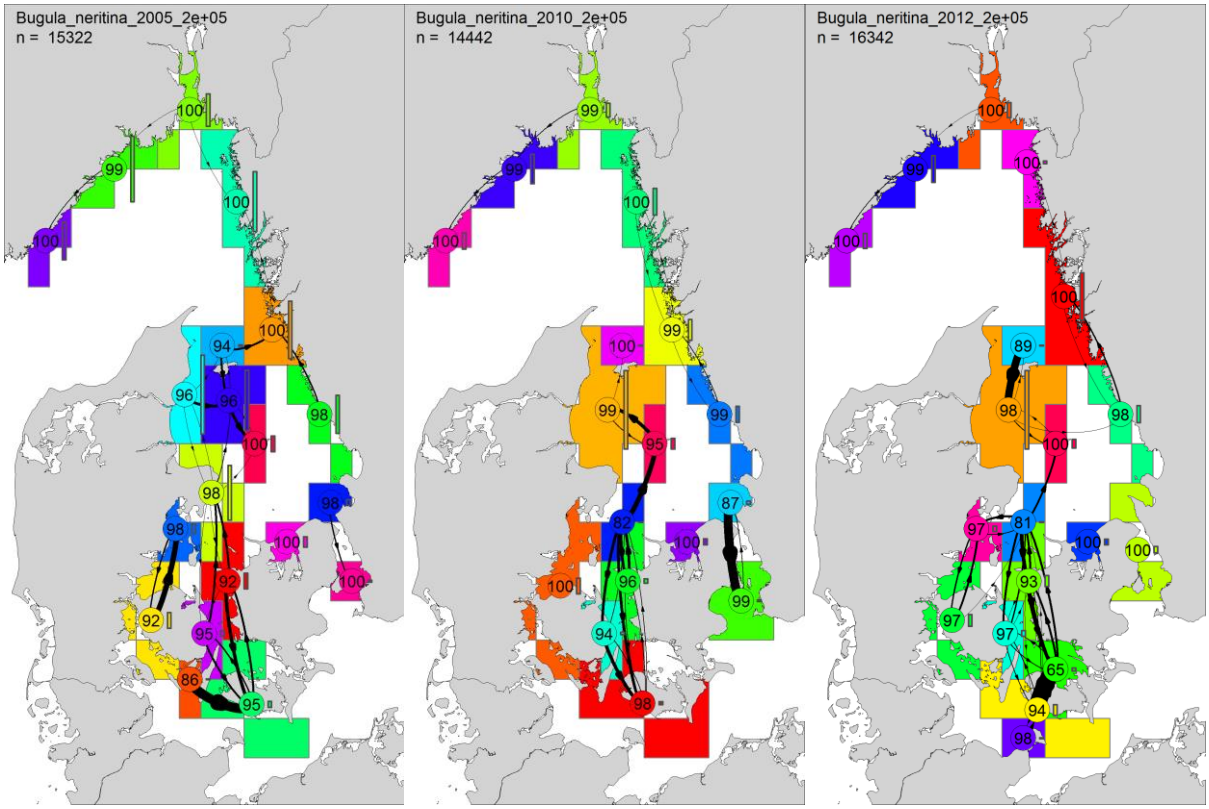
4.2.2 Multiple generations



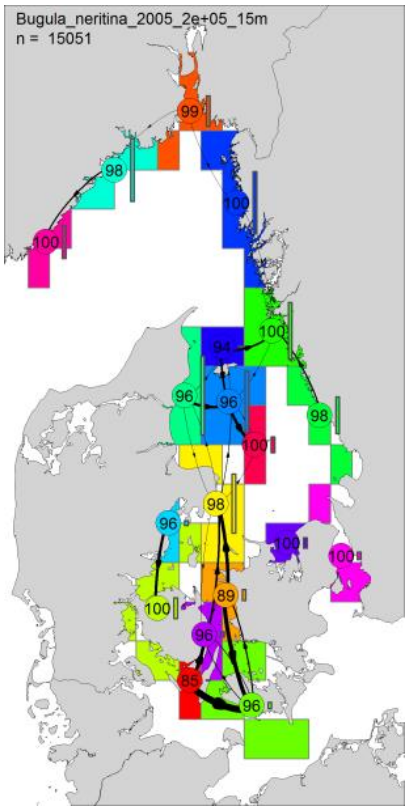
5 Bugula neritina

5.1 Hydrographic regions

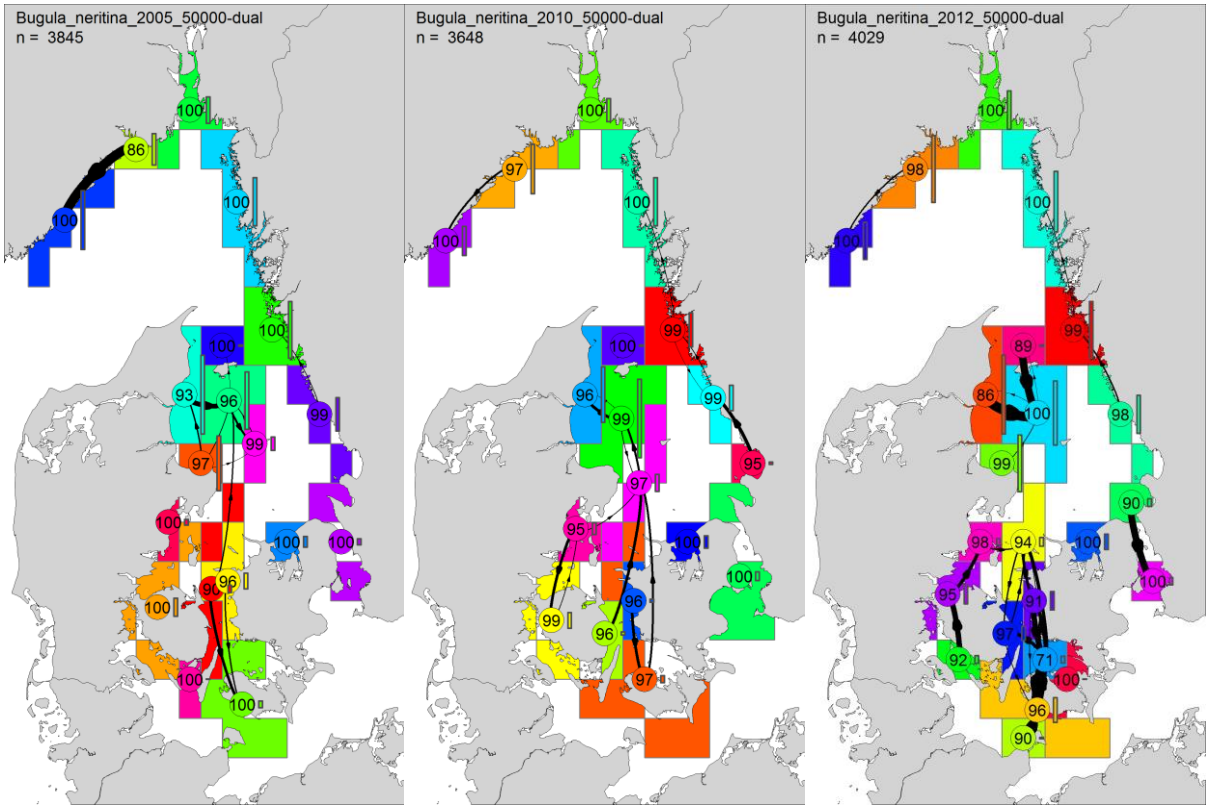
5.1.1 200 000 agents



5.1.2 200 000 agents (0-15 m)

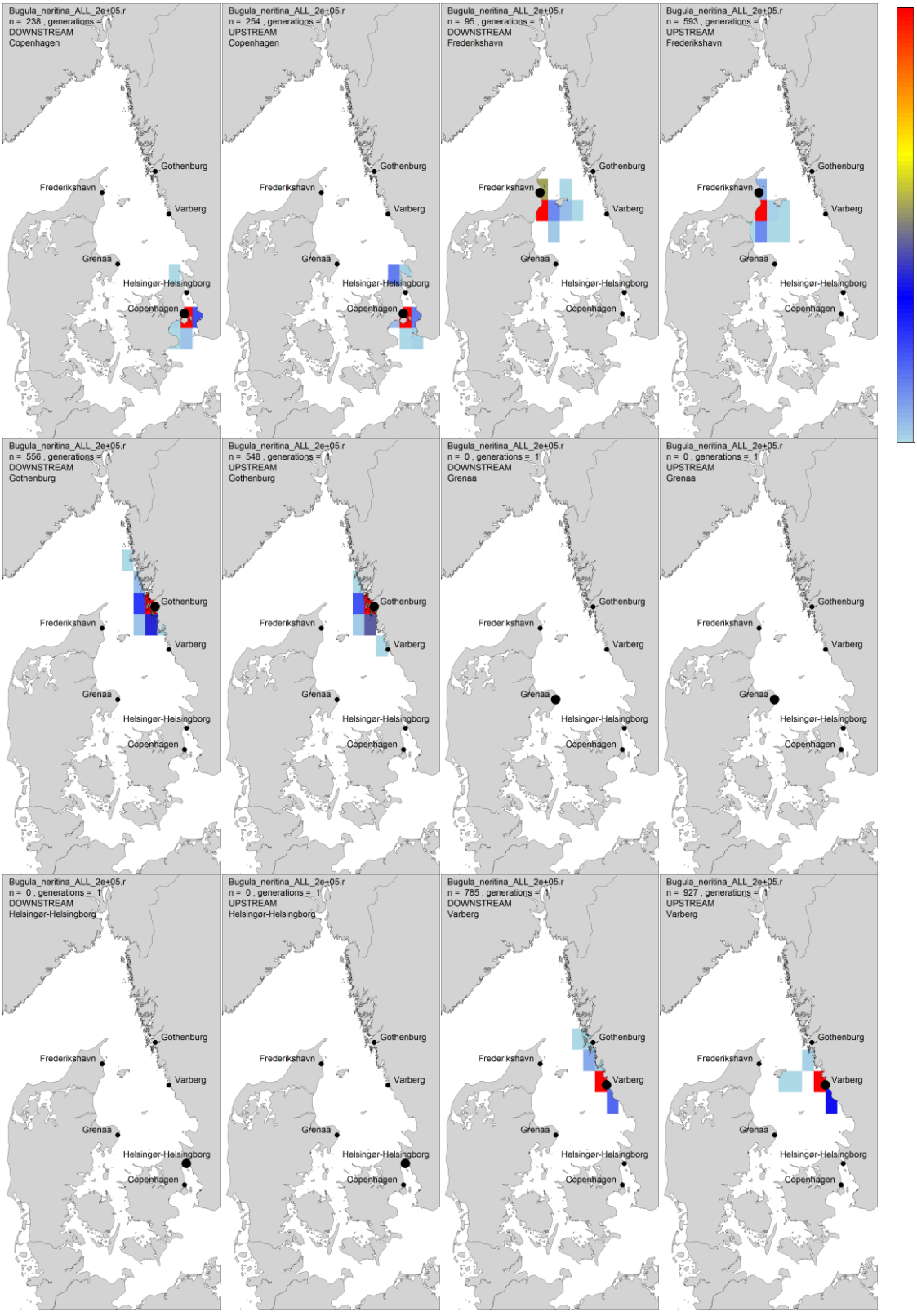


5.1.3 50 000 agents

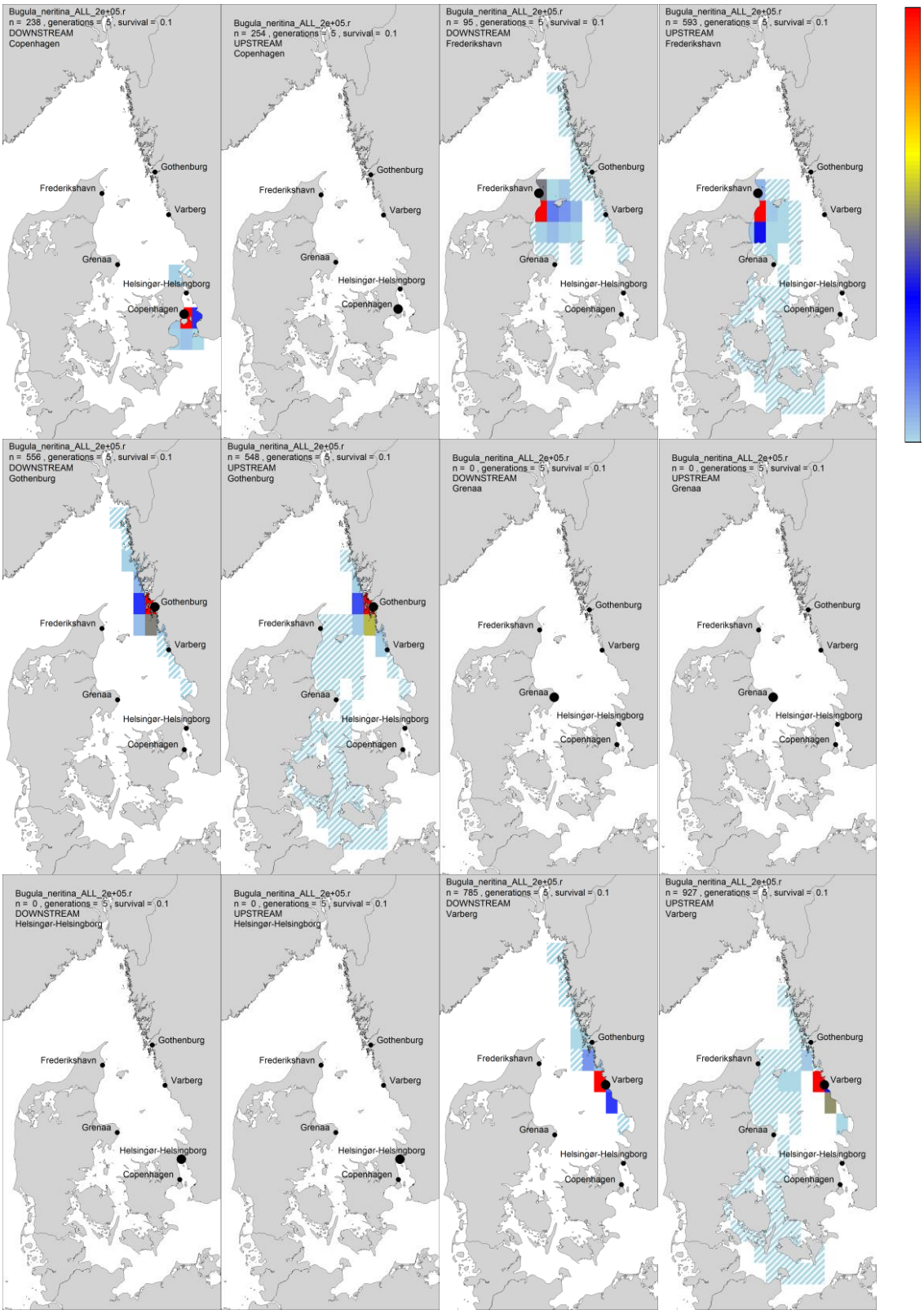


5.2 Dispersal probability plots

5.2.1 Single generation



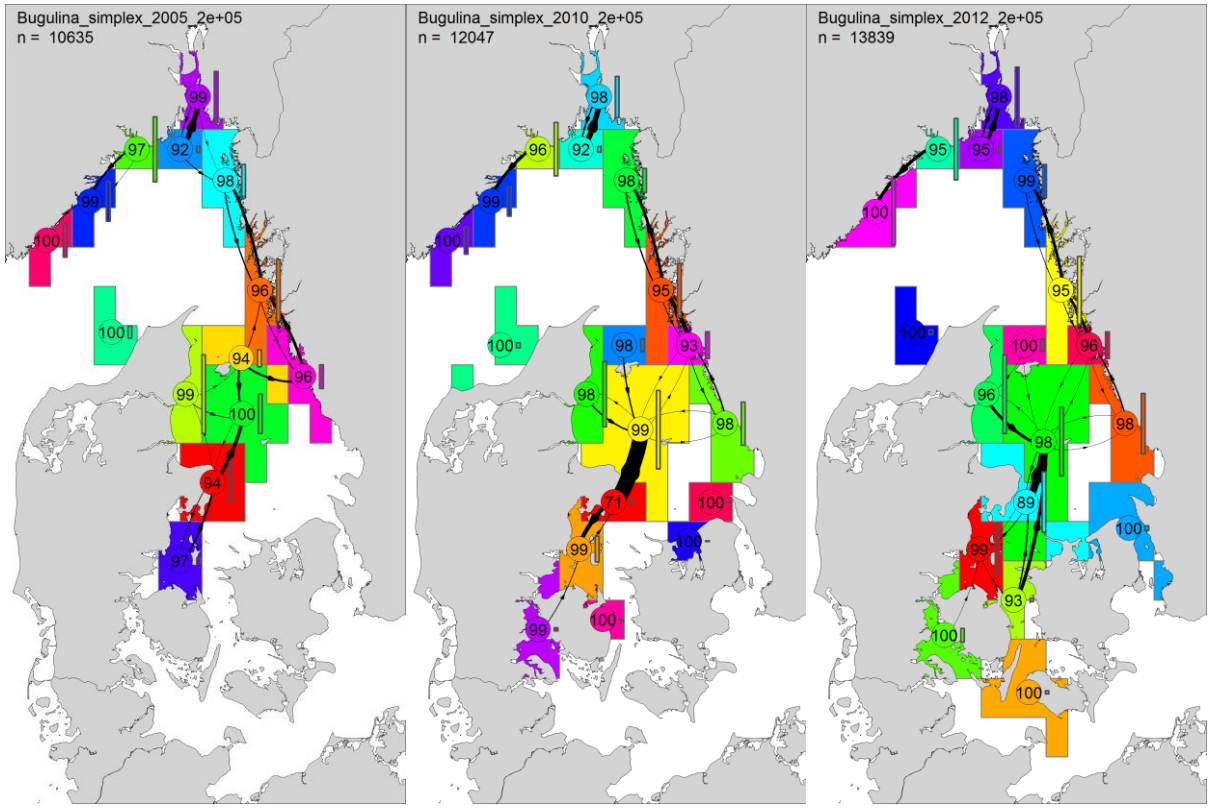
5.2.2 Multiple generations



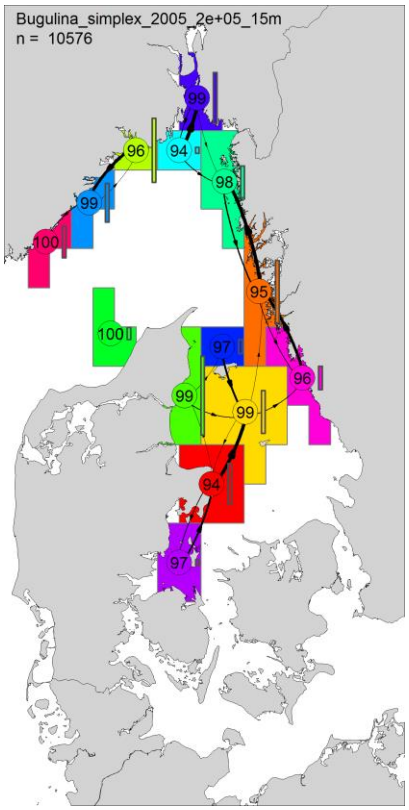
6 Bugulina simplex

6.1 Hydrographic regions

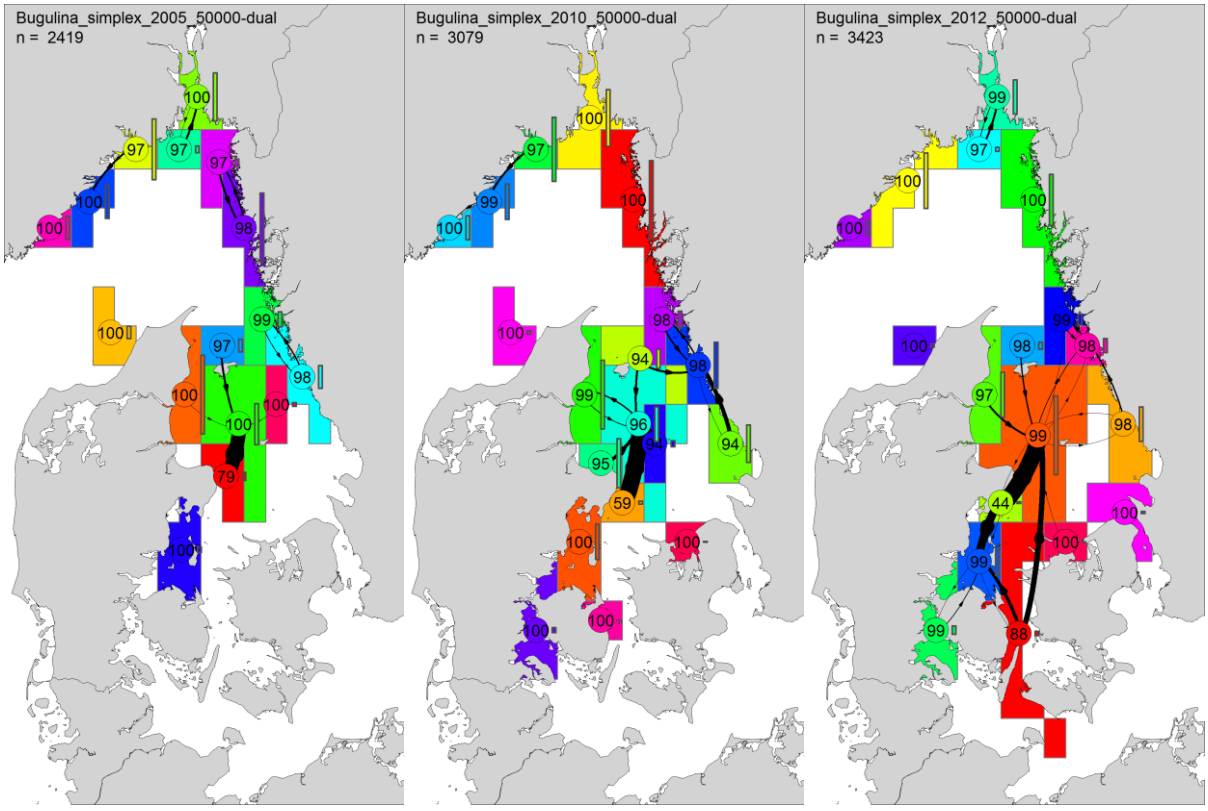
6.1.1 200 000 agents



6.1.2 200 000 agents (0-15 m)

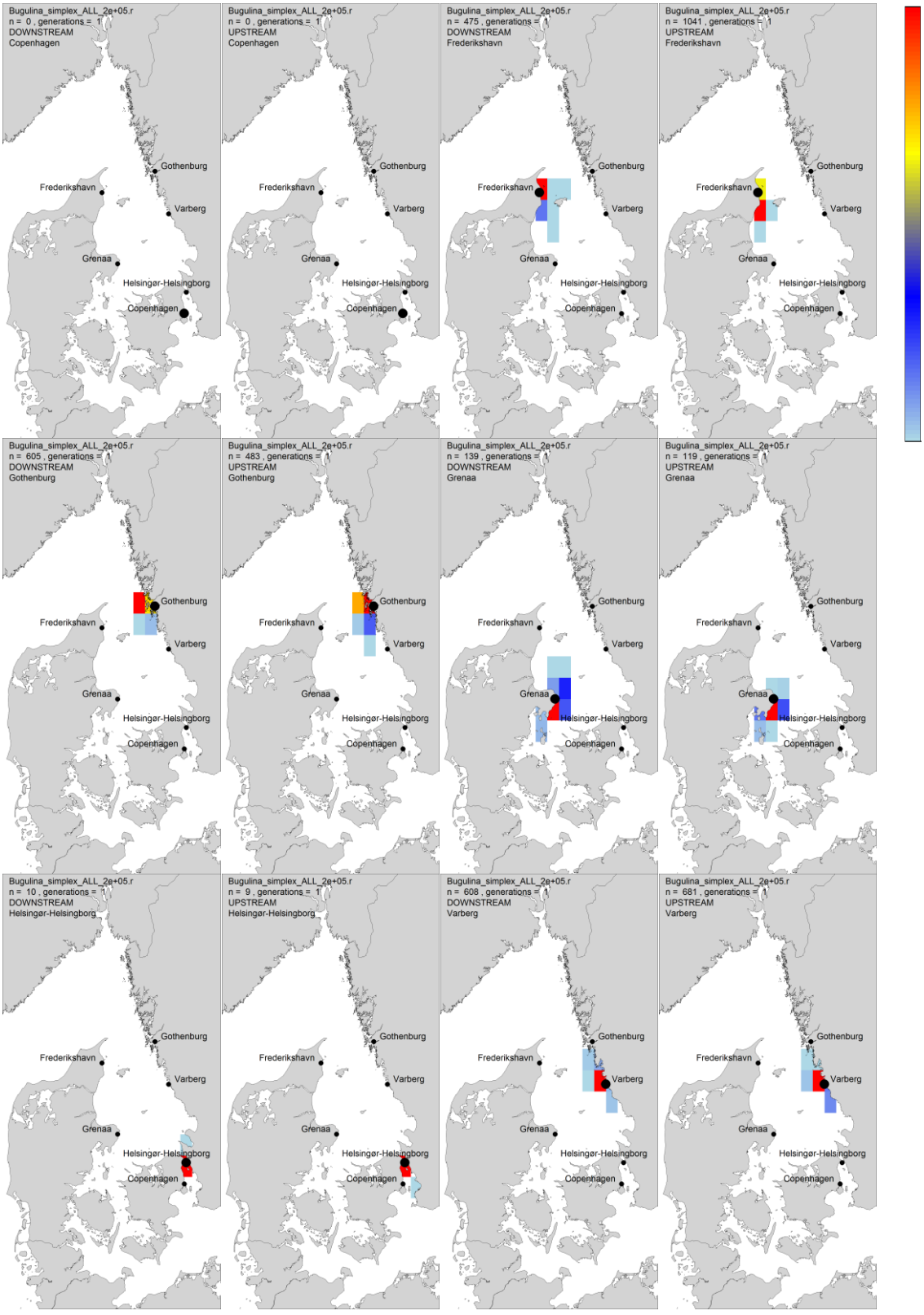


6.1.3 50 000 agents

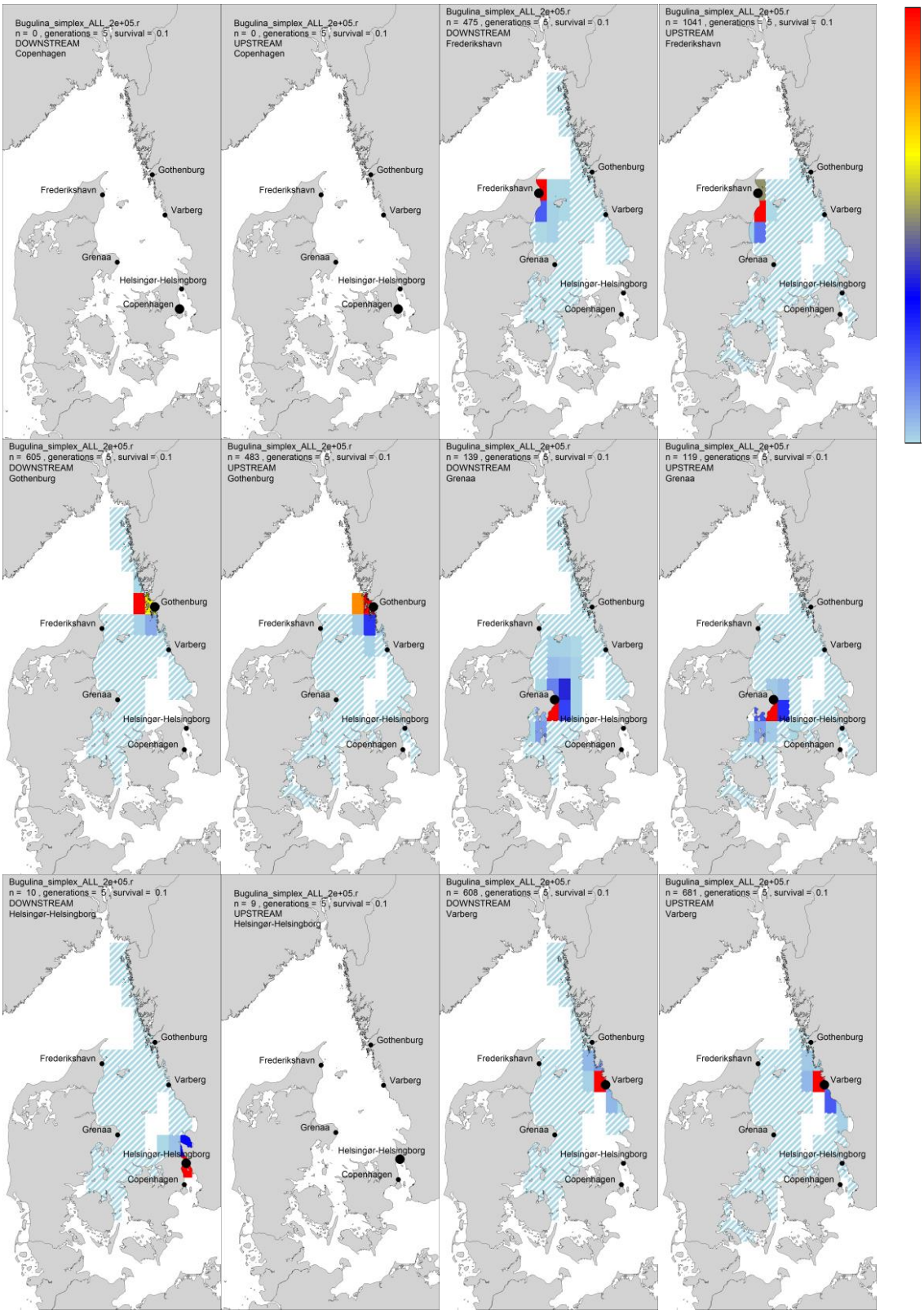


6.2 Dispersal probability plots

6.2.1 Sinlge generation



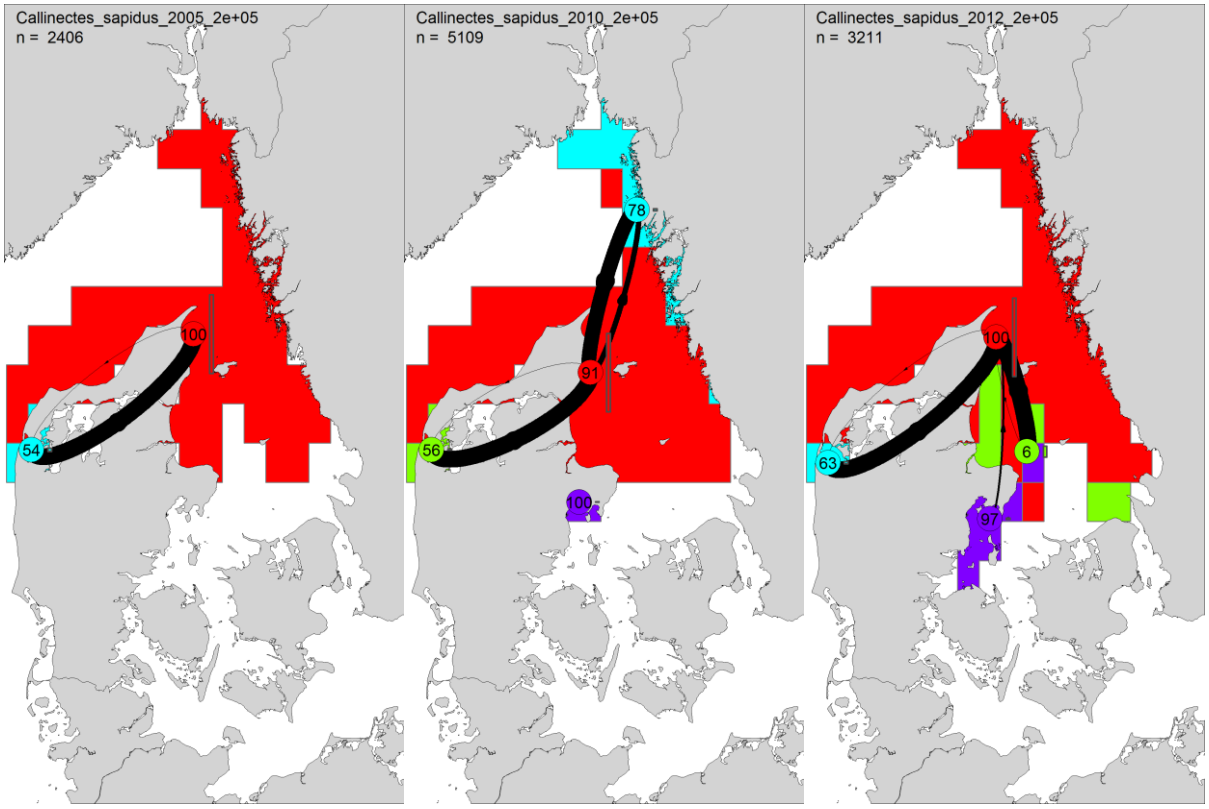
6.2.2 Multiple generations



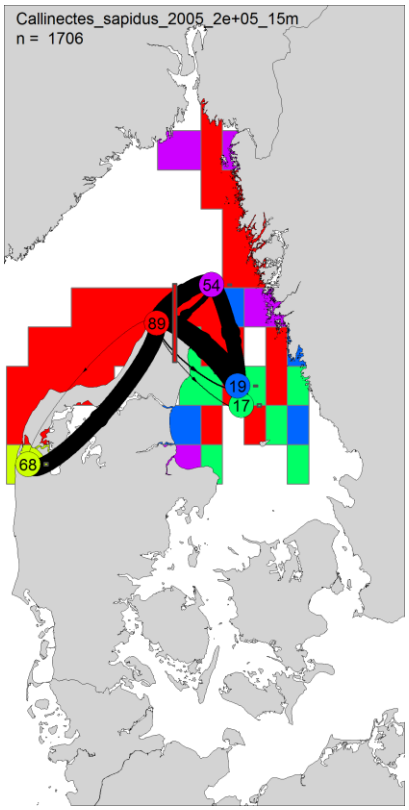
7 Callinectes sapidus

7.1 Hydrographic regions

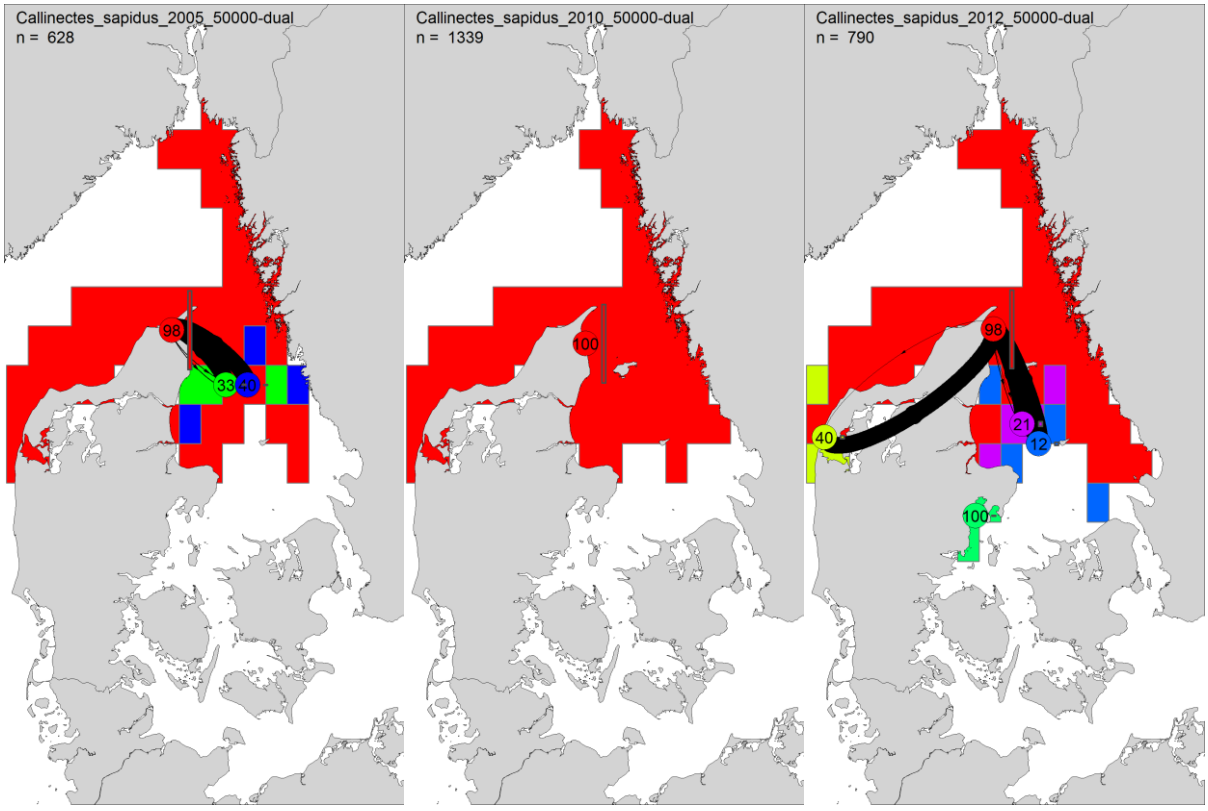
7.1.1 200 000 agents



7.1.2 200 000 agents (0-15 m)

