

Resilience and alternative stable states in colonial seabird metapopulations

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Goal

- Creation of new breeding habitats to compensate loss in port sites important sites.
- We use a metapopulation model to investigate this.

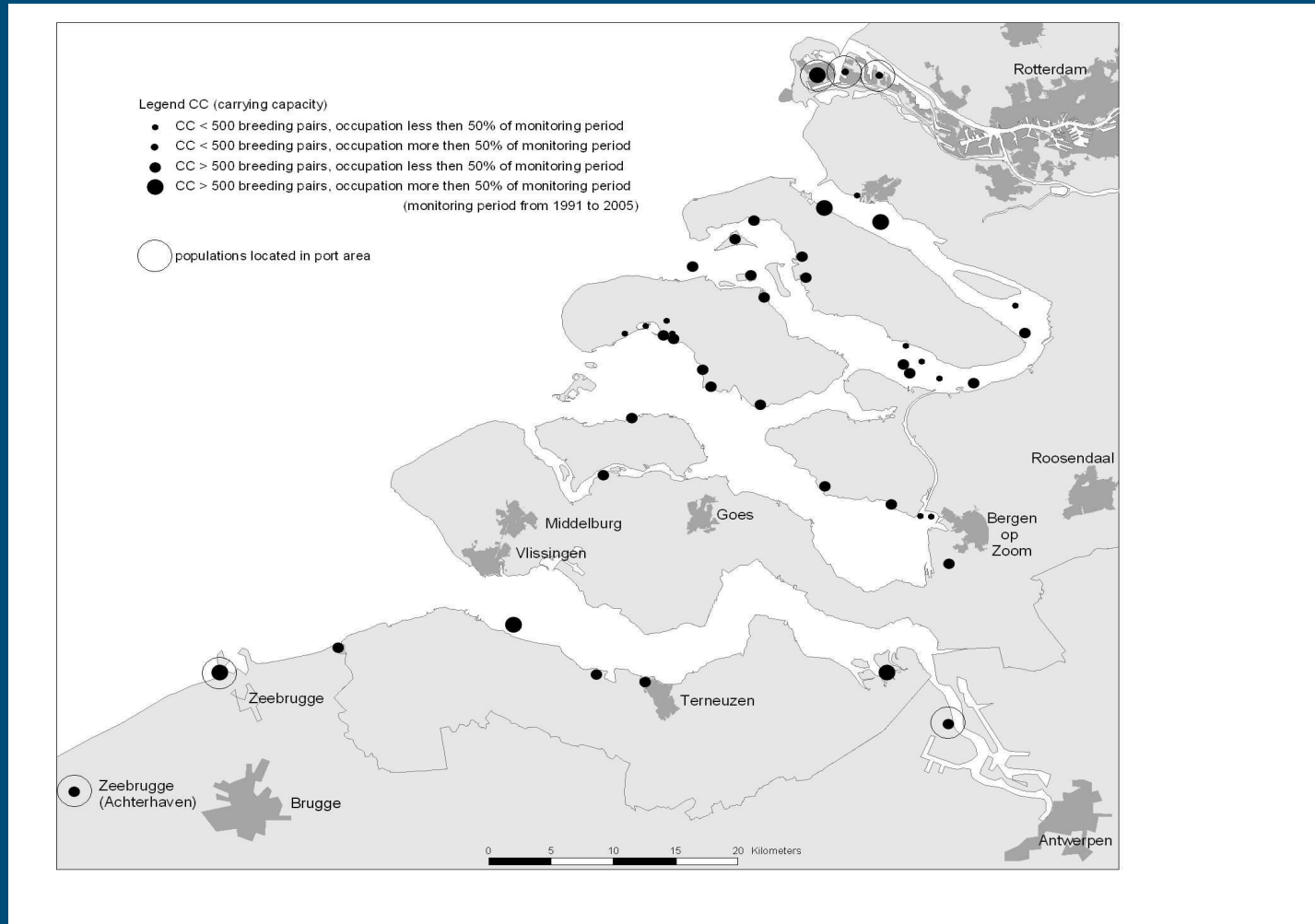
Species



Common Tern
Sterna hirundo
Visdief



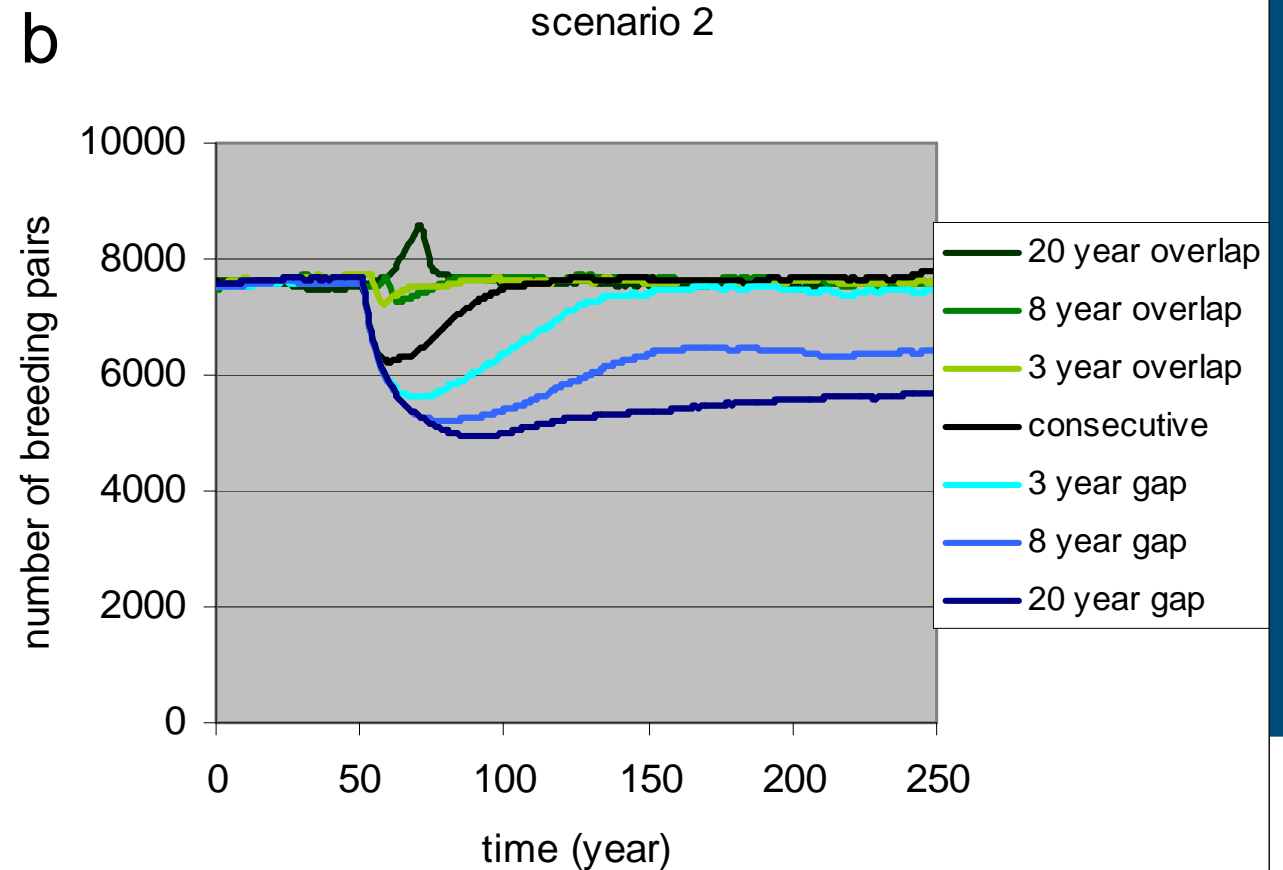
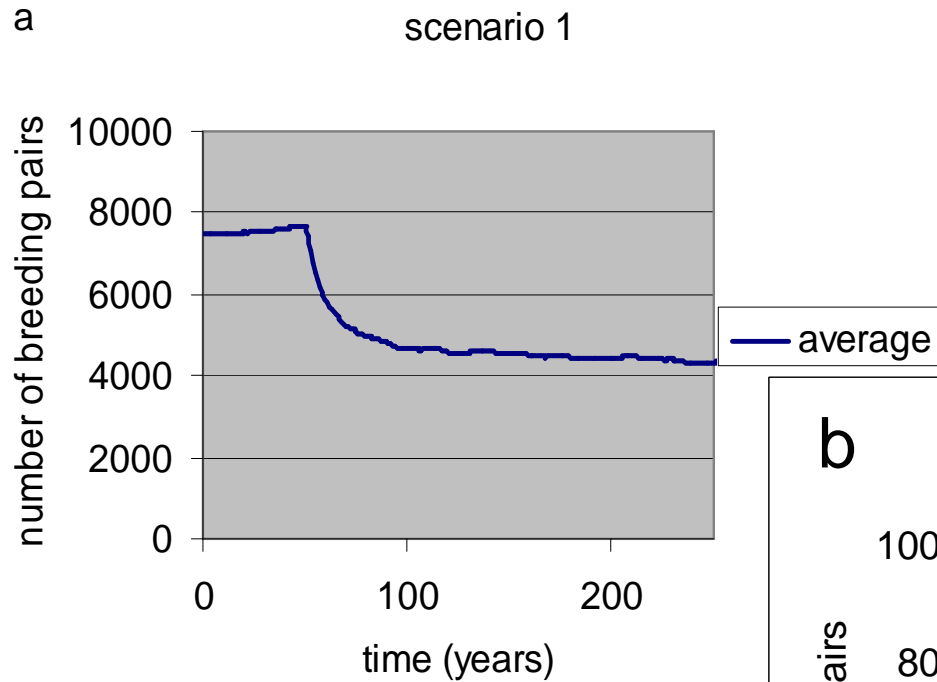
Location: Rhine-Meuse-Scheldt estuary



