

High Throughput DNA-metabarcoding in river biomonitoring:

Optimization of an OTU-based diatom index

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01

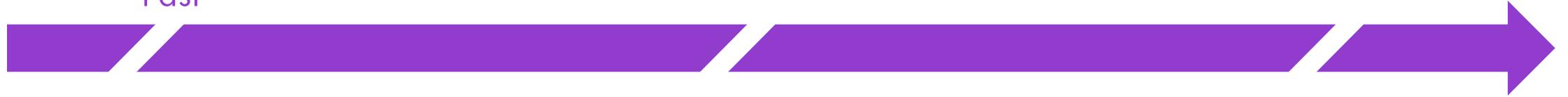
Introduction

Historical background, problematics, hypotheses

Diatom-based biomonitoring

classical methods

Past



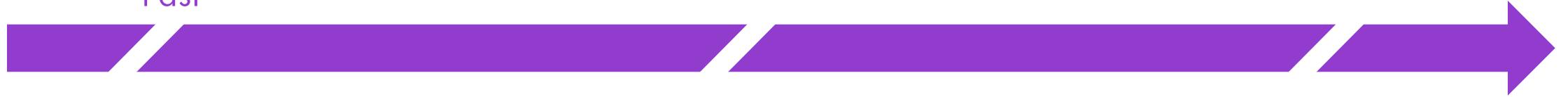
▮ Diatoms as indicators: short generation time, large diversity, sensitivity, implemented in WFD



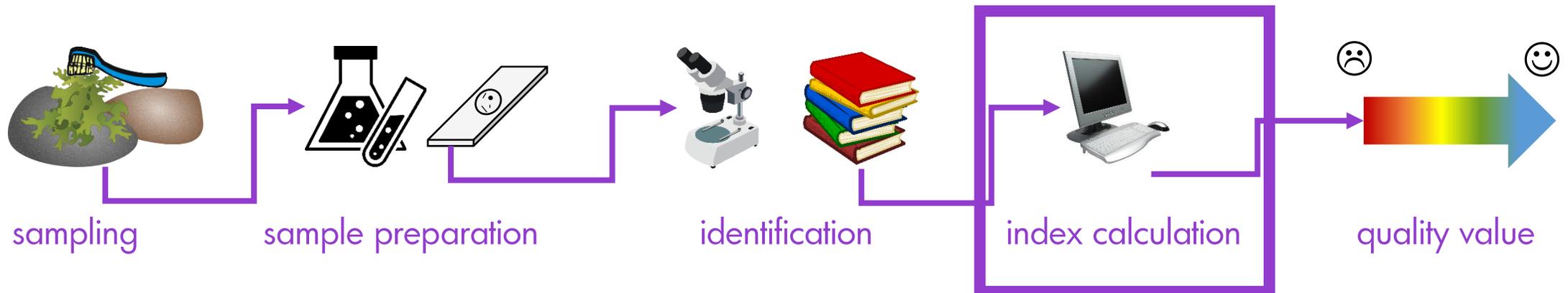
Diatom-based biomonitoring

classical methods

Past



• Diatoms as indicators: short generation time, large diversity, sensitivity, implemented in WFD

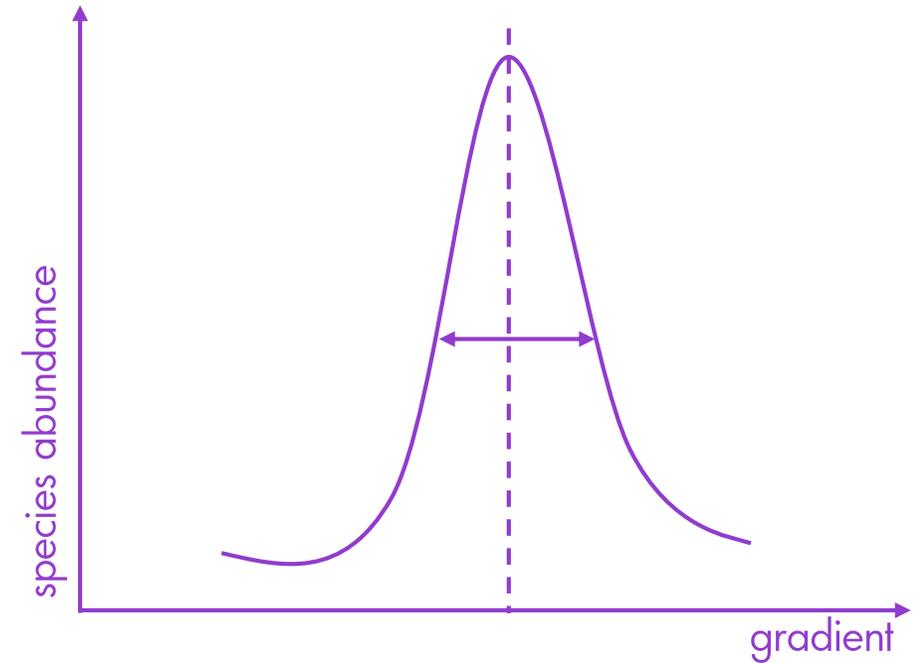


Diatom-based biomonitoring

classical methods

$$\text{index} = \frac{\sum_{j=1}^n a_j s_j v_j}{\sum_{j=1}^n a_j v_j}$$

a : relative abundance of j species
 s : sensitivity value (optimum) of j species
 v : indicator value (tolerance) of j species



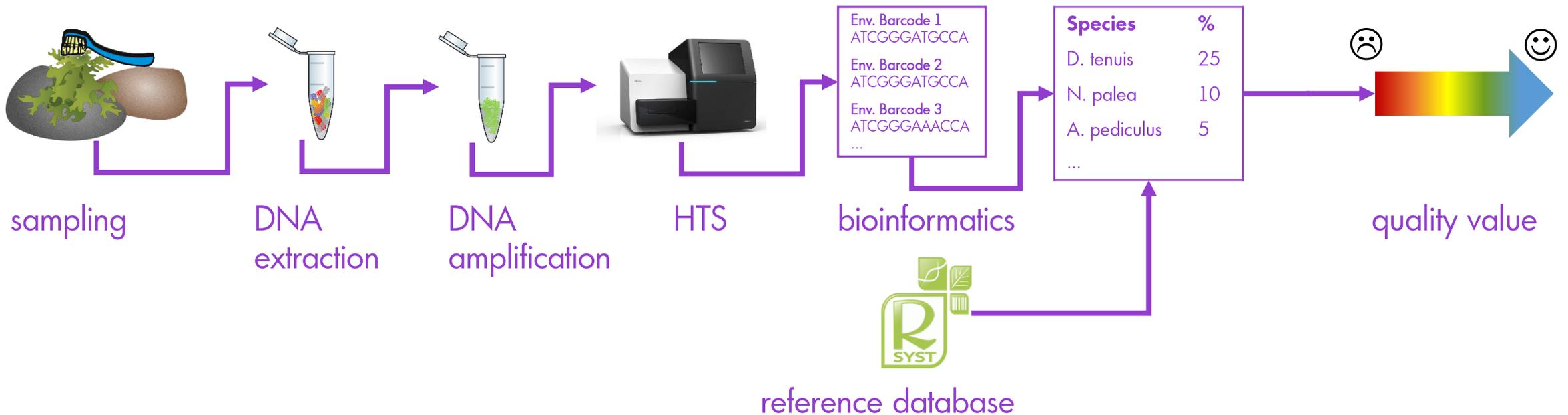
- 🔬 Basis: morphological identification via microscope, ecological profile of species
- 🔬 Withdraws: time-consuming, requires real experts and harmonization, several misidentification

Diatom-based biomonitoring

time for a change



 High throughput DNA-metabarcoding: simultaneous analysis of multiple taxa from bulk samples or environmental sample