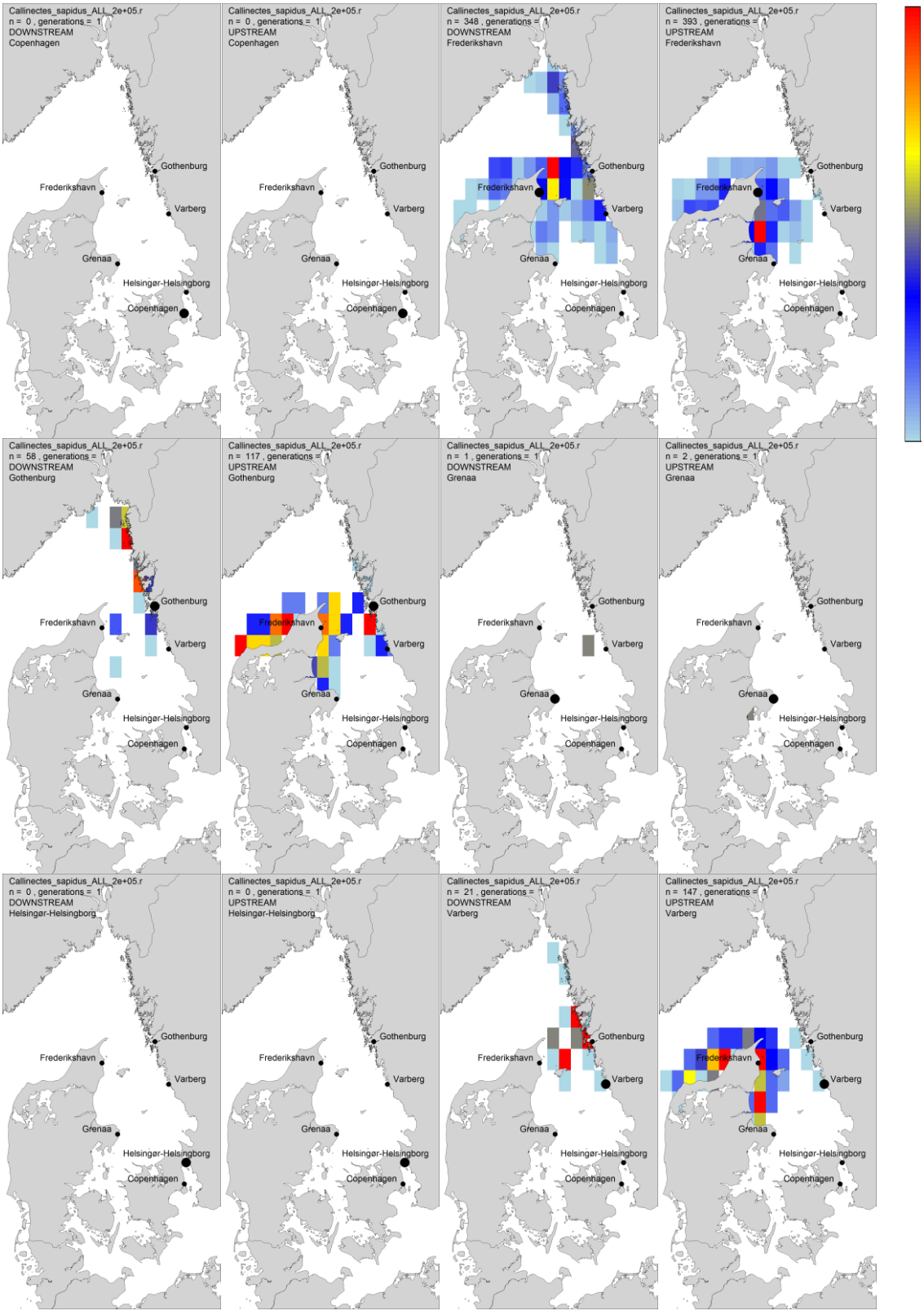


7.1.3 50 000 agents

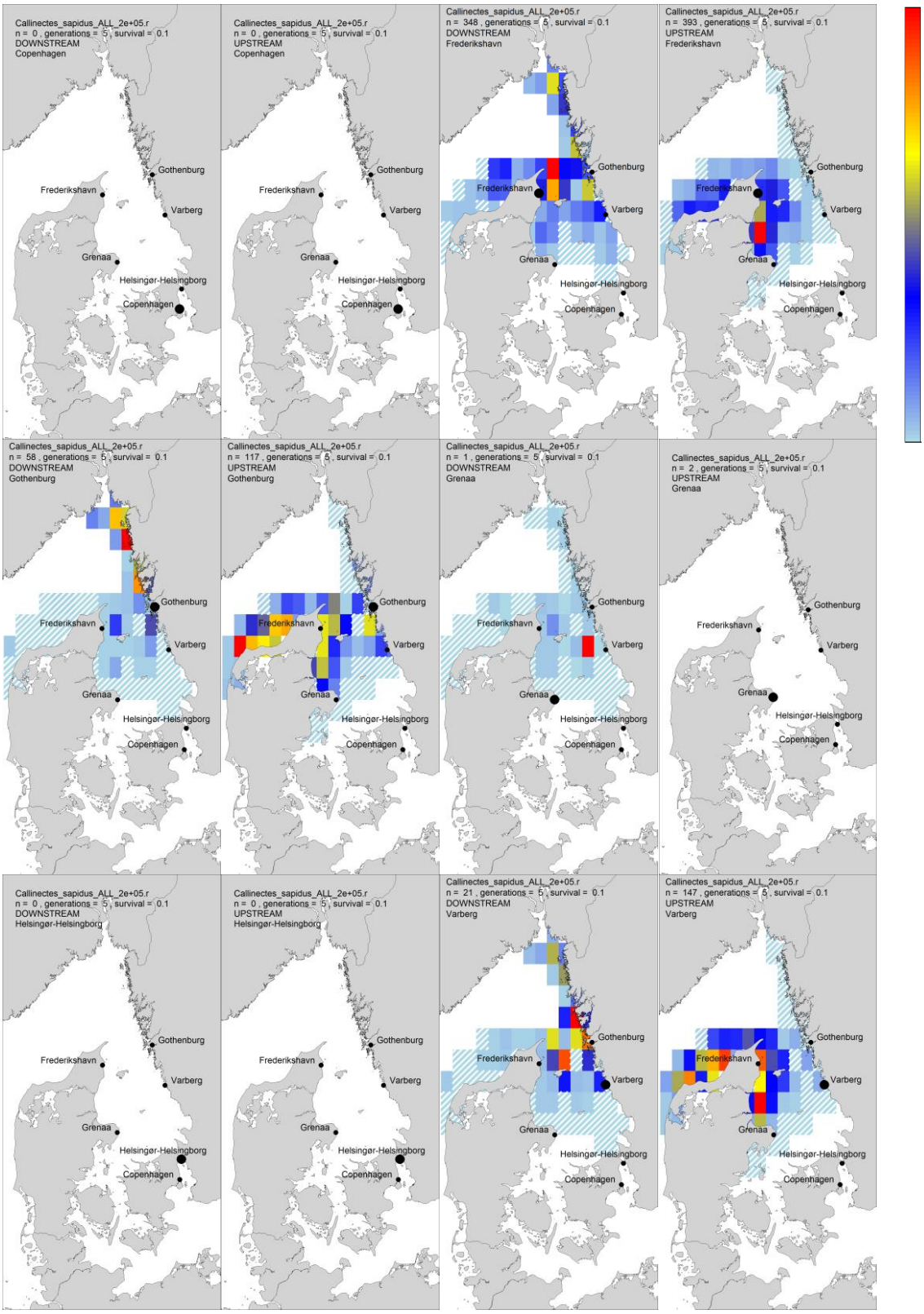


7.2 Dispersal probability plots

7.2.1 Single generation



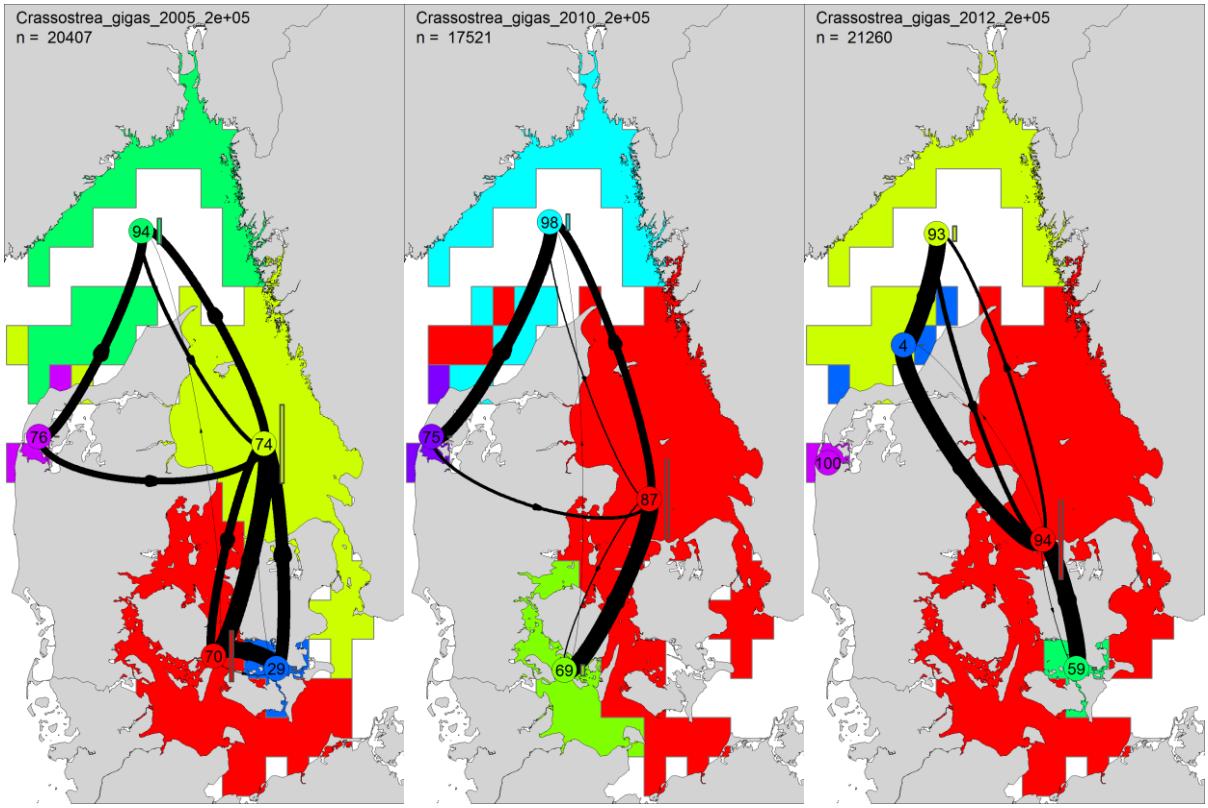
7.2.2 Multiple generations



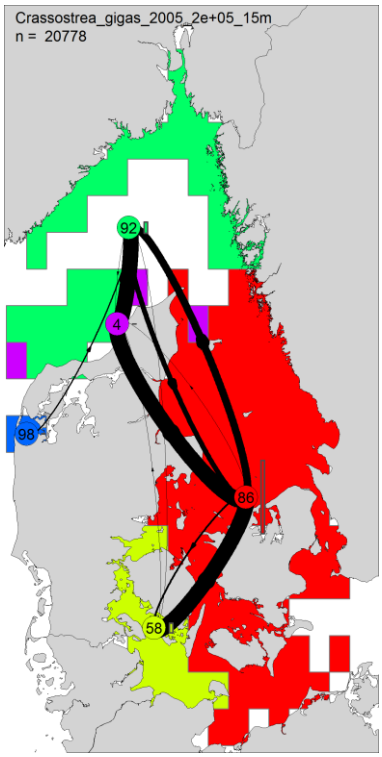
8 Crassostrea gigas

8.1 Hydrographic regions

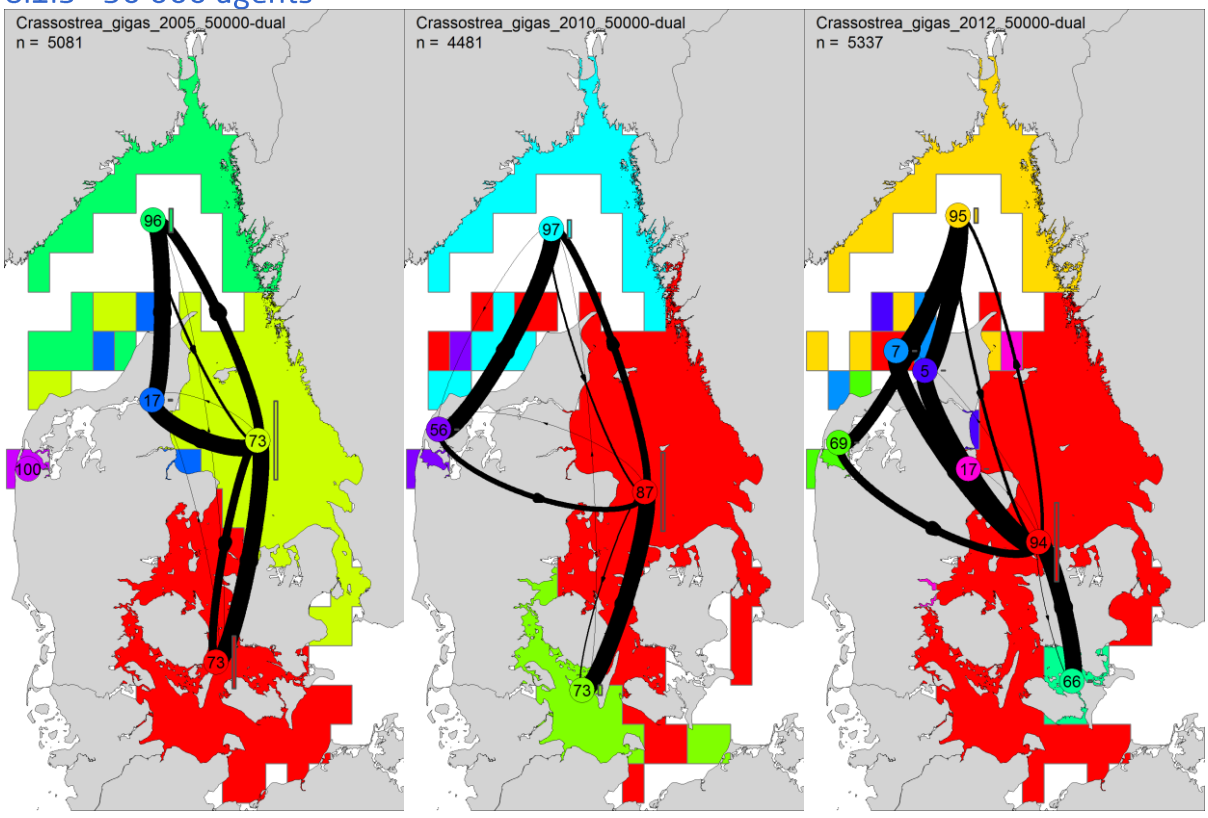
8.1.1 200 000 agents



8.1.2 200 000 agents (0-15 m)

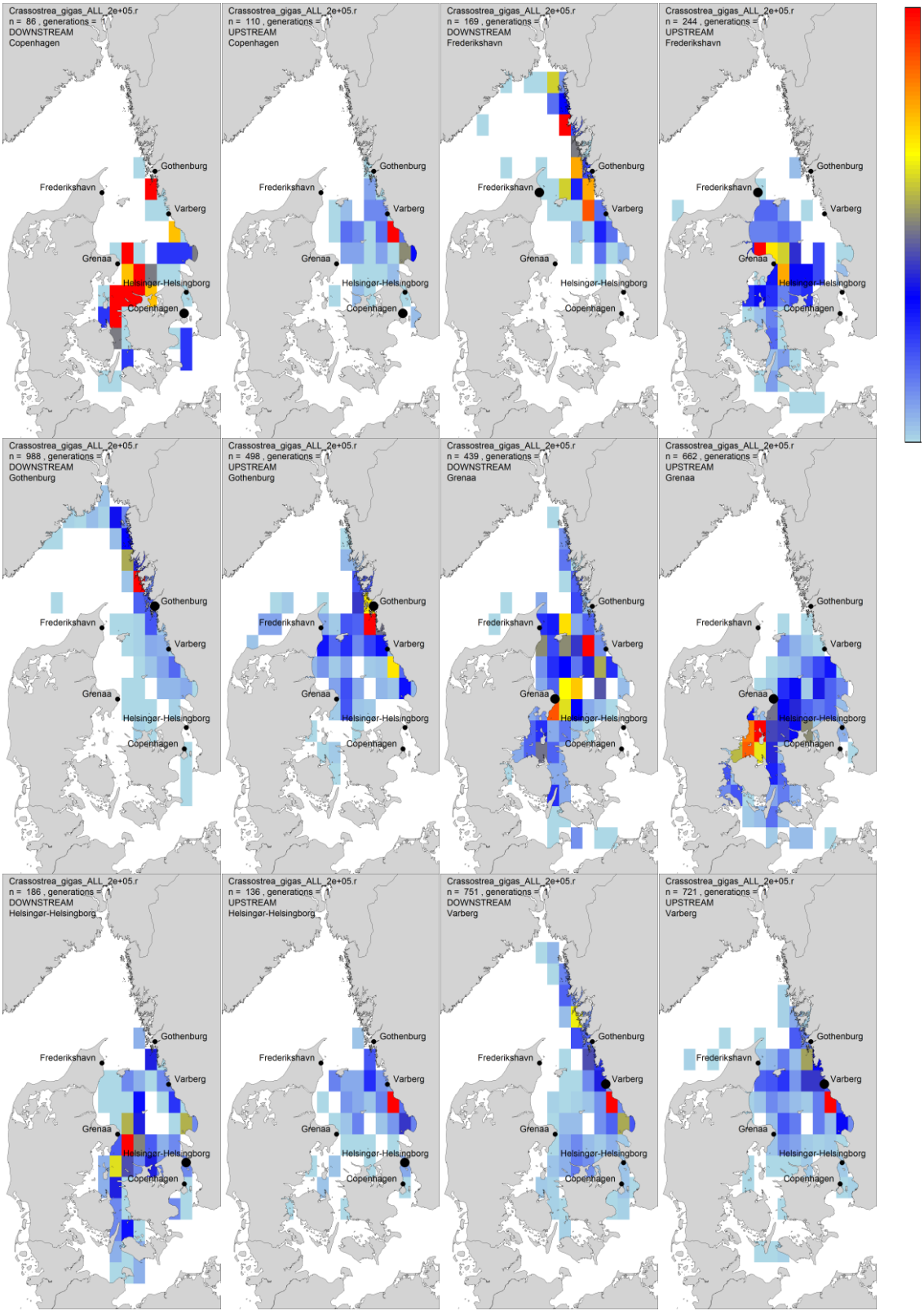


8.1.3 50 000 agents

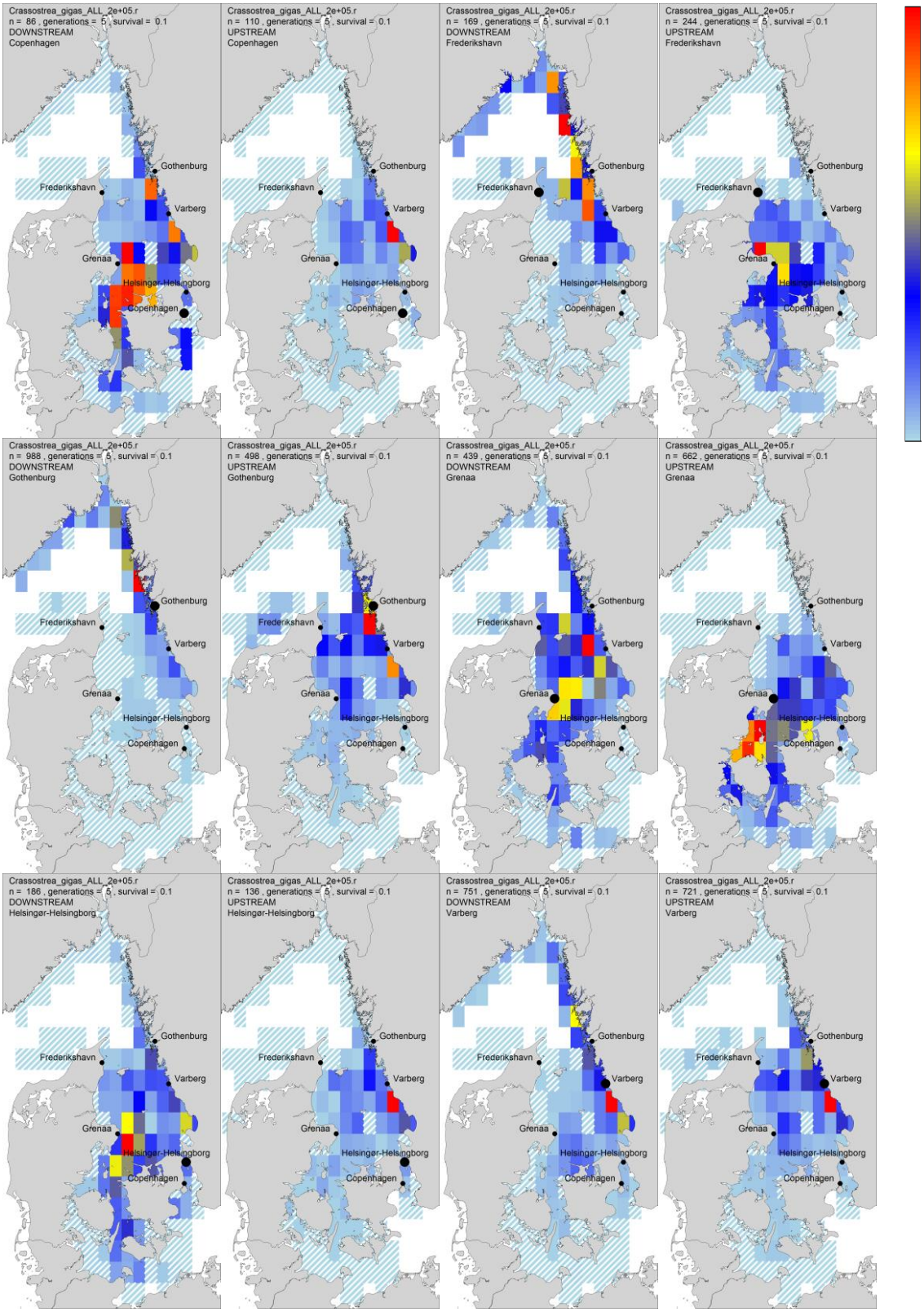


8.2 Dispersal probability plots

8.2.1 Single generation



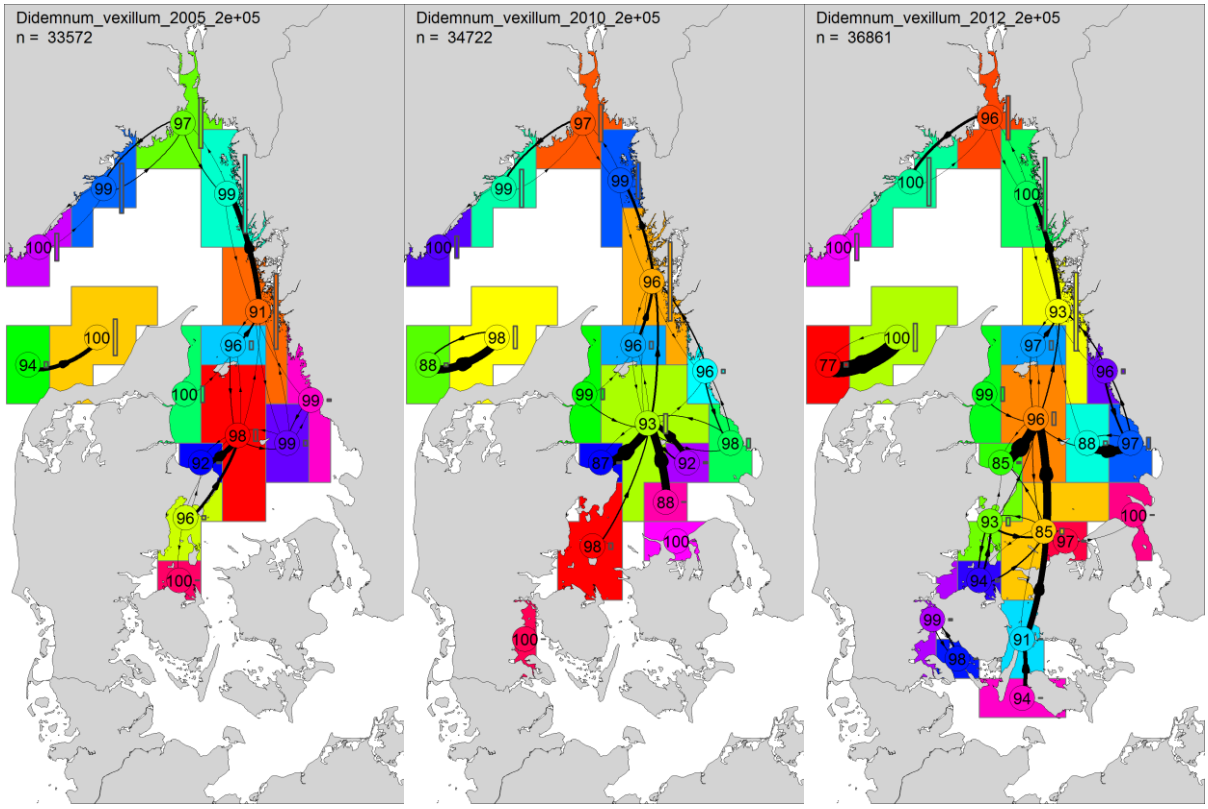
8.2.2 Multiple generations



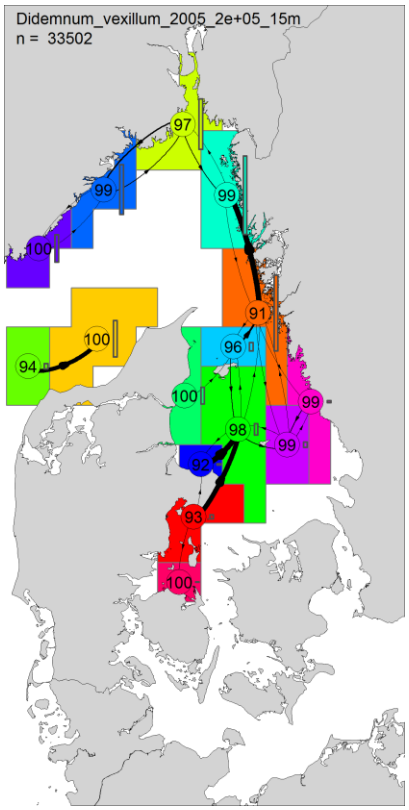
9 Didemnum vexillum

9.1 Hydrographic regions

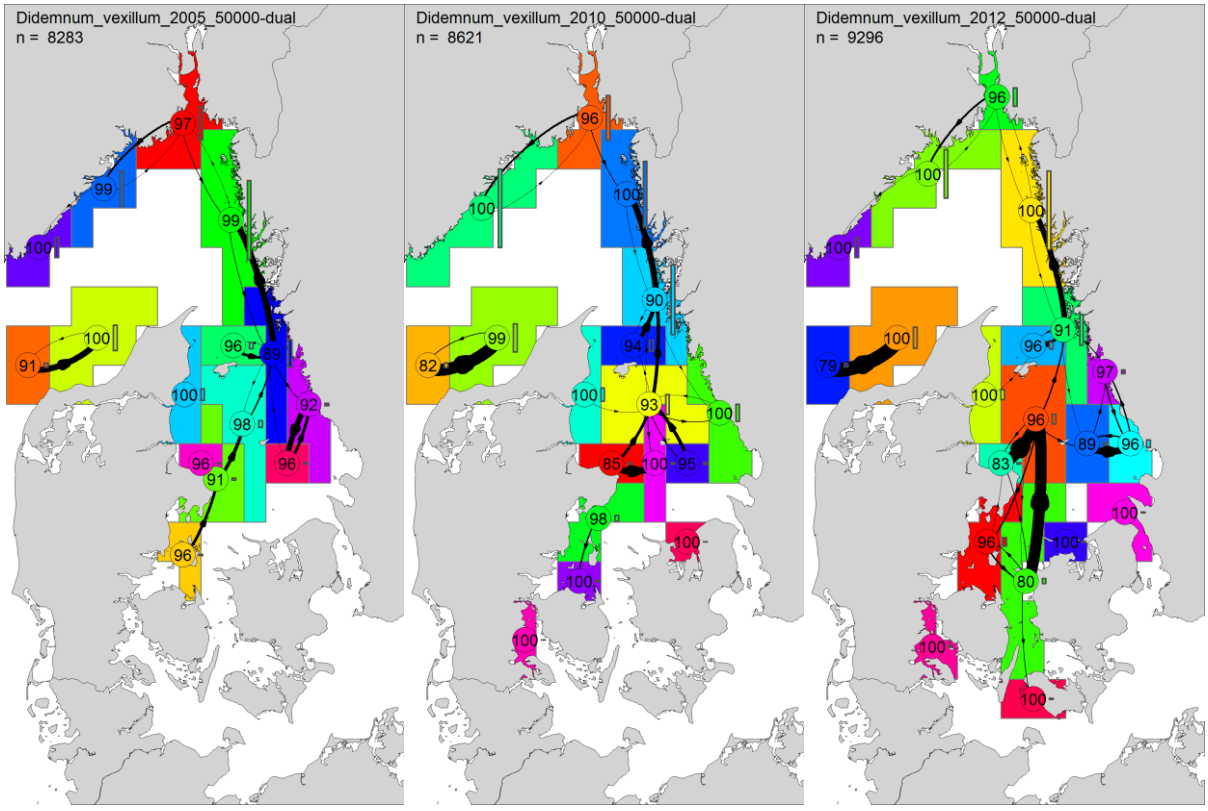
9.1.1 200 000 agents



9.1.2 200 000 agents (0-15 m)