2 Scenarios (4)

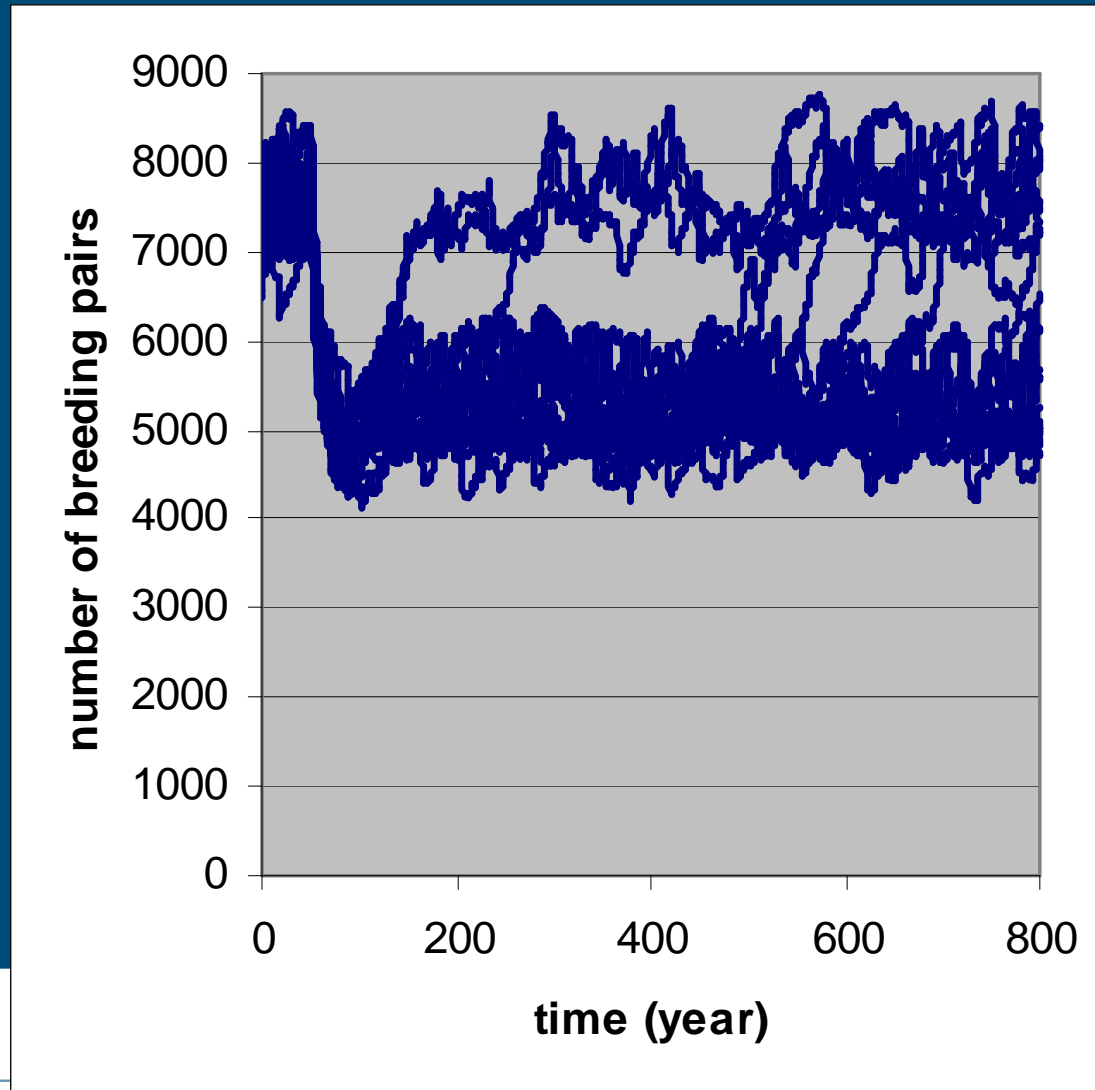
1. without port habitats
2. with new habitats in the port areas as compensation

Scenarios 1 and 2 at different overlap times



Individual simulations

Scenario 1



Conclusions

- Compensation might be an option
- but very slow recovery from decline
- which make overlap very important !

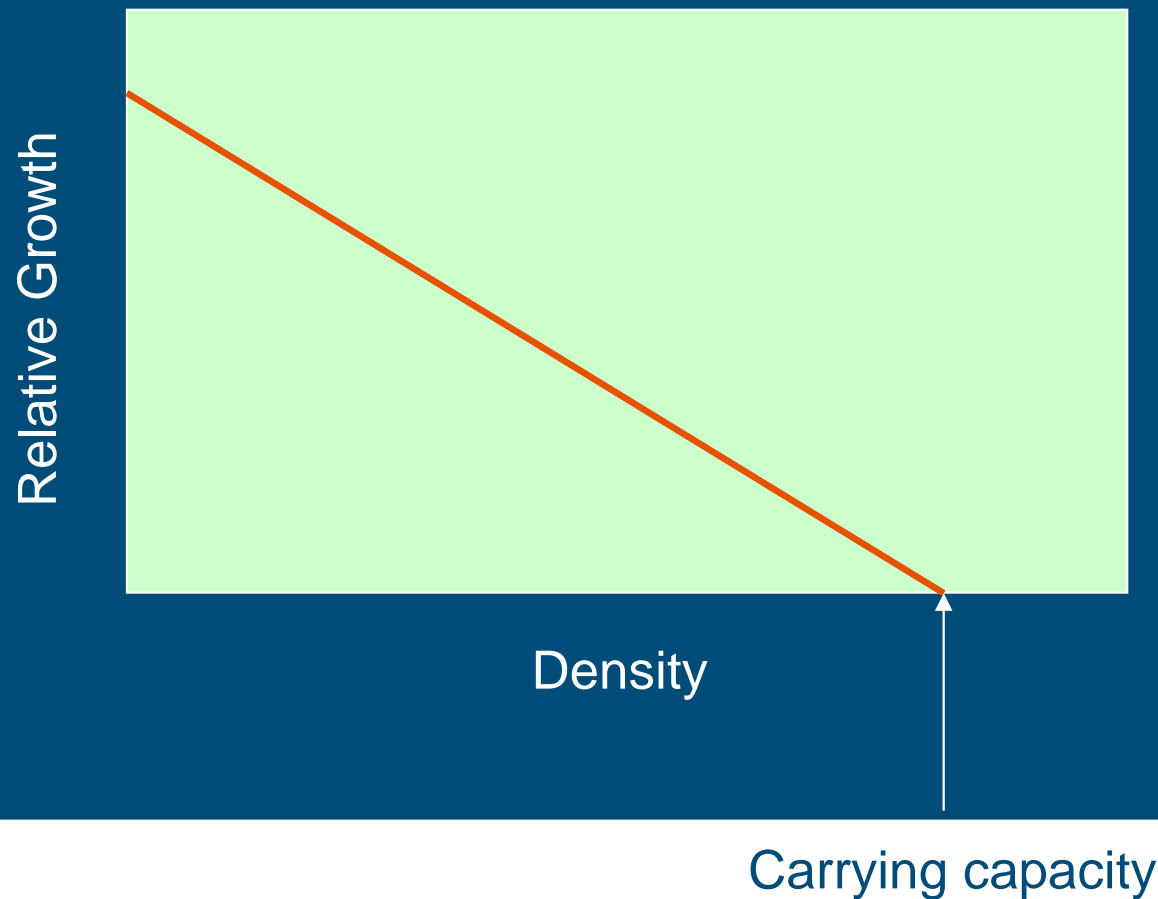
- There seem to be multiple attractors in the model
- Due to density dependent relations?????