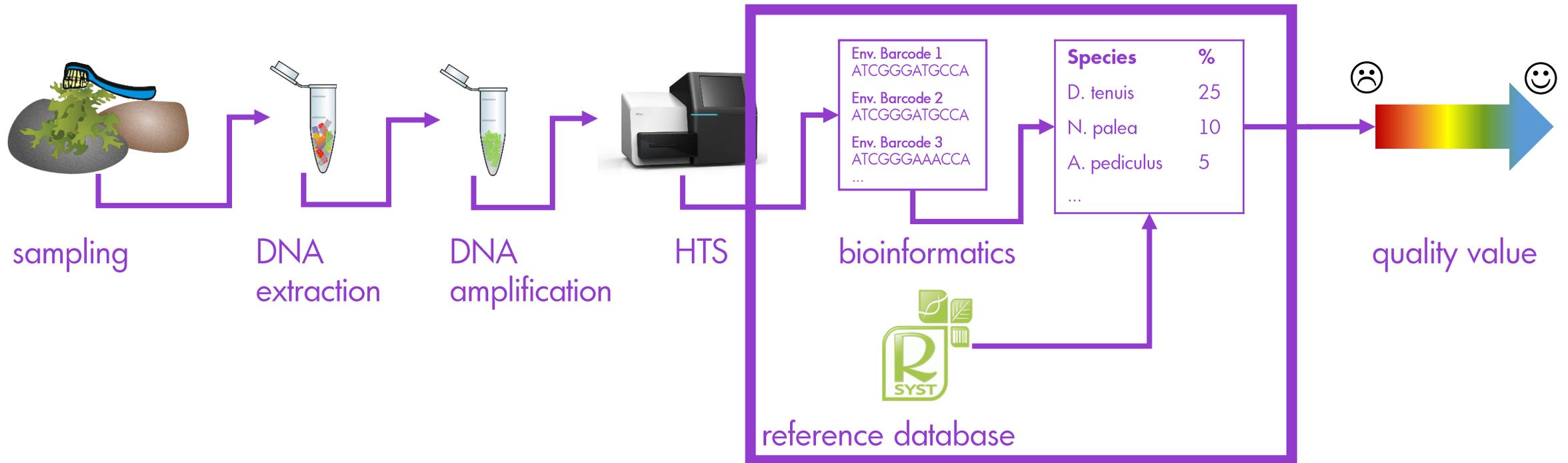


Diatom-based biomonitoring

time for a change

Present

 High throughput DNA-metabarcoding: simultaneous analysis of multiple taxa from bulk samples or environmental sample