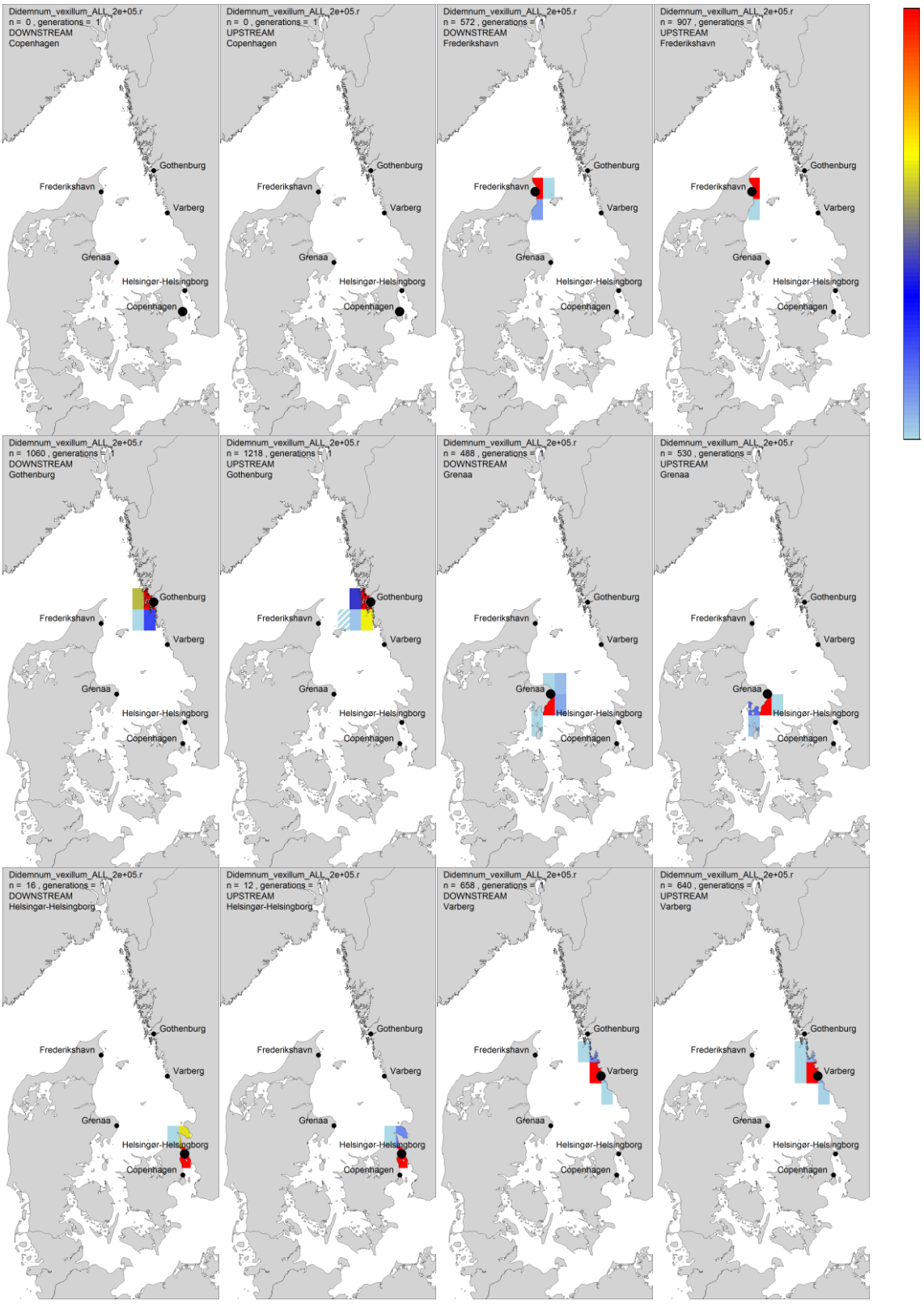


9.1.3 50 000 agents

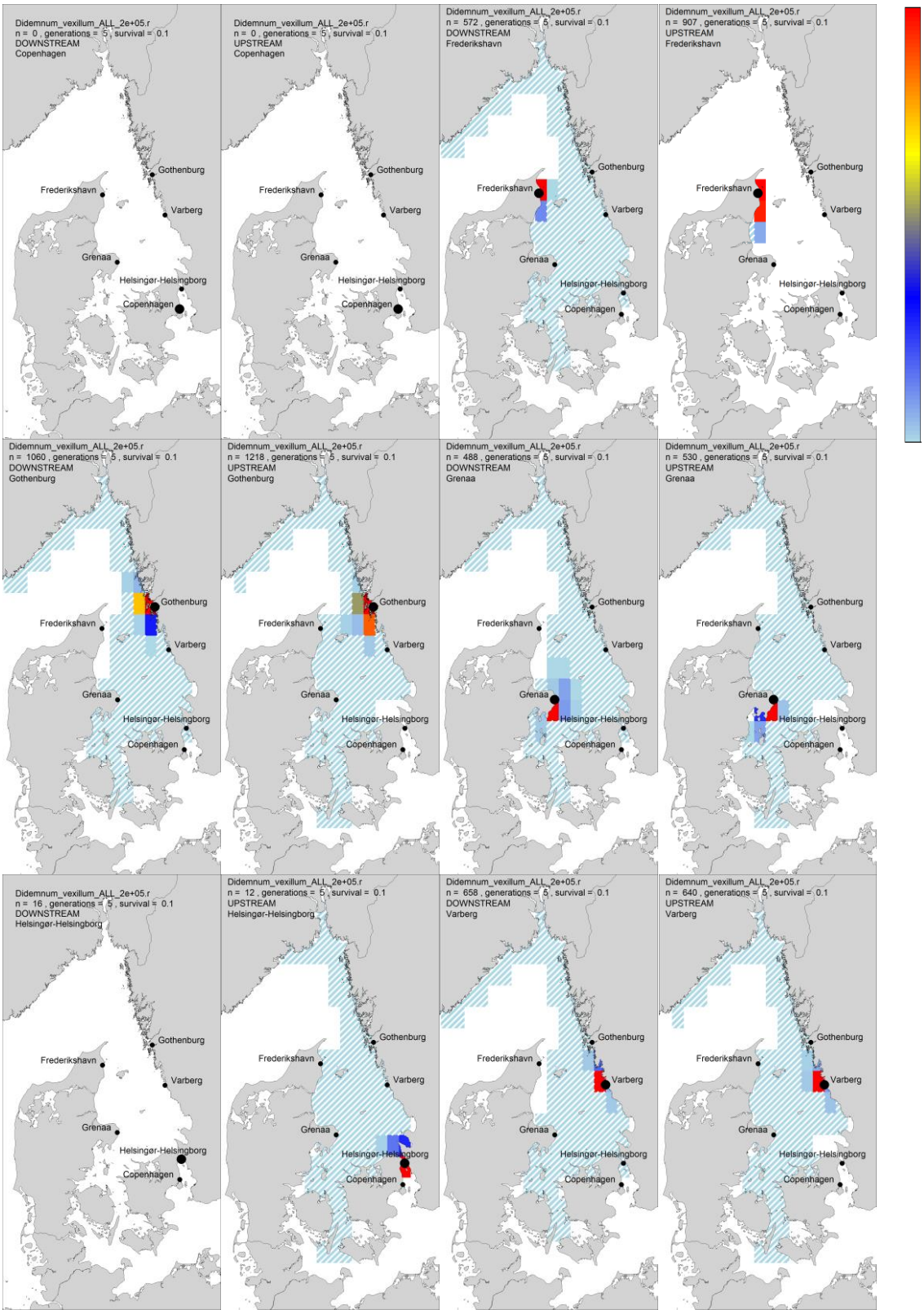


9.2 Dispersal probability plots

9.2.1 Single generation



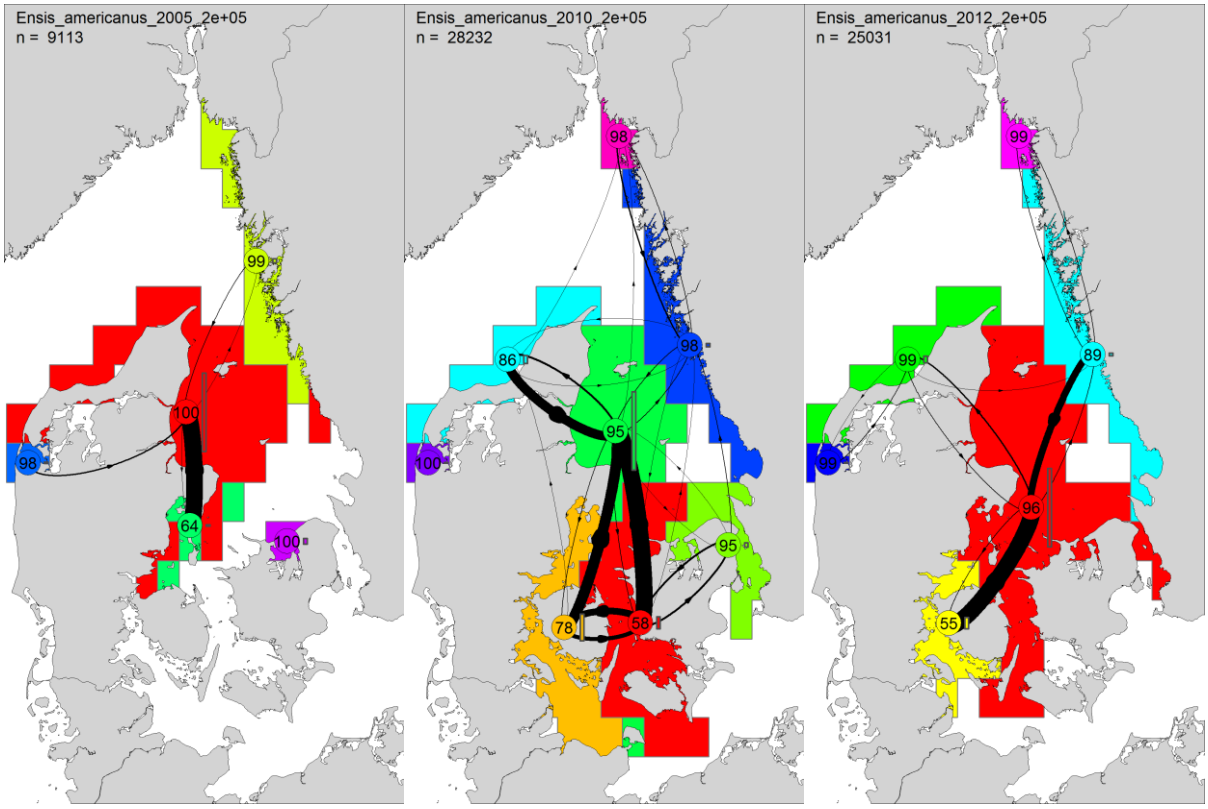
9.2.2 Multiple generations



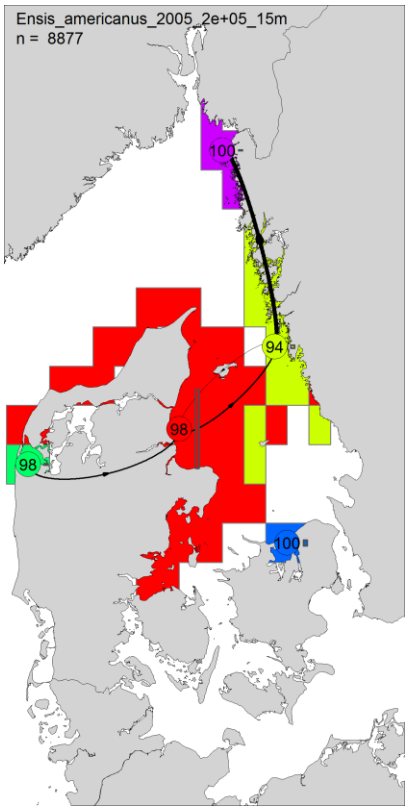
10 Ensis directus

10.1 Hydrographic regions

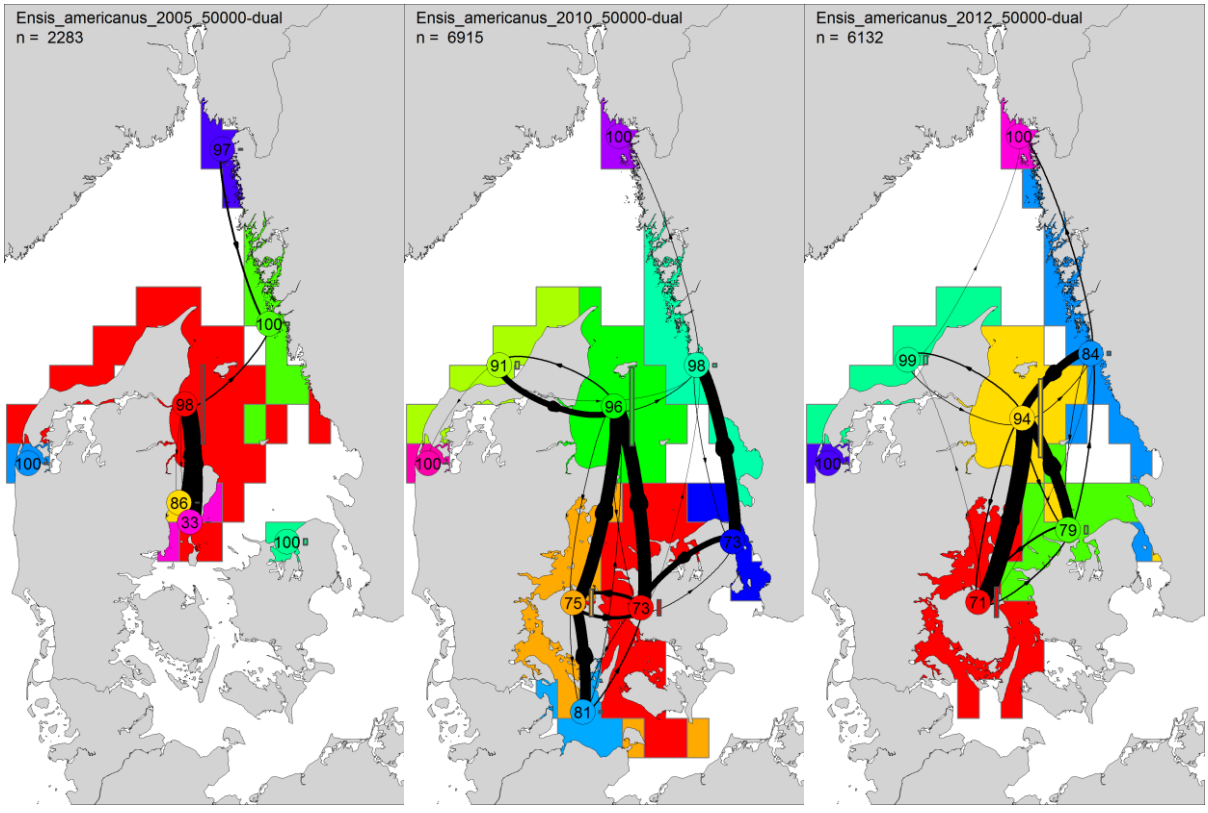
10.1.1 200 000 agents



10.1.2 200 000 agents (0-15 m)

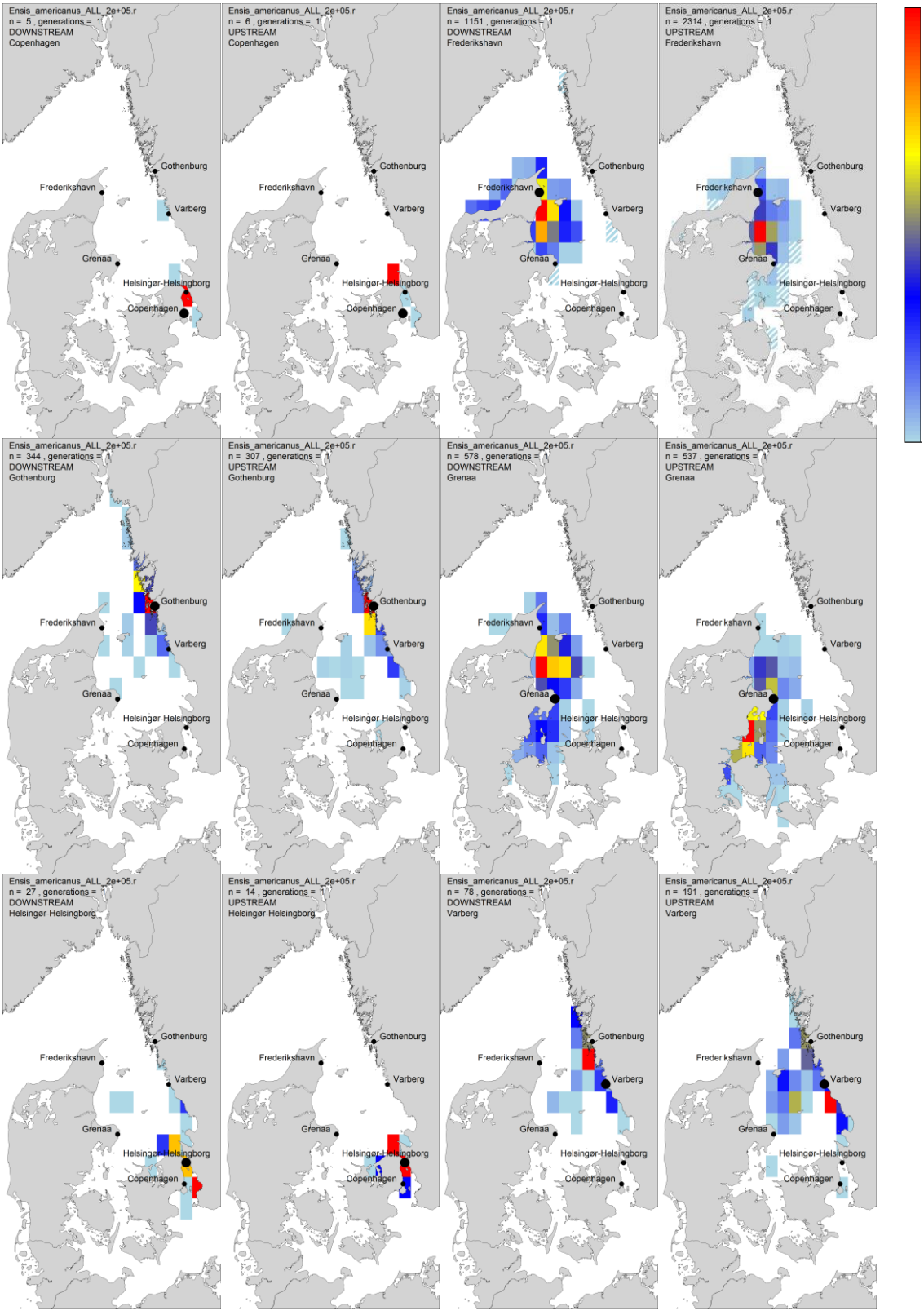


10.1.3 50 000 agents

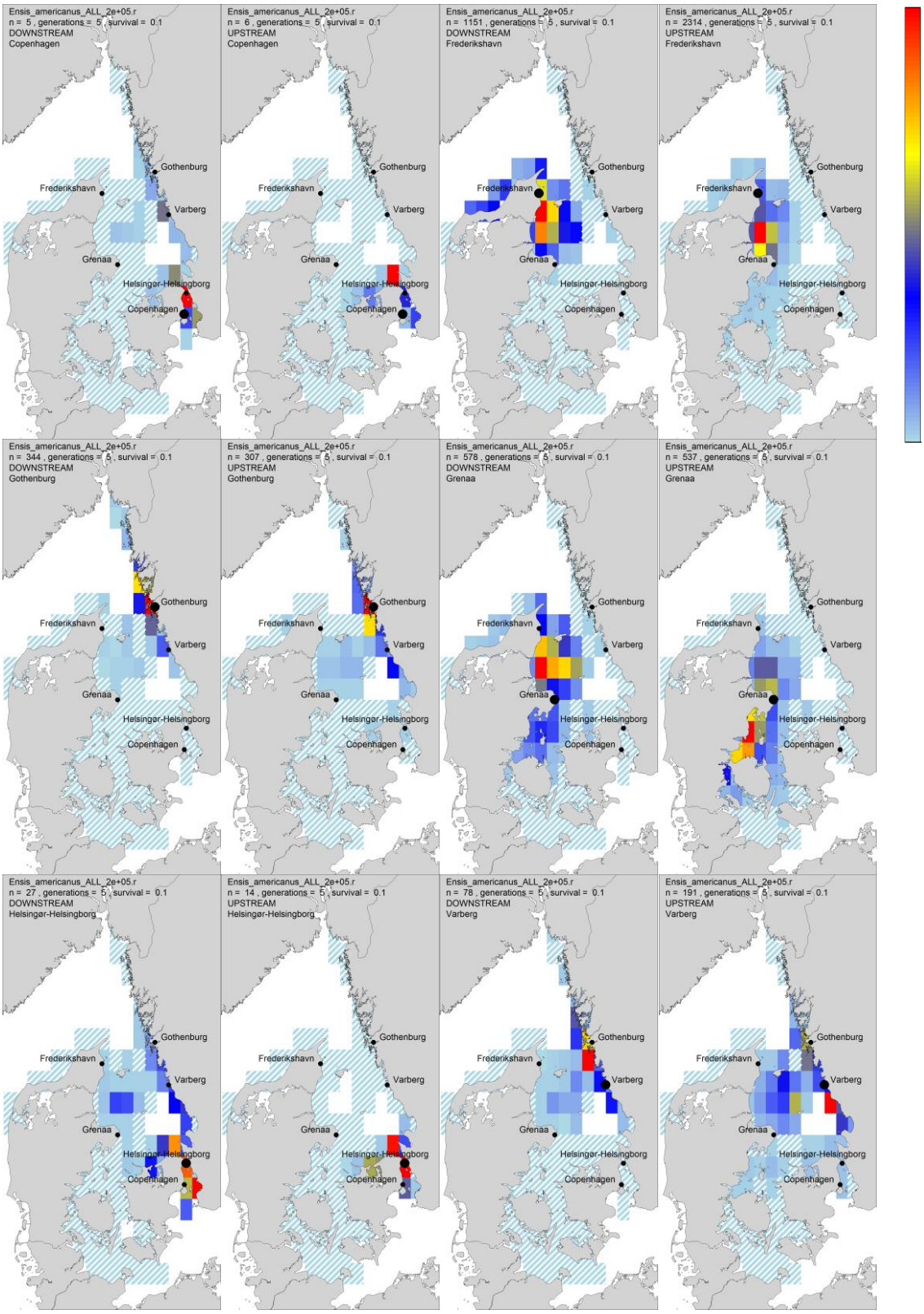


10.2 Dispersal probability plots

10.2.1 Single generation



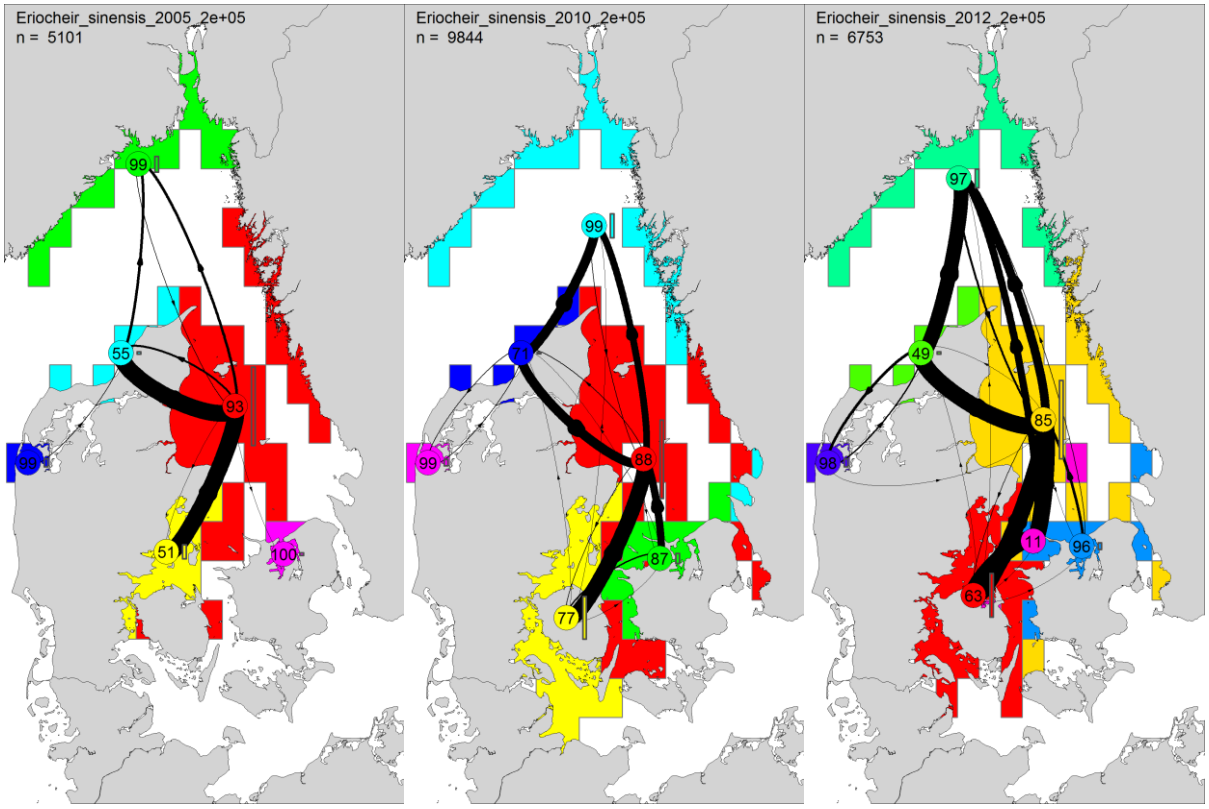
10.2.2 Multiple generations



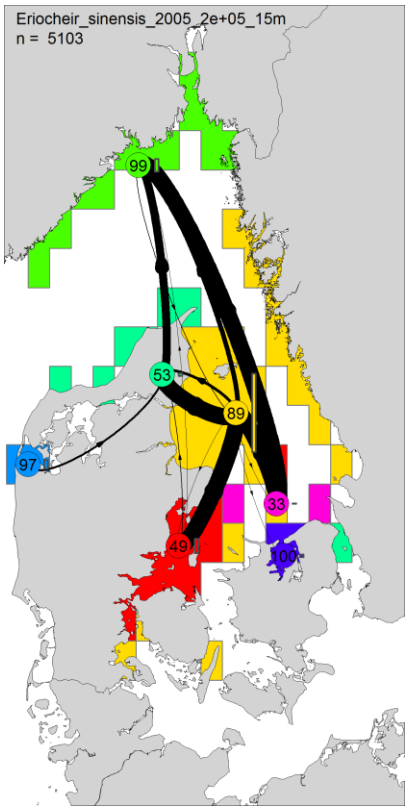
11 Eriocheir sinensis

11.1 Hydrographic regions

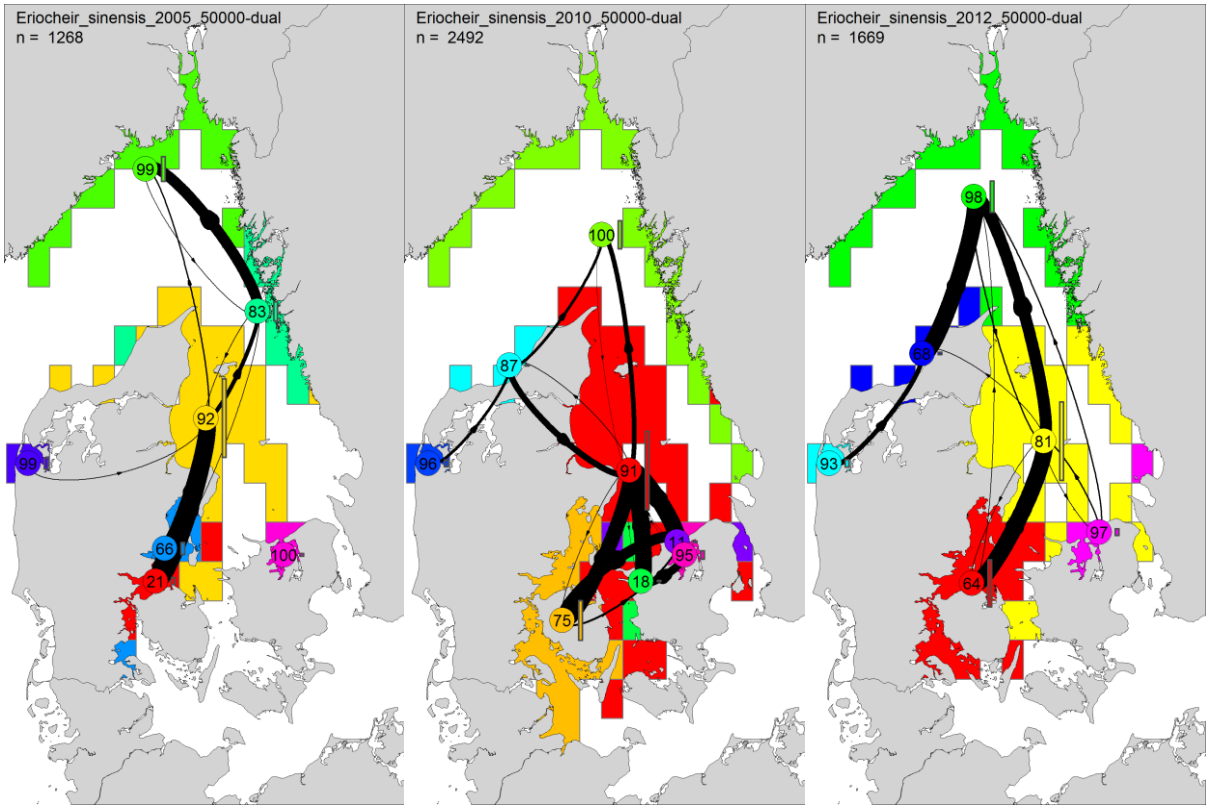
11.1.1 200 000 agents



11.1.2 200 000 agents (0-15 m)

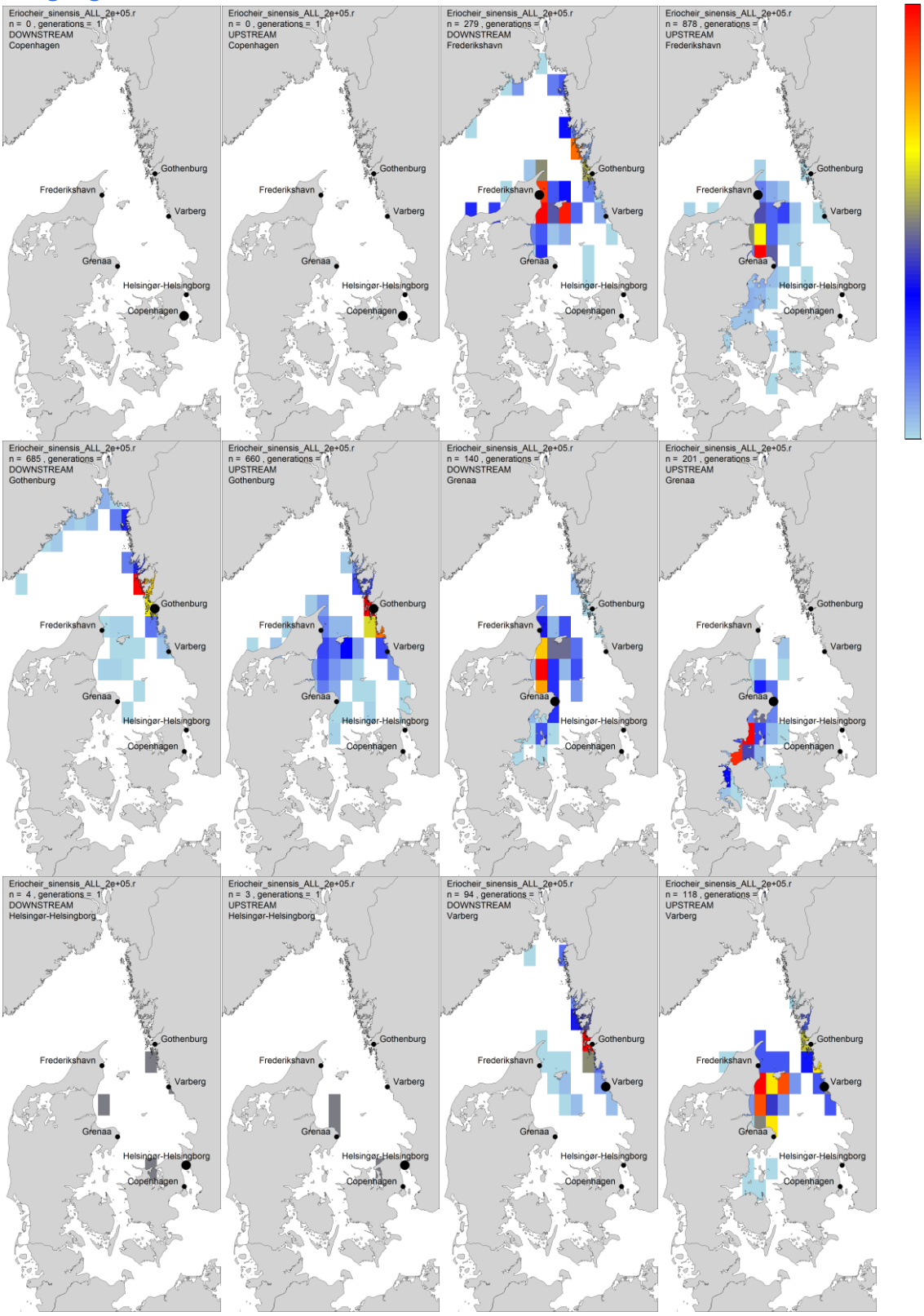


11.1.3 50 000 agents

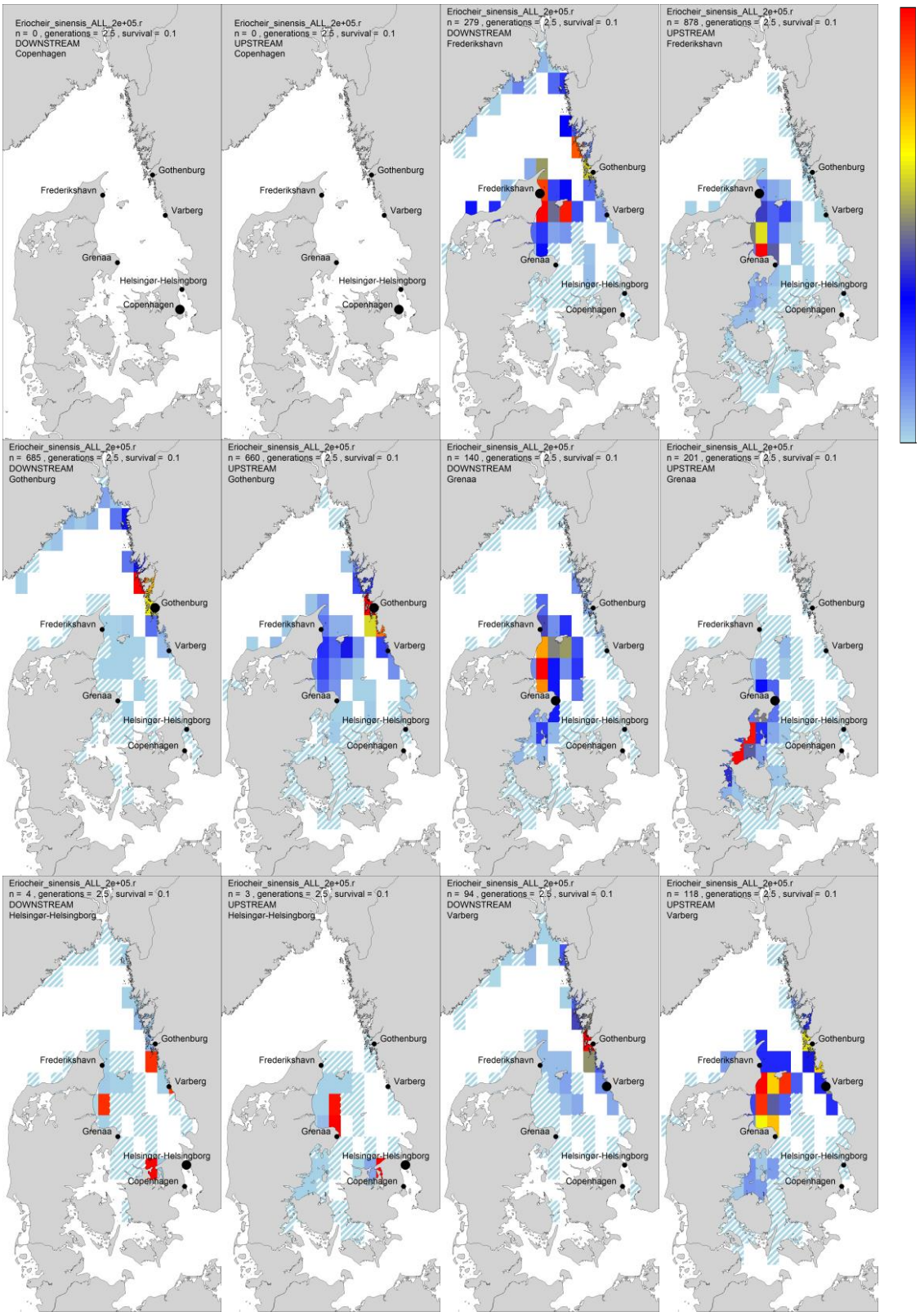


11.2 Dispersal probability plots

11.2.1 Single generation



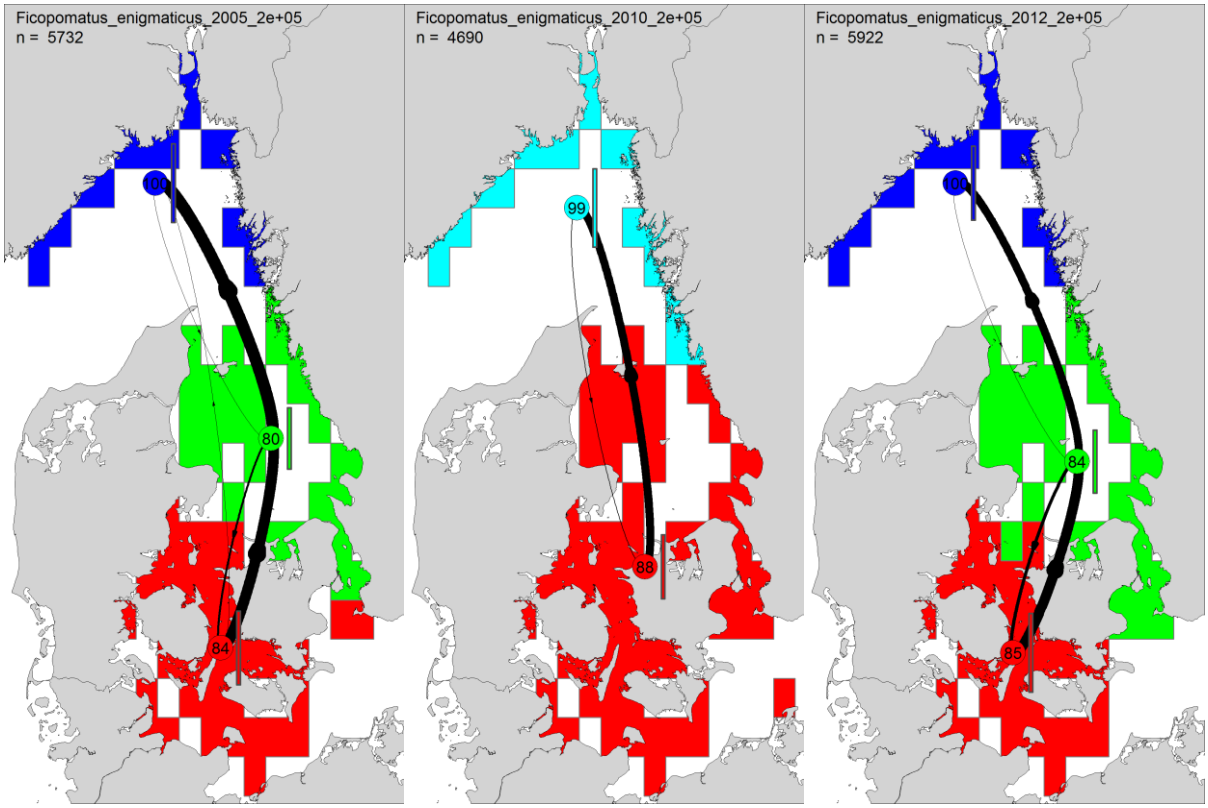
11.2.2 Multiple generations



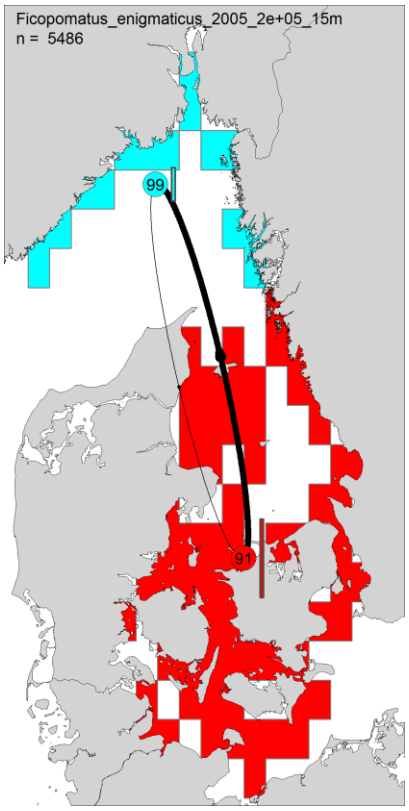
12 Ficopomatus enigmaticus

12.1 Hydrographic regions

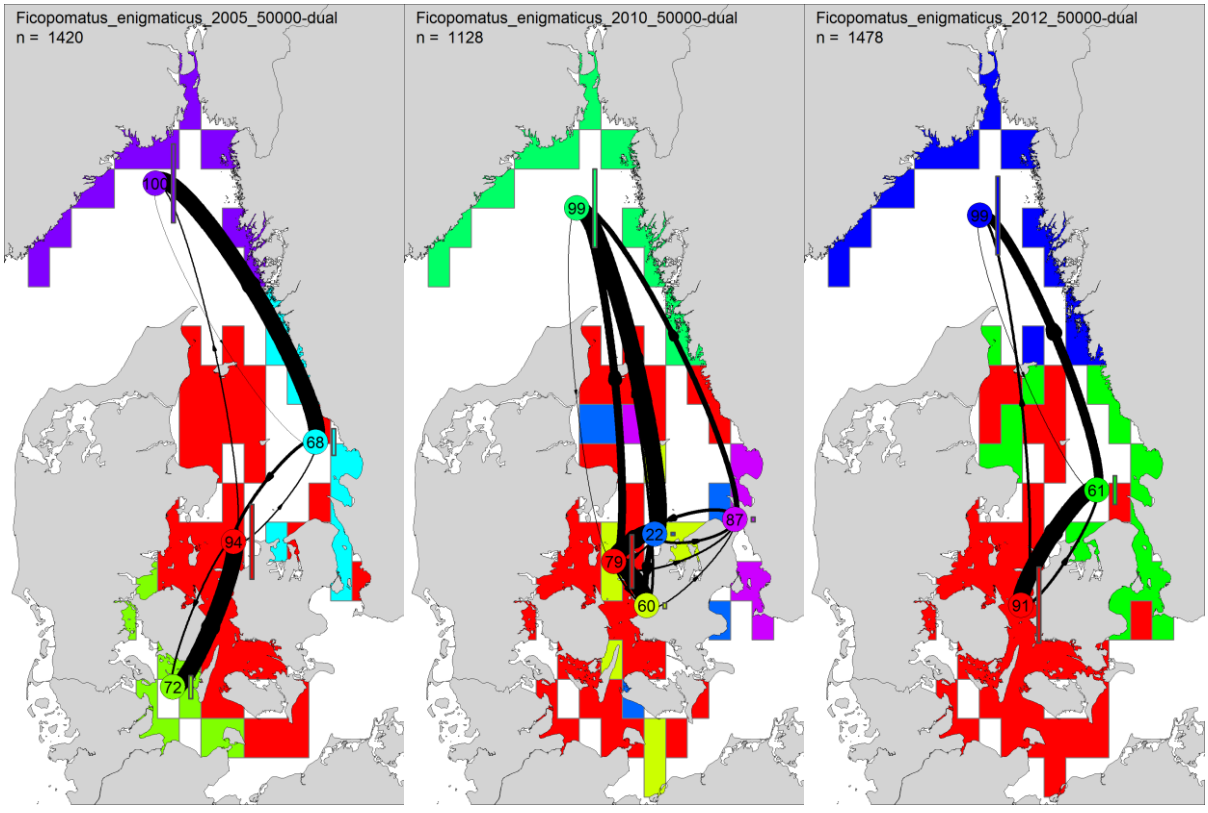
12.1.1 200 000 agents



12.1.2 200 000 agents (0-15 m)