New study

- Objective what is the effect of density dependent relation on the metapopulationsdynamics of sea birds.
- Because when we understand the process->we can apply our model successfully
 - simpler metapopulation model
 - artificial breeding site configurations

Density Dependent Growth

Traditional density dependent growth e.g. logistic growth curve



But in Seabirds higher densities are not always bad because

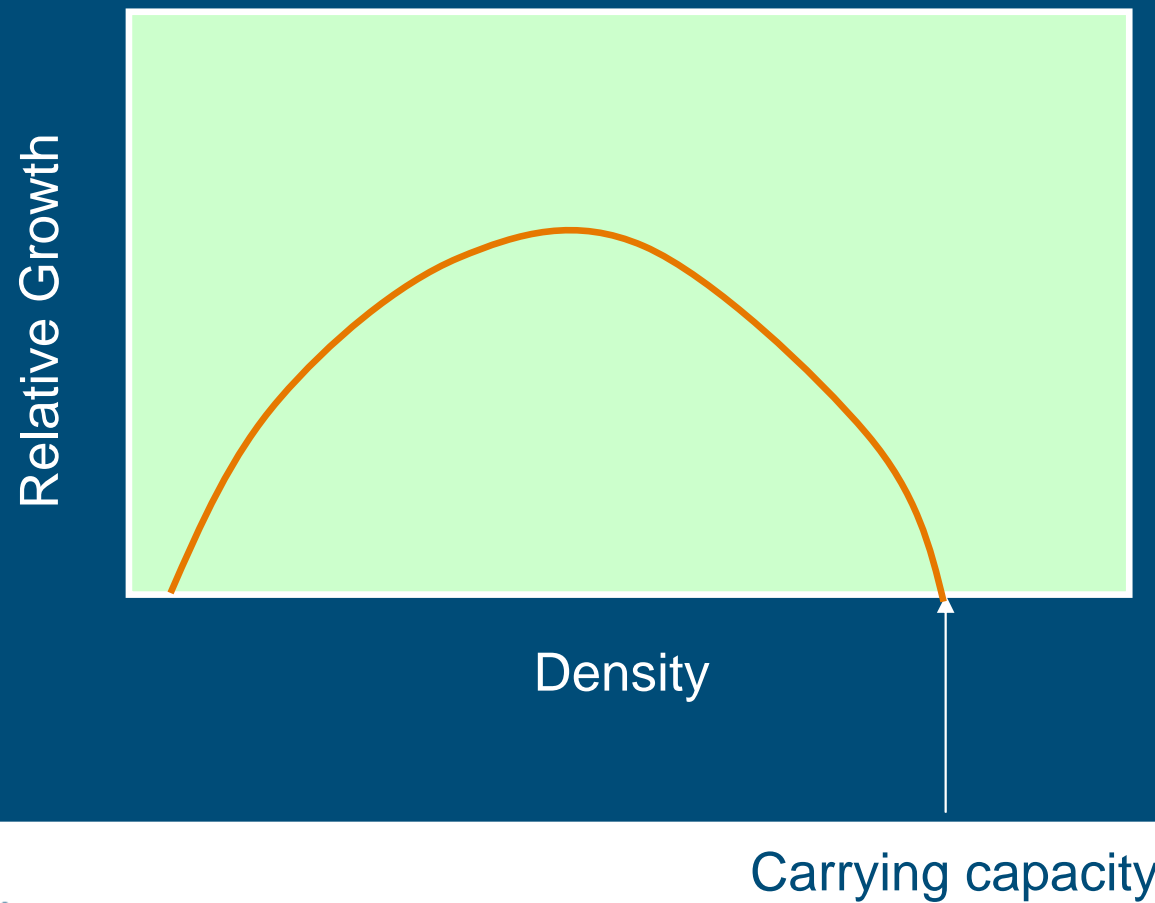
1. *Faster discovery food patches*

2. *Lower per capita nest predation*

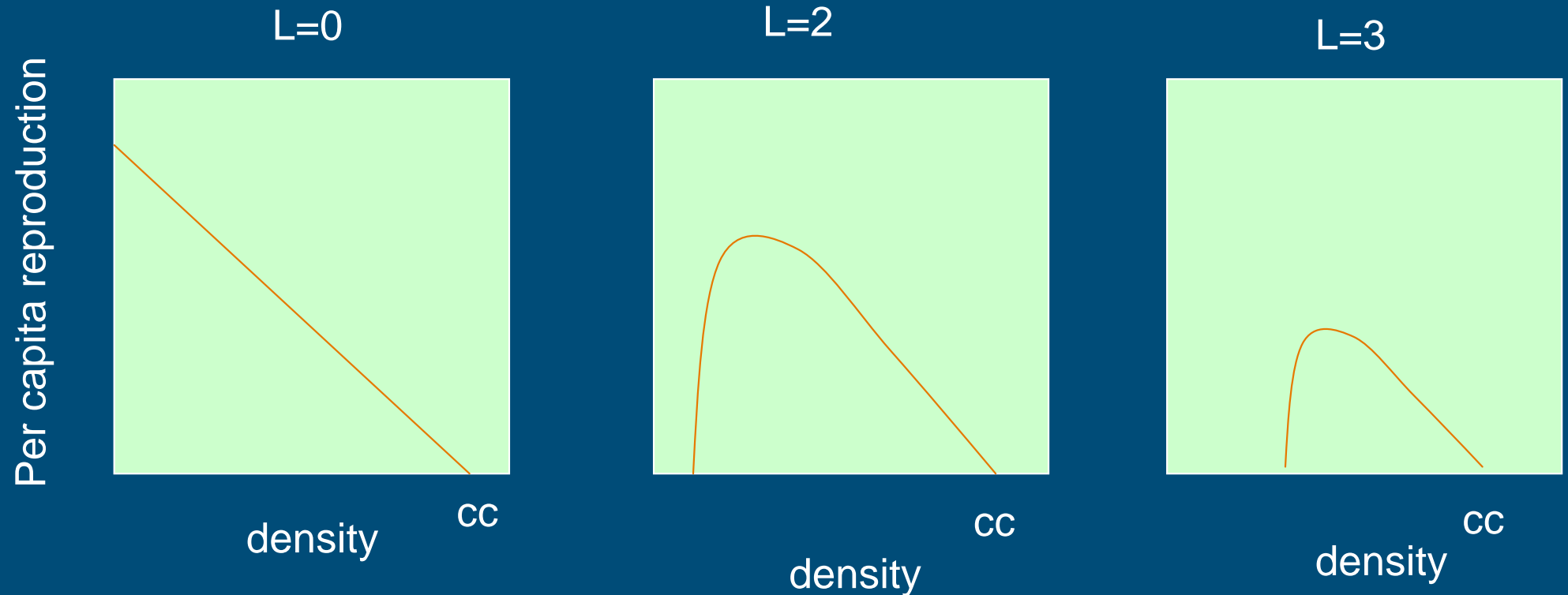
- more chicks & same amount of predators
- more birds -> better early warning system, as individuals have to spend less time being alert
- group defense against predators