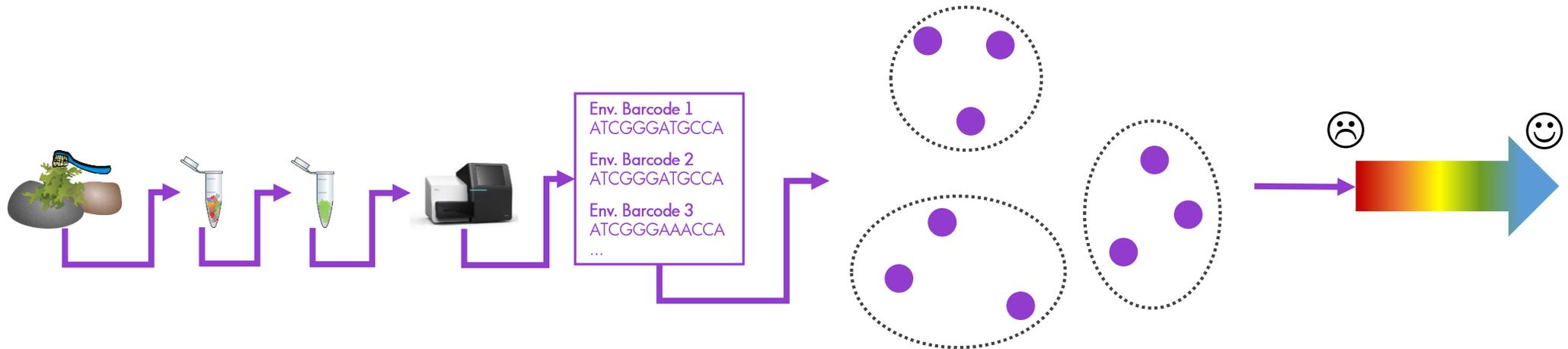


Diatom-based biomonitoring

biomonitoring 2.0

Future

-  Taxonomy-free OTU-based quality assessment
-  Pre-defined distance similarity



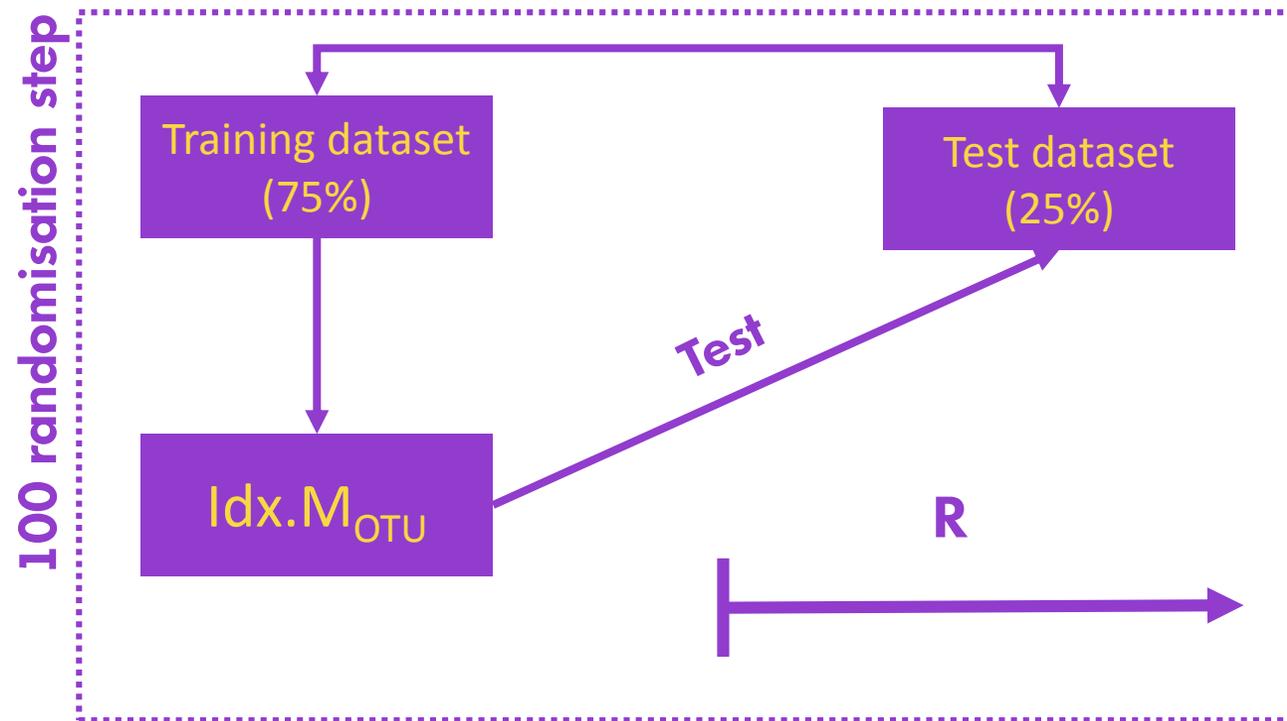
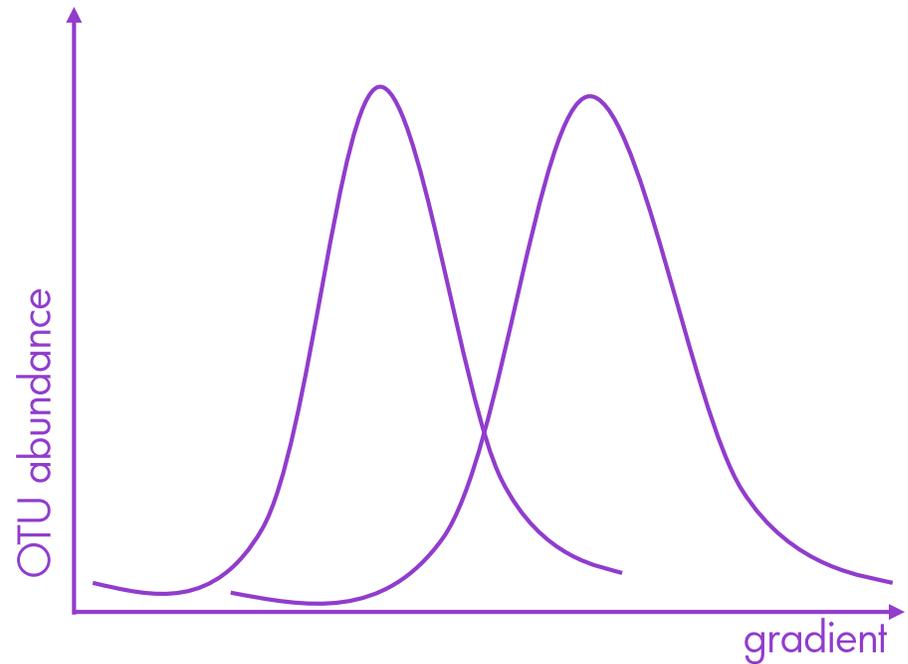