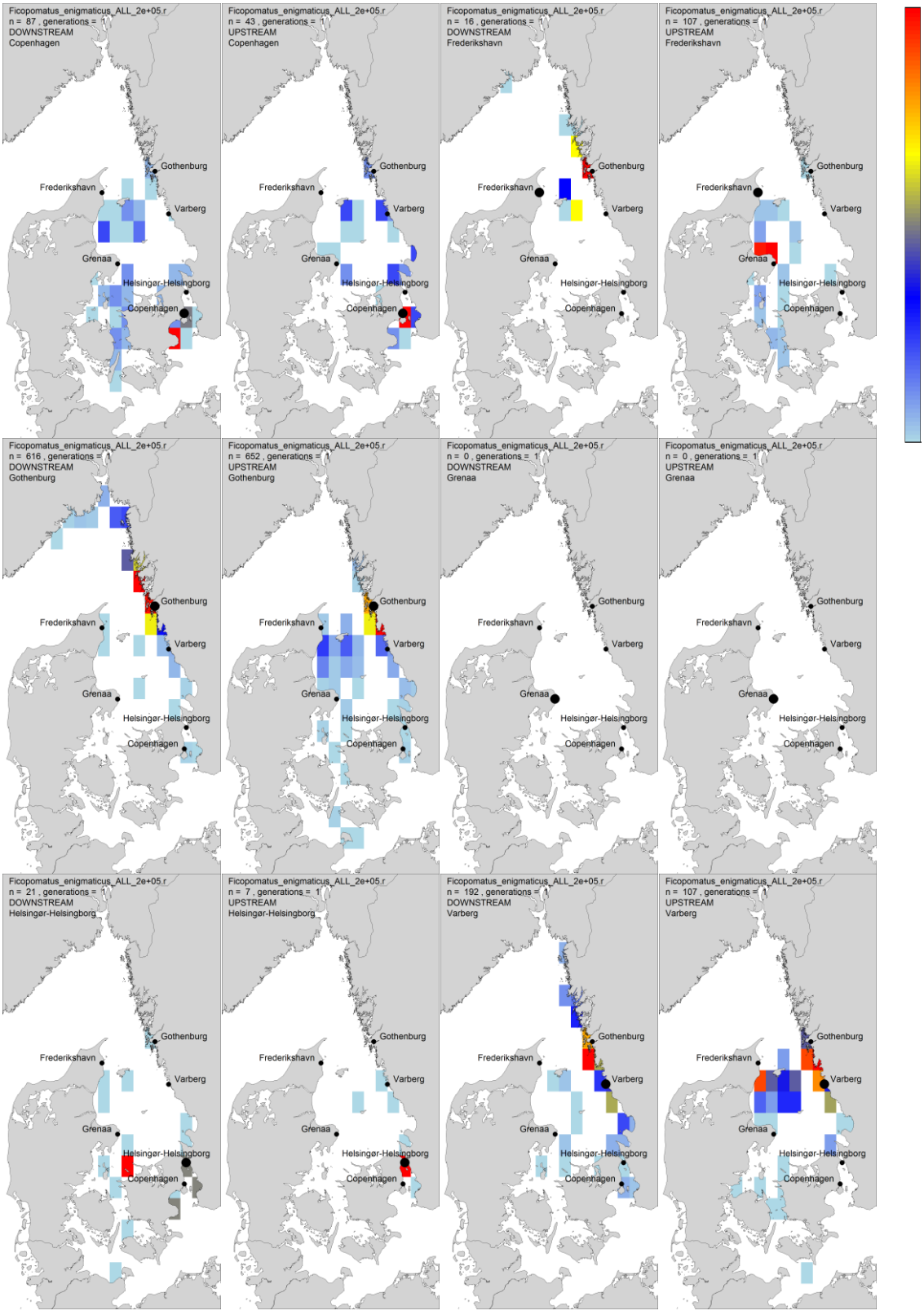


12.1.3 50 000 agents

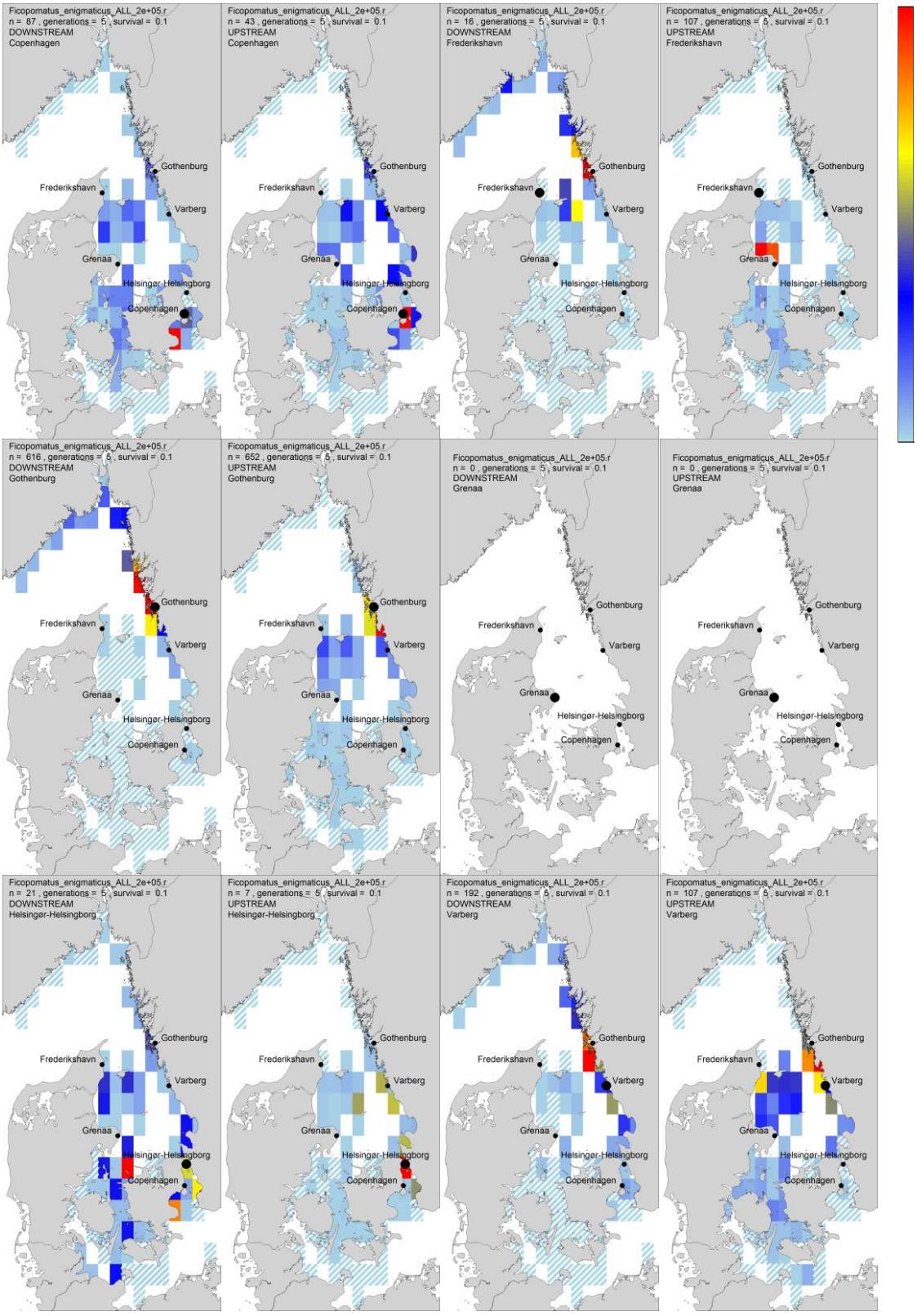


12.2 Dispersal probability plots

12.2.1 Single generation



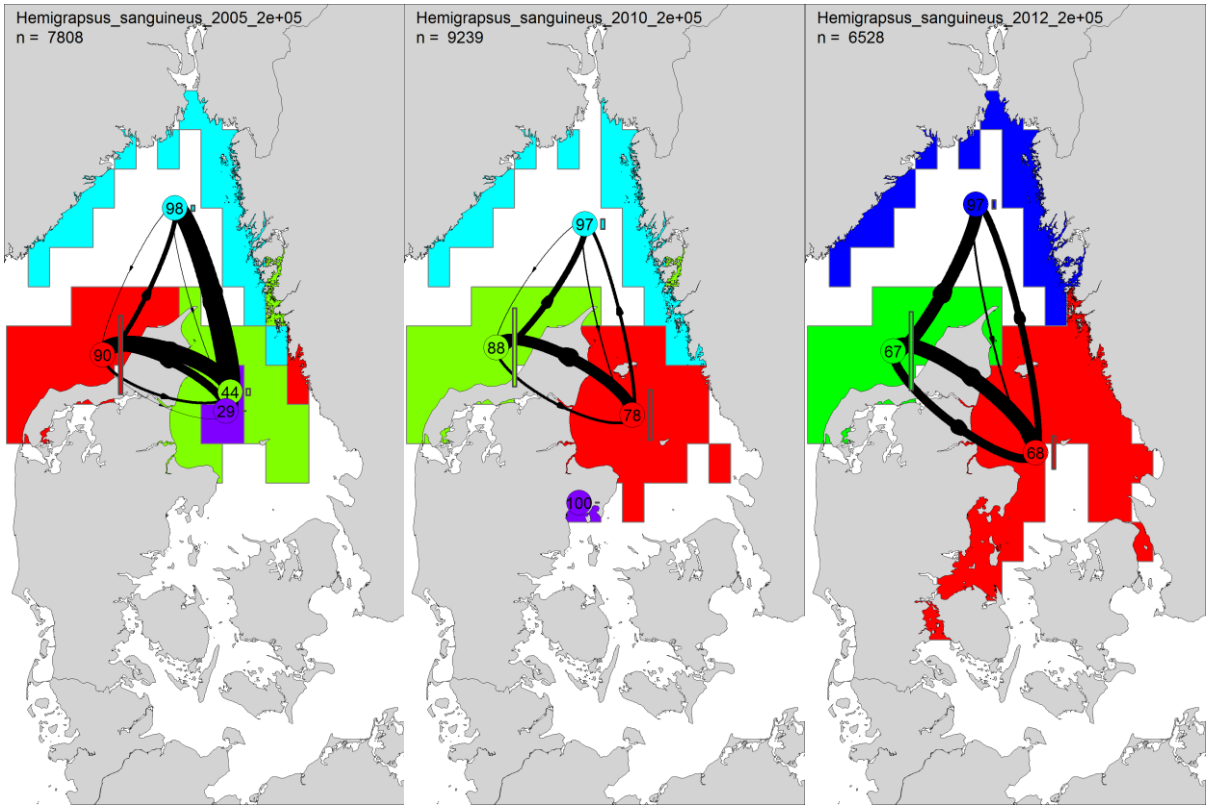
12.2.2 Multiple generations



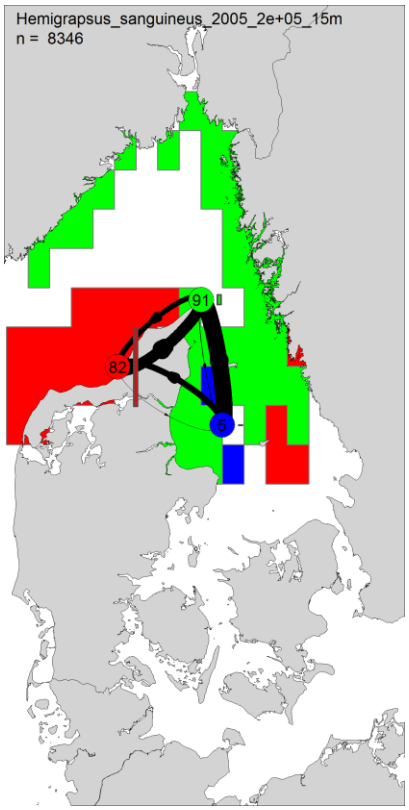
13 Hemigrapsus sanguineus

13.1 Hydrographic regions

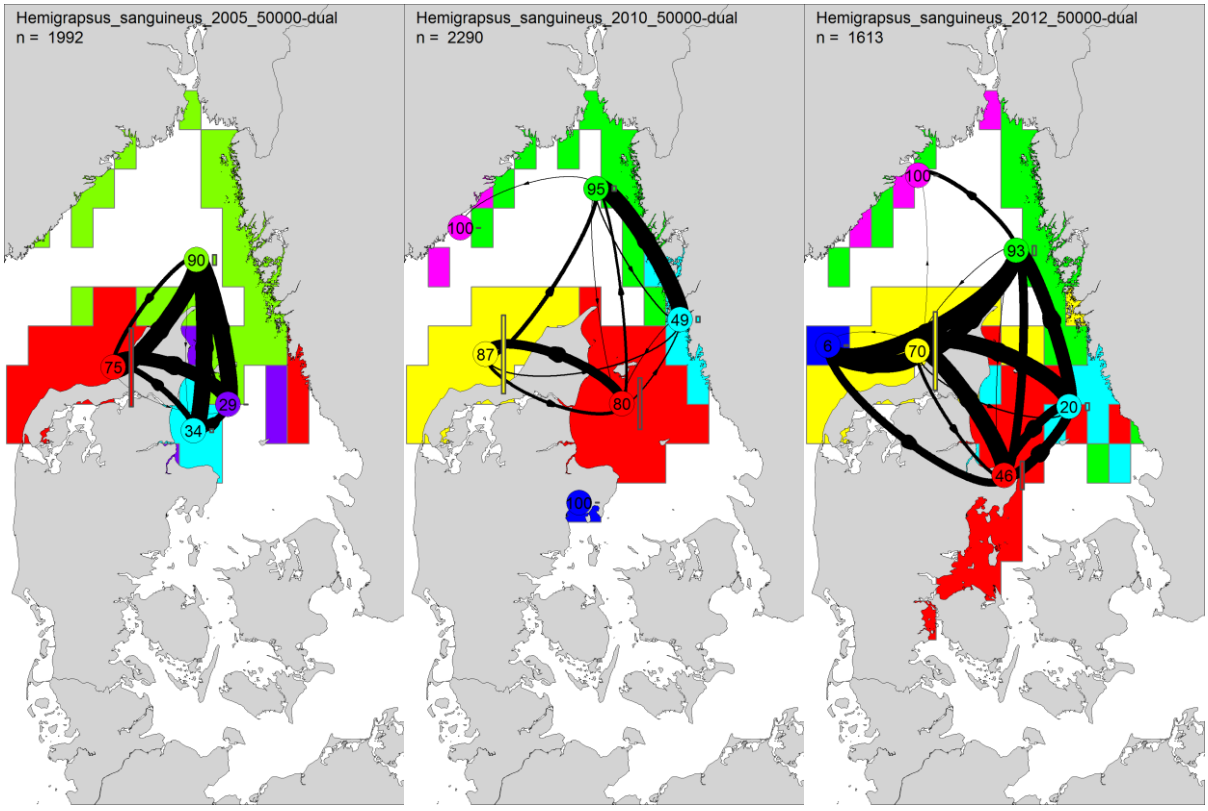
13.1.1 200 000 agents



13.1.2 200 000 agents (0-15 m)

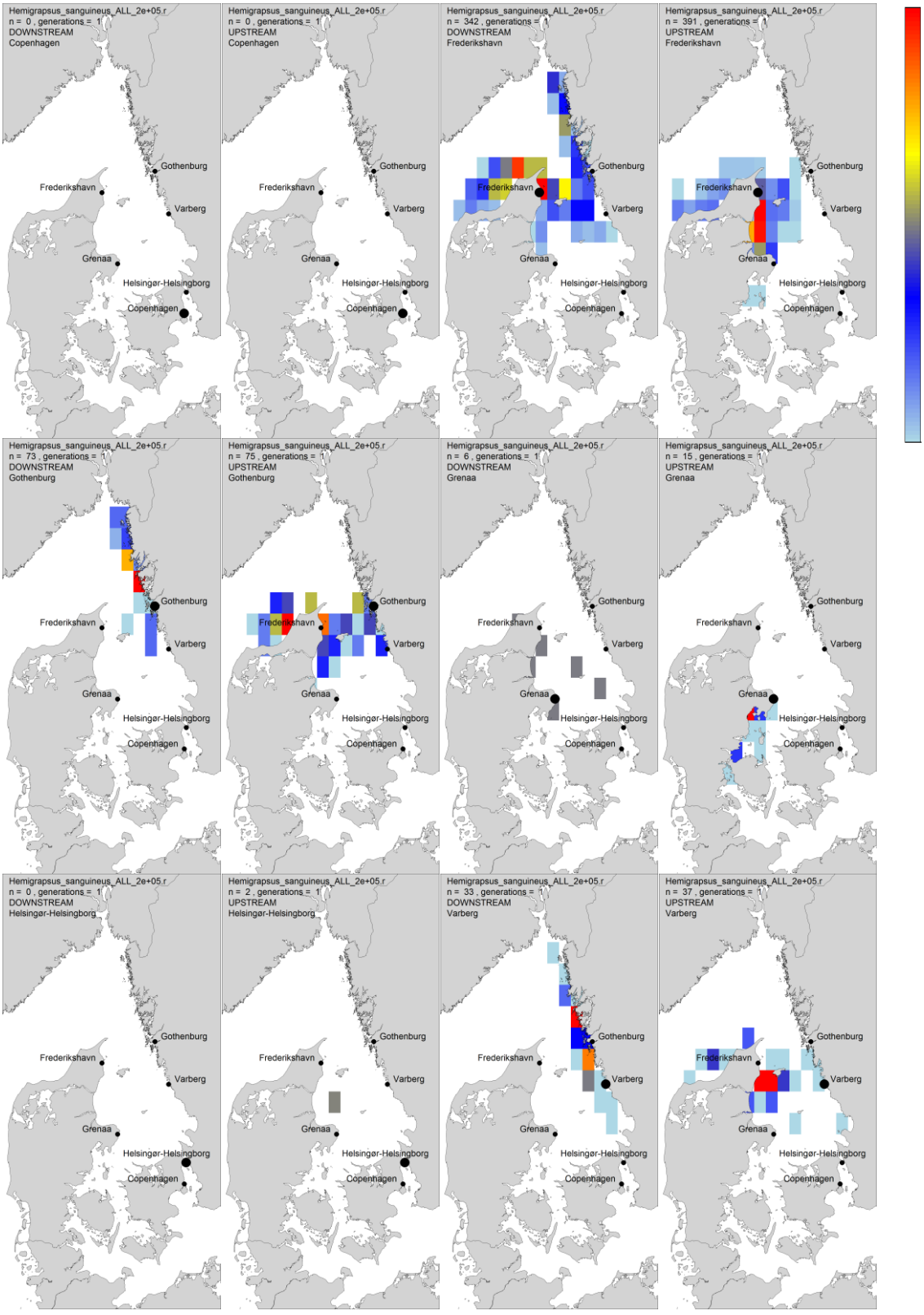


13.1.3 50 000 agents

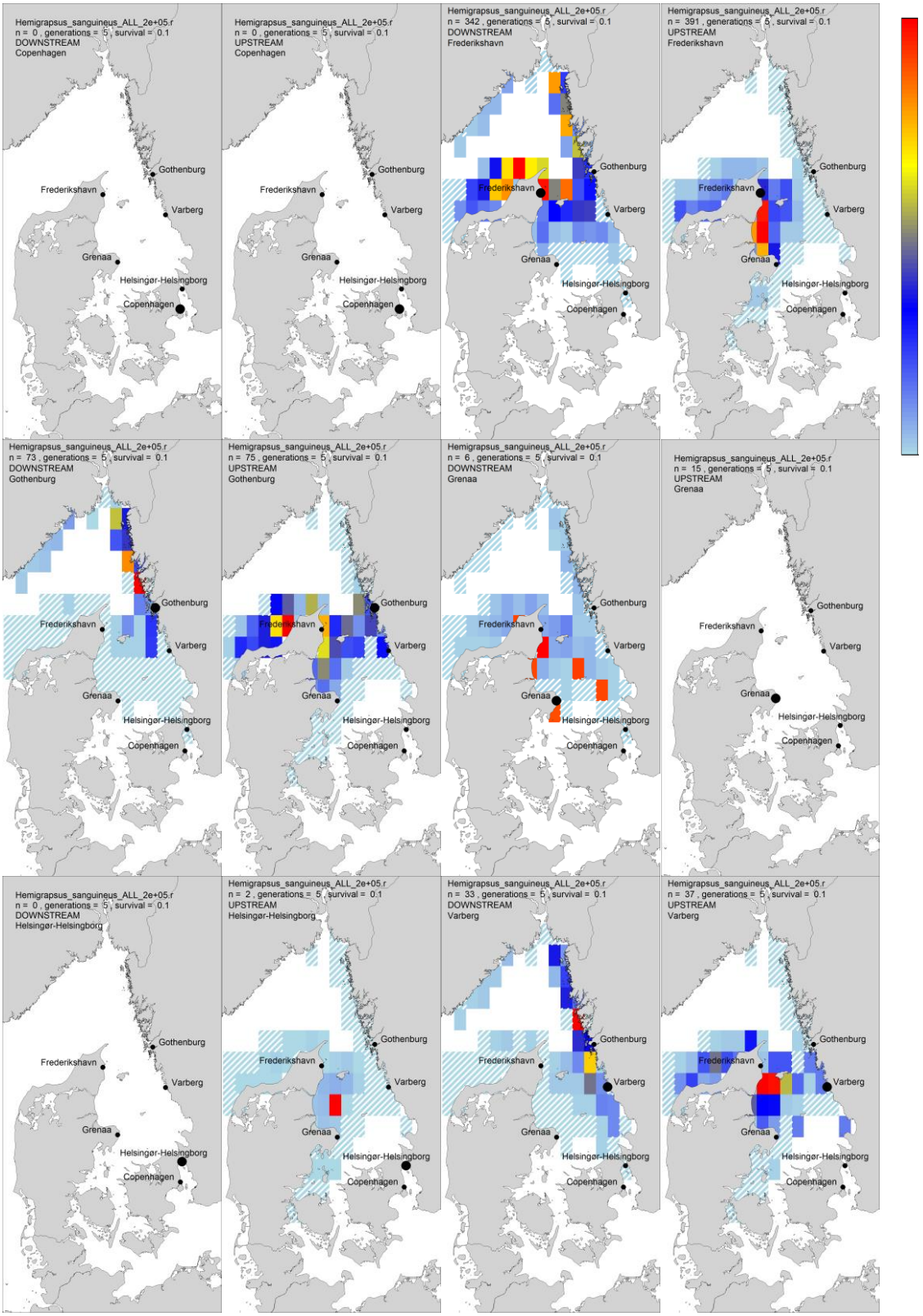


13.2 Dispersal probability plots

13.2.1 Single generation



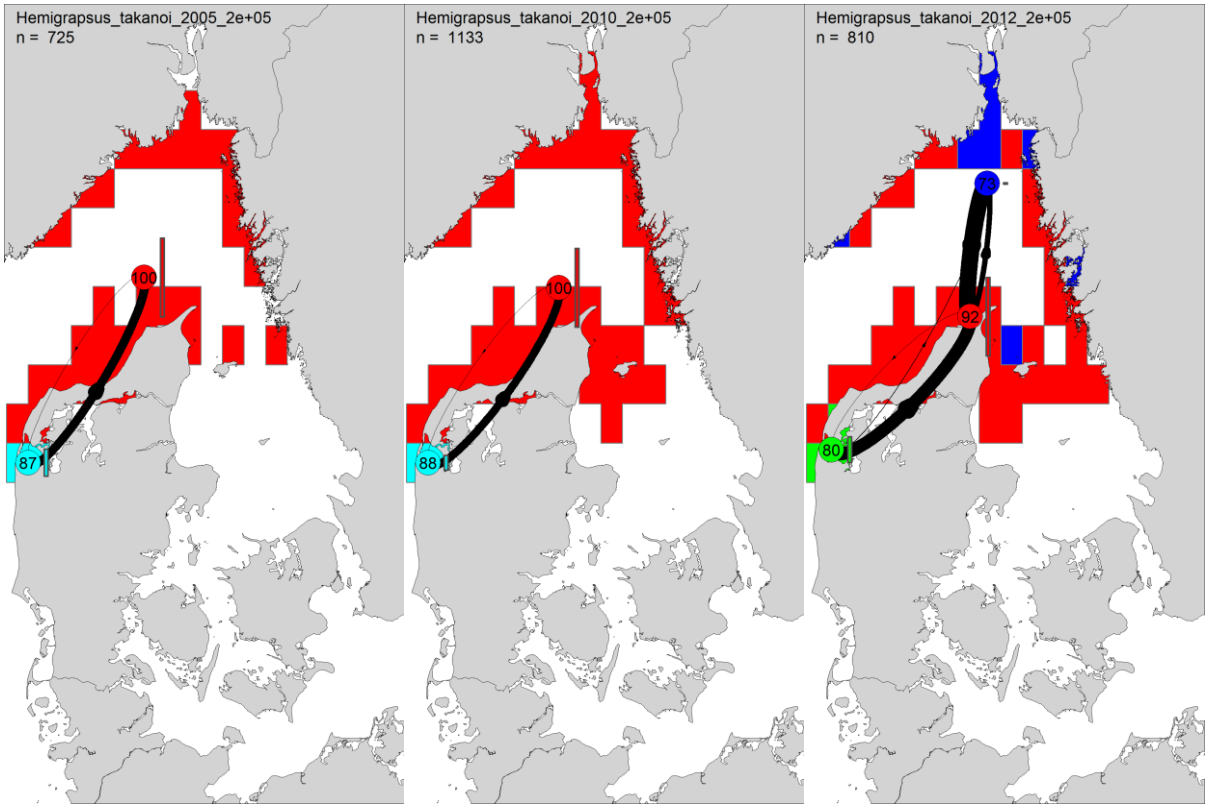
13.2.2 Multiple generations



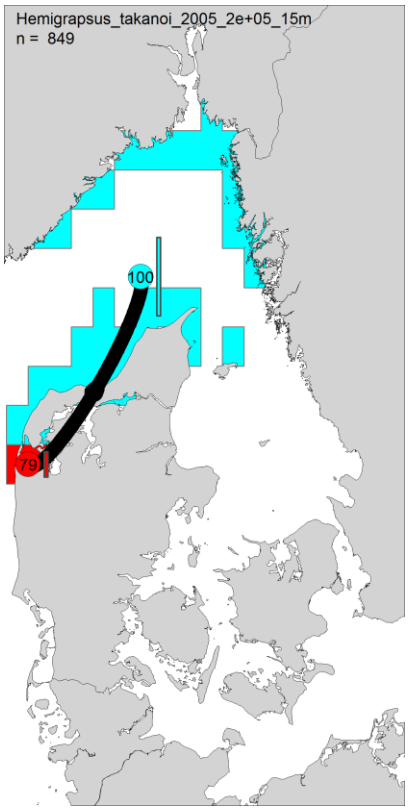
14 Hemigrapsus takanoi

14.1 Hydrographic regions

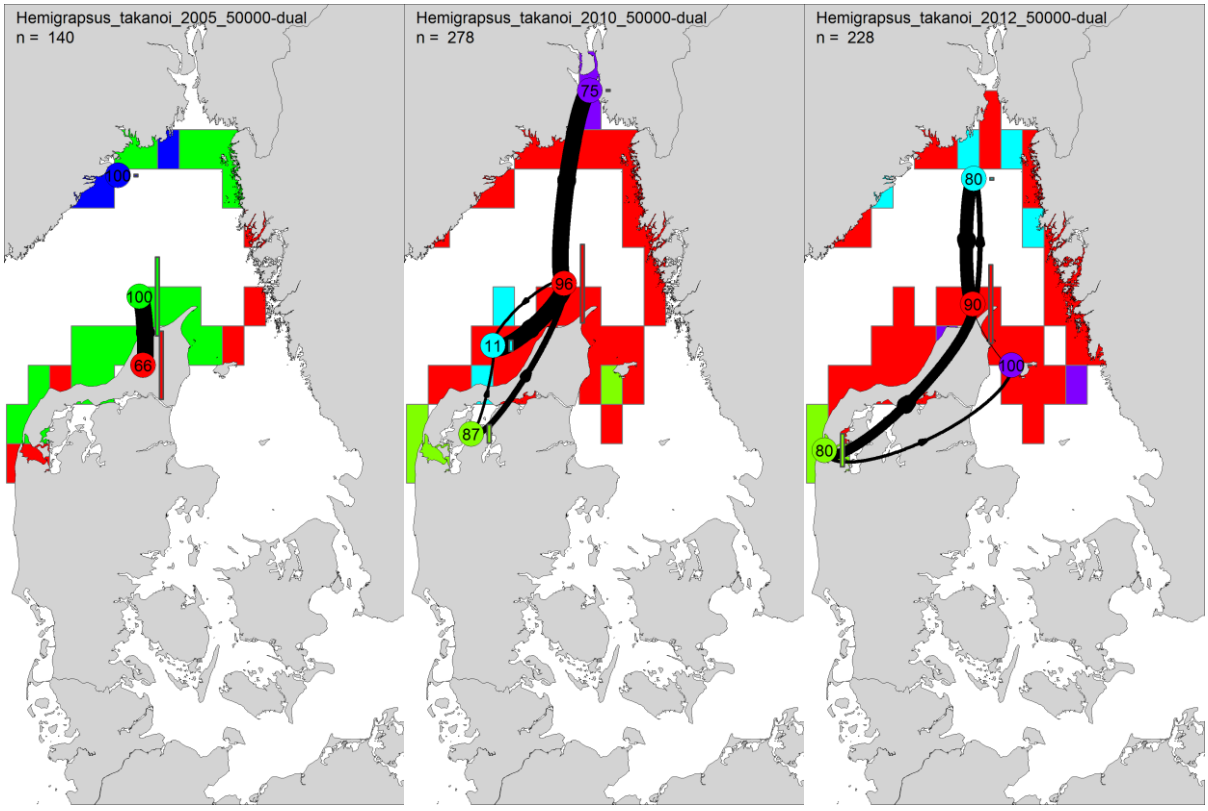
14.1.1 200 000 agents



14.1.2 200 000 agents (0–15 m)