3. *Facilitated mating*, as very low densities might hamper couple formation

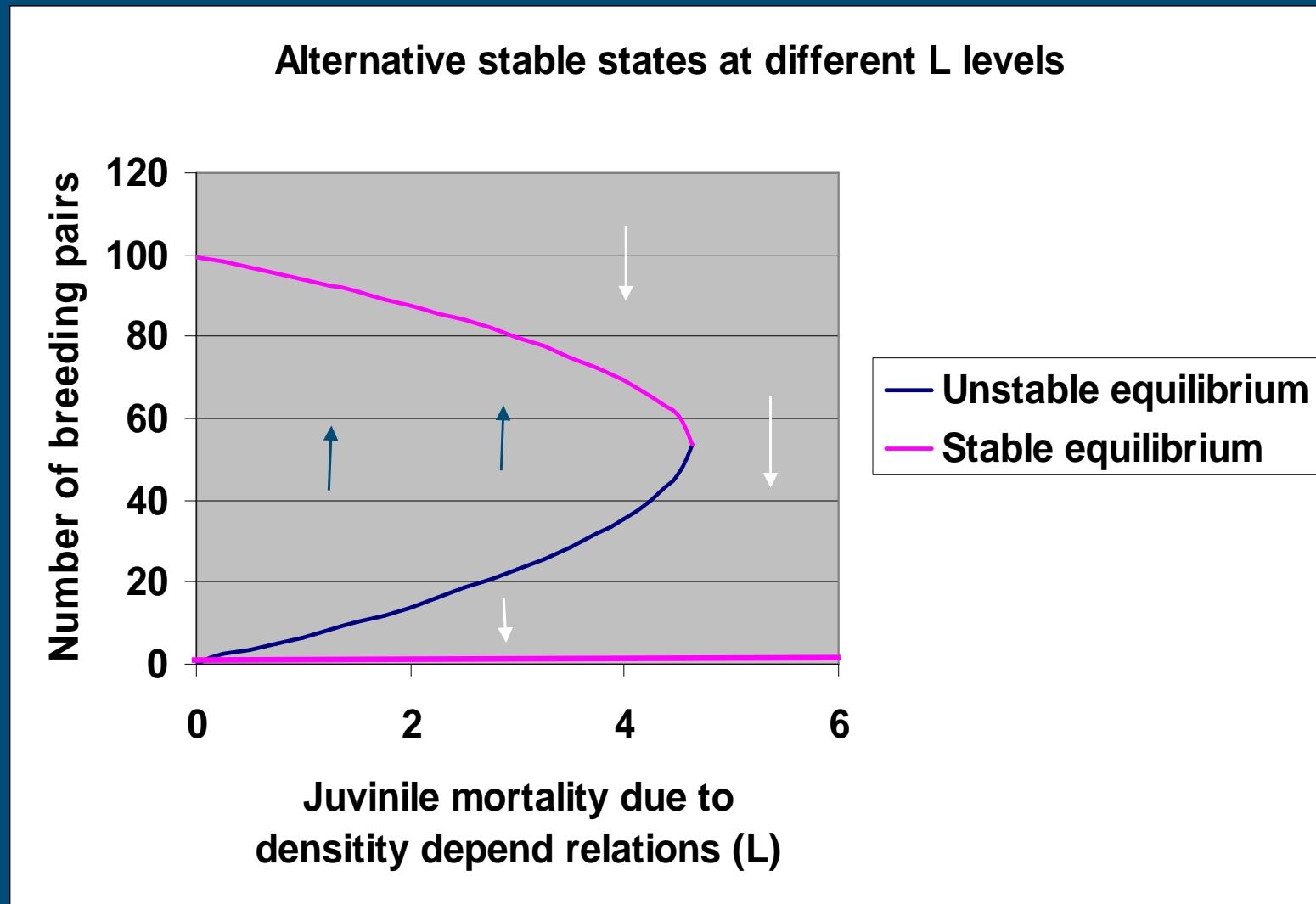
In our Tern study we use



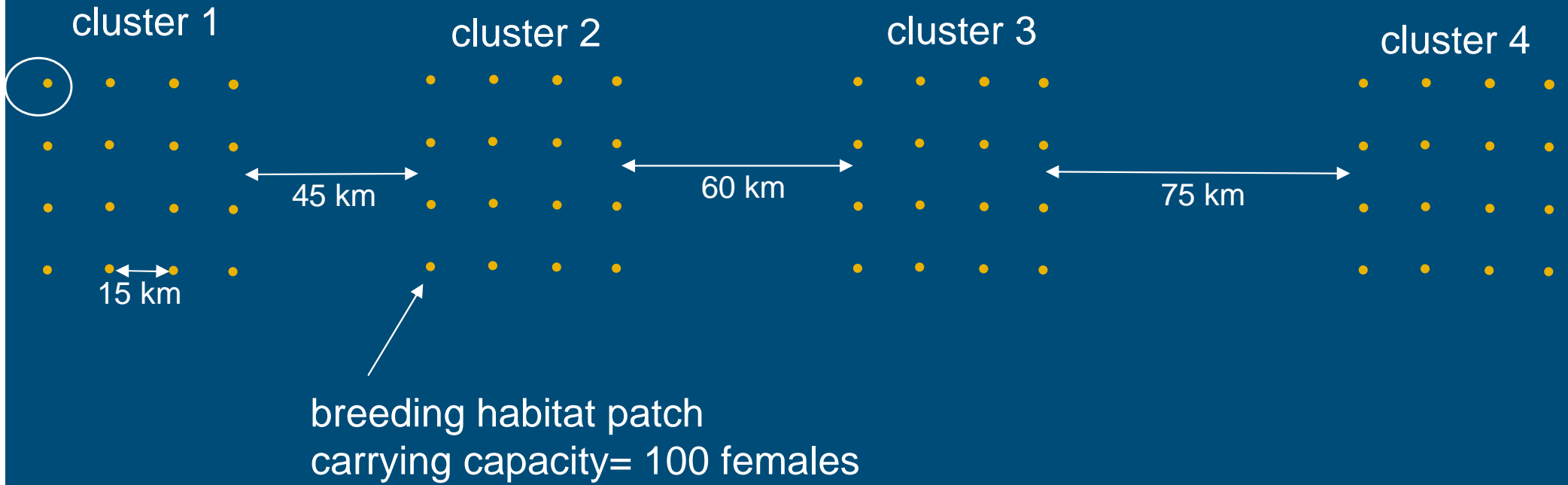
We introduce a parameter L determining loss of chickens at low density.



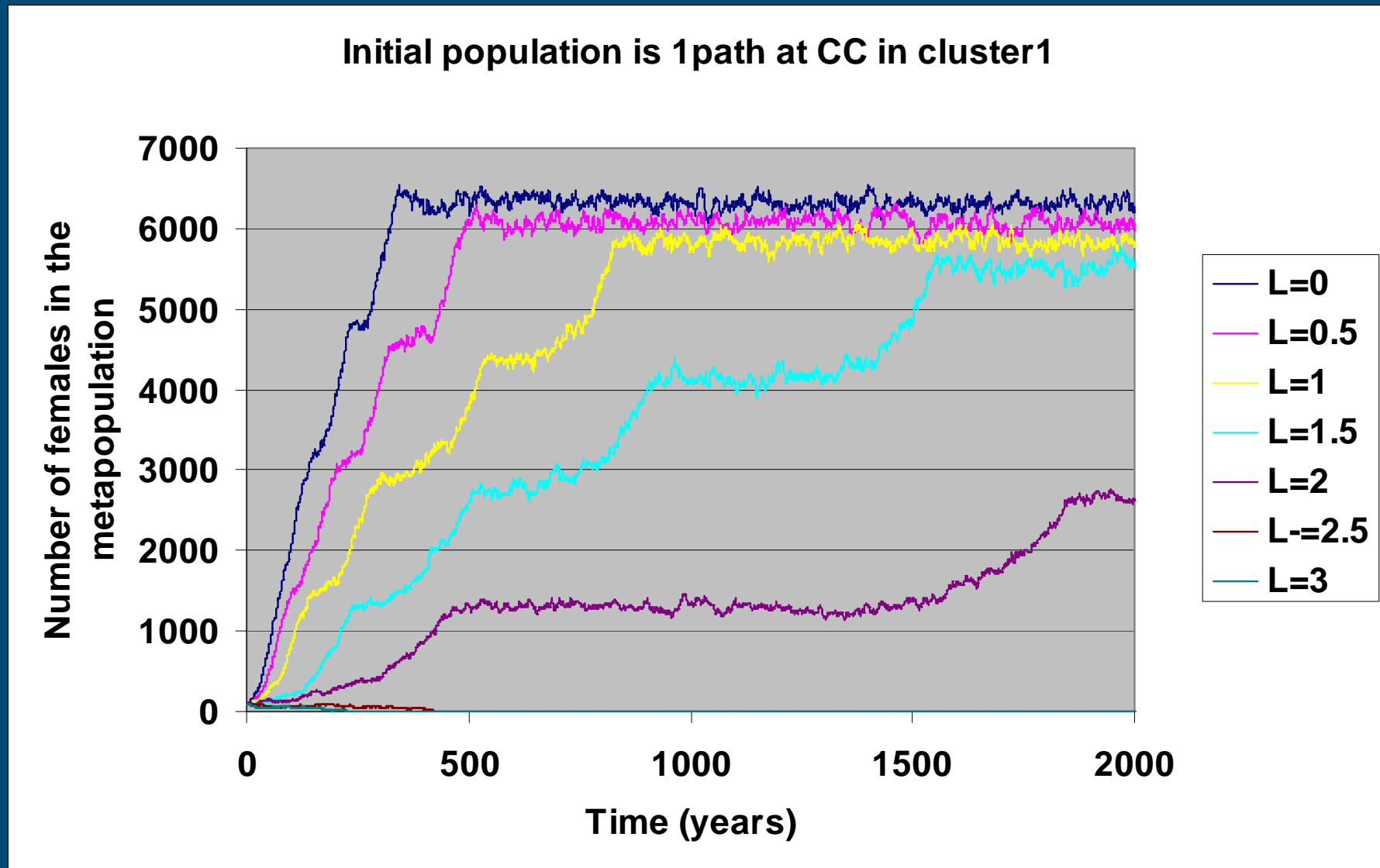
Alternative stable states in a patch (deterministic)



