

# Is the metapopulation concept applicable to North Sea species

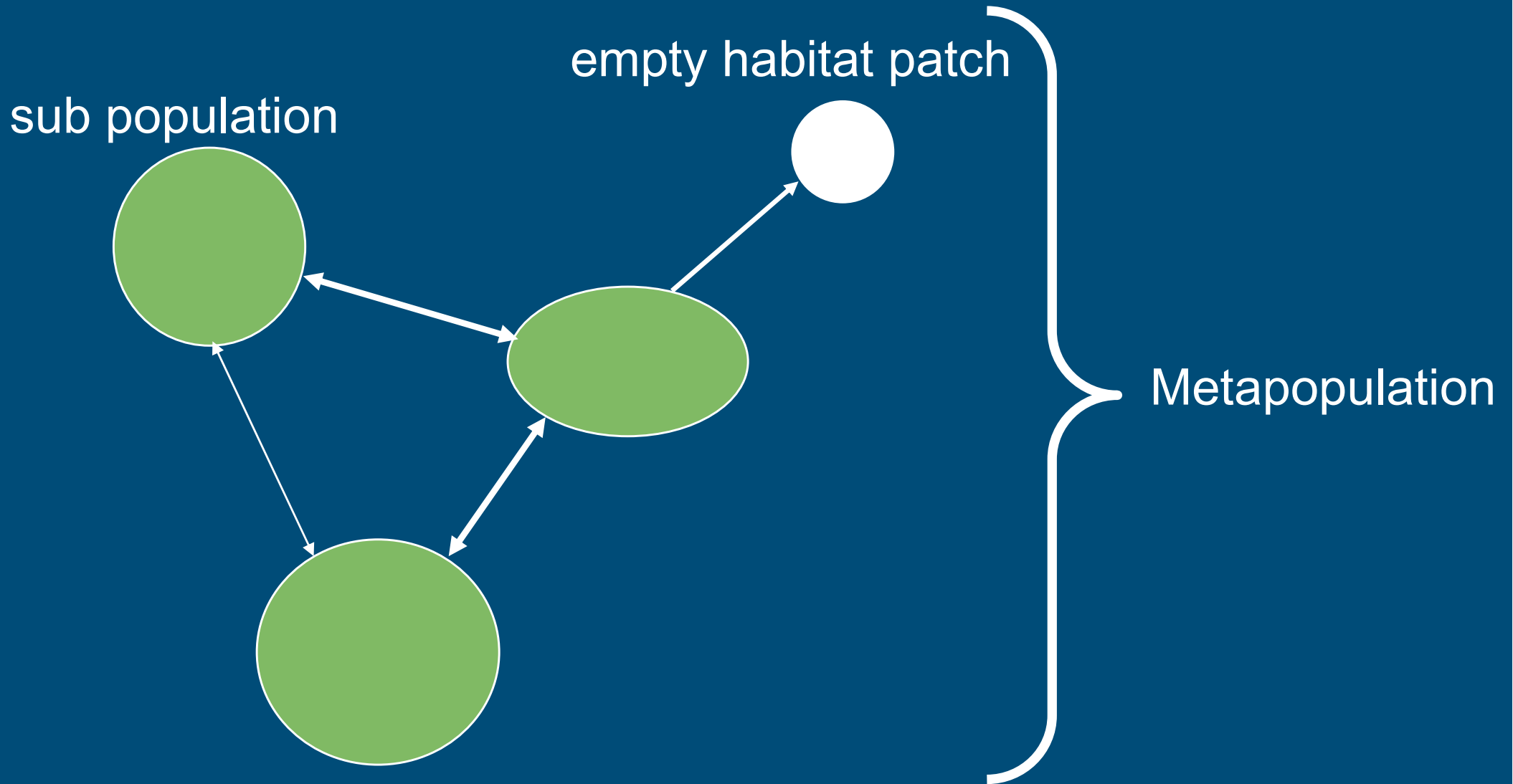