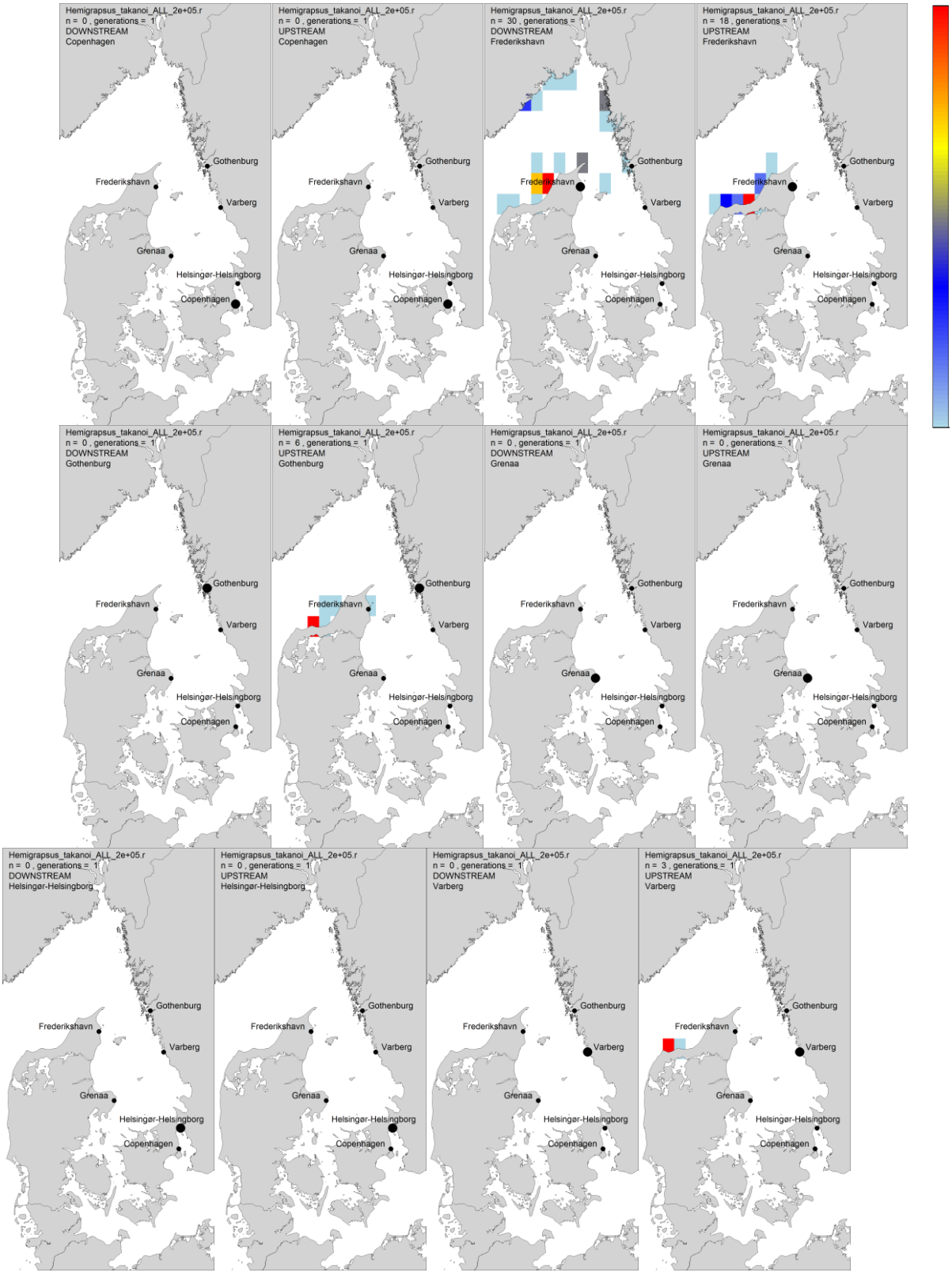


14.1.3 50 000 agents

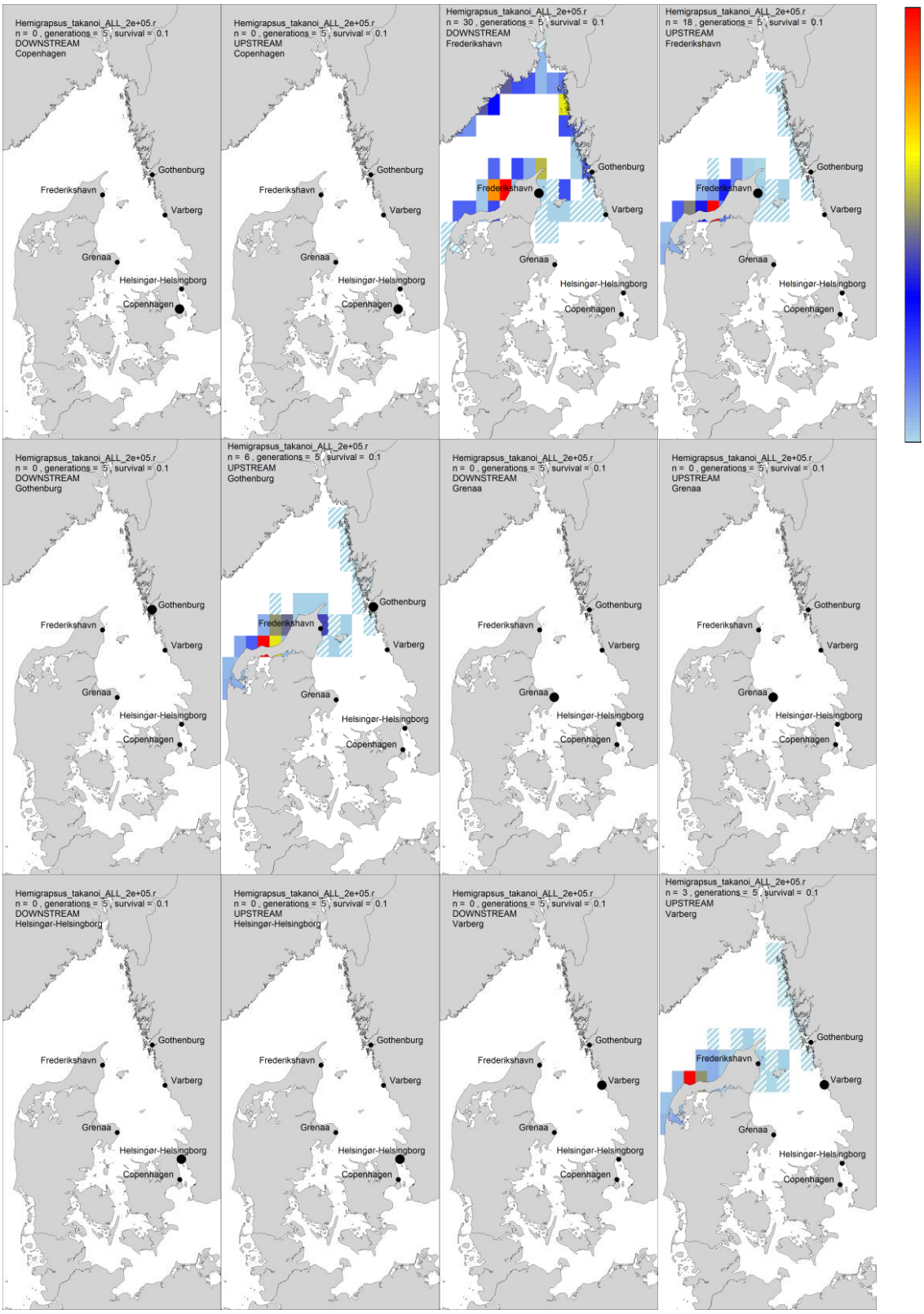


14.2 Dispersal probability plots

14.2.1 Single generation



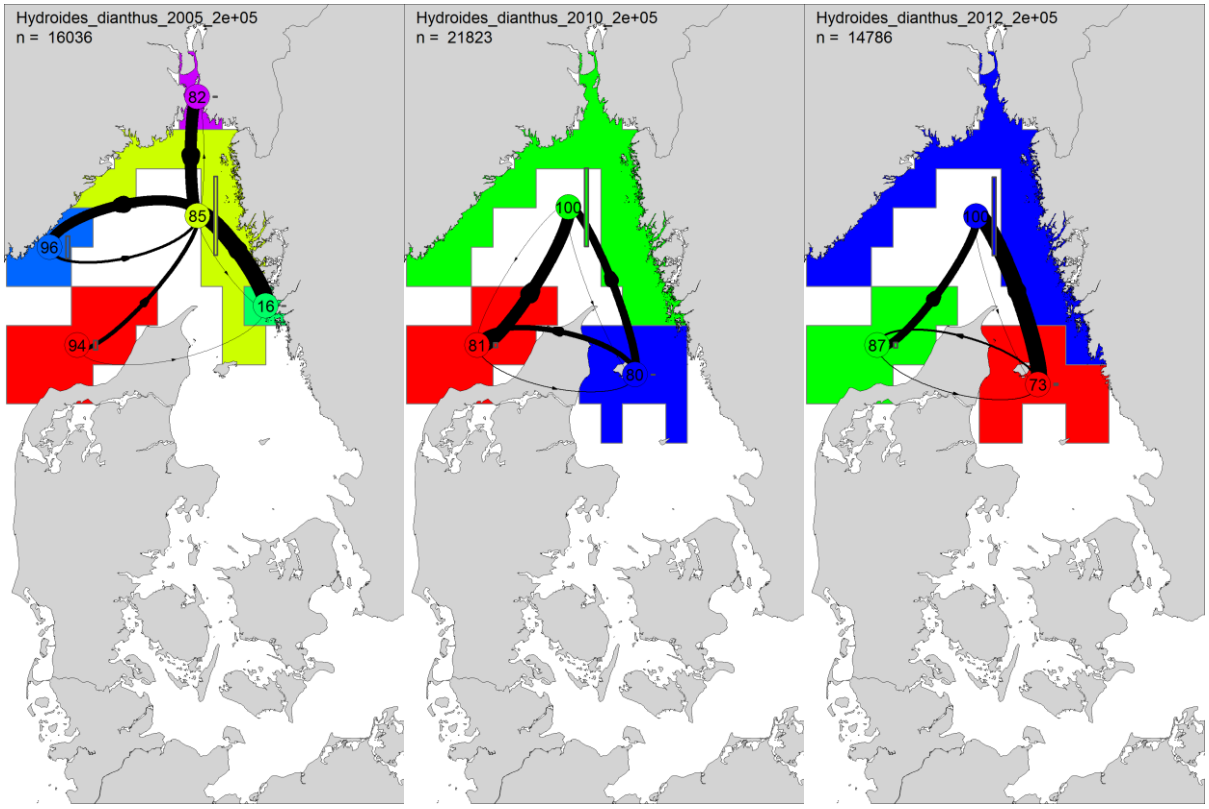
14.2.2 Multiple generations



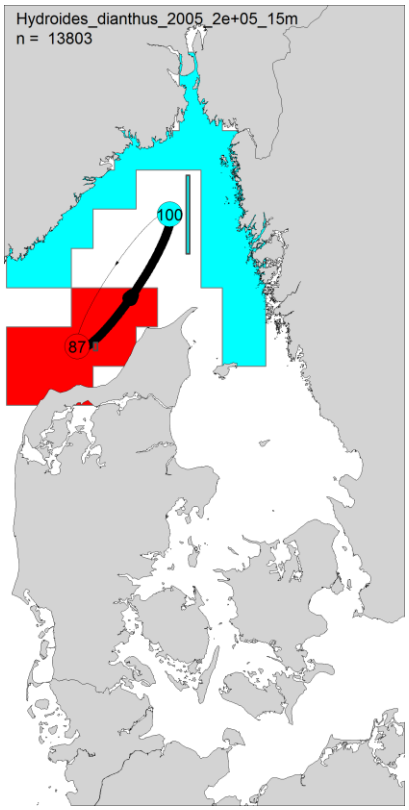
15 Hydroides dianthus

15.1 Hydrographic regions

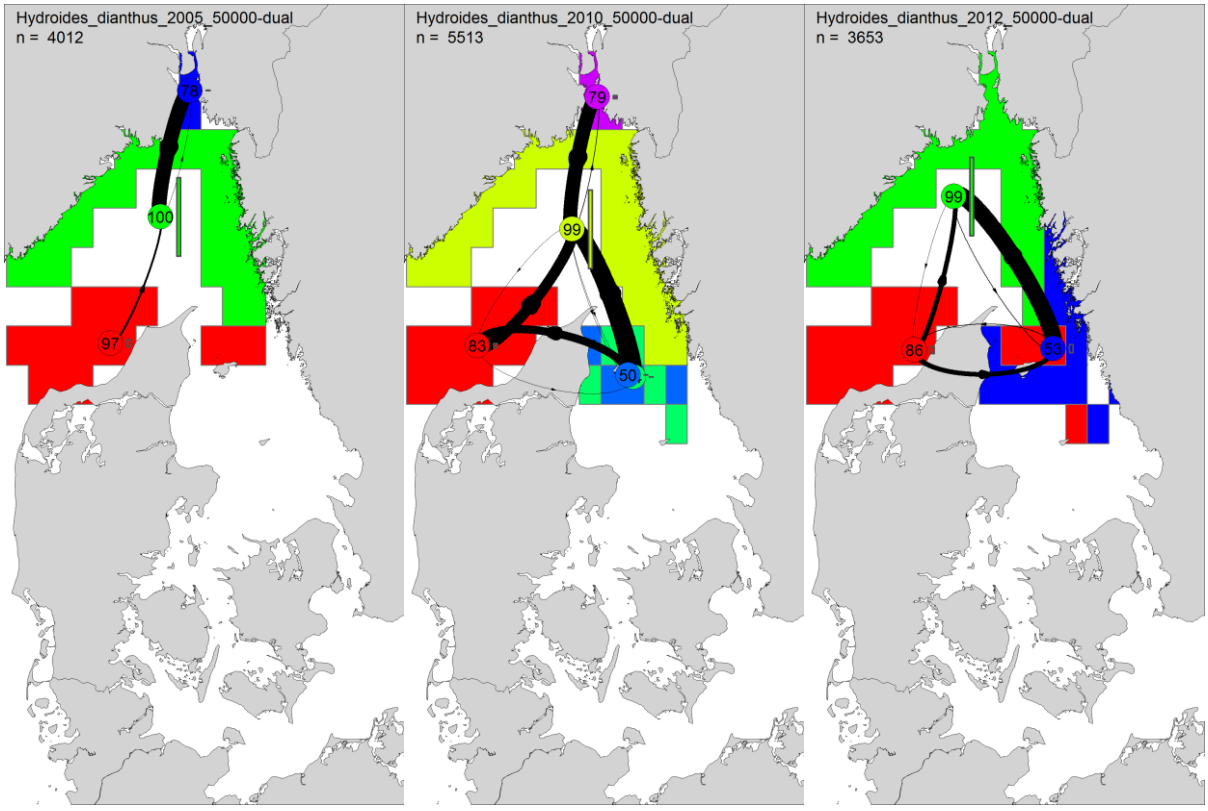
15.1.1 200 000 agents



15.1.2 200 000 agents (0-15 m)

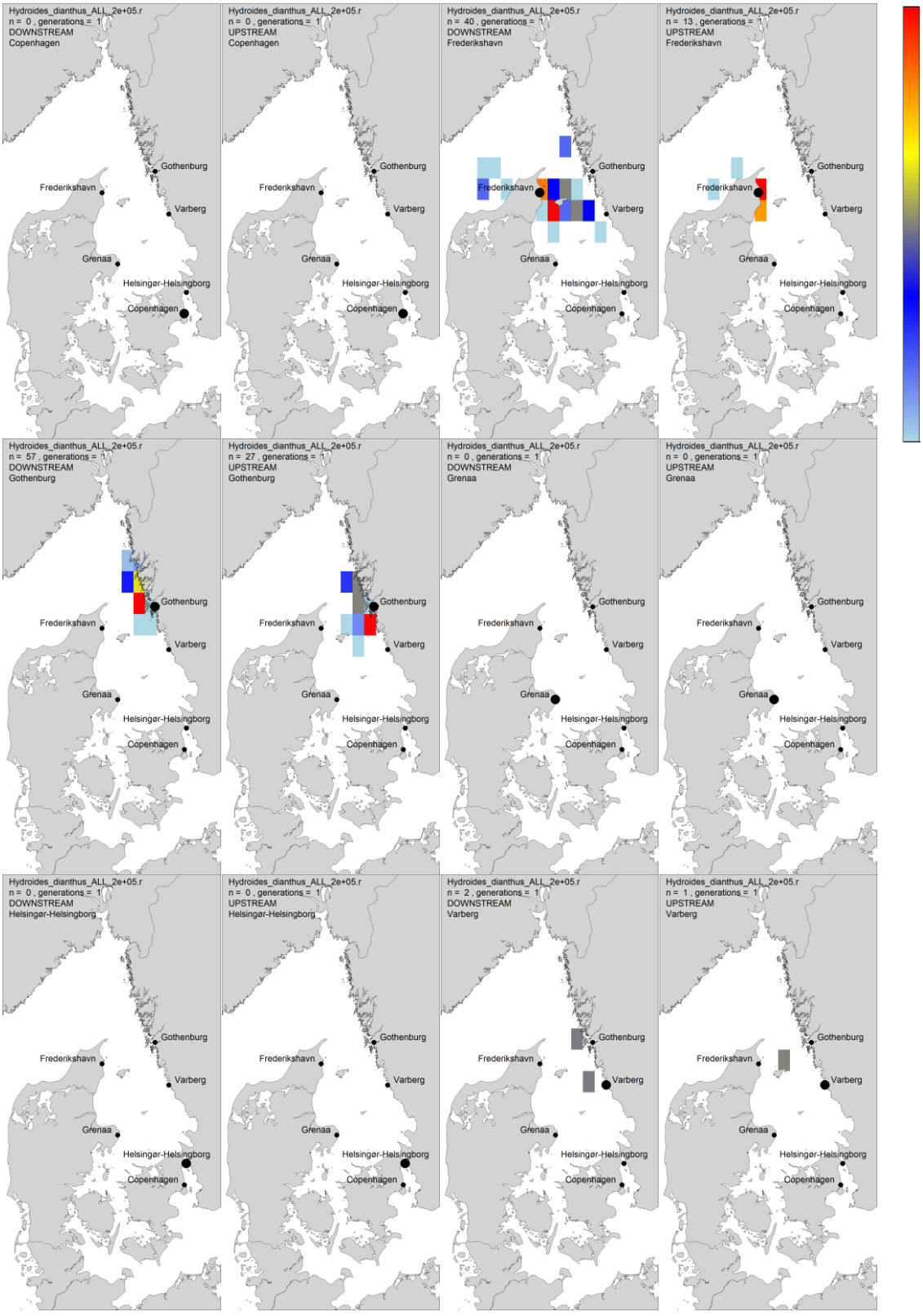


15.1.3 50 000 agents

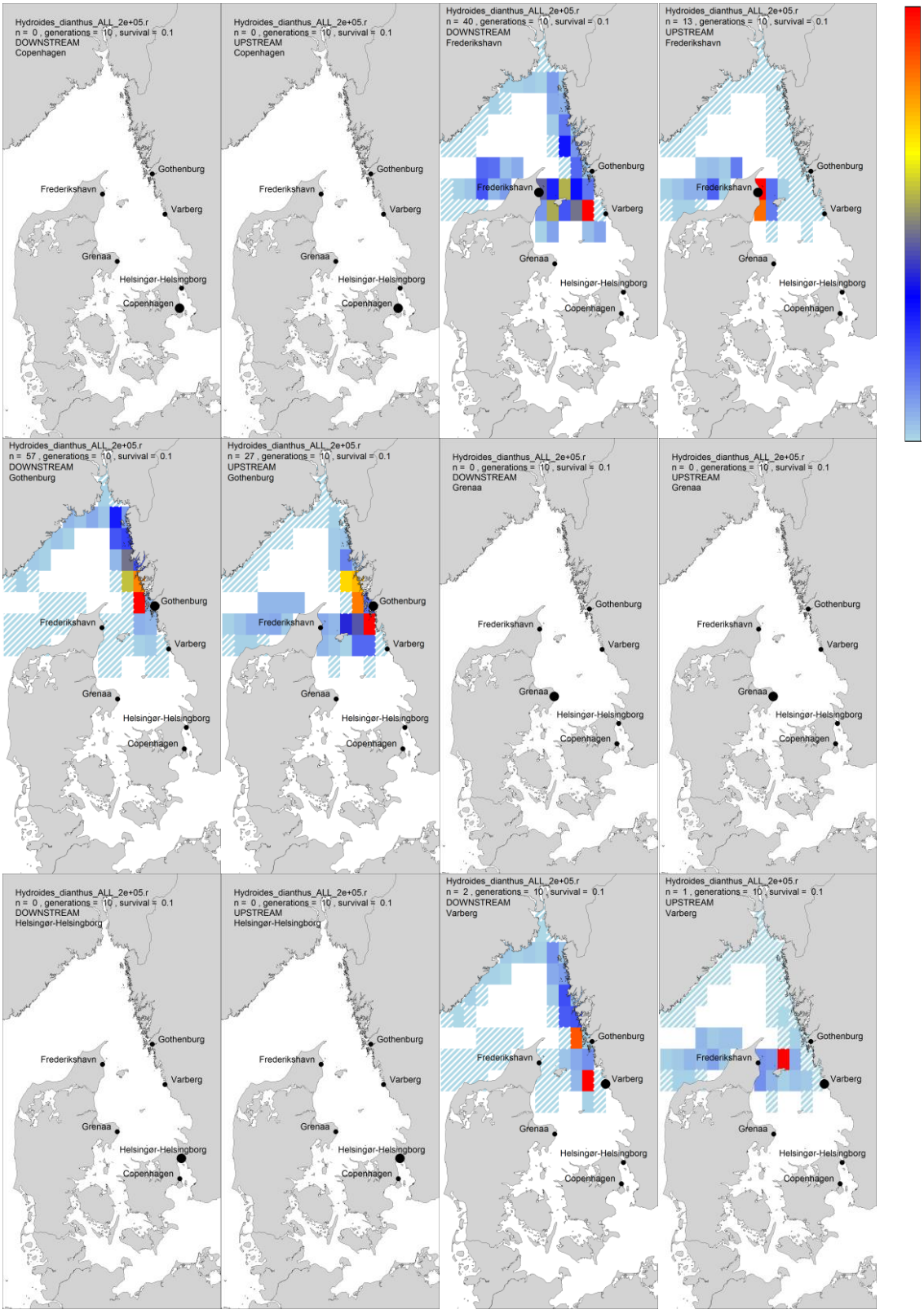


15.2 Dispersal probability plots

15.2.1 Single generation



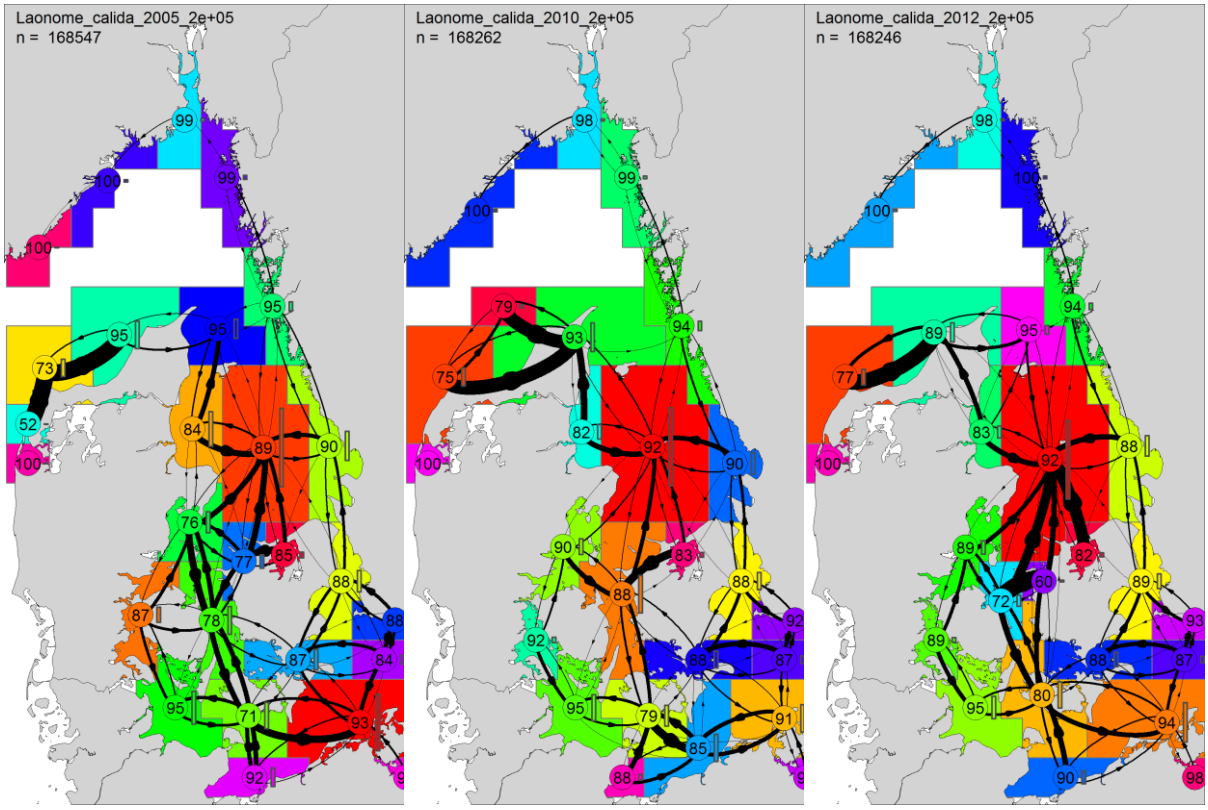
15.2.2 Multiple generations



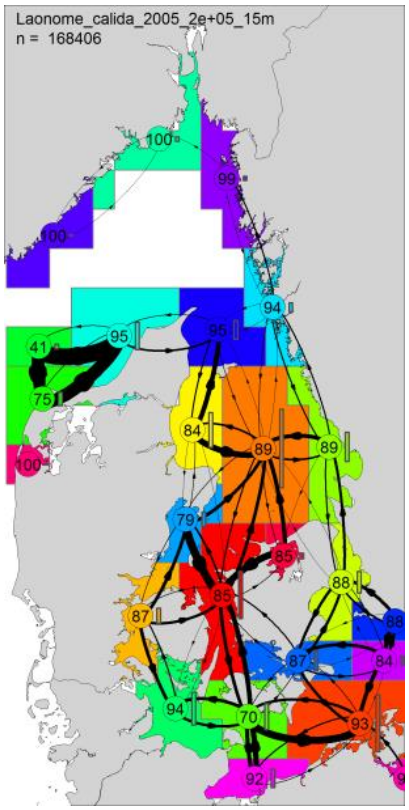
16 Laonome calida

16.1 Hydrographic regions

16.1.1 200 000 agents



16.1.2 200 000 agents (0-15 m)

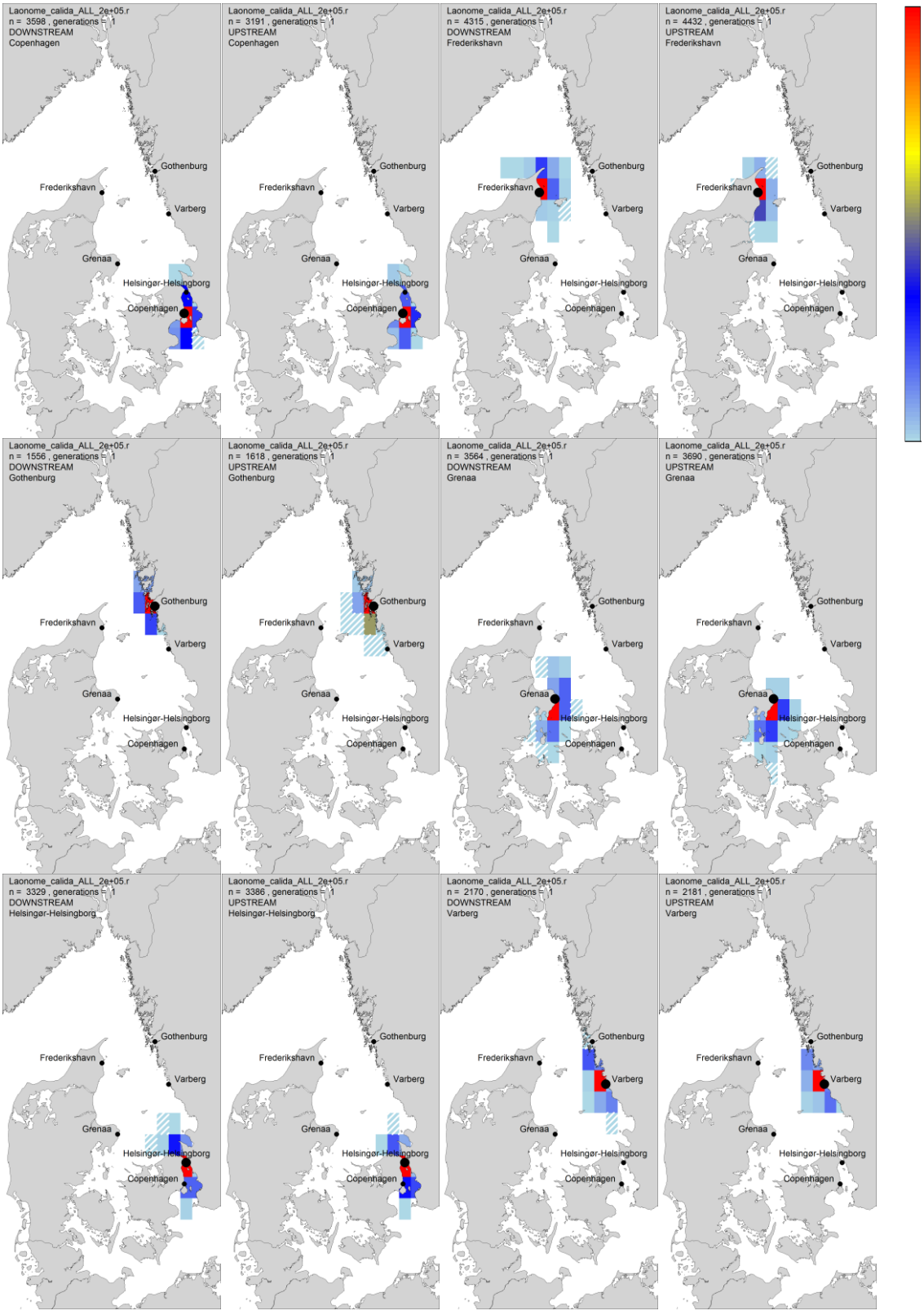


16.1.3 50 000 agents

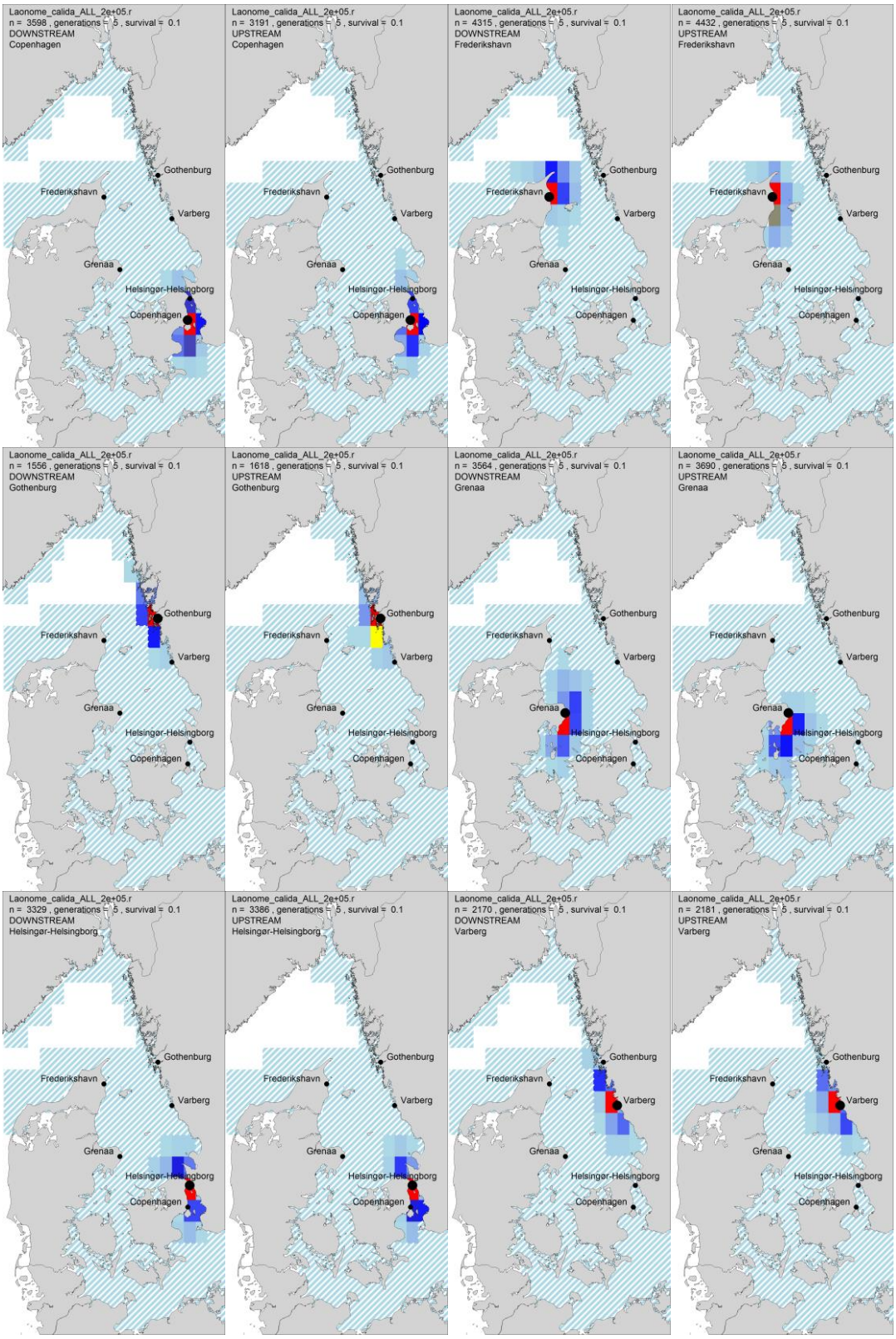
NOT INCLUDED

16.2 Dispersal probability plots

16.2.1 Single generation



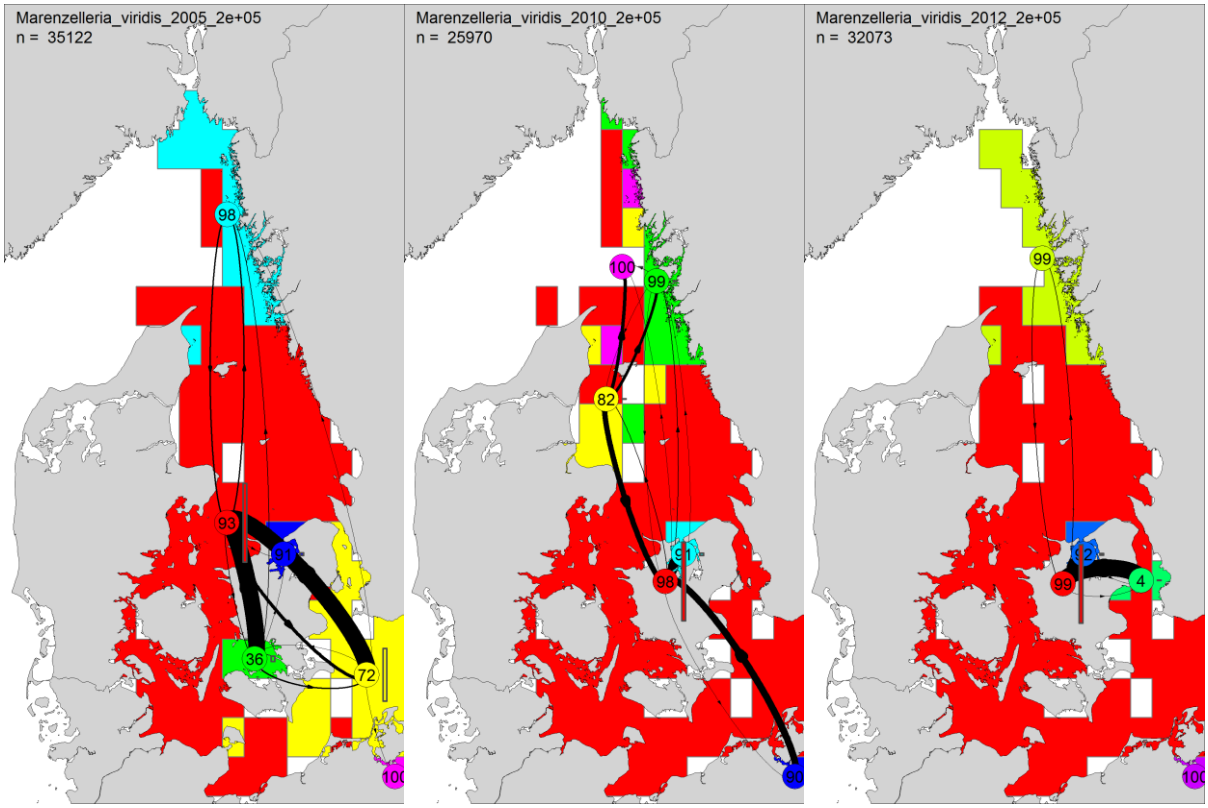
16.2.2 Multiple generations



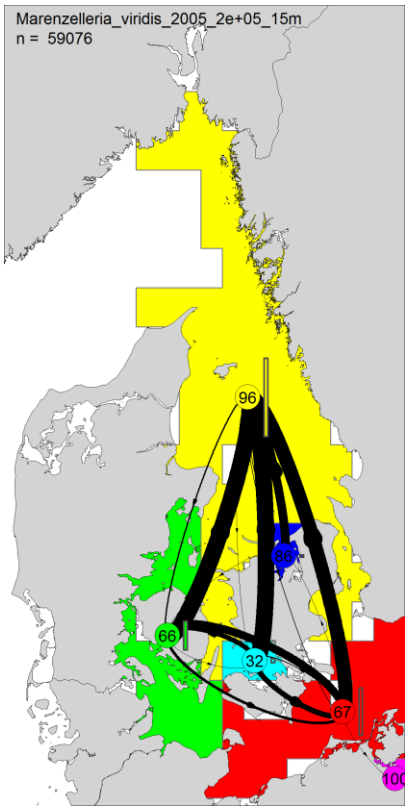
17 Marenzelleria viridis

17.1 Hydrographic regions

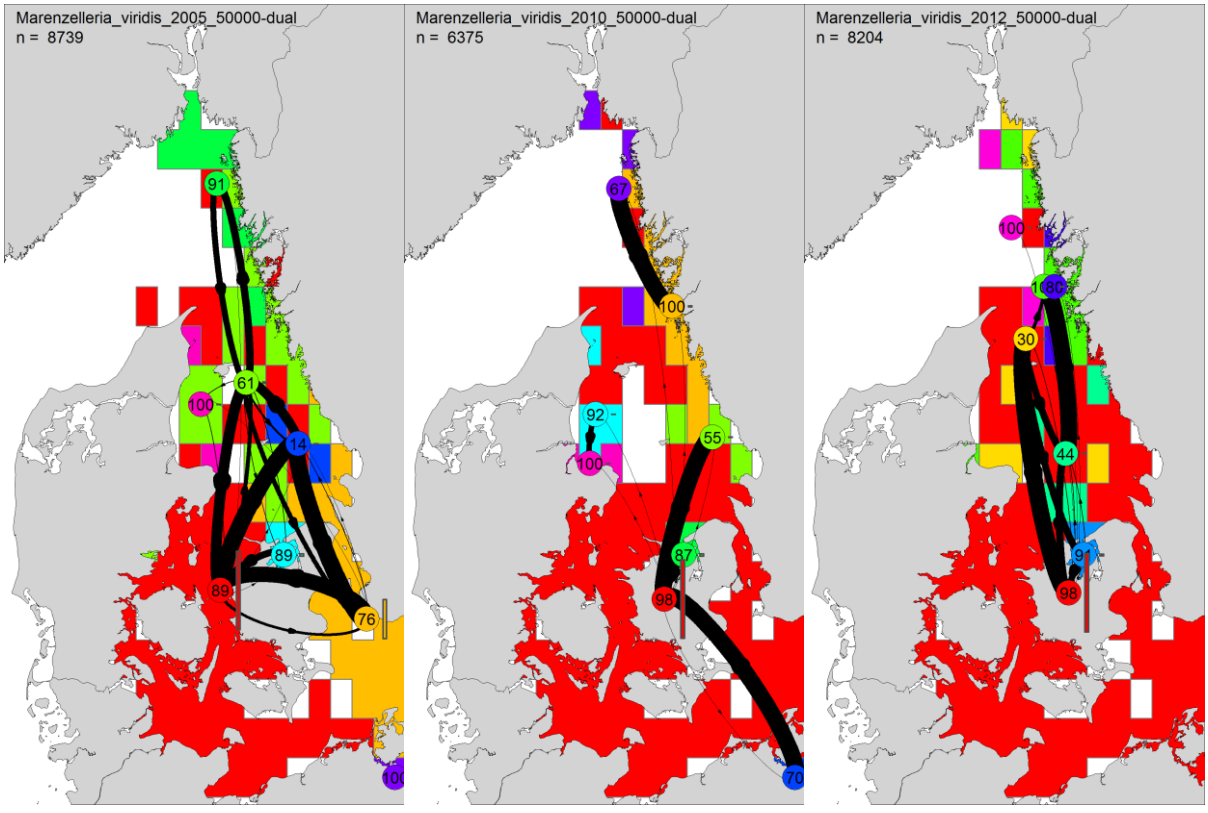
17.1.1 200 000 agents



17.1.2 200 000 agents (0-15 m)