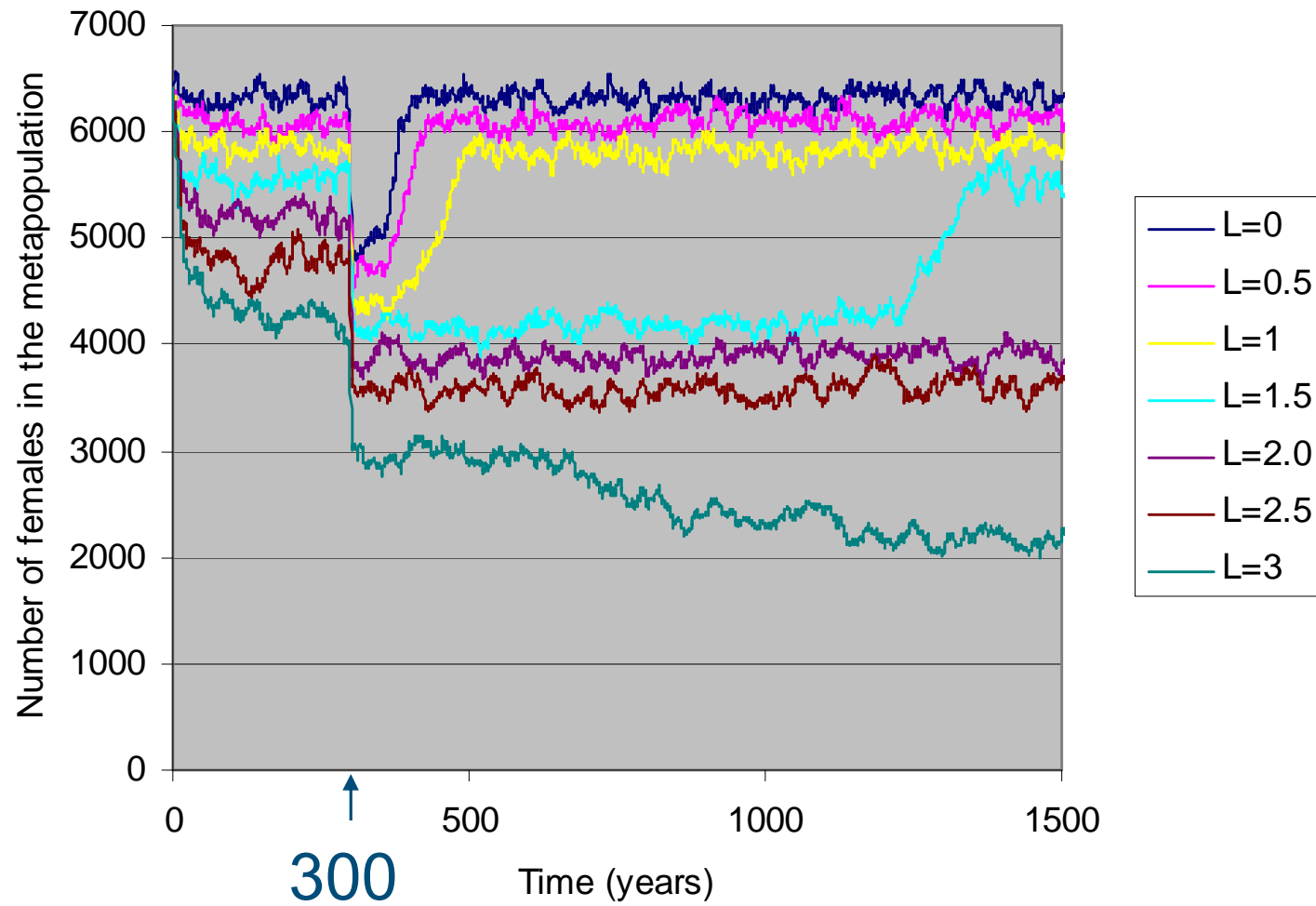
landscape



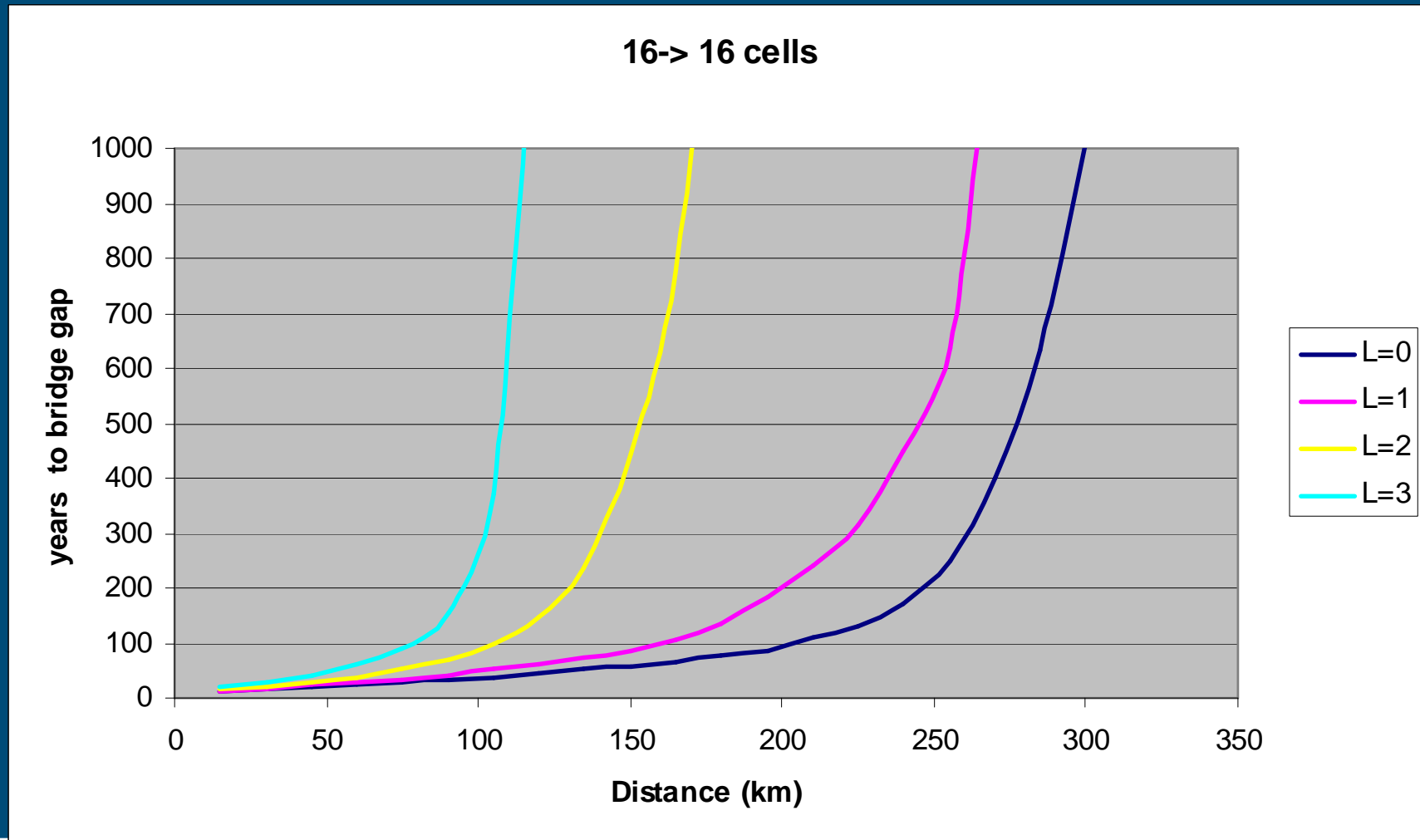
Initial conditions single patch= CC



Effect of disturbance of cluster 4



Time to bridge a gap between two clusters of 16 patches



Conclusions

- Low reproductive success at low densities -> alternative stable states at the patch level.
- Causing that a high number of colonists are needed to start up a population
- Causing increased recolonization times
- Implicating that seabird patches are virtually more isolated than expected
- Causing stronger multiple (spatially based) attractors in de metapopulations.