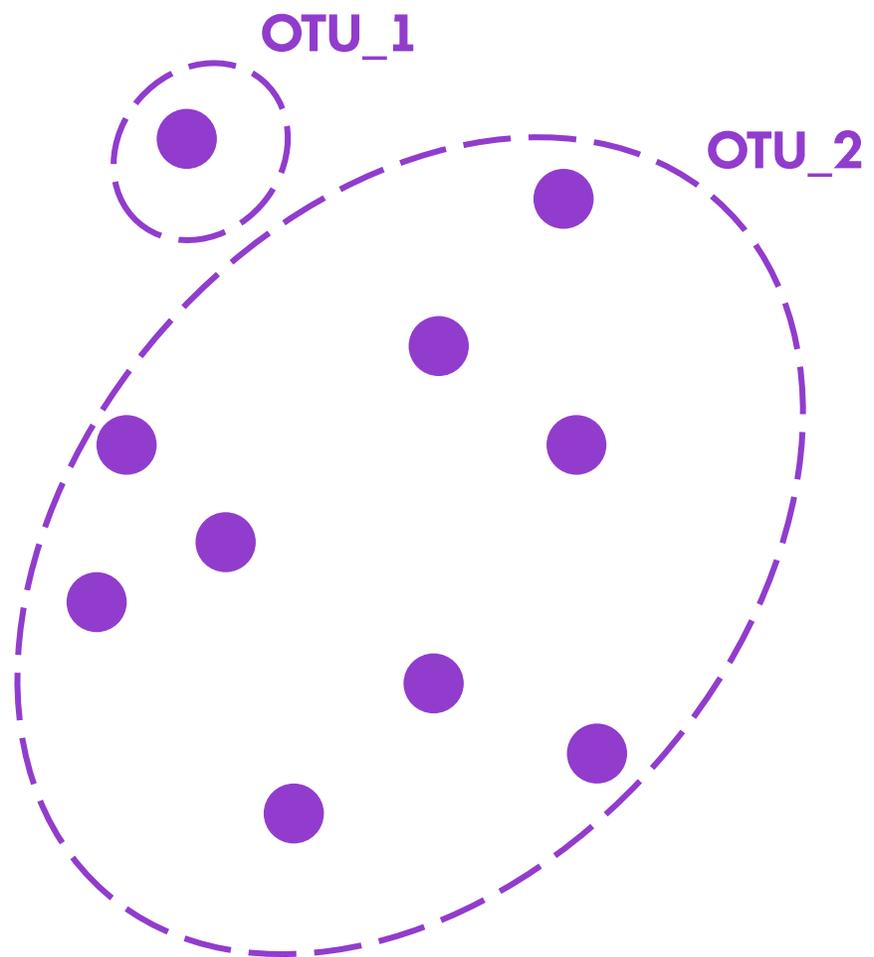
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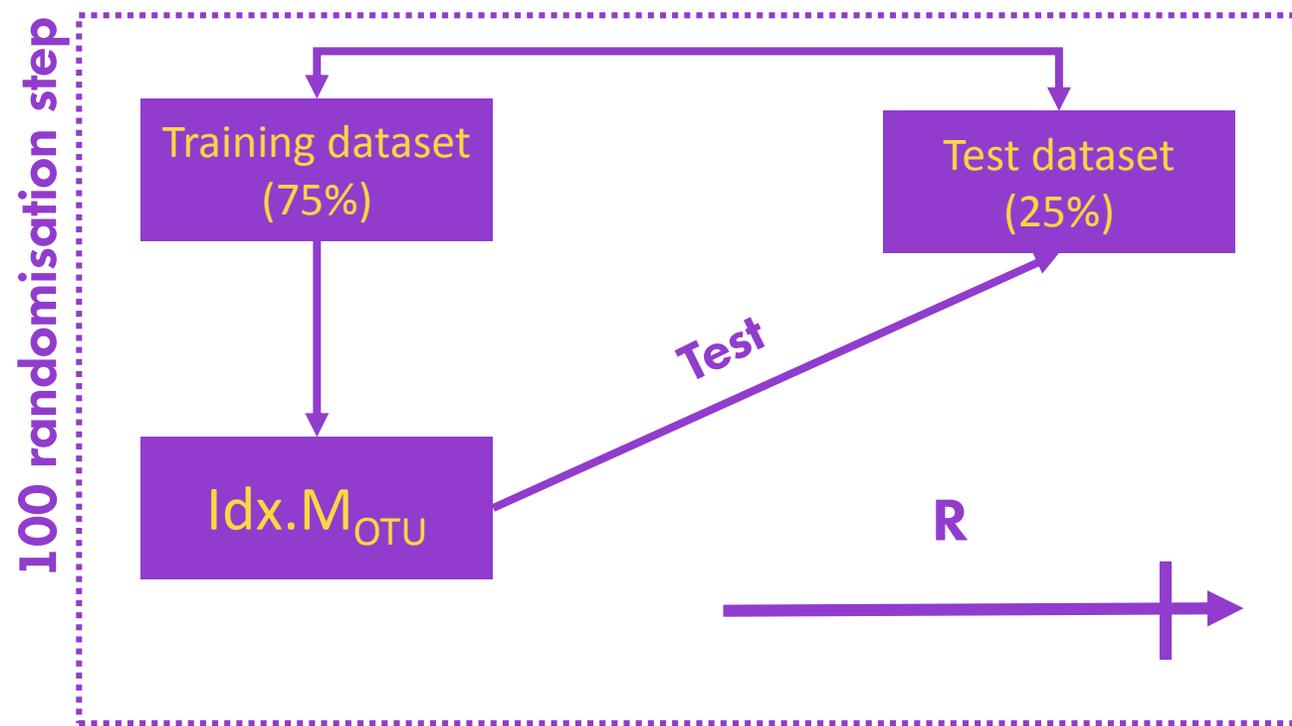
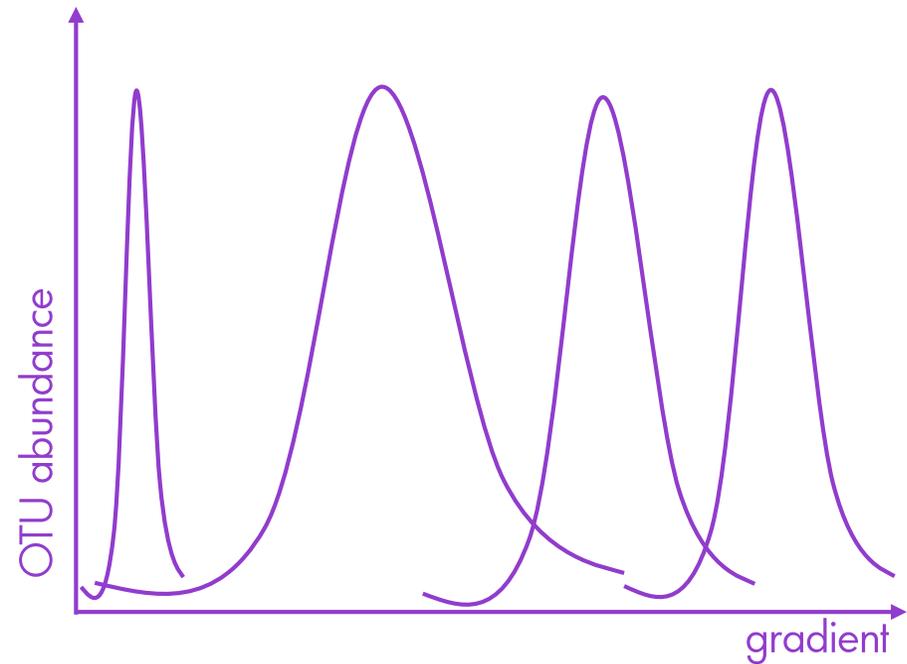
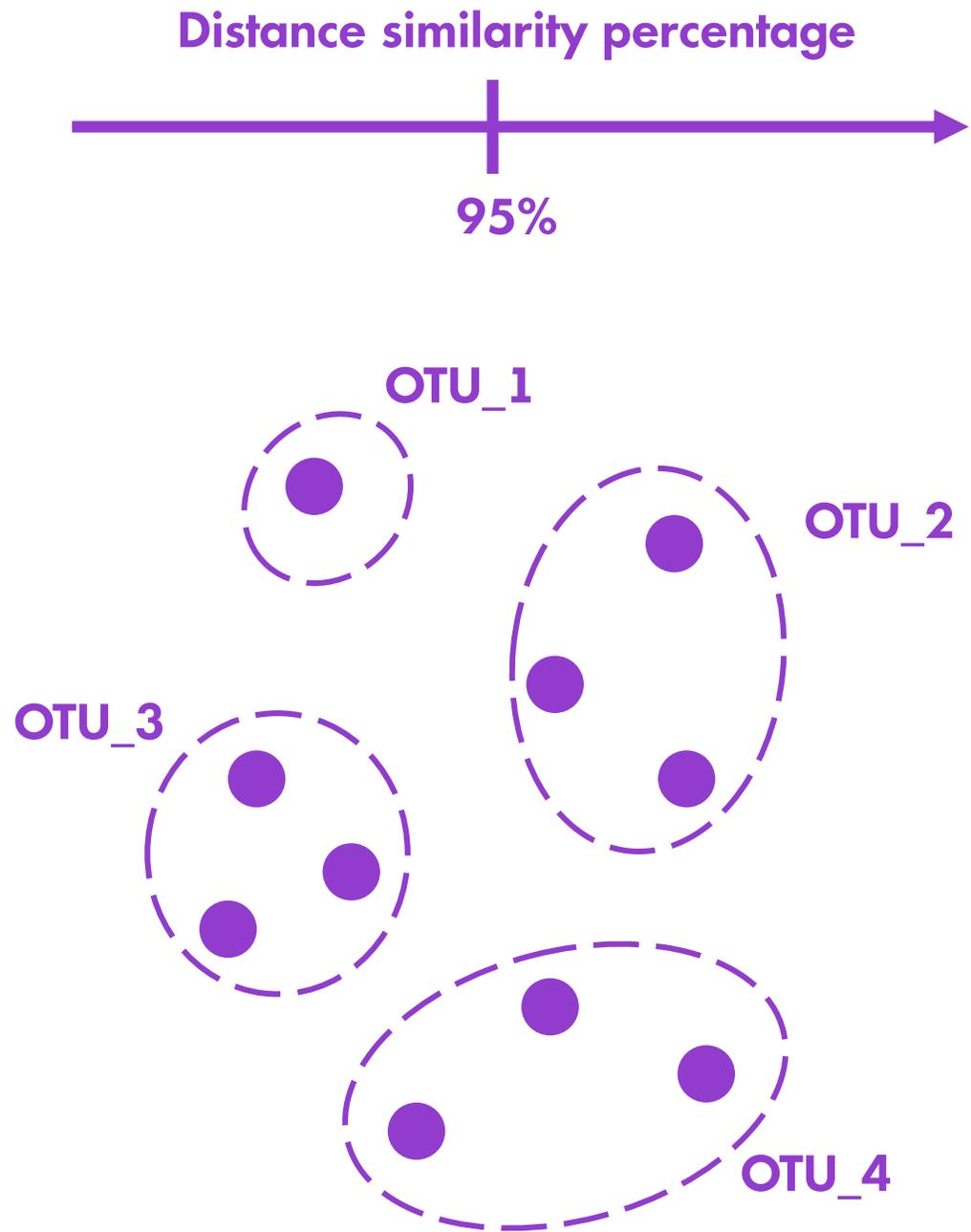
Material & Methods