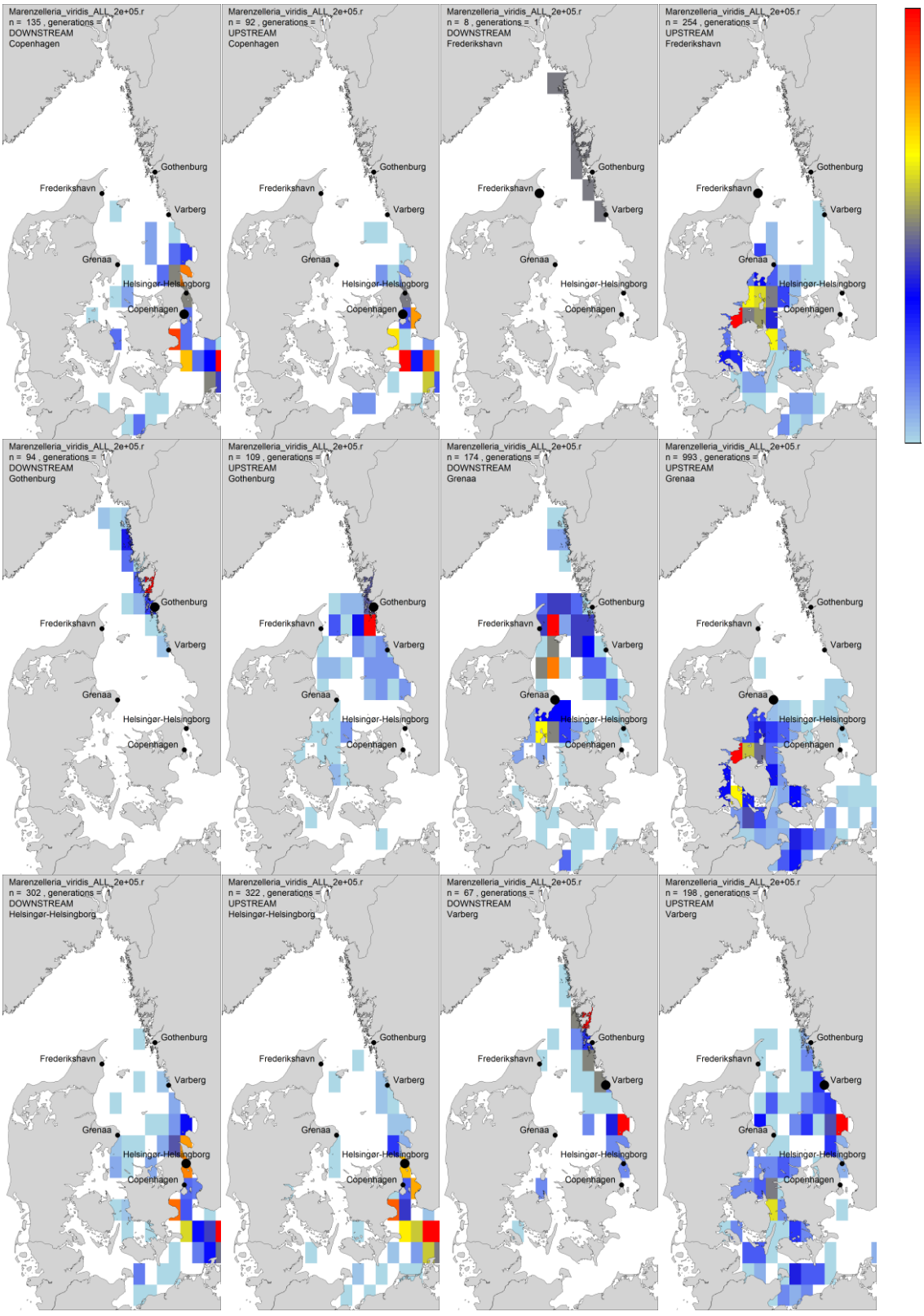


17.1.3 50 000 agents

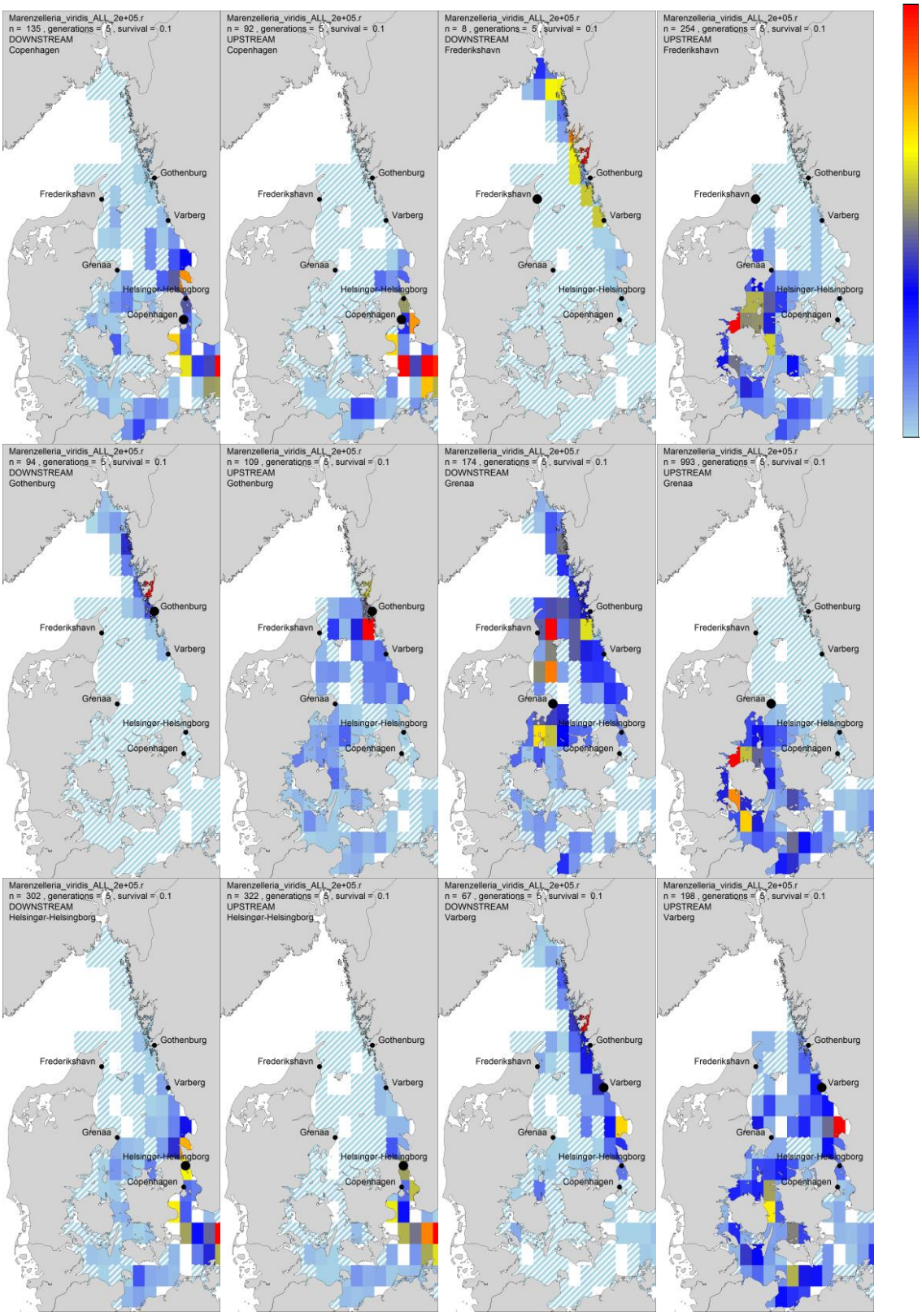


17.2 Dispersal probability plots

17.2.1 Single generation



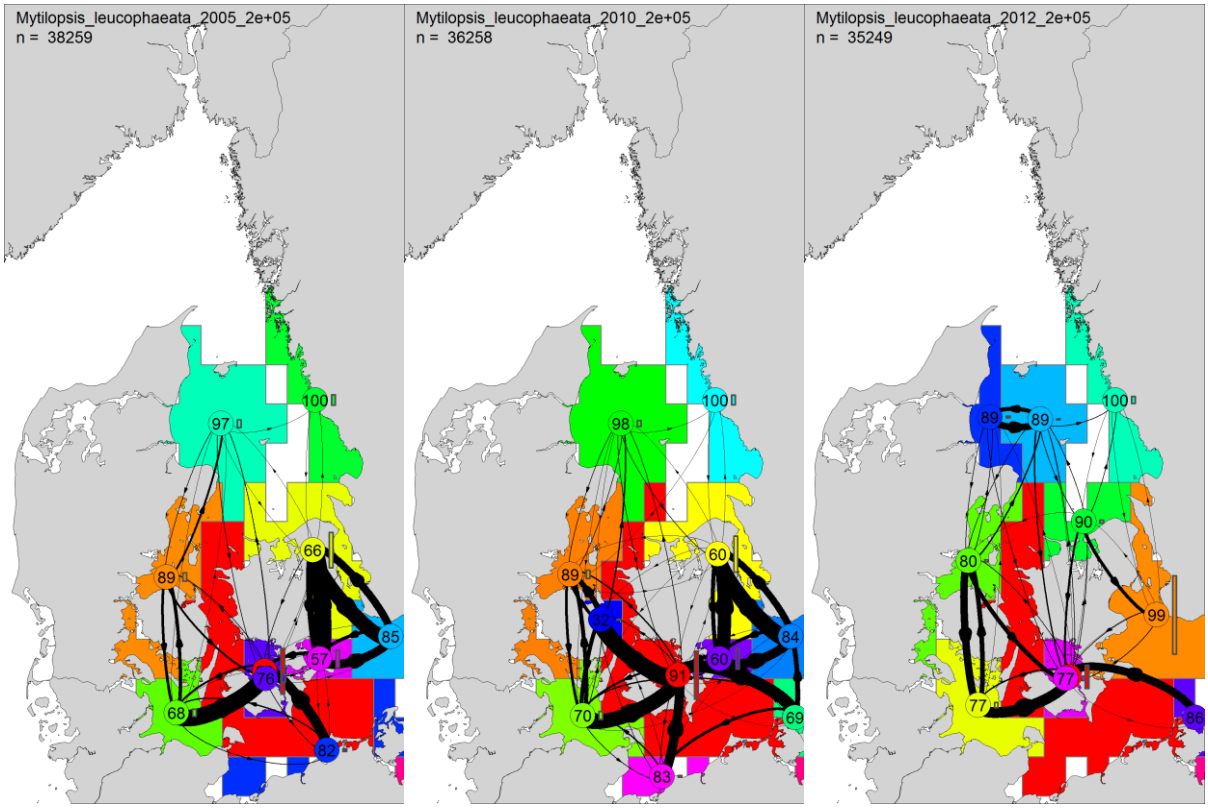
17.2.2 Dispersal probability plots - Multiple generations



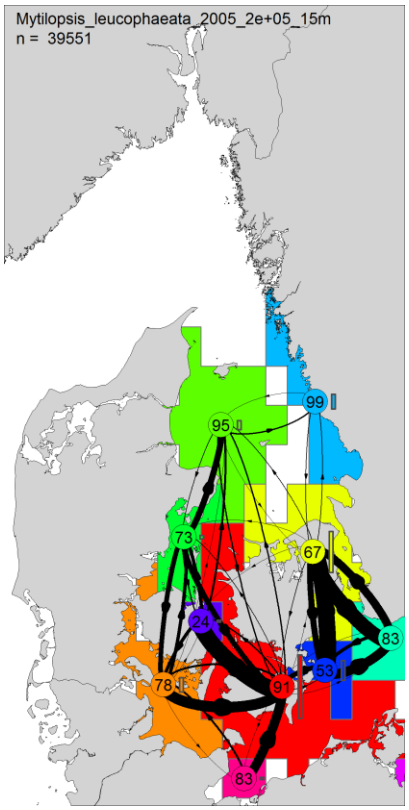
18 Mytilopsis leucophaeata

18.1 Hydrographic regions

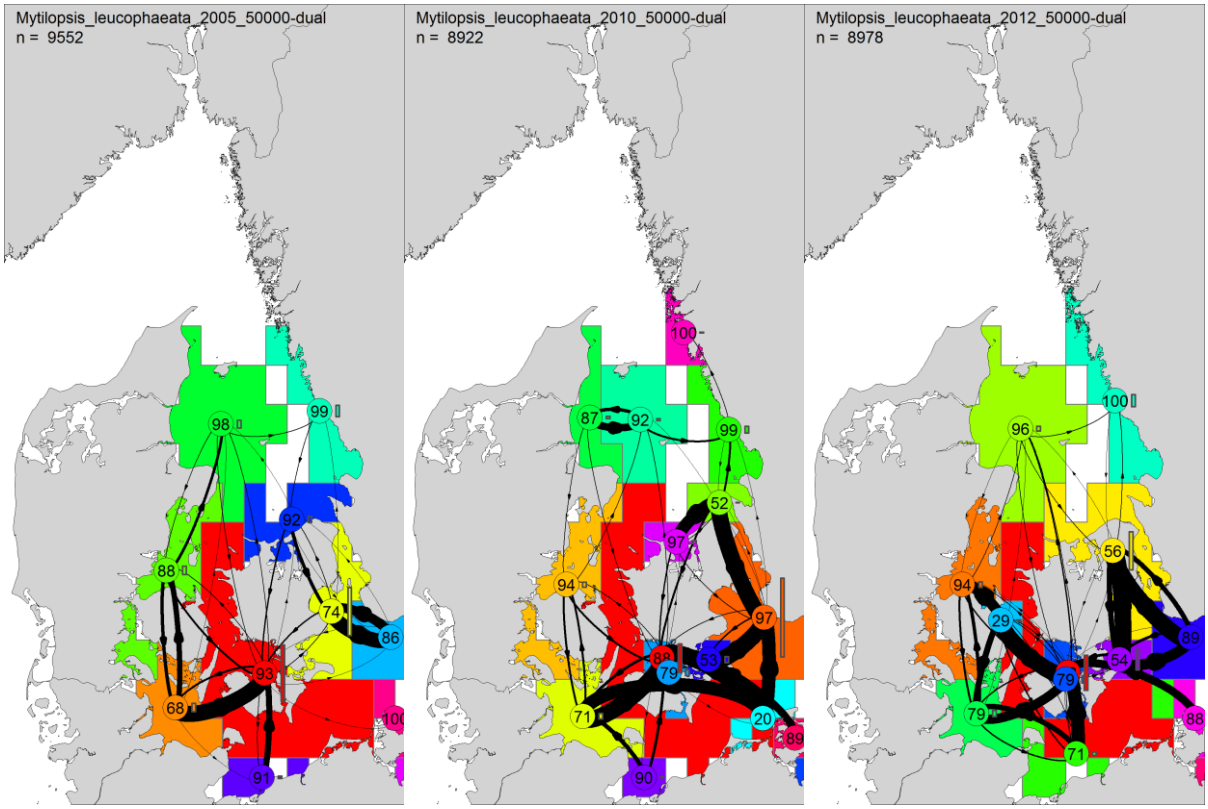
18.1.1 200 000 agents



18.1.2 200 000 agents (0-15 m)

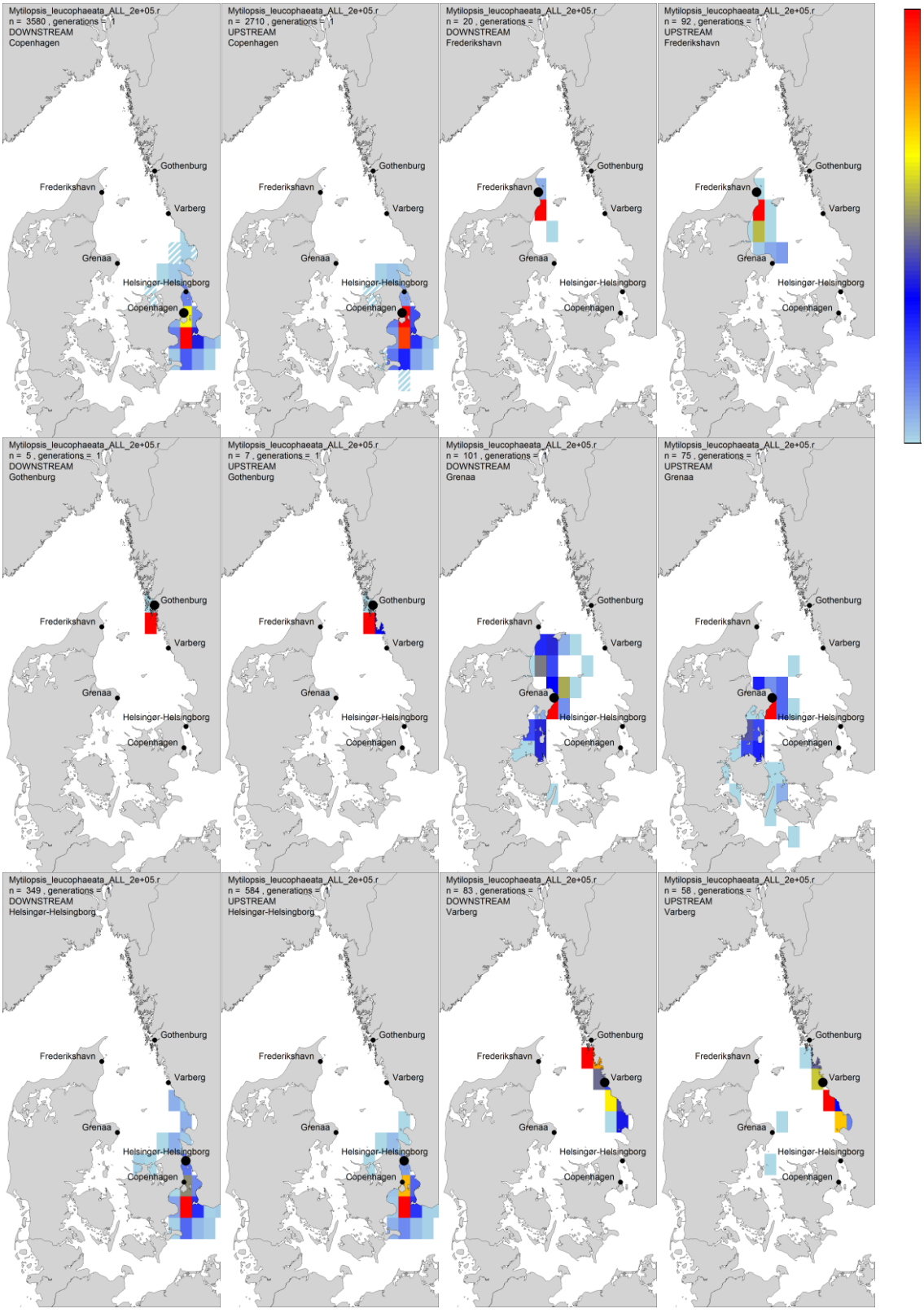


18.1.3 50 000 agents

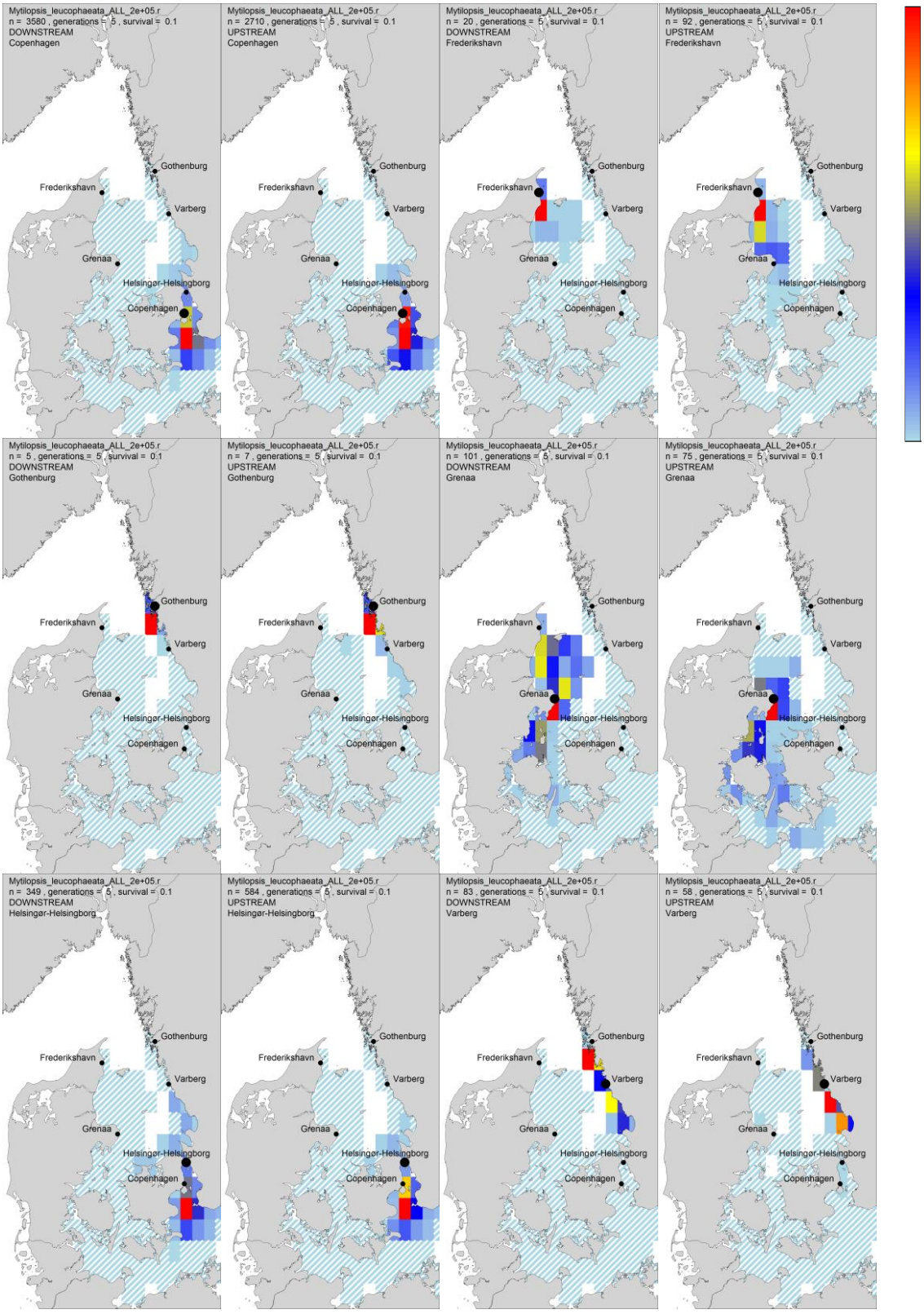


18.2 Dispersal probability plots

18.2.1 Single generation



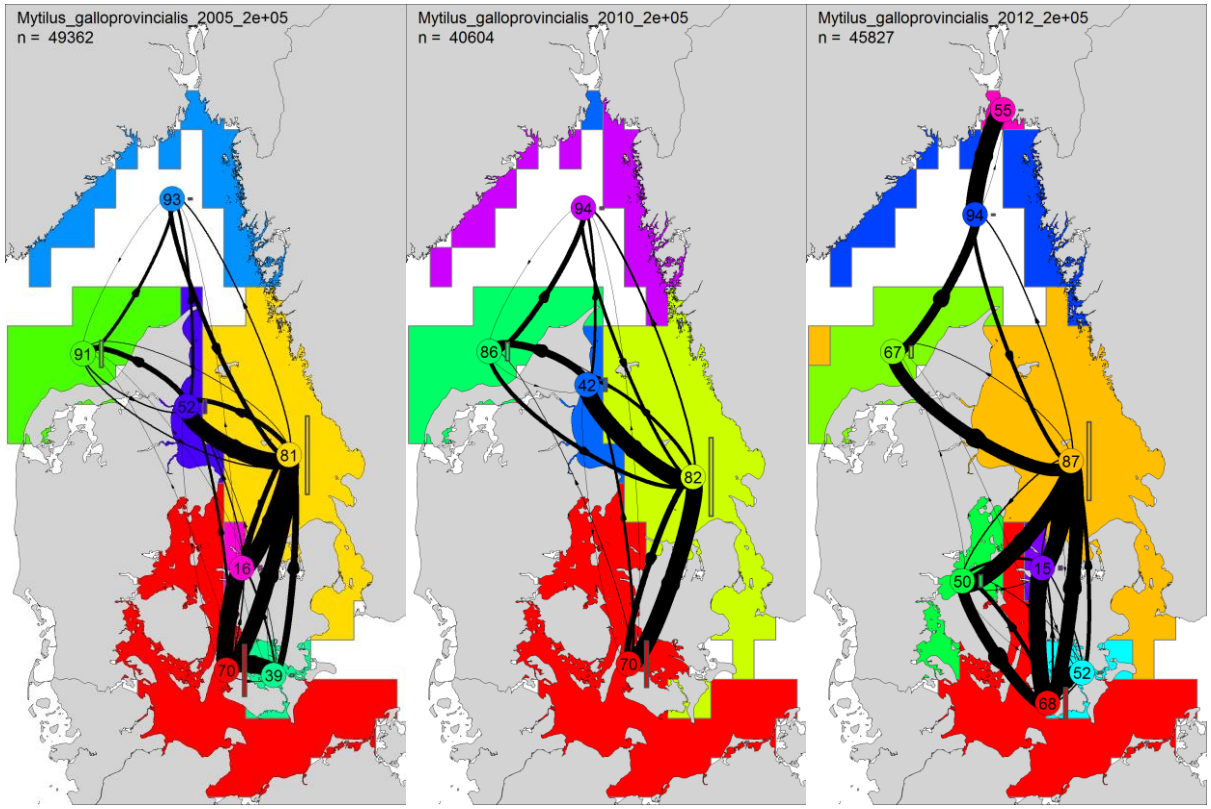
18.2.2 Multiple generations



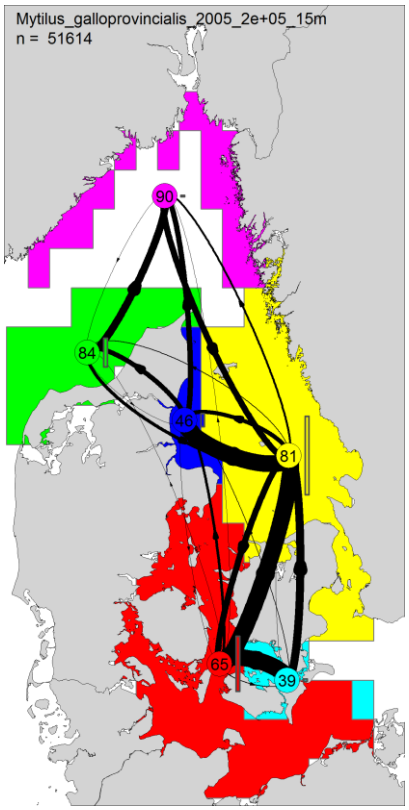
19 Mytilus galloprovincialis

19.1 Hydrographic regions

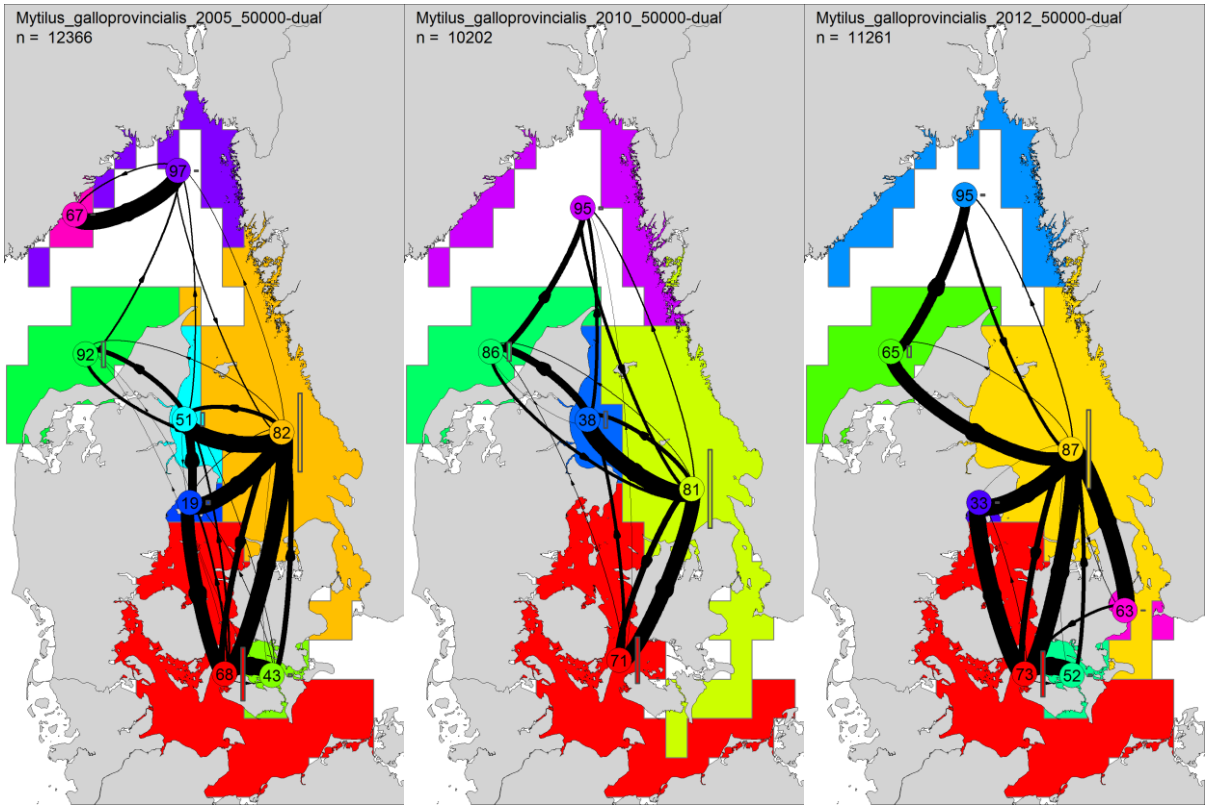
19.1.1 200 000 agents



19.1.2 200 000 agents (0-15 m)