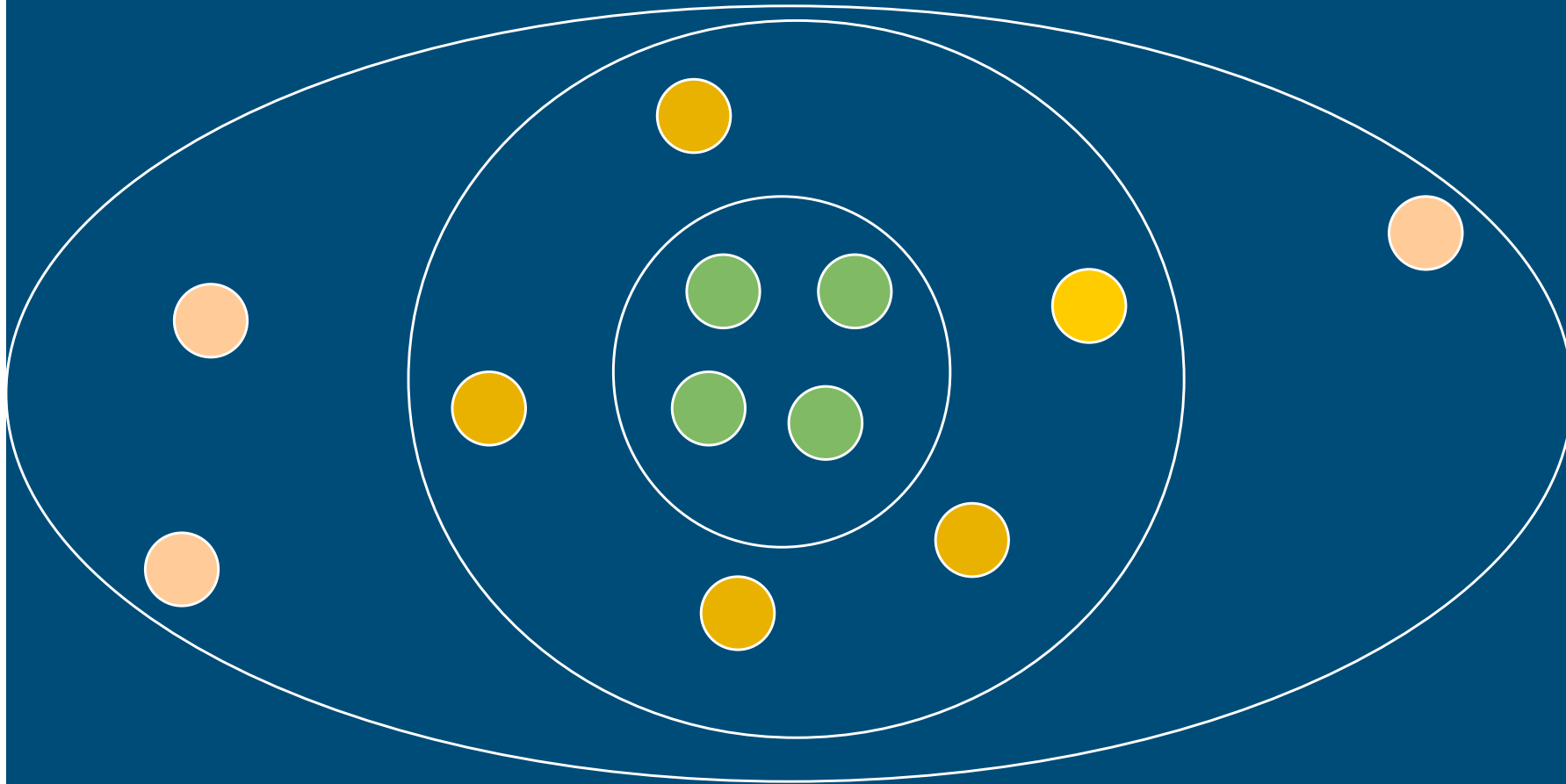
Thank you for your attention



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WAGENINGENUR

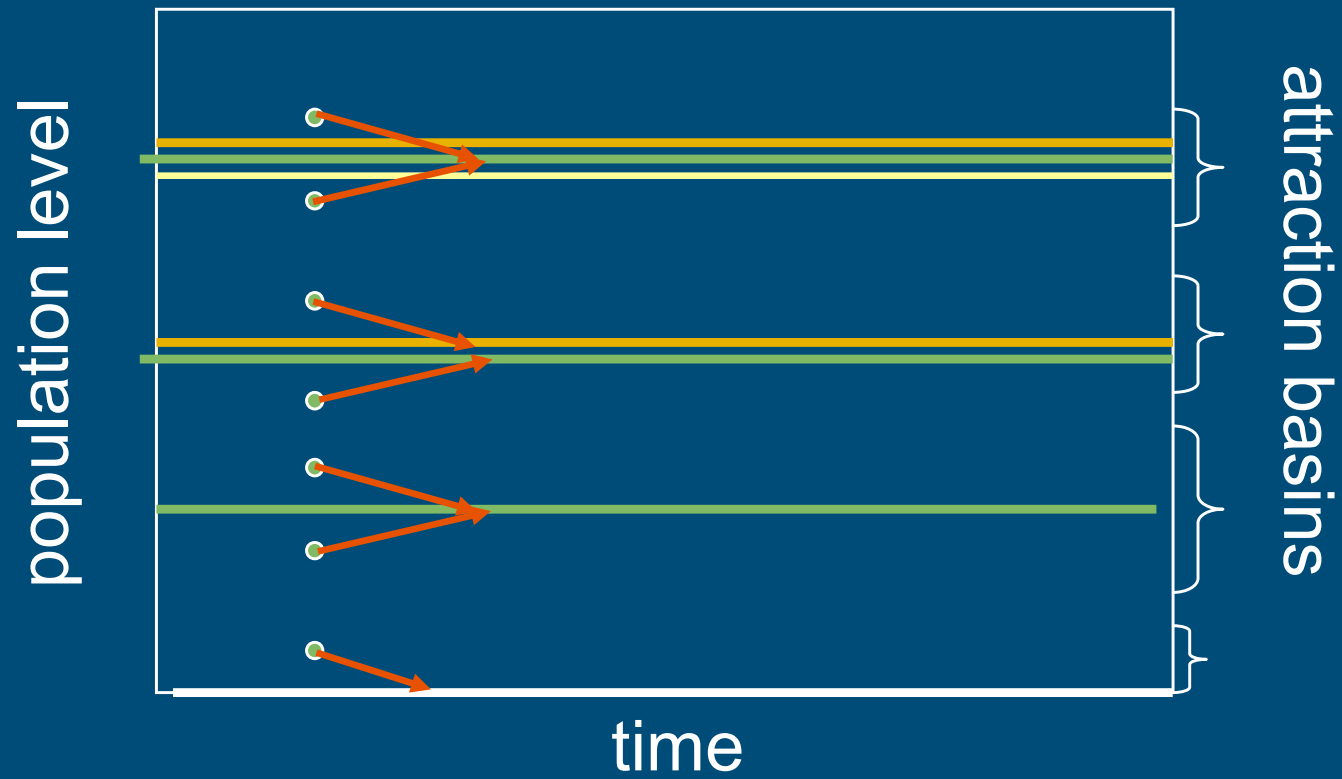
Multiple stable states hypothesis



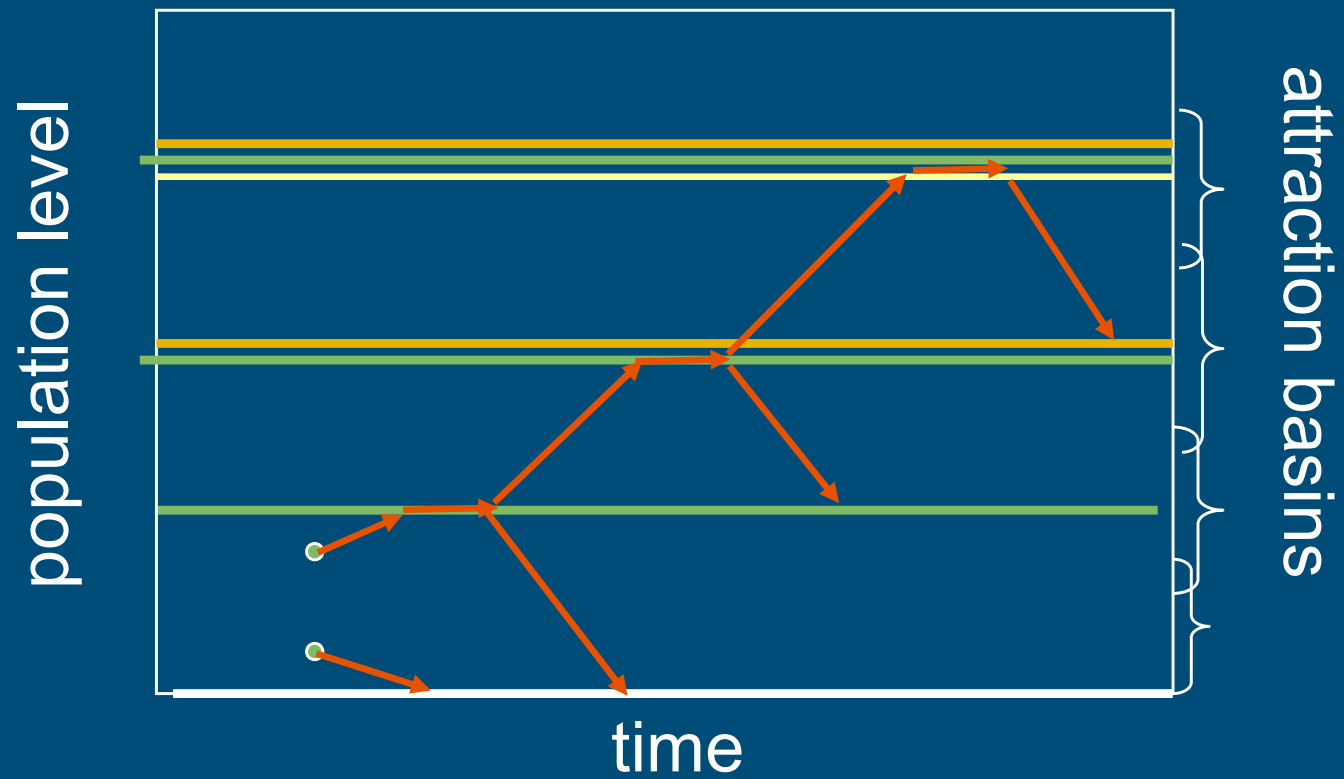
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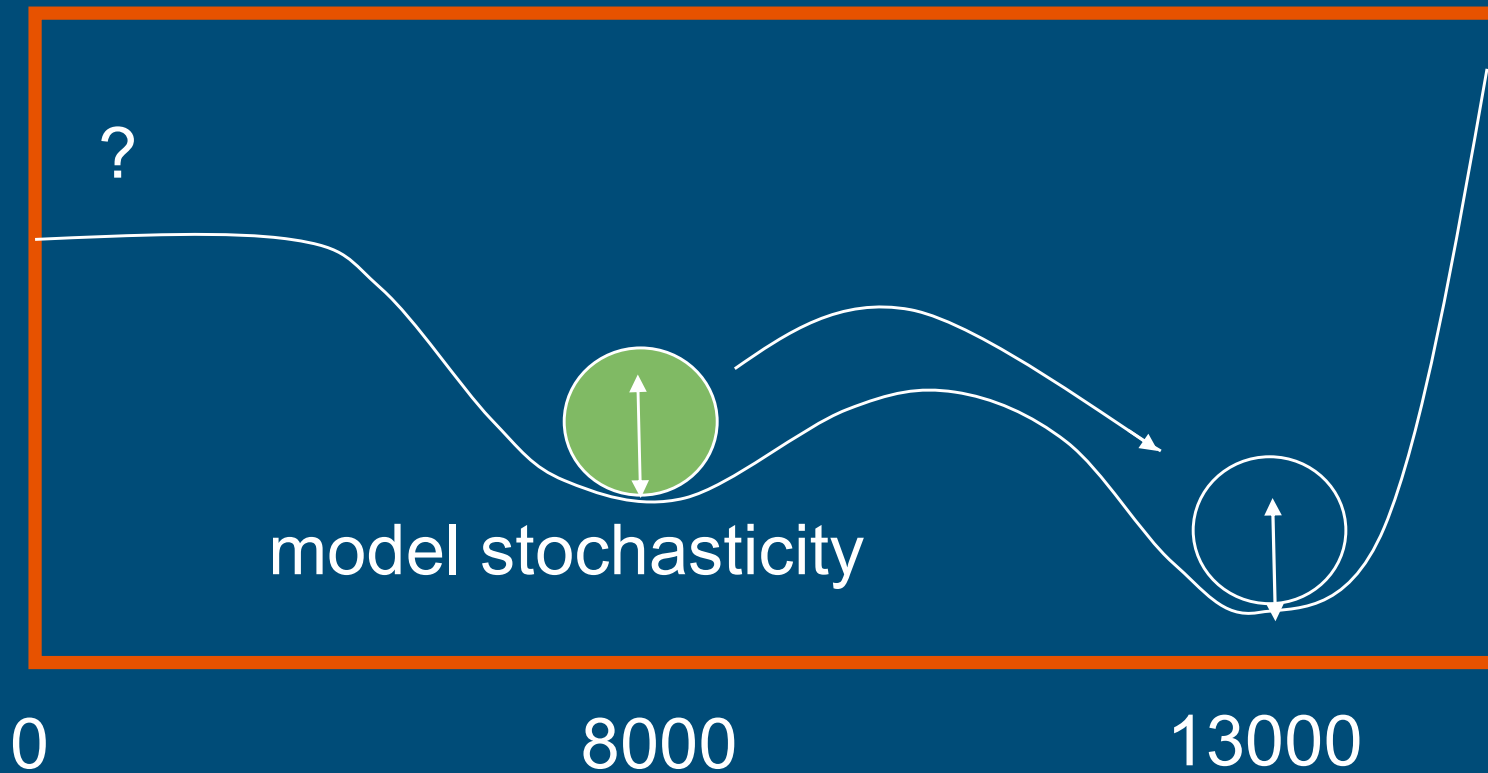
Multiple stable states