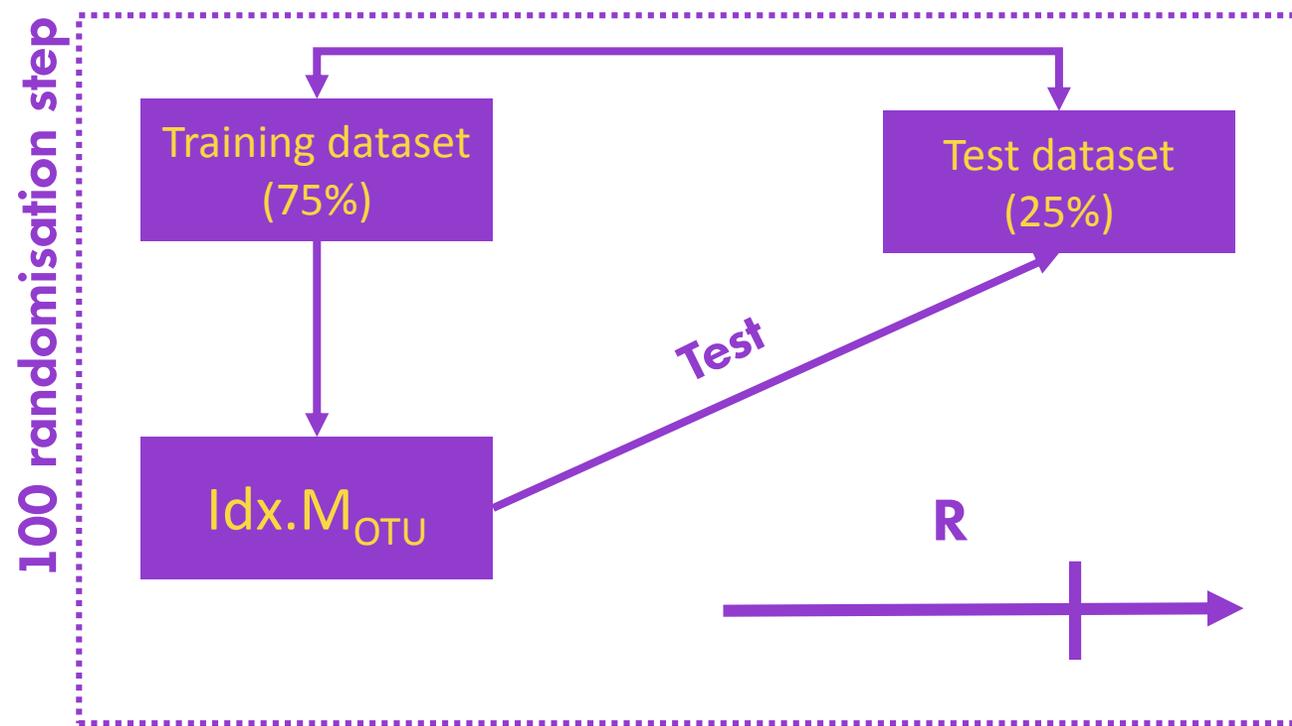
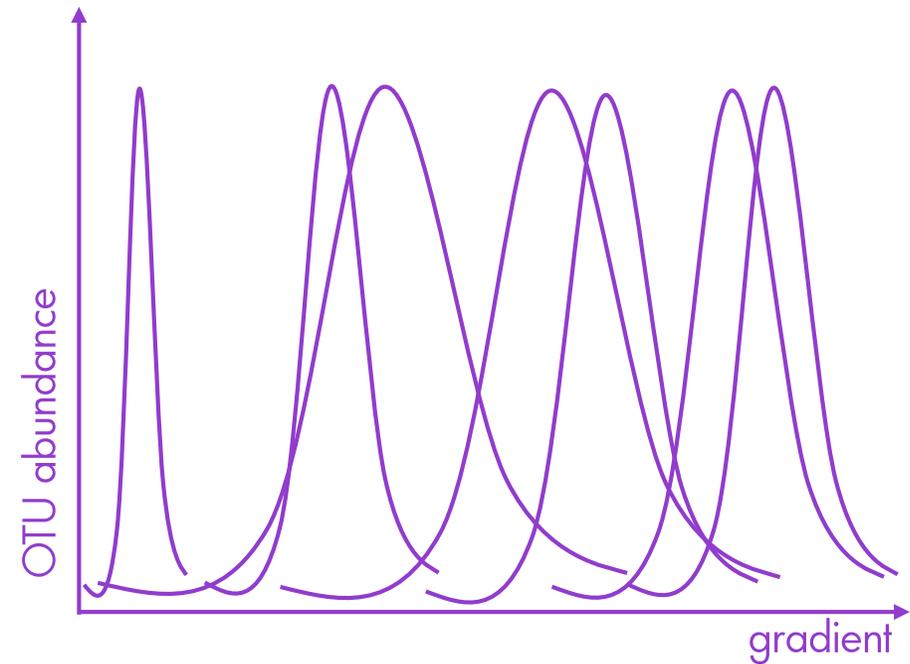
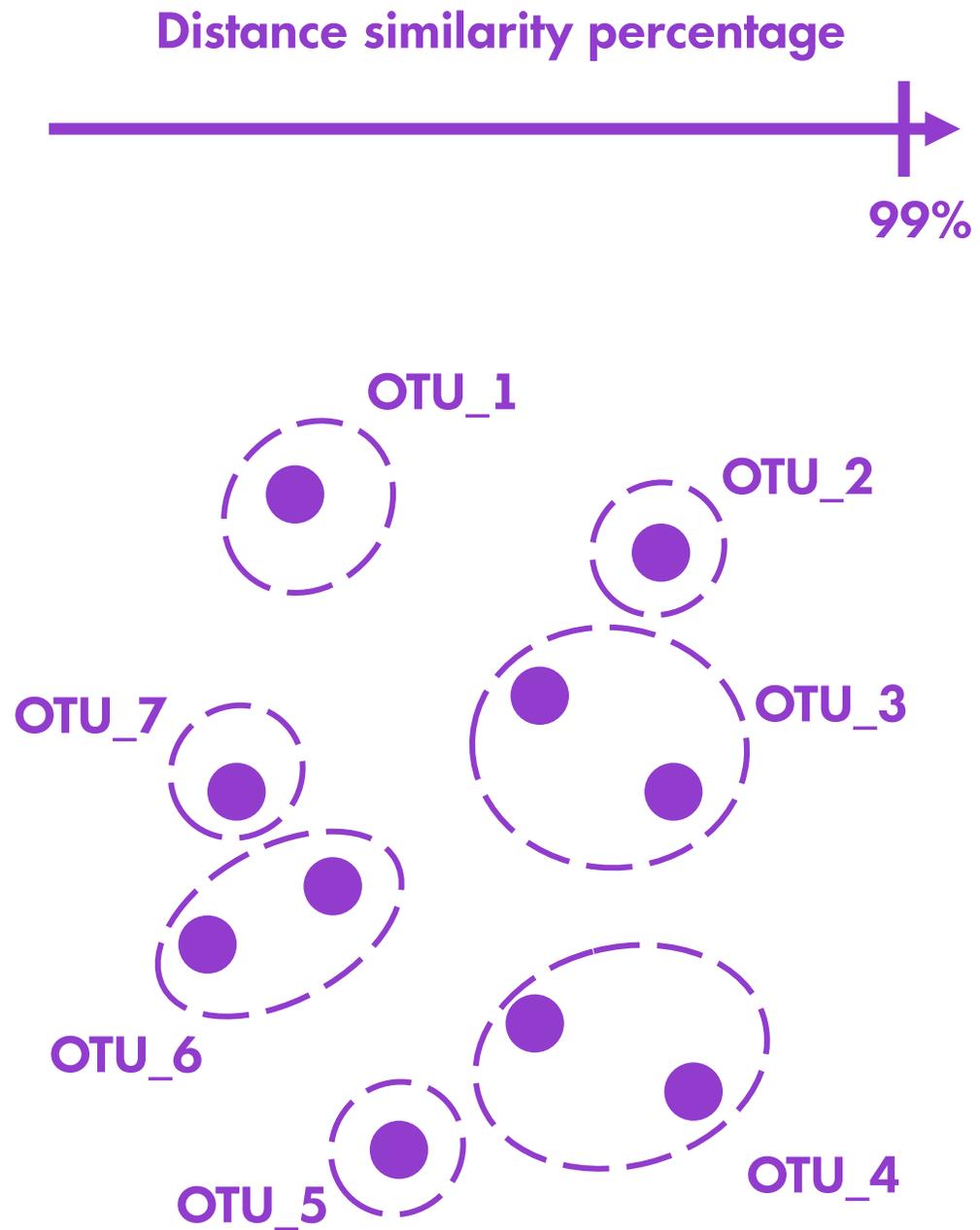
Index development, test of the distance similarities