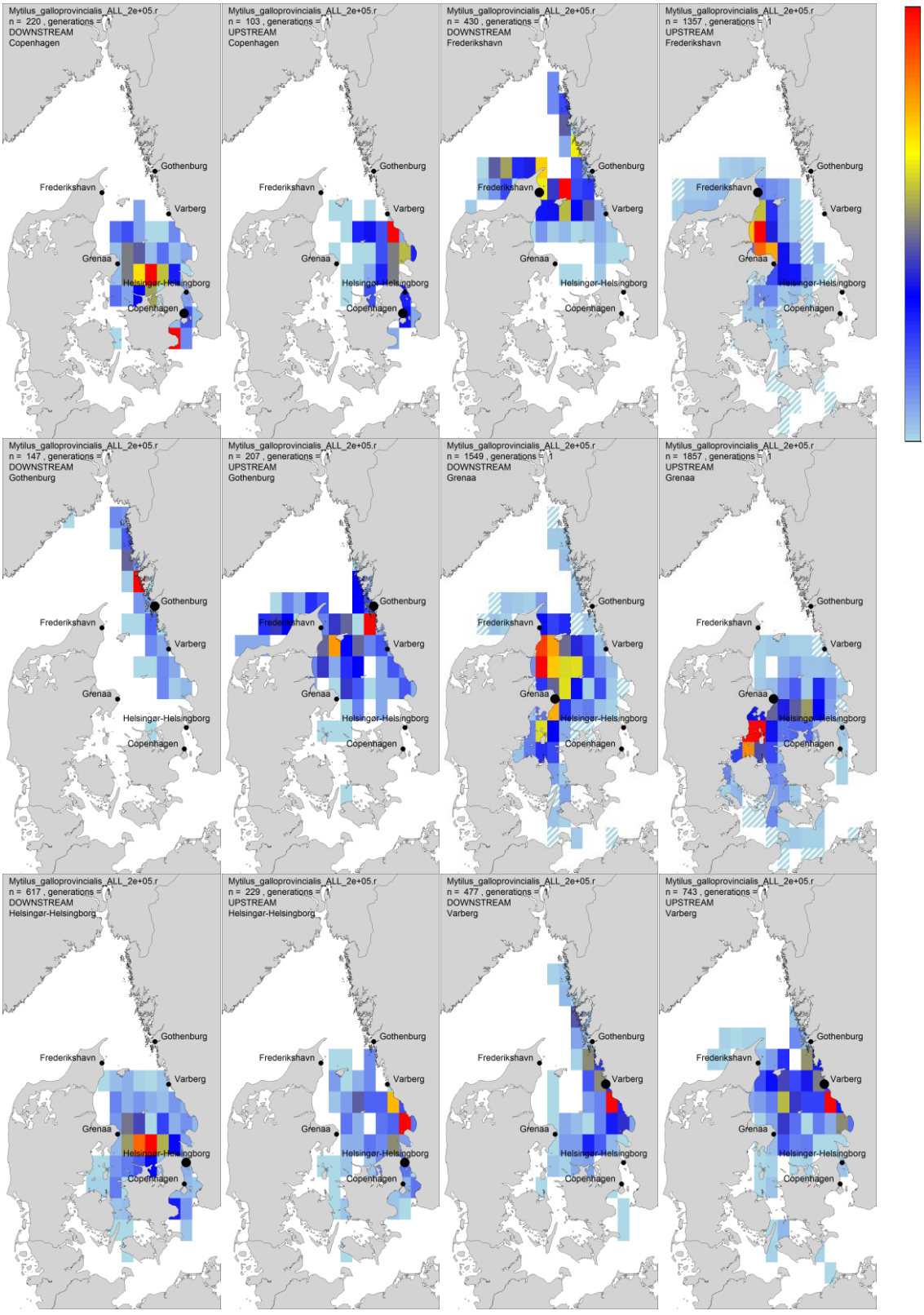


19.1.3 50 000 agents

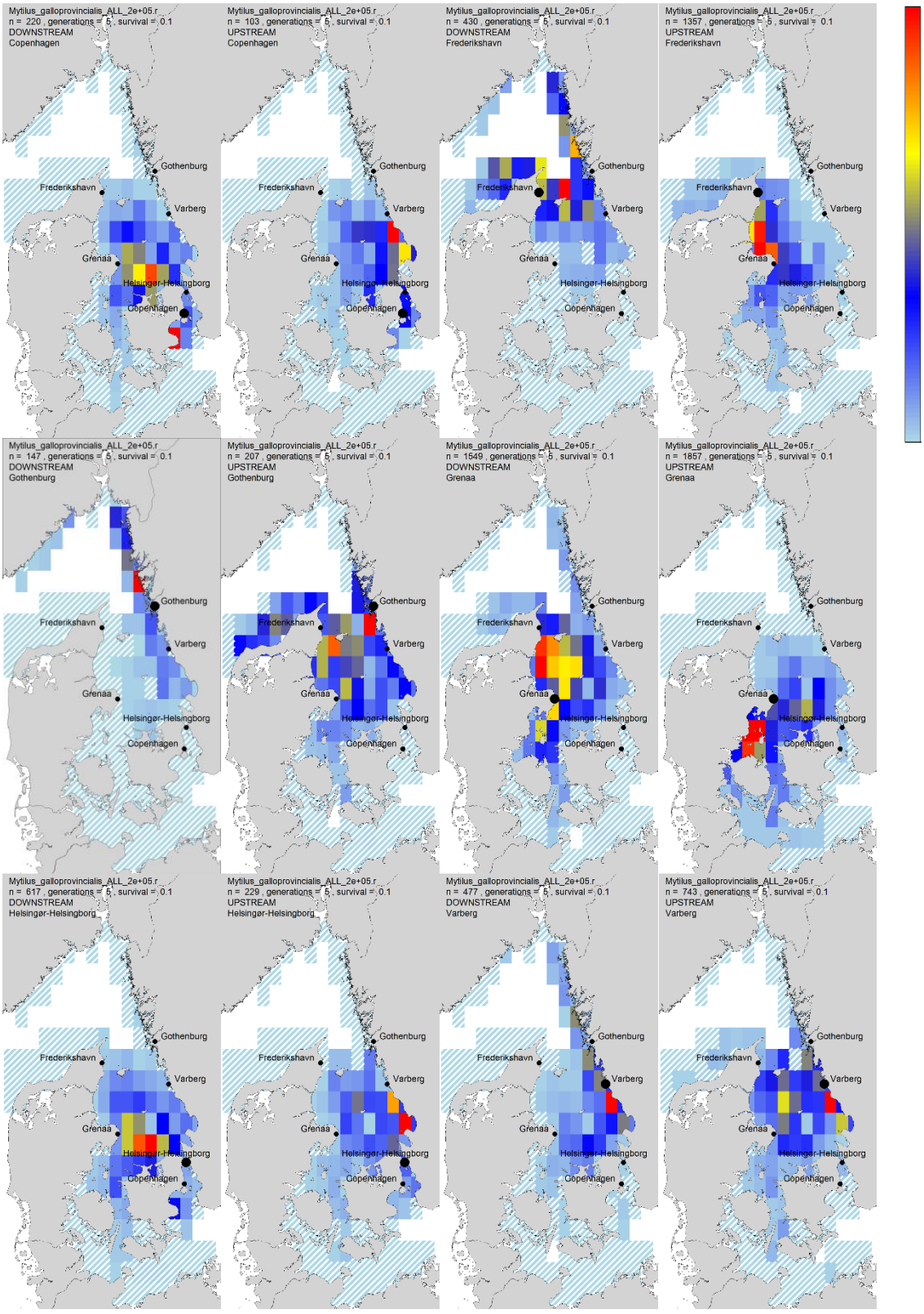


19.2 Dispersal probability plots

19.2.1 Single generation



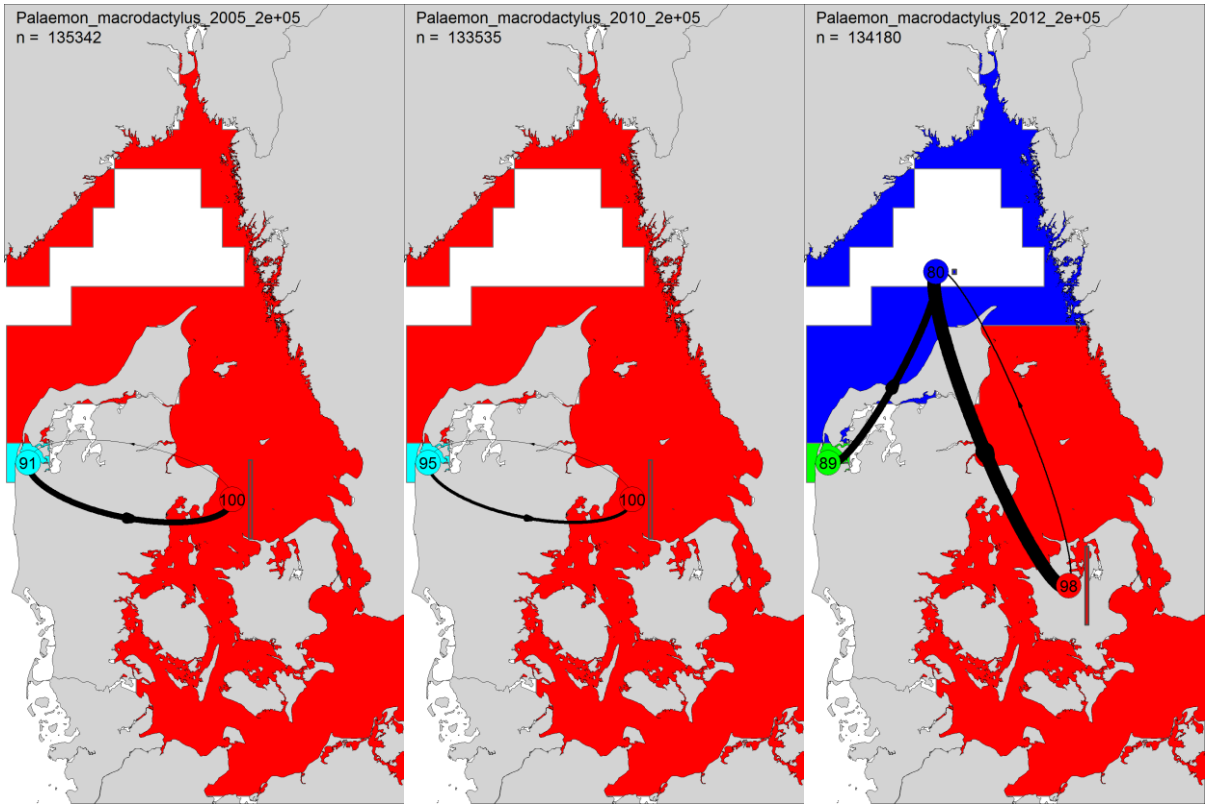
19.2.2 Multiple generations



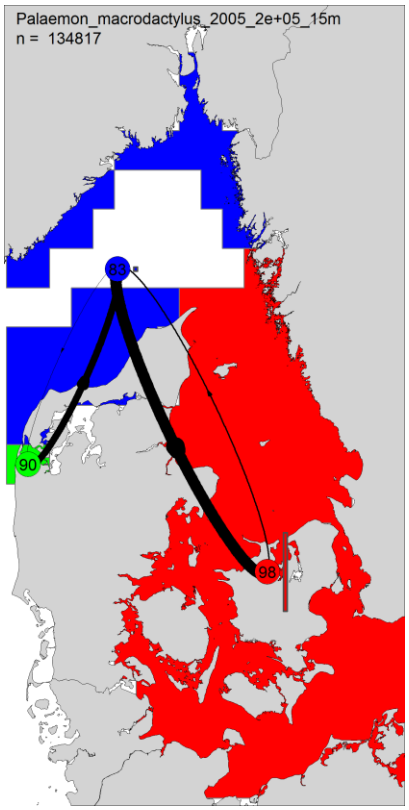
20 Palaemon macrodactylus

20.1 Hydrographic regions

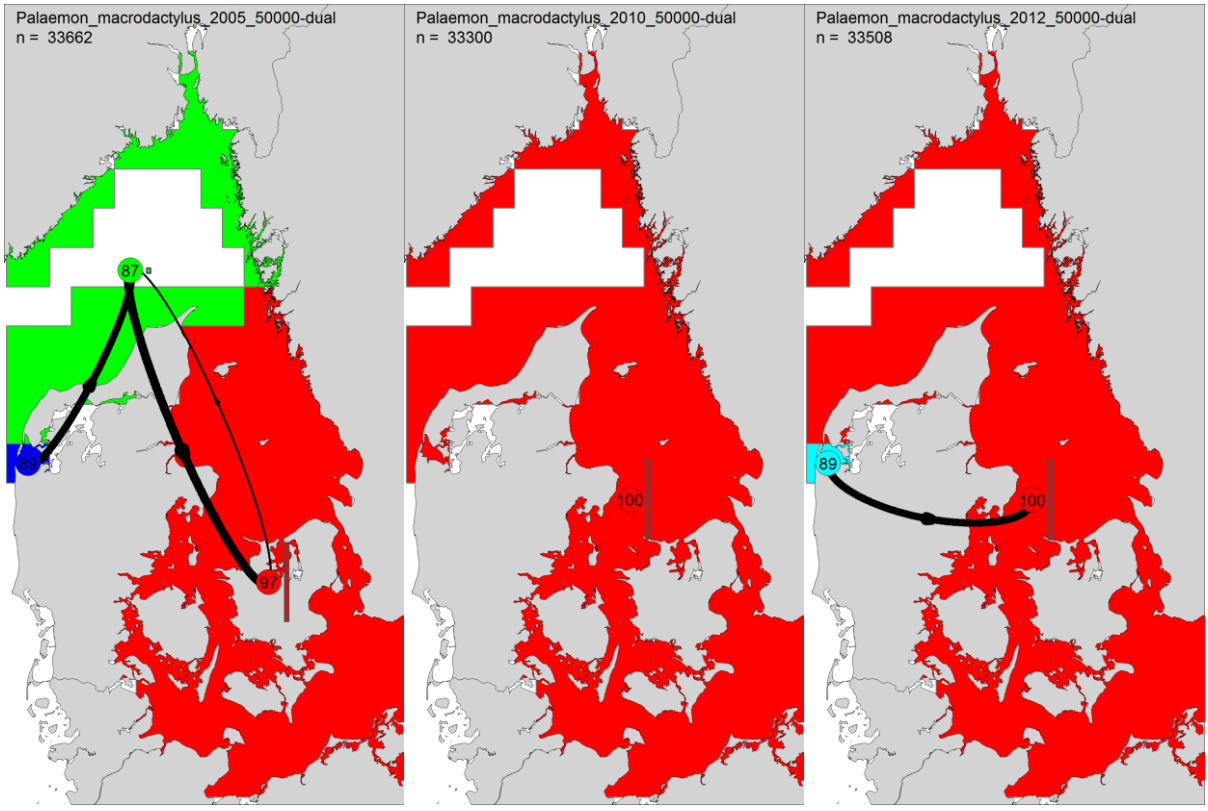
20.1.1 20 000



20.1.2 200 000 agents (0-15 m)

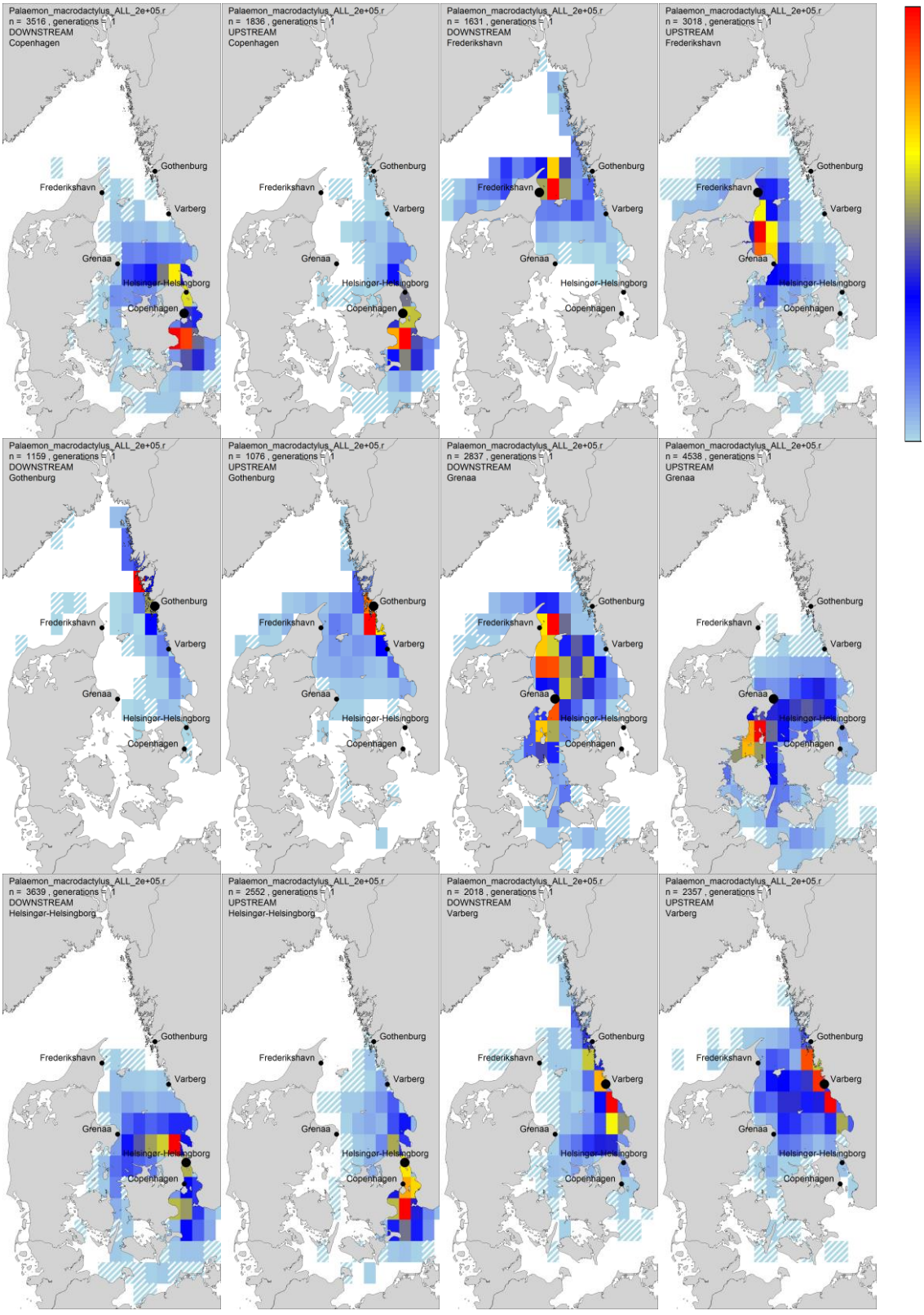


20.1.3 50 000 agents

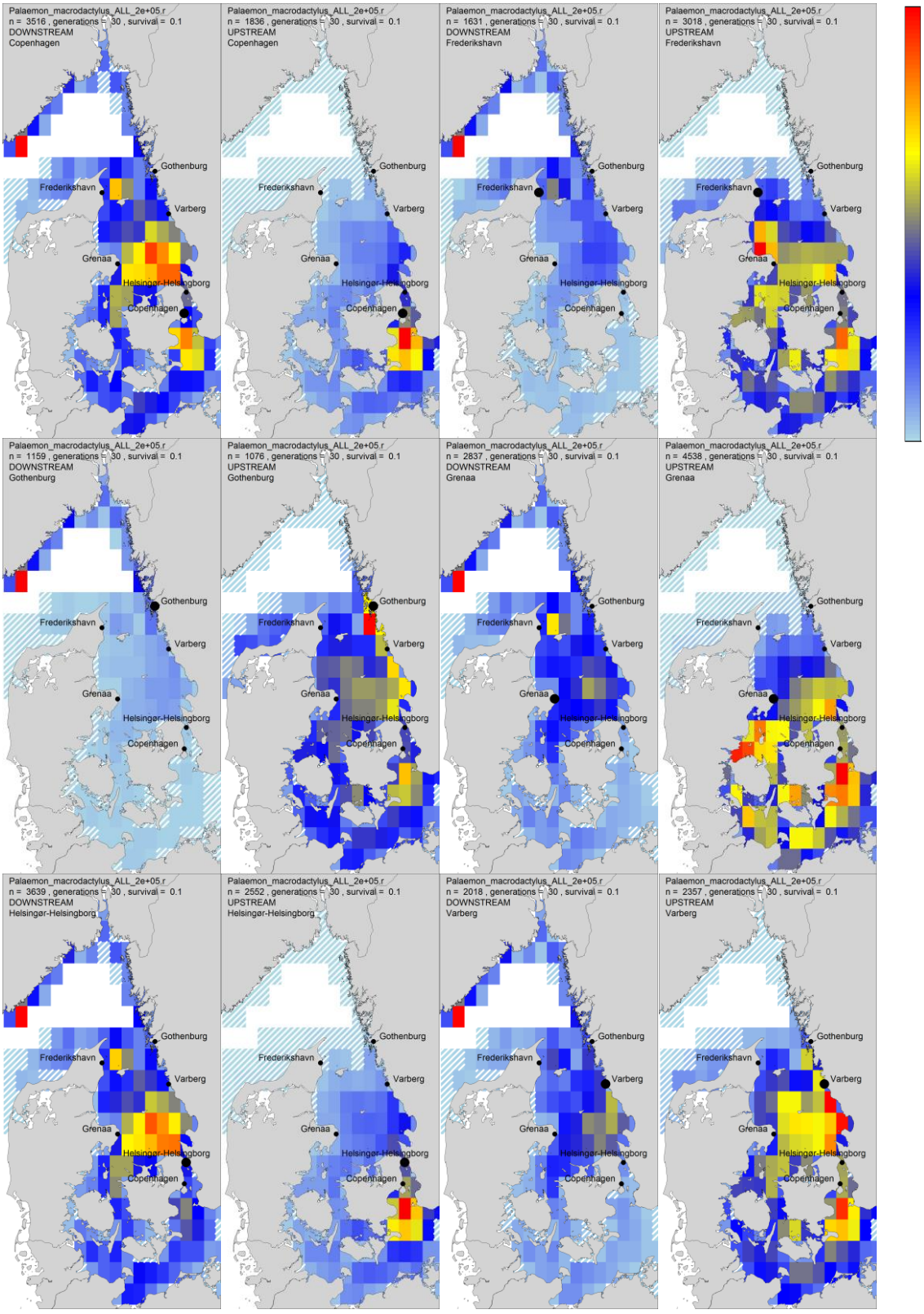


20.2 Dispersal probability plots

20.2.1 Single generation



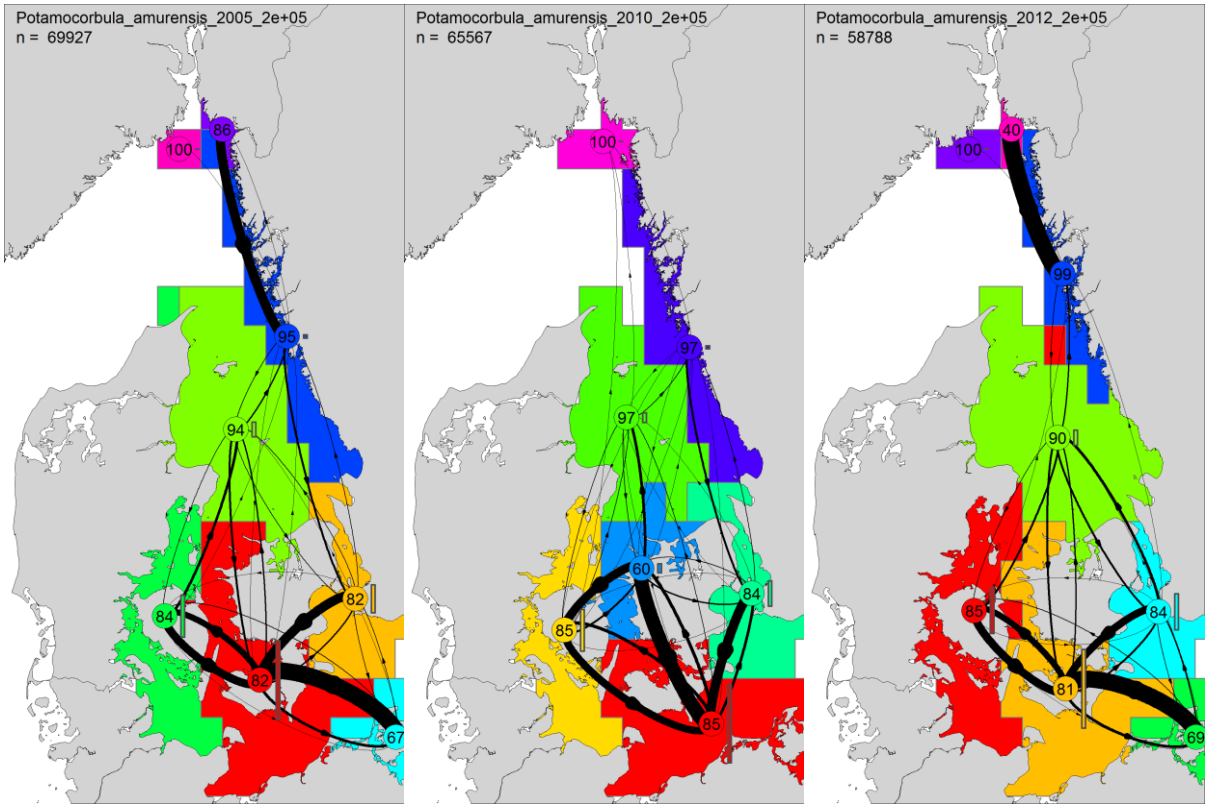
20.2.2 'Multiple generations



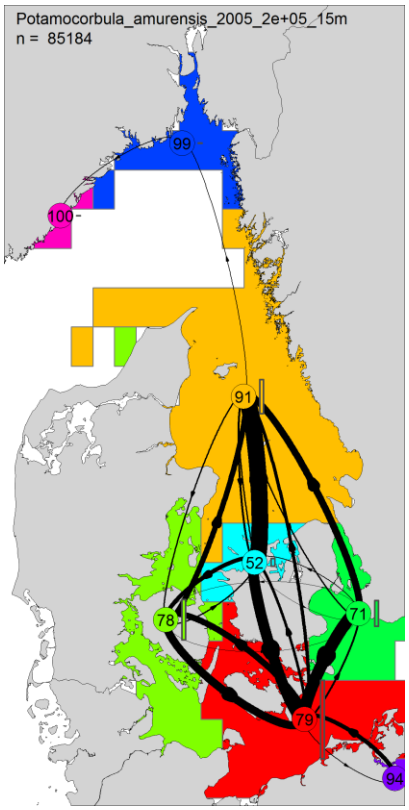
21 Potamocorbula amurensis

21.1 Hydrographic regions

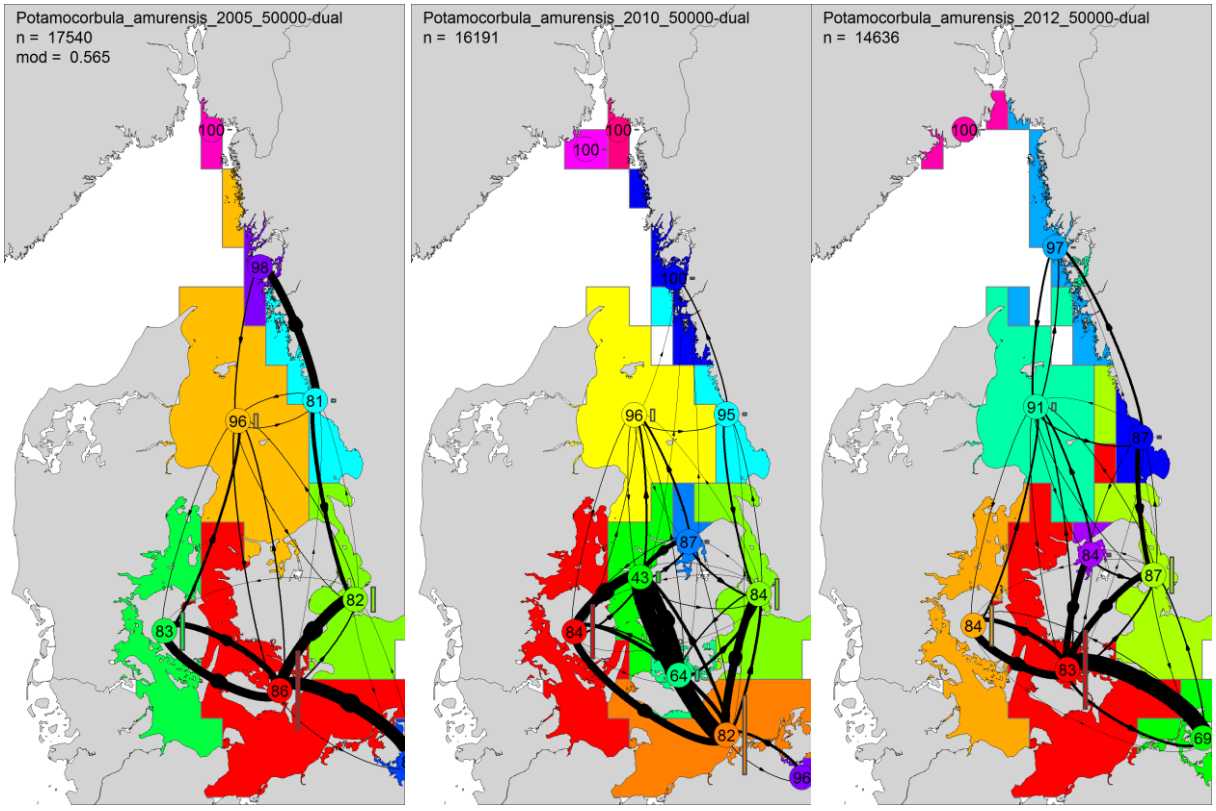
21.1.1 200 000 agents



21.1.2 200 000 agents (0-15 m)

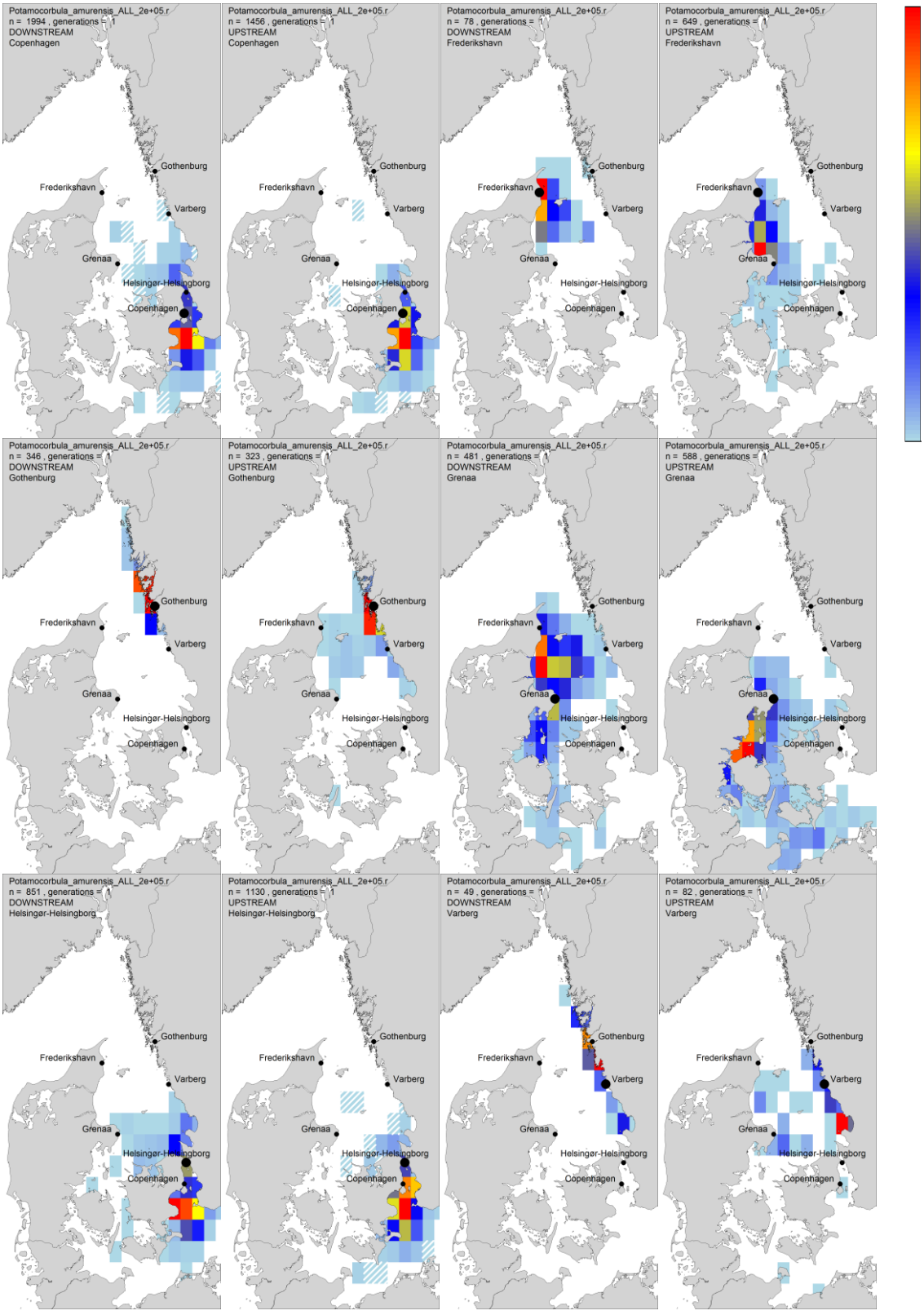


21.1.3 50 000 agents

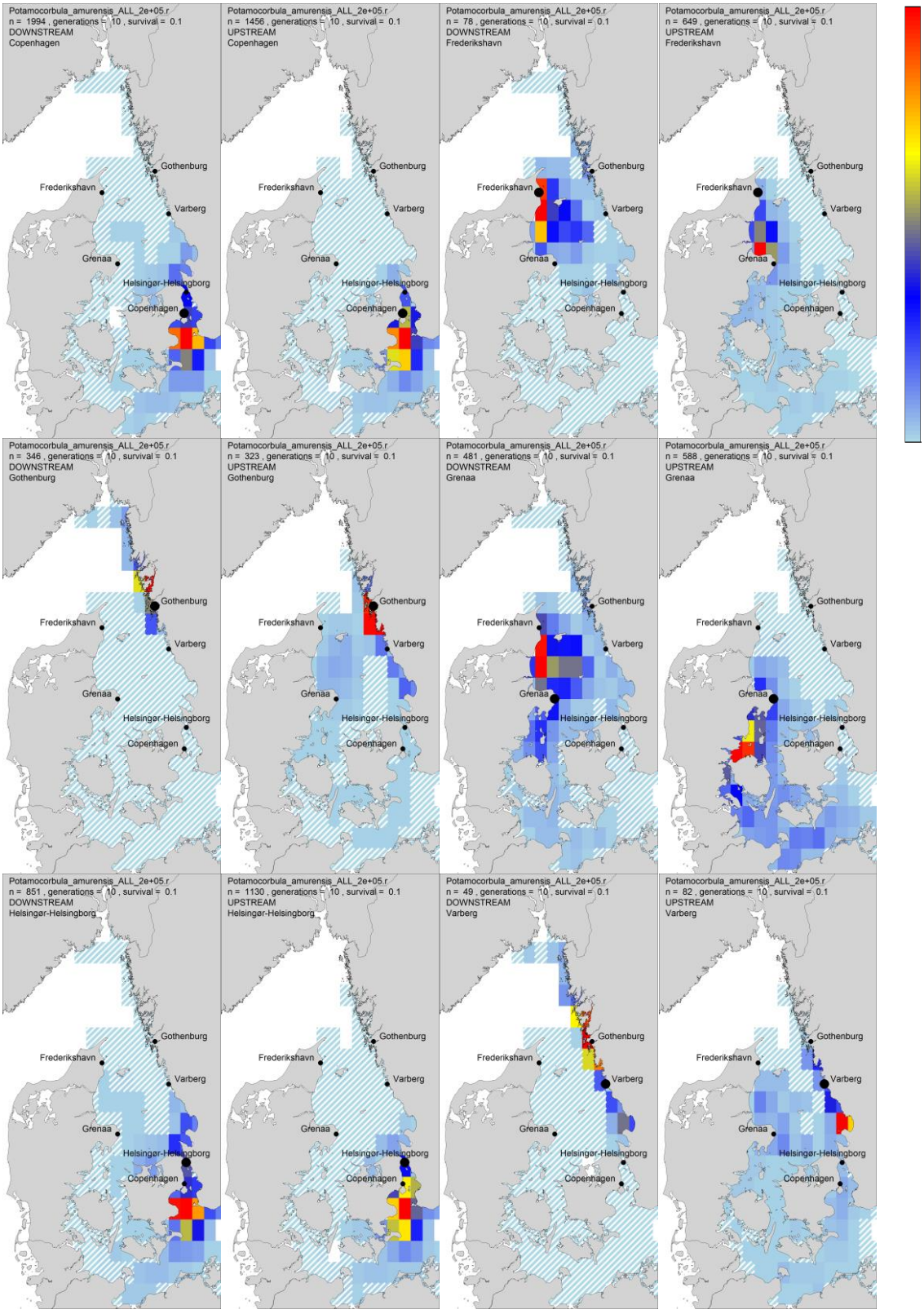


21.2 Dispersal probability plots

21.2.1 Single generation



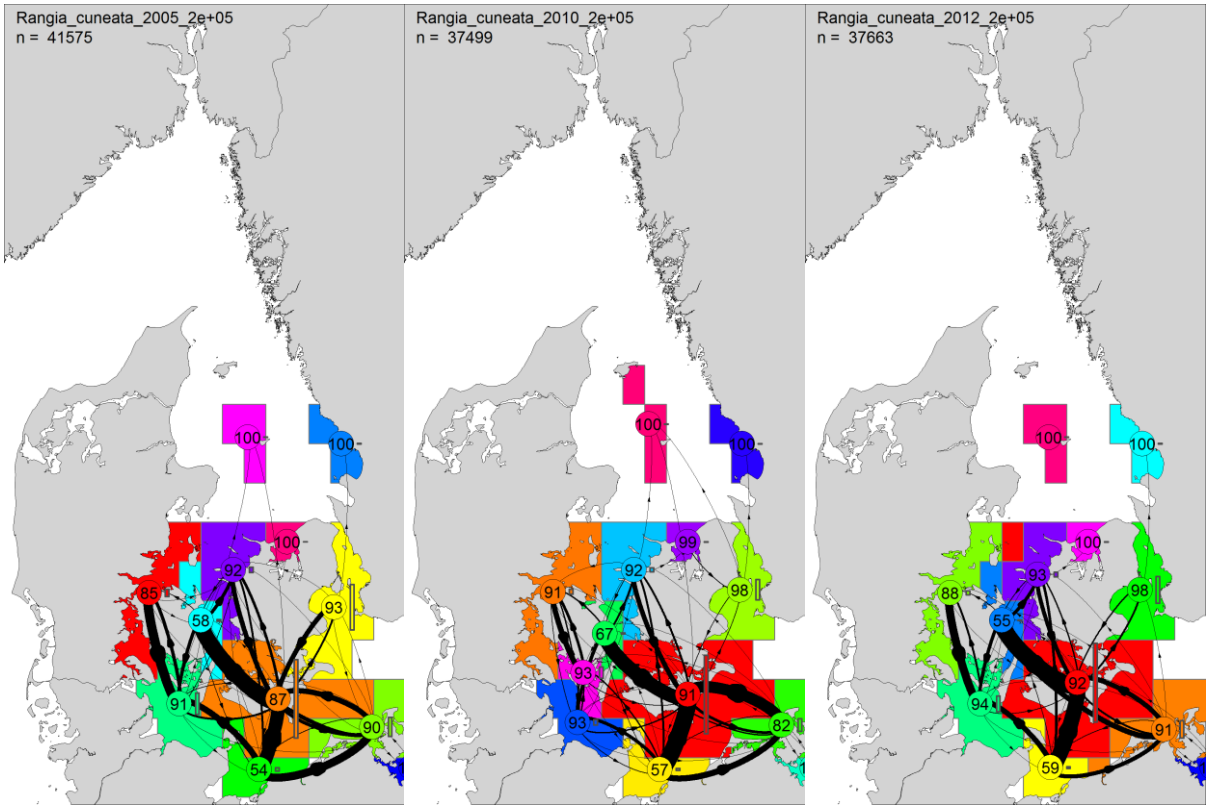
21.2.2 Multiple generations



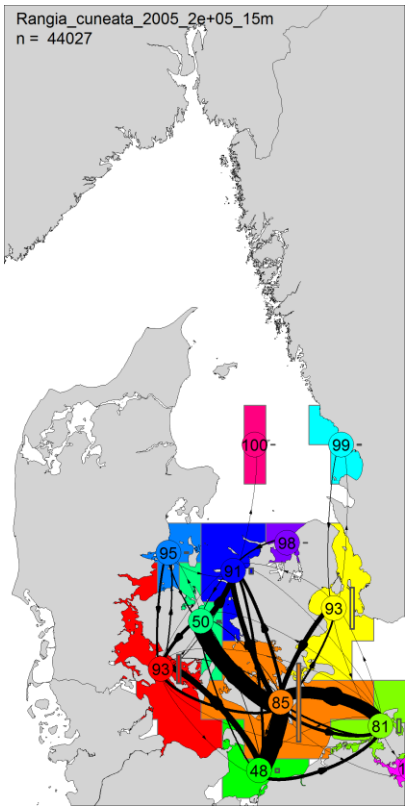
22 Rangia cuneate

22.1 Hydrographic regions

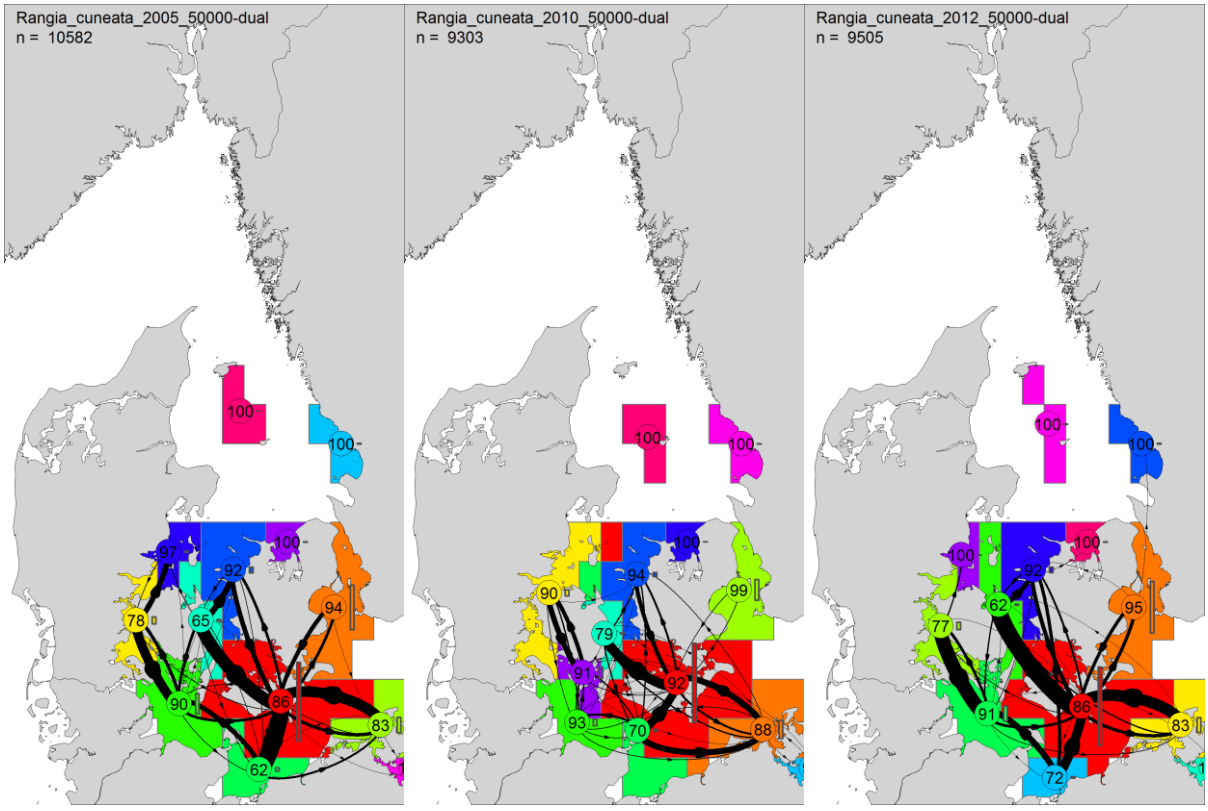
22.1.1 200 000 agents



22.1.2 200 000 agents (0-15 m)