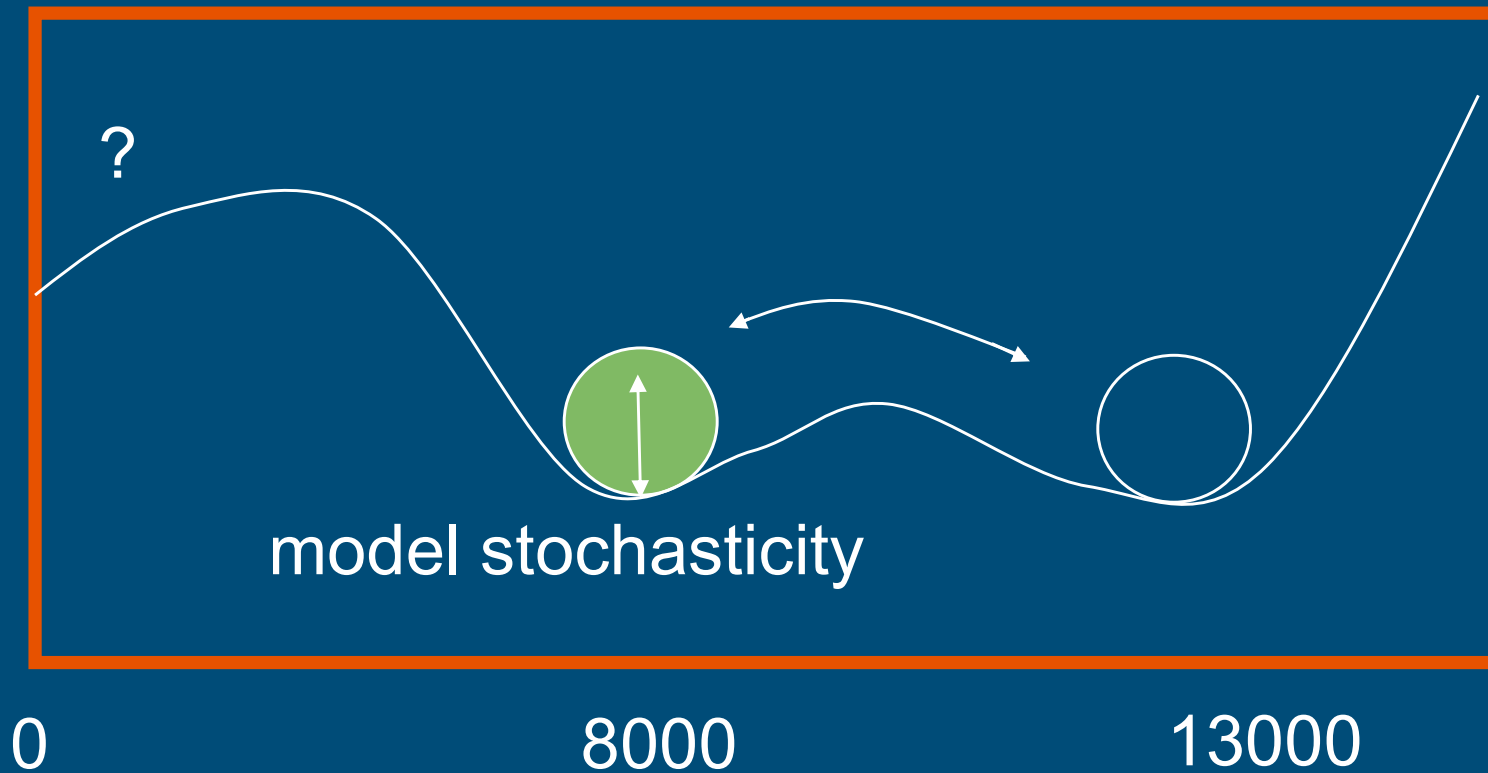
Multiple stable states



multiple stable states



multiple stable states



That compensation might work

- Sterneneiland harbor of Zeebrugge (2004)
 - 1832 breeding pairs of the Common Tern (Visdief)
 - 138 breeding pairs of the Little Tern (Dwergstern)
 - 4067 breeding pairs of the Sandwich Tern (Grotestern)

End

De volgende stap?

1. alternatieve stabiele toestanden uitwerken
 - nieuwe pub: wanneer AST.
2. model detaileren (b.v. fourageren concurrentie)
3. andere soorten (grote en kleine, zee zoogd.)
4. andere schaal
5. andere knoppen (dan nieuw broed habitat)
6. combinaties 1-5



Future

- Finalizing Common tern publication
 - Improve our model
 - Look at Dynamics over time
 - Look at scenario change e.g. 0->3

- Other coastal birds
 - Little Tern (Dwerg stern), Sandwich Tern (grote stern)
 - Meeuwen

- Sea mammals

Discussion

- Sea or coastal birds
- metapopulation in title
- auteur volgorde
 - Peter, Robert, Alex, Rene, Eric, Pieter
- Arja en Jan Willem ook Auteur

Journal

■ Journal

- Landscape urban planning (2.0)
- Animal conservations(1.9)
- Restoration ecology(1.6)
- J wildlife management(1.5)
- Population ecology(1.5)
- Biodiversity and conservation(1.4)
- Landscape ecology(2.6)