Distance similarity percentage

80%



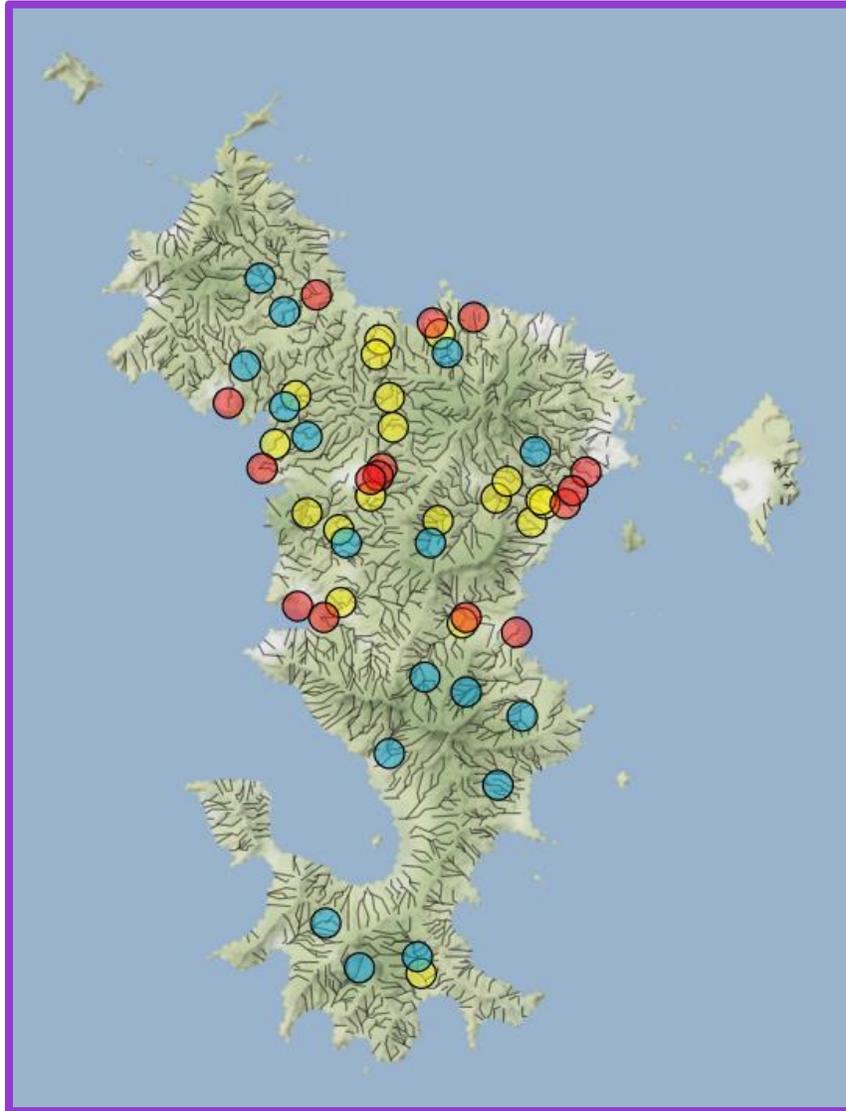




Hypotheses

How **distance similarity** affect the efficacy of the OTU-based index in term of

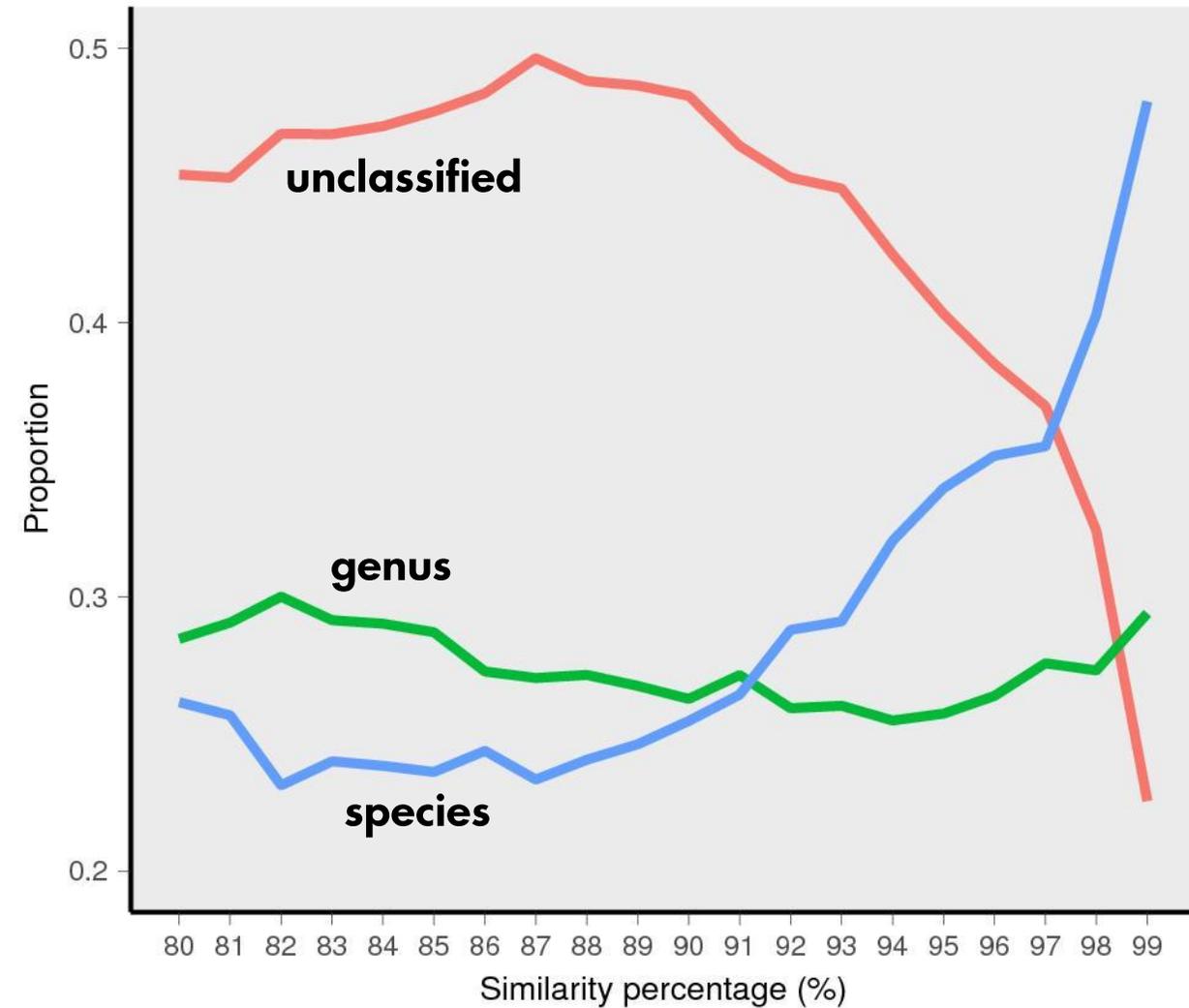
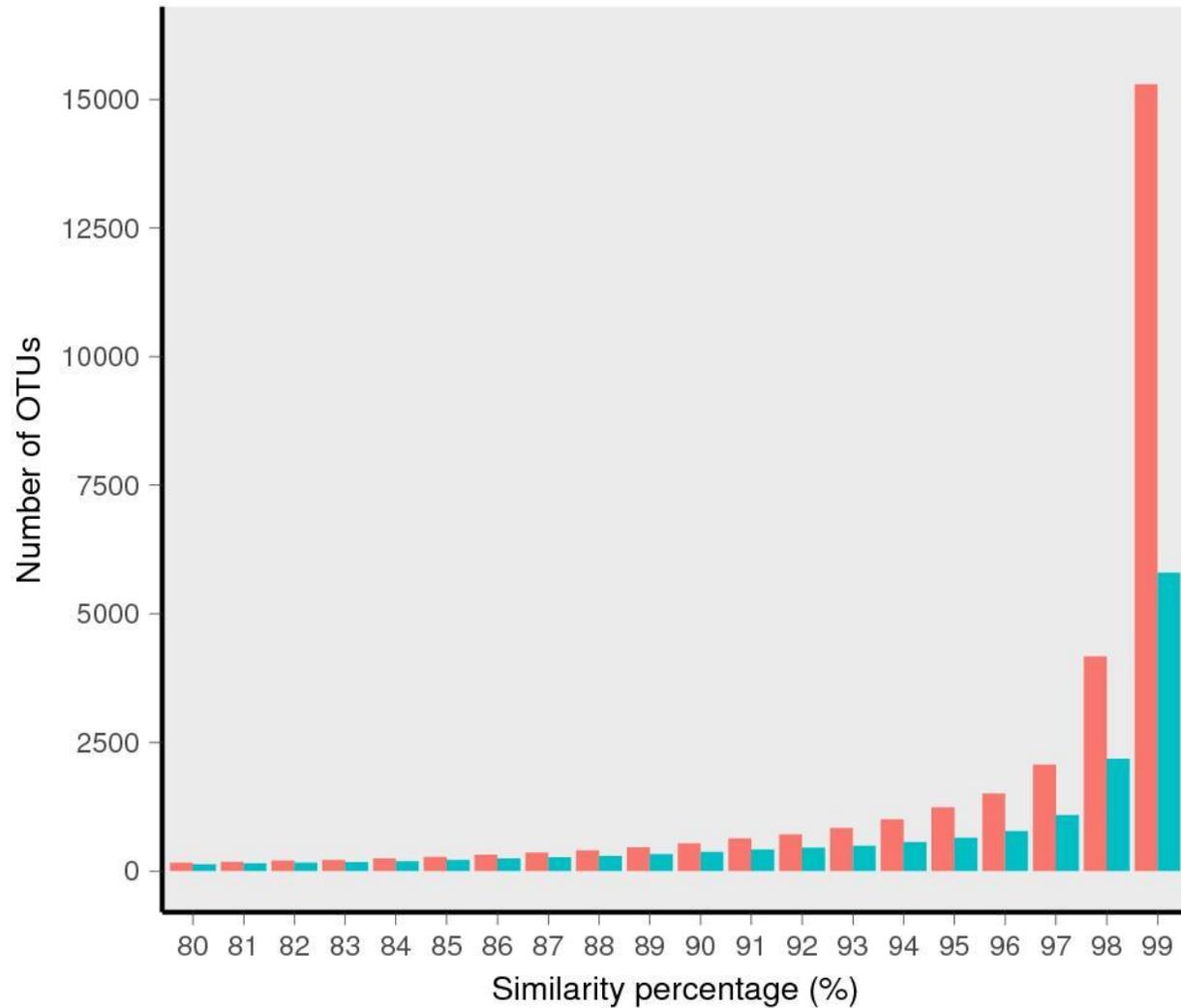
- ? number of OTUs and taxonomic resolution
- ? number of predictable factors
- ? correlation between the index values calculated for the test database and the environmental gradient
- ? discrimination power of index and
- ? index values stability