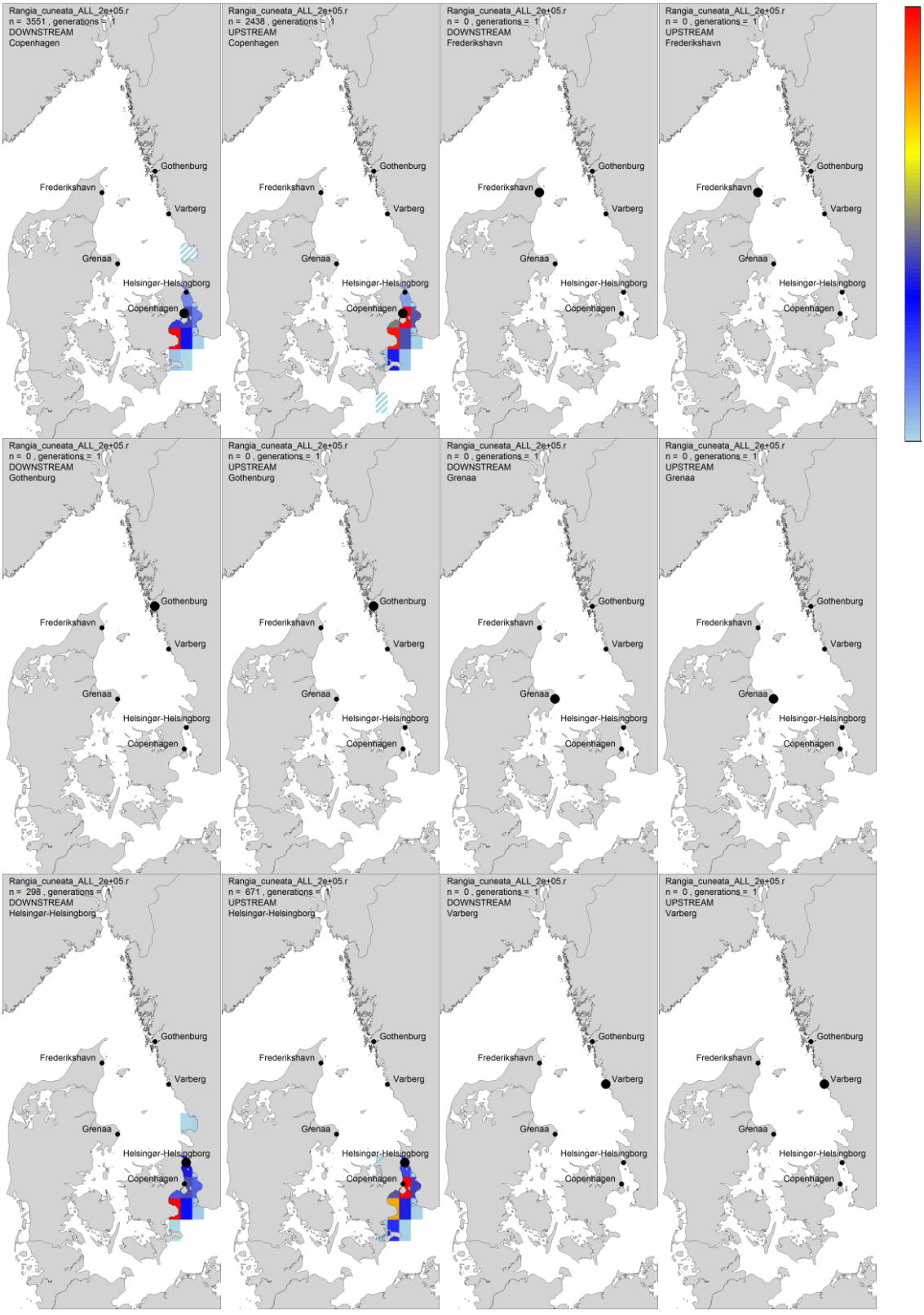


22.1.3 50 000 agents

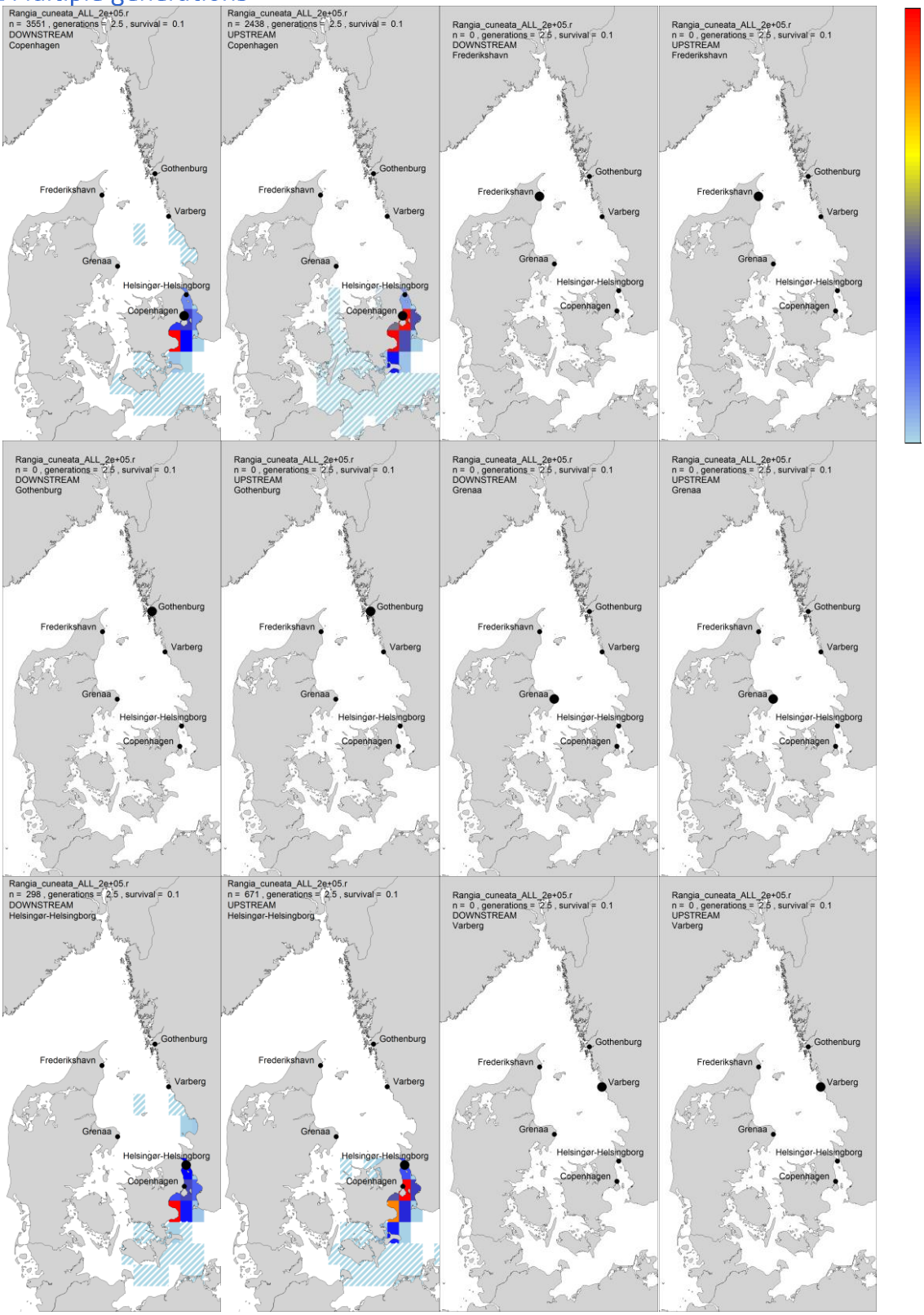


22.2 Dispersal probability plots

22.2.1 Single generation



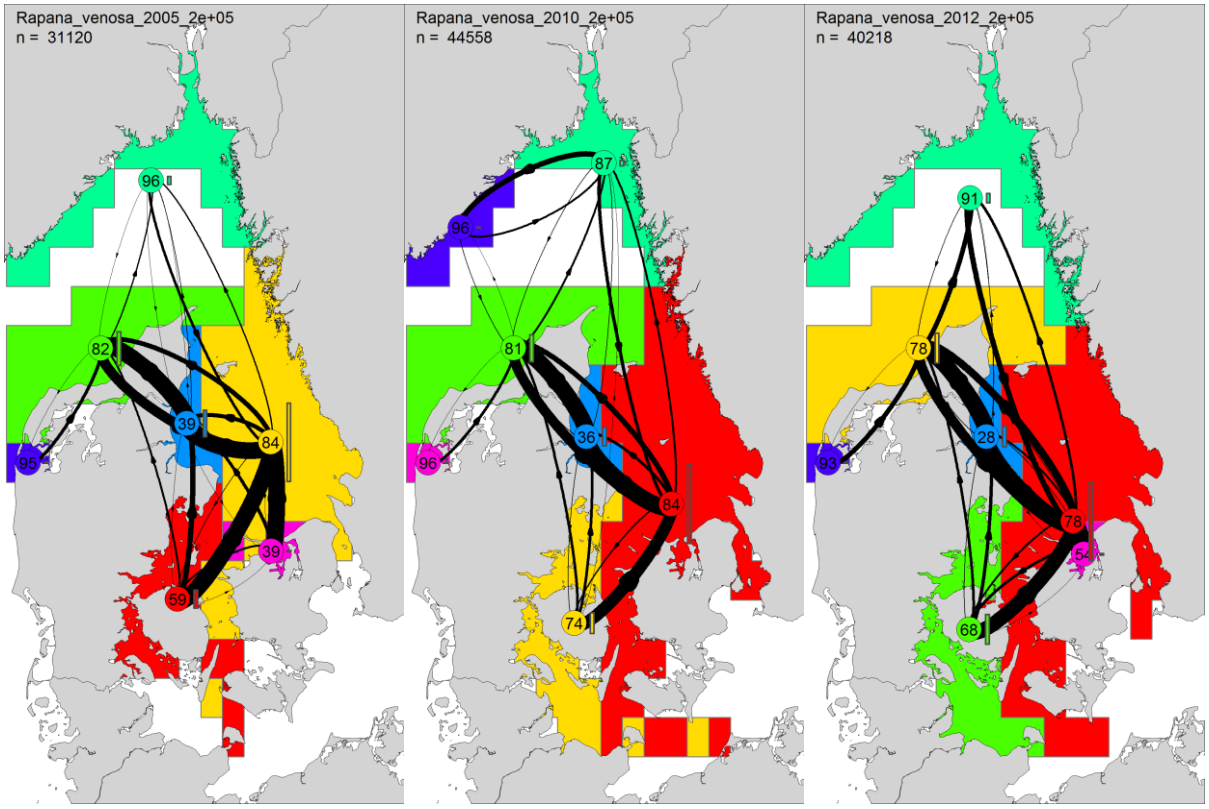
22.2.2 Multiple generations



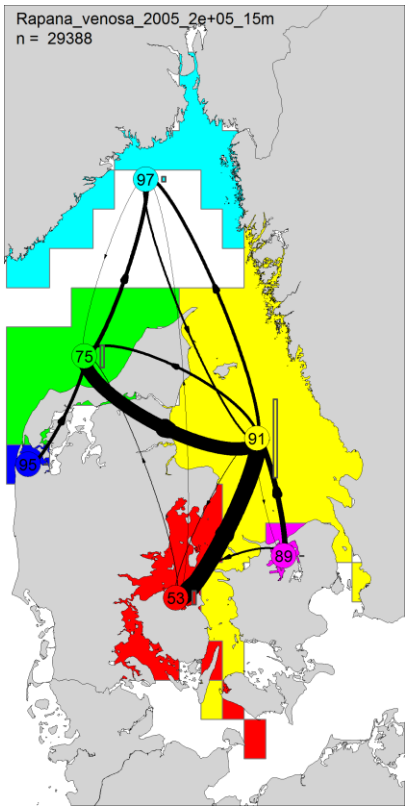
23 Rapana venosa

23.1 Hydrographic regions

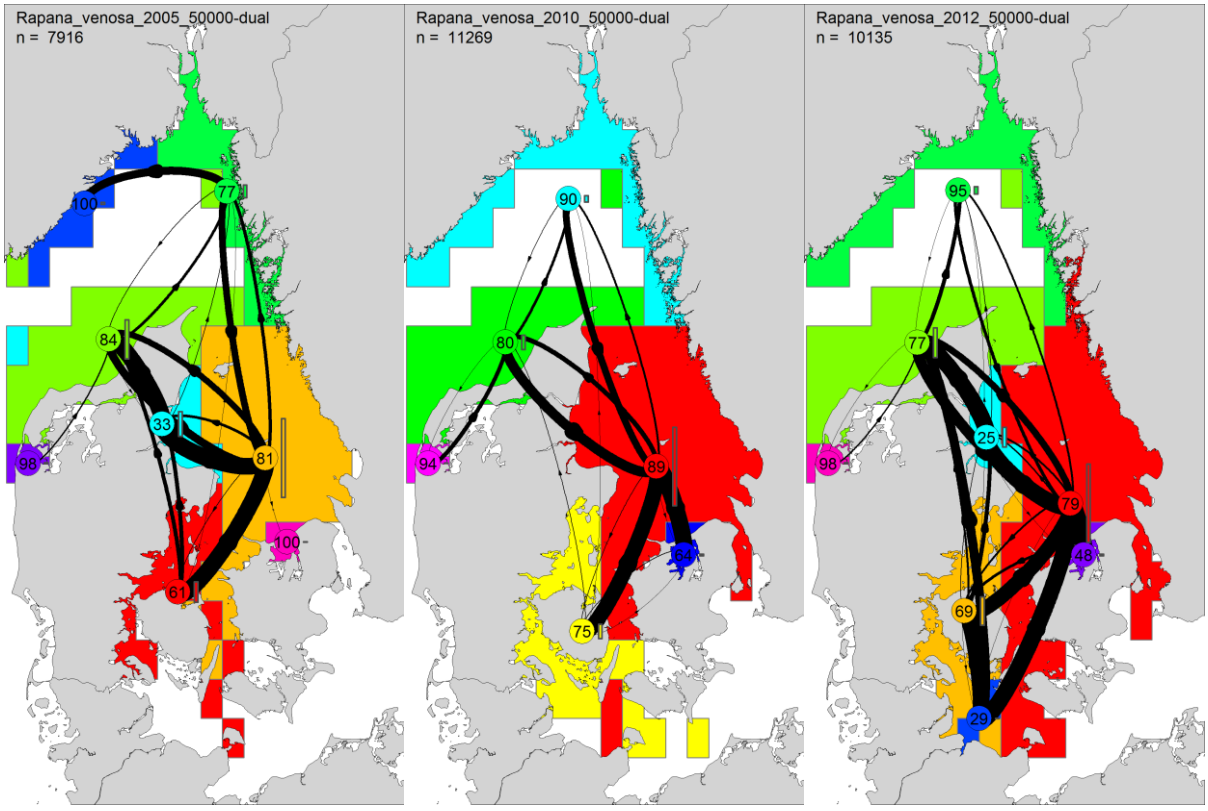
23.1.1 200 000 agents



23.1.2 200 000 agents (0-15 m)

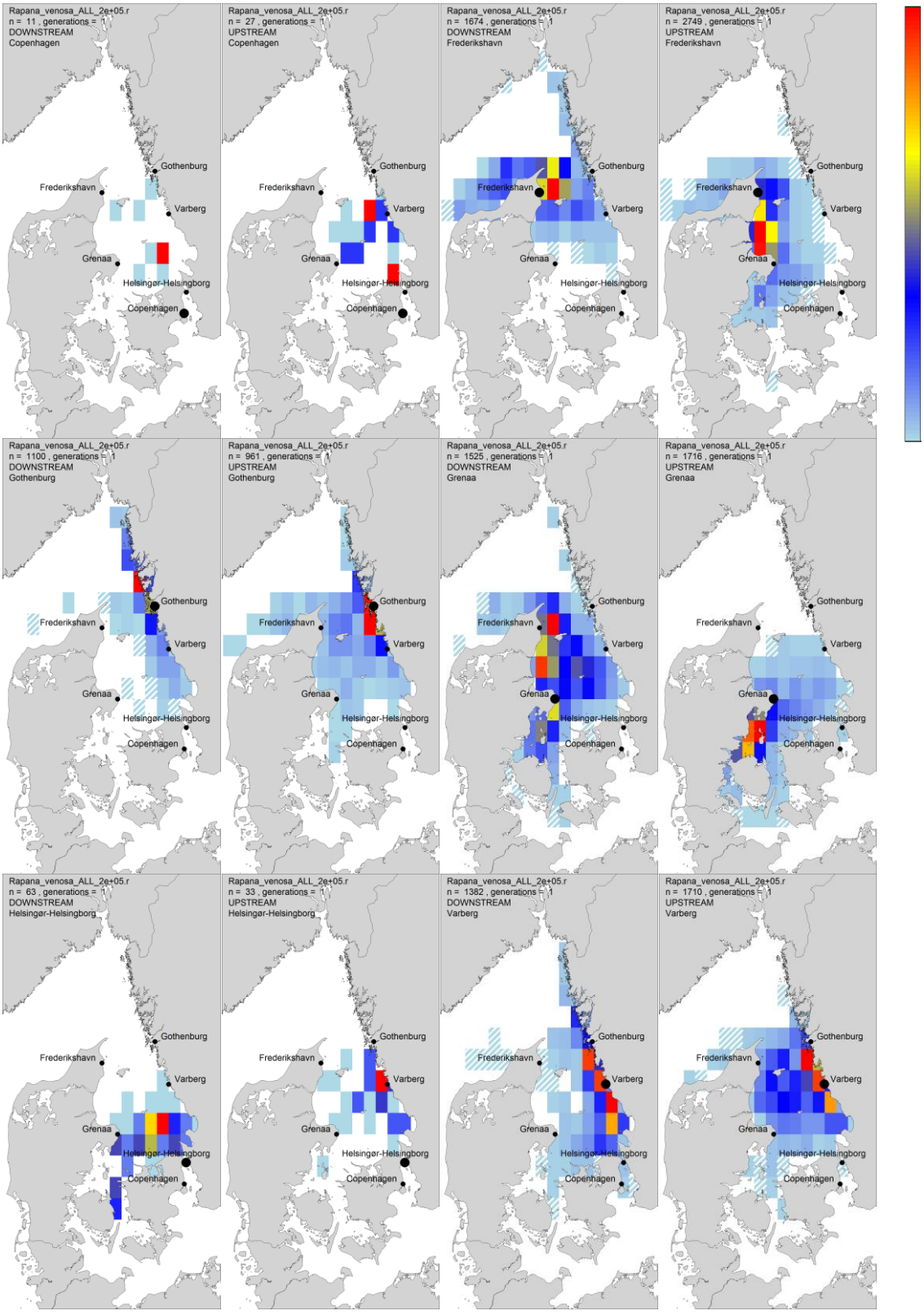


23.1.3 50 000 agents

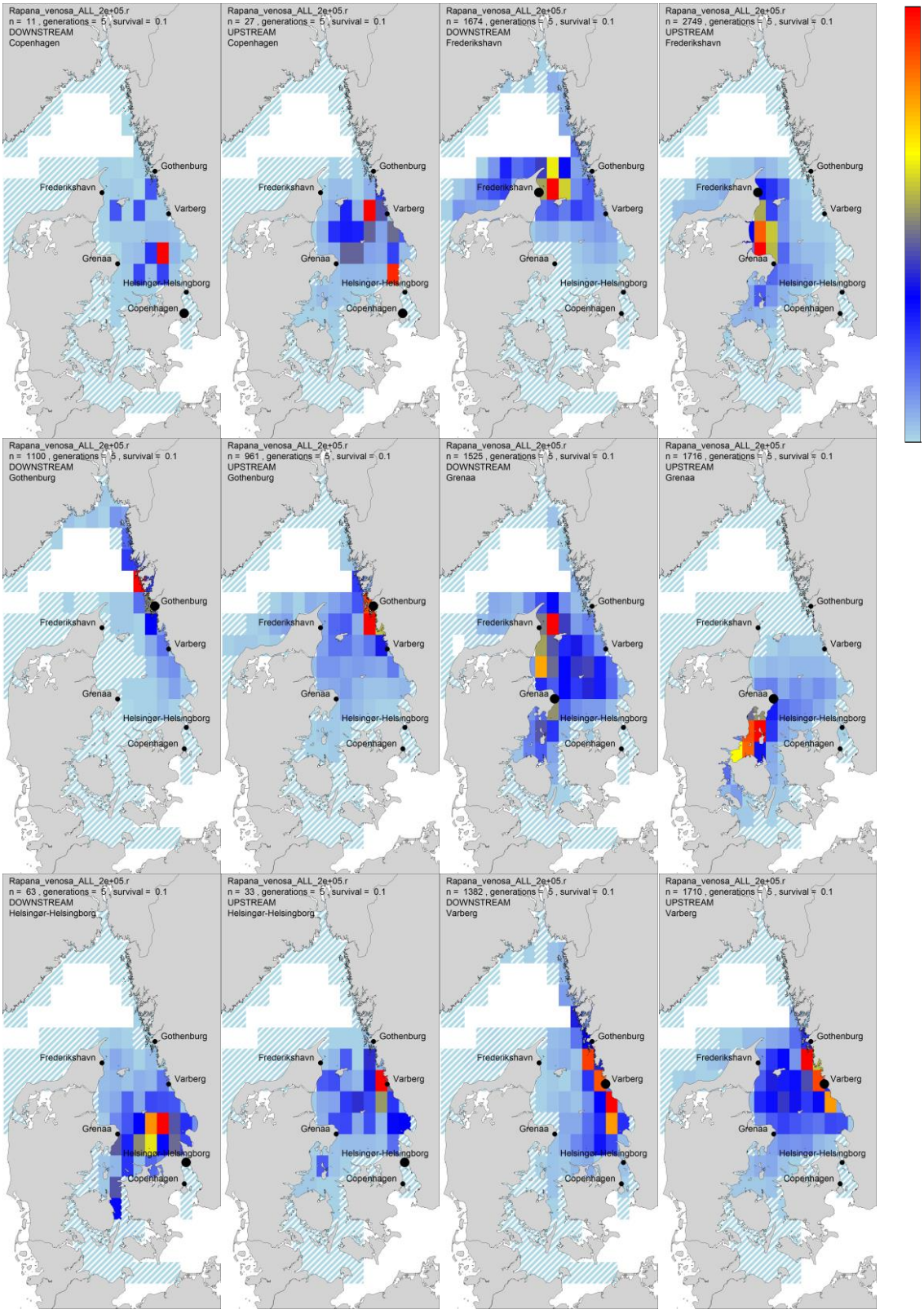


23.2 Dispersal probability plots

23.2.1 Single generation



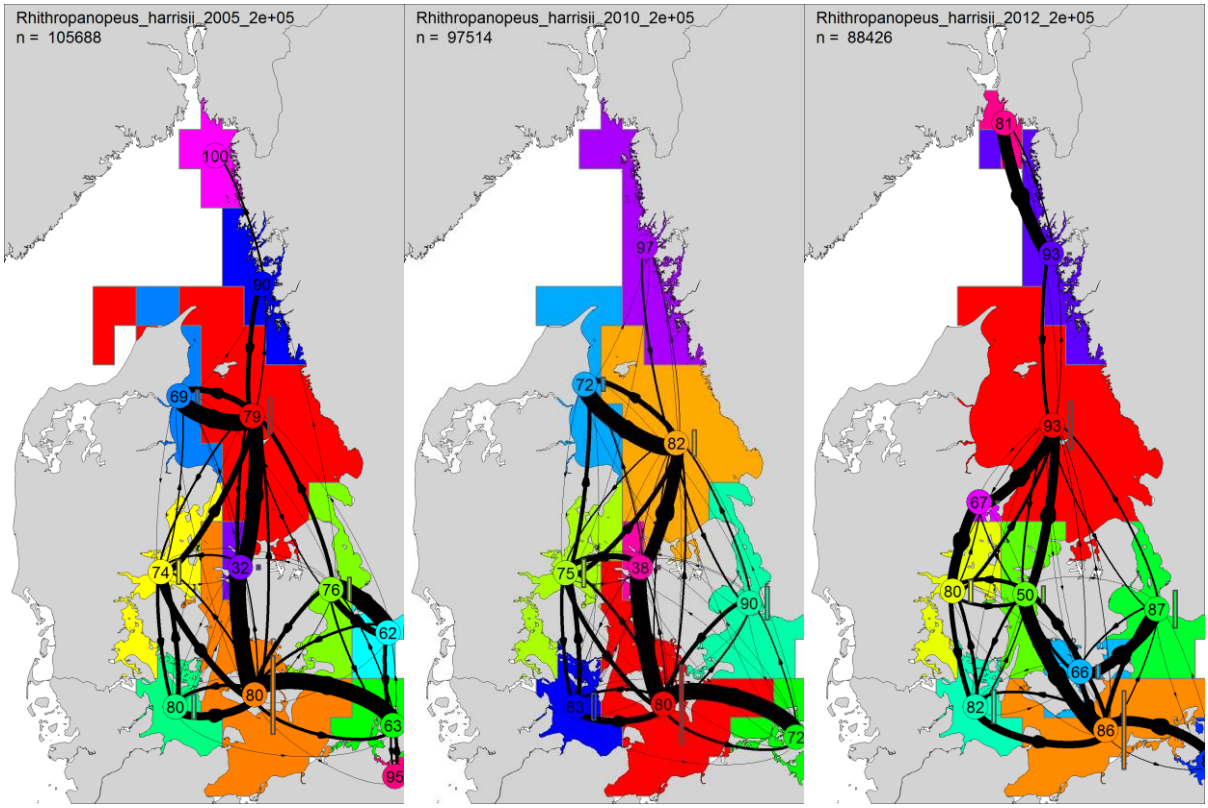
23.2.2 Multiple generations



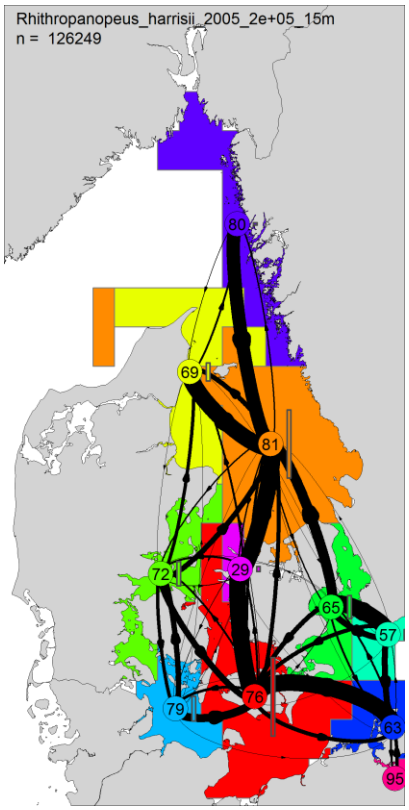
24 Rhithropanopeus harrisii

24.1 Hydrographic regions

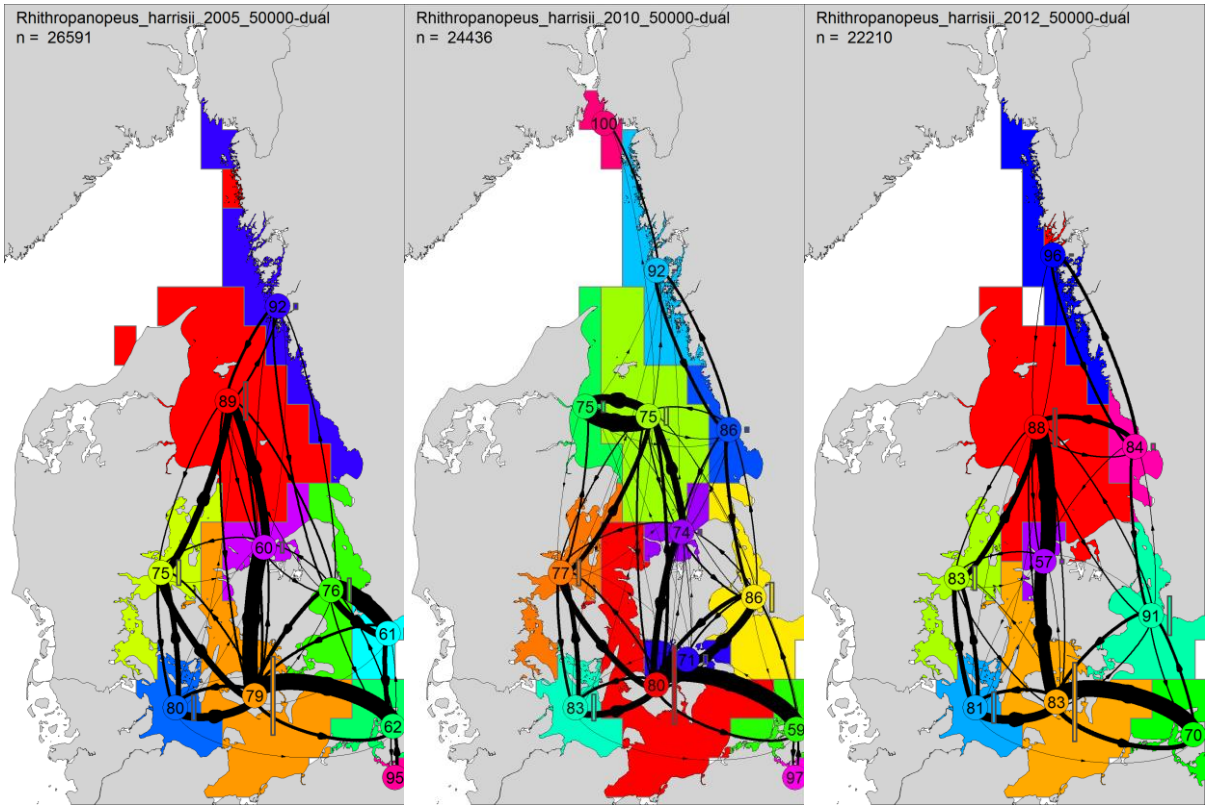
24.1.1 200 000 agents



24.1.2 200 000 agents (0–15 m)

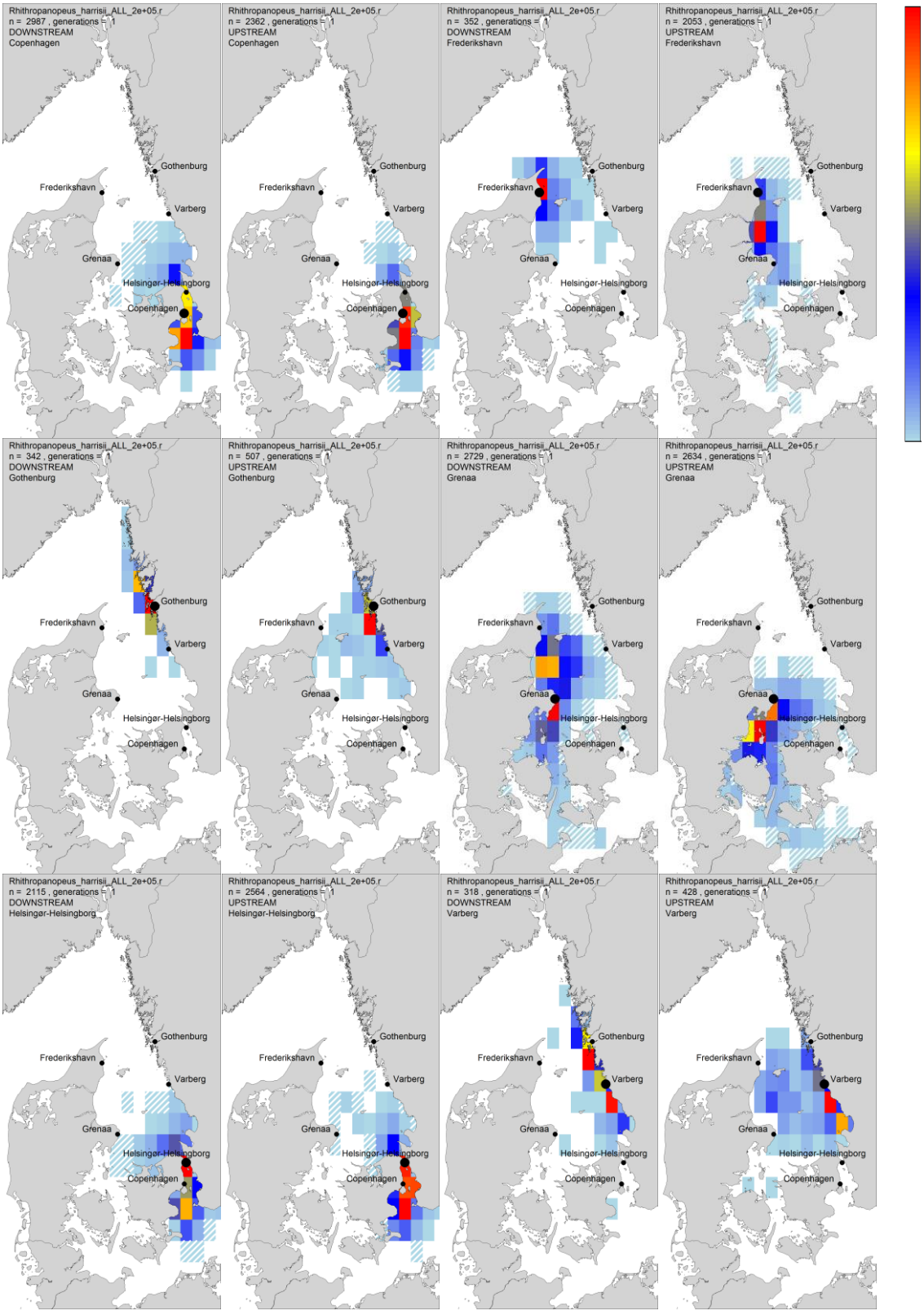


24.1.3 50 000 agents

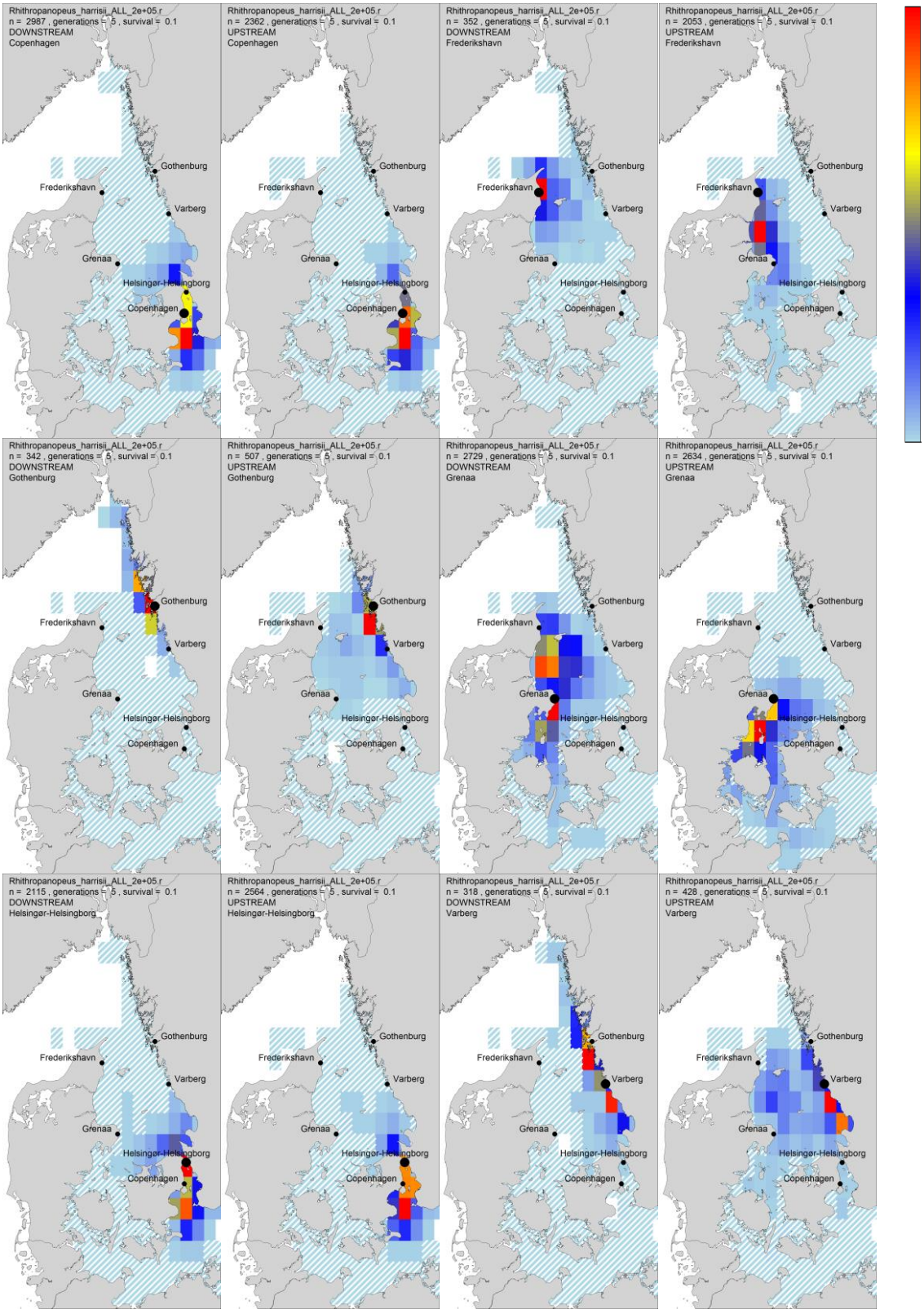


24.2 Dispersal probability plots

24.2.1 Single generation



24.2.2 Multiple generations



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