**Meeting minutes – Computational Ecology (08.12.23)**

Team:

* Daniela Kemp
* Dominik Buob

**Population dependent dispersal**

* Stable population = Carrying Capacity (650) 🡪 Increased mortality when >100%
* Dispersal probability equal in both patches
  + Realistic assumptions
    - Patch 2 is more far away from the mainland than patch 1 and has therefore a different dispersal condition à Equilibrium theory of island biogeography (ETIB)

1. Number of species on an island represents a dynamic equilibrium between extinction rates and colonization rates

* Correlated variables: Extinction rates – Size of island

2. Colonization rates are inversely proportional to mainland distance (Degree of insulation): Large, contiguous nature reserves have a lower extinction risk for populations, Islands that are close to the source area (e.g. mainland) of colonizing species tend to have comparatively higher species numbers than those that are further away from the source area

* Correlated variables: Immigration – Isolation

* Patch 2 is smaller than patch 1, would lead to a smaller carrying capacity (e.g. 300 instead of 650)

**Metapopulation theories**

* + According to the theory, do all population in both patches have a quantifiable extinction rate and after a local extinction of one patch, it can be re-populated. However the dynamic of different populations (patch 1 and patch 2) does not happen synchronal -->
  + Density dependence: Population density must influence fecundity or mortality, or both (competition for resources, density stress (scramble competition), territorial behavior, diseases, predators) --> Populationswachstum bricht ein bei einer Populationsgröße nahe der Carrying capacity (1. Umwelt, Krankheit, 10-15% dead)
  + Life histories: How fast do individual grow and how long do they live, from what age can they produce offspring and how often, how many and how large do offspring become, sexually or vegetatively? à “Iteroparitie” (=mehrmalige Reproduktion) --> Generationswechsel bleibt stabil (1 mal im Jahr)
  + Marginal value theorem: Energy gain per time decreases. In each habitat (patch) there is an optimal search time at which energy gain per time is maximized --> Part of the natural fecundity percentage
  + Climate change impact: Change in mating and breeding time, change of ressources and their availability --> Limit the amount of gametes? --> impact fertility --> Increasing mortality/less offspring/offspring which cannot reproduce?
    - Decreases L\_max due too shrinking habitat --> higher pop. Crashes, less gamete production
    - Or by Modified b (recovery rate)
  + **Source-Sink Dynamik conditions:** Only within meta populations, difference in patch quality, empty + occupied patches, individual also in bad patches, spatial structure of the patches need to change over time, immigration from source (birth>mortality) to sink (mortality>birth, immigration>extinction) --> on long term extinction, different dispersal probabilities in each patch (e.g. patch 1: 10% / patch 2: 0,0001%, ressources limited for pop over carrying capacity, diseases increases --> decreased L\_max = decreased patch quality (e.g. 680 of 500)
  + MVP: Minimum Viable Population à Otherwise extinction due genetic depression --> threshold if a

**Population Viability Analysis (PVA) – How it’s calculated by ecologists**

* + Intrinsic mean survival time, central currency relative quantification of the probability of persistence, measure of the probability of persistence of the population
  + Many population simulations with the same initial conditions
  + Mean value of the survival time of all populations of the different simulations results (Tm)
  + Formula: Tm=t/P0(t) à e.g. Tm=60 years, T=30 years, P0(t)à0,5 à50% Extinction probability

**Possible scenarios**

1. Modell: Vorteil von einem Phänotyp in patch 1 nicht sehr wichtig, aber in patch 2 wichtig ob local adaptation sufficient or source-sink dynamik
2. Maximal pop size is arrived --> L\_max decreases (shrinking population): Zeile 77, 78