03

Results

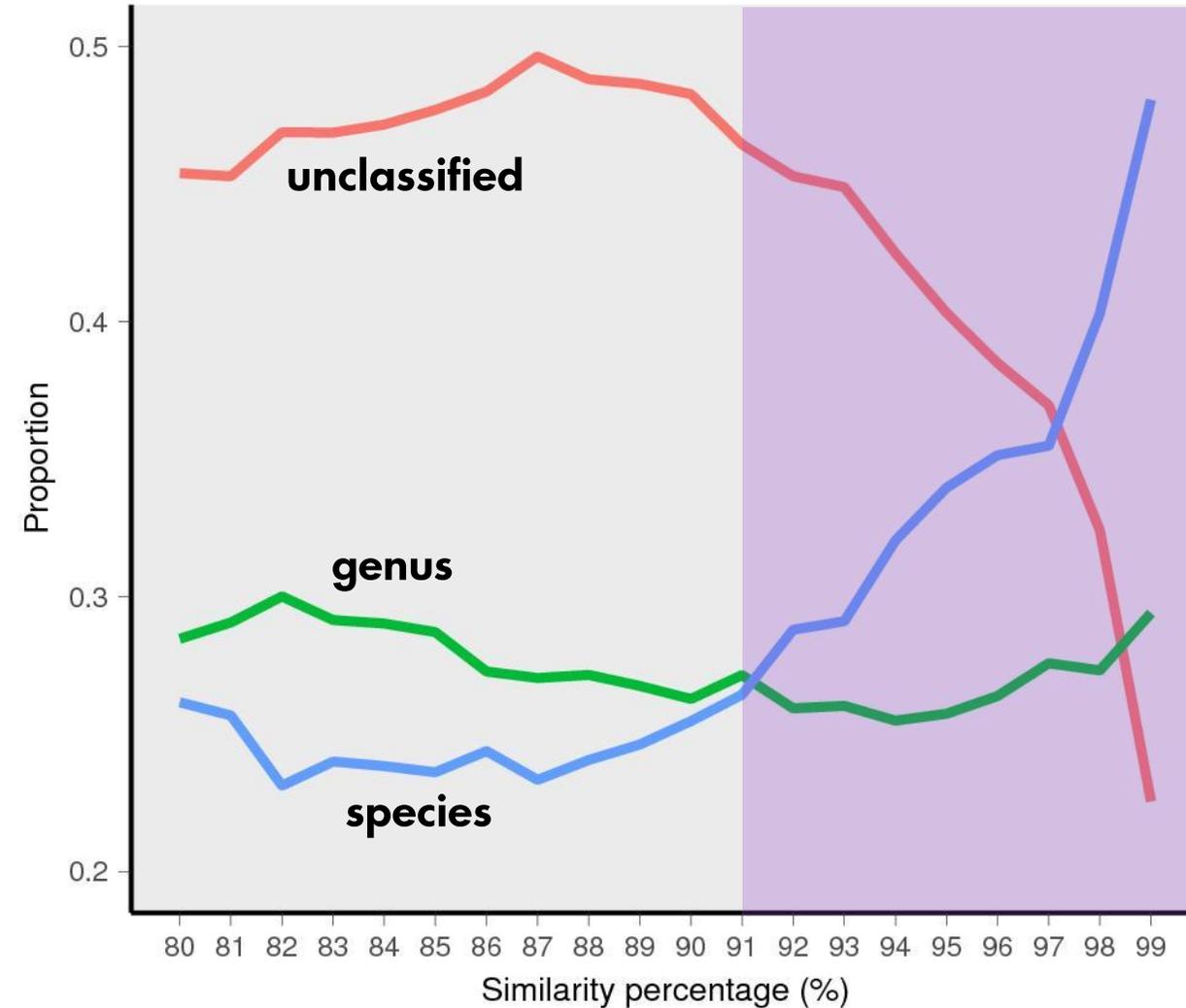
Taxonomic resolution



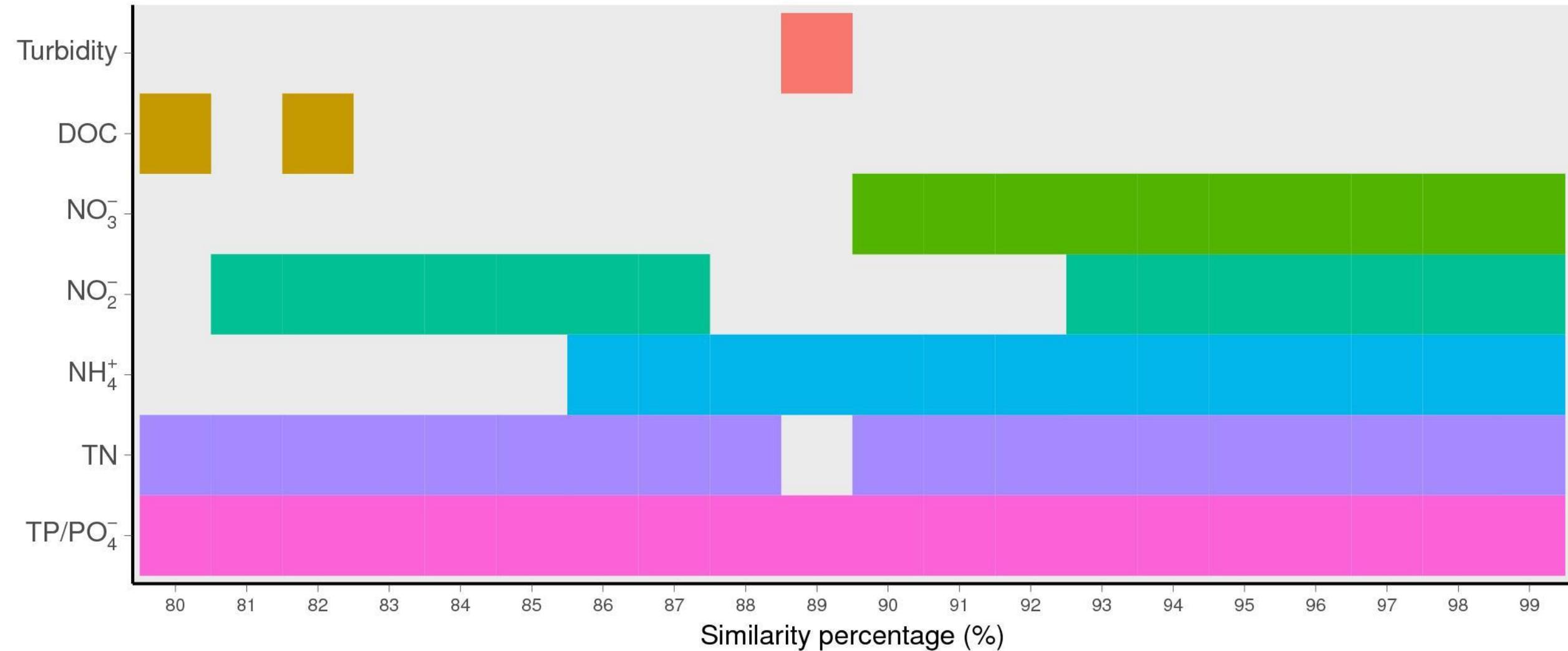
Taxonomic resolution

- Lack of complete reference database
- Exponential increase in species level identification
- Strong decrease of unclassified OTUs