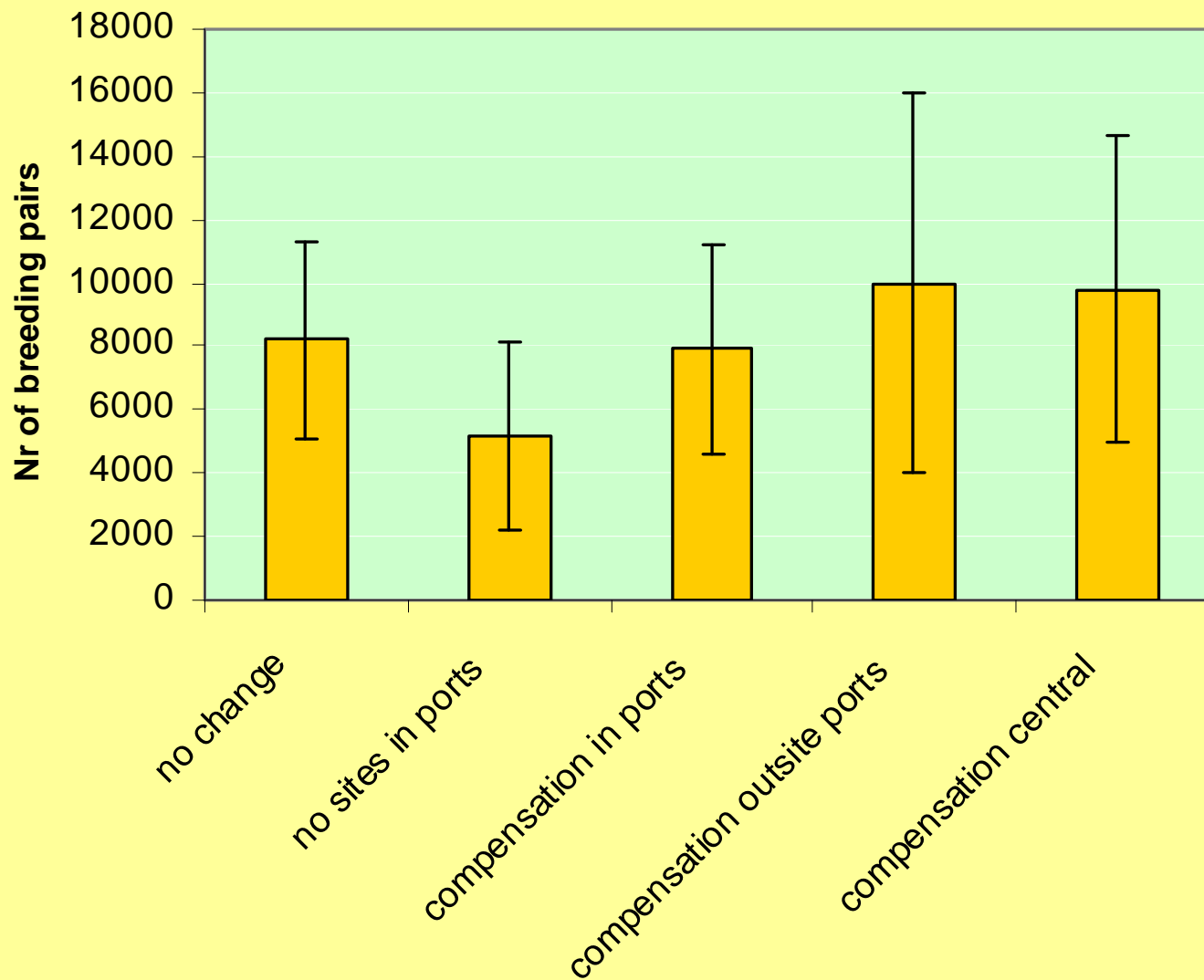
Further improvement

- sterkte (hoofd boodschap)
- zwakte (verbeter punten)
 - -
 - -
 - -
 - -
 - -

Improvement (Peter)

- Study transition fase !
- More info about spatial distribution !
- Parameter sensitiviteit ?
 - survival
 - Recruitment
 - Dispersal assumptions

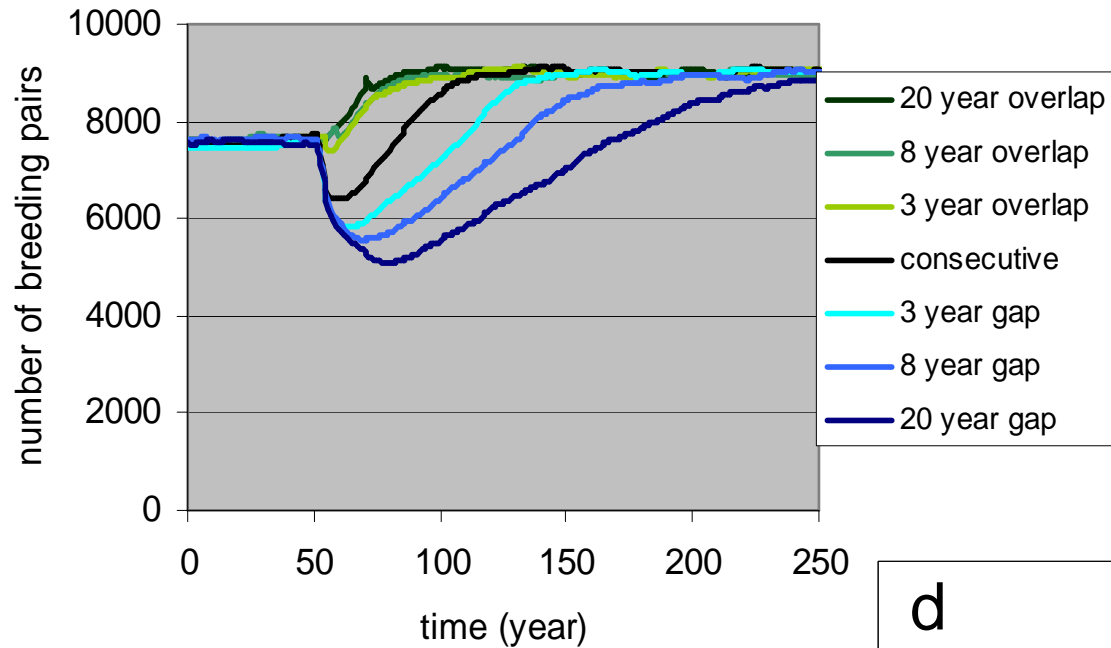
Scenarios



Error bars
max min
(50 simulations)

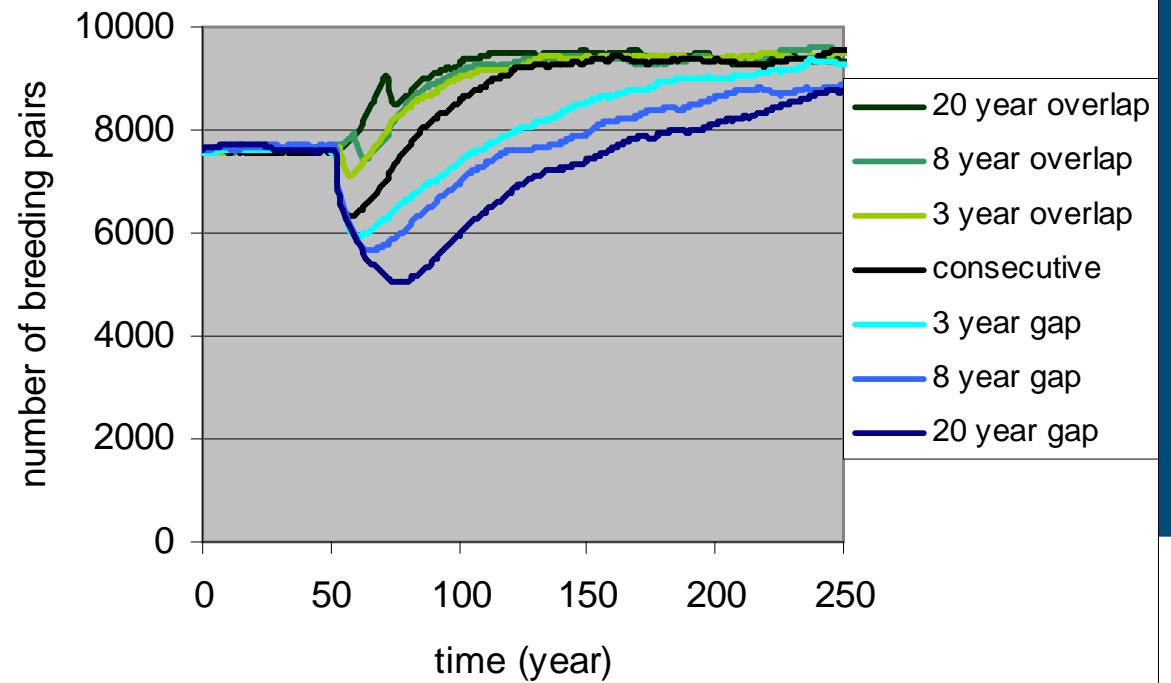
C

scenario 3



d

scenario 4



4 Scenarios

1. without port habitats
2. with new habitats in the port areas as compensation
3. **extra** new habitats in the neighbourhood of port areas as compensation
4. **extra** habitats on an central location in the habitat network as compensation

Problem

- Breeding habitats of many coastal birds strongly decline.
 - Recreation, Economic activities, Water regulation
- Therefore these birds seek more and more artificial nesting sites.
 - Rooftops, harbor plains
- This is problematic because birds are protected and can no be removed