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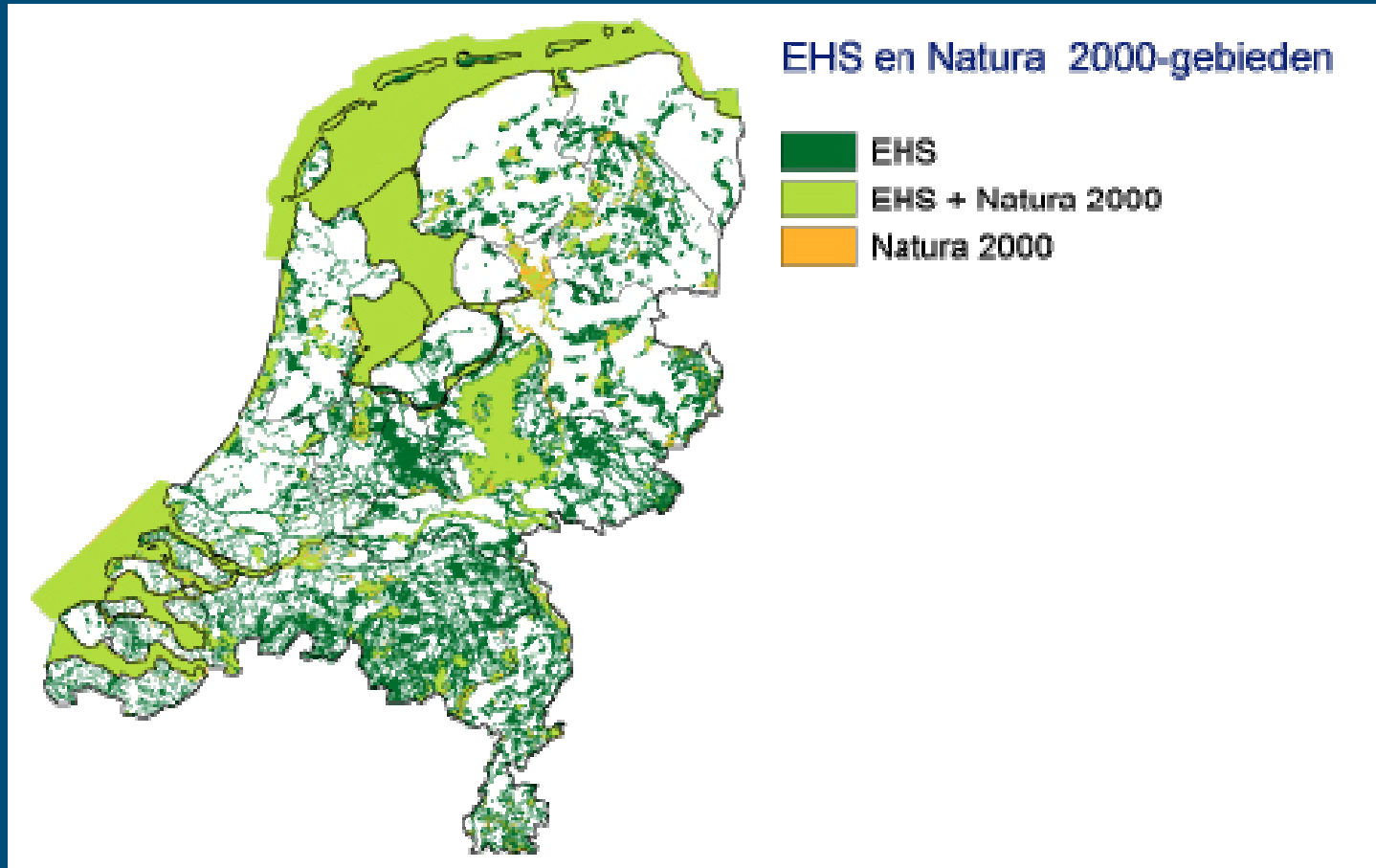
# What is a Metapopulation