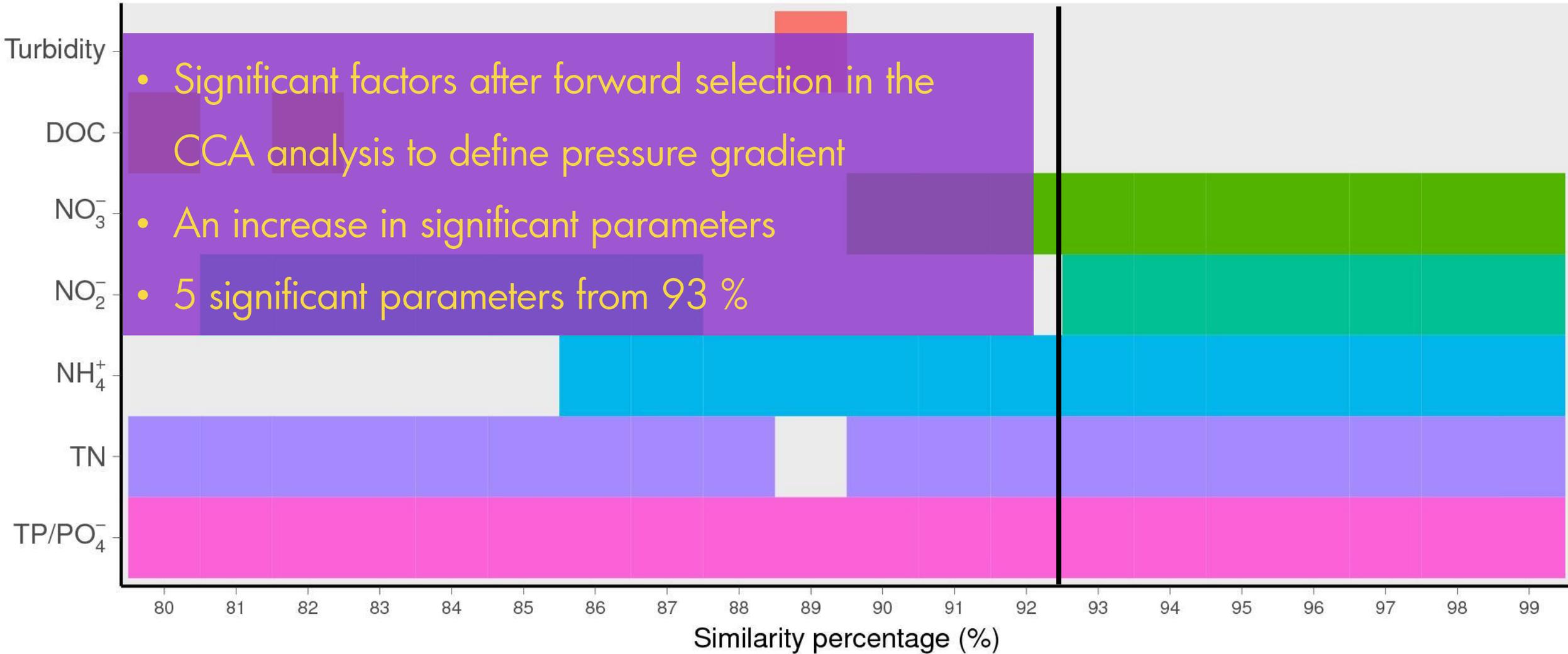
Does it matter?



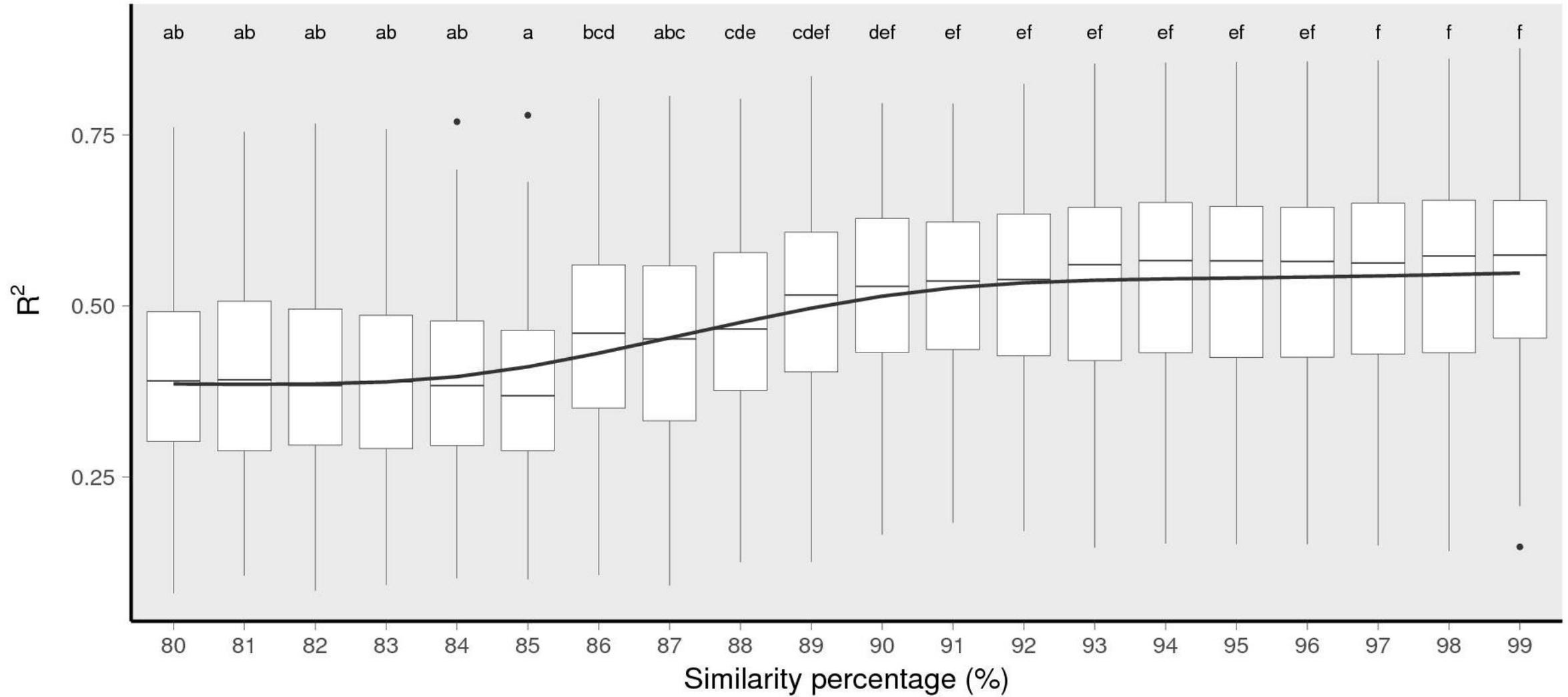
Predictable factors