# Metapopulation properties

- Colonization and extinction process largely determine population size and persistence
- Alternatives
  - a species is everywhere and the habitat selects
  - one big population

# On land a large succes



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# North sea

- Highly productive sea
- Diverse coastal habitats
- Diverse sediment composition
- Depth range 20-200m
- Hard substrates added by man
- Well studied sea

# However not often used !

- Why not ?

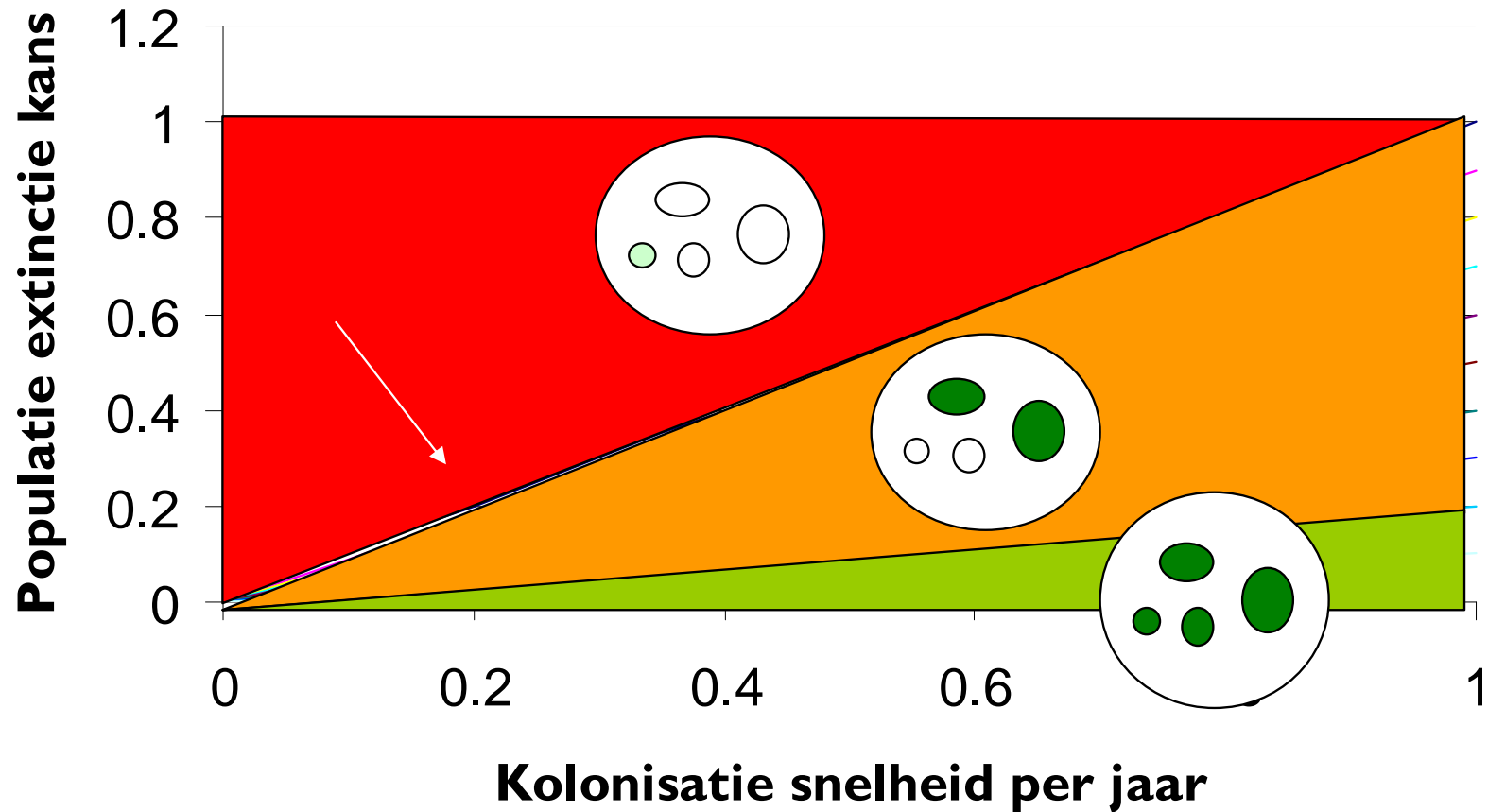
# Metapopulation theory

- MacArthur and Wilson (1967)
- Levins (1969, 1970):

$$\frac{dP}{dt} = cP\left(1 - \frac{P}{M}\right) - eP$$

$$P = M\left(1 - \frac{e}{c}\right)$$

## Fractie bezette populaties volgens Levins model in evenwicht



# What can we learn from this?

- Its all about patches !
- Empty suitable patches -> metapopulation
- This only occurs when **extinction rates/colonization rates** are large.

# What about the North Sea?

## ■ Patches

- difficult to define living patches and empty suitable patches because of scattered sampling especially of rare species.

■ -> no clear species or habitat maps

# What about the North Sea?

- And are extinction rates/ colonization rates high?
  - water is a more constant environment than air  
-> less extinctions
  - Its easier to float in the sea because the specific mass of water is close to that of the animals->easy dispersal  
-> higher colonization rate than on land.
- So extinction / colonization is expected to be lower than on land



# Conclusions

- Metapopulations are difficult to discover
- Metapopulations are less likely in the sea

# But what about the species?



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# May be if we look at the species side?

- Traits that support extinction rates
  - low adult longevity
  - exploited by man
  - sensitive to natural disasters
  - occurring at low densities
  - strong Allee or depensation effects
  
- Extinction points

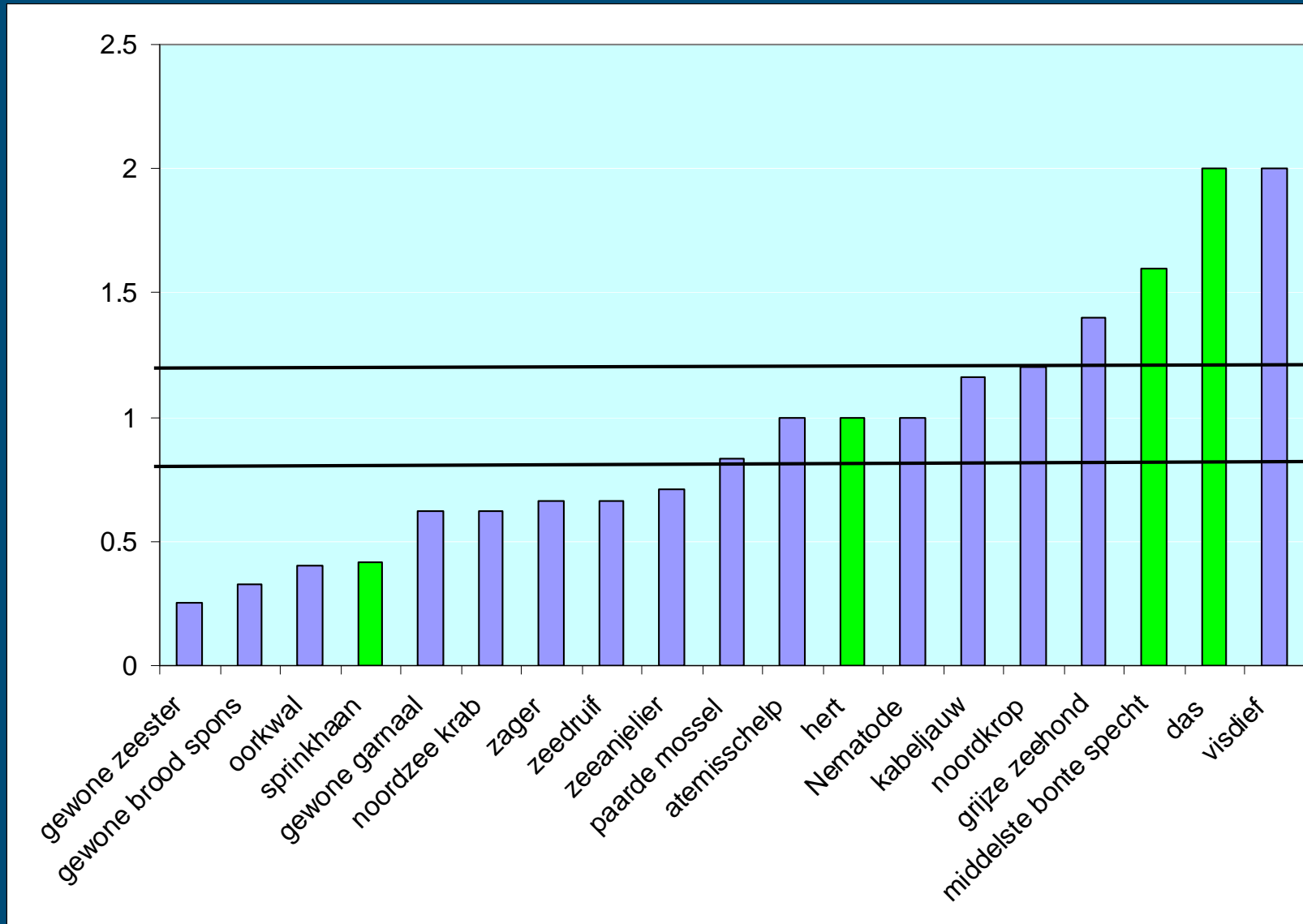
# May be if we look at the species side?

- Traits that support colonization rate
  - large nr of offspring
  - mobile offspring (dispersal)
  - mobile adults (dispersal)
  - occurring at high densities
  - small Allee or depensation effects
  
- Colonization points

# Metapopulation theory predicts:

- Extinction / Colonization should be high
- So we calculate Extinction points / Colonization points (preliminary)
  - High values: species -> metapopulation
  - Low values: species -> are everywhere , habitat selects

# Results species analysis



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# Conclusions

- Metapopulations are less likely in North Sea compared to land (medium & e/c)
- There is less knowledge about spatial distribution of North Sea species (sampling)
- The e/c species analysis shows some promising species, but the best are breeding on land

# Future

- We expect increasing importance of the metapopulation concept for sea species.
  - Increasing knowledge (genetic)
  - Increasing need for spatial explicit decisions (protected areas, increased use of hard substrate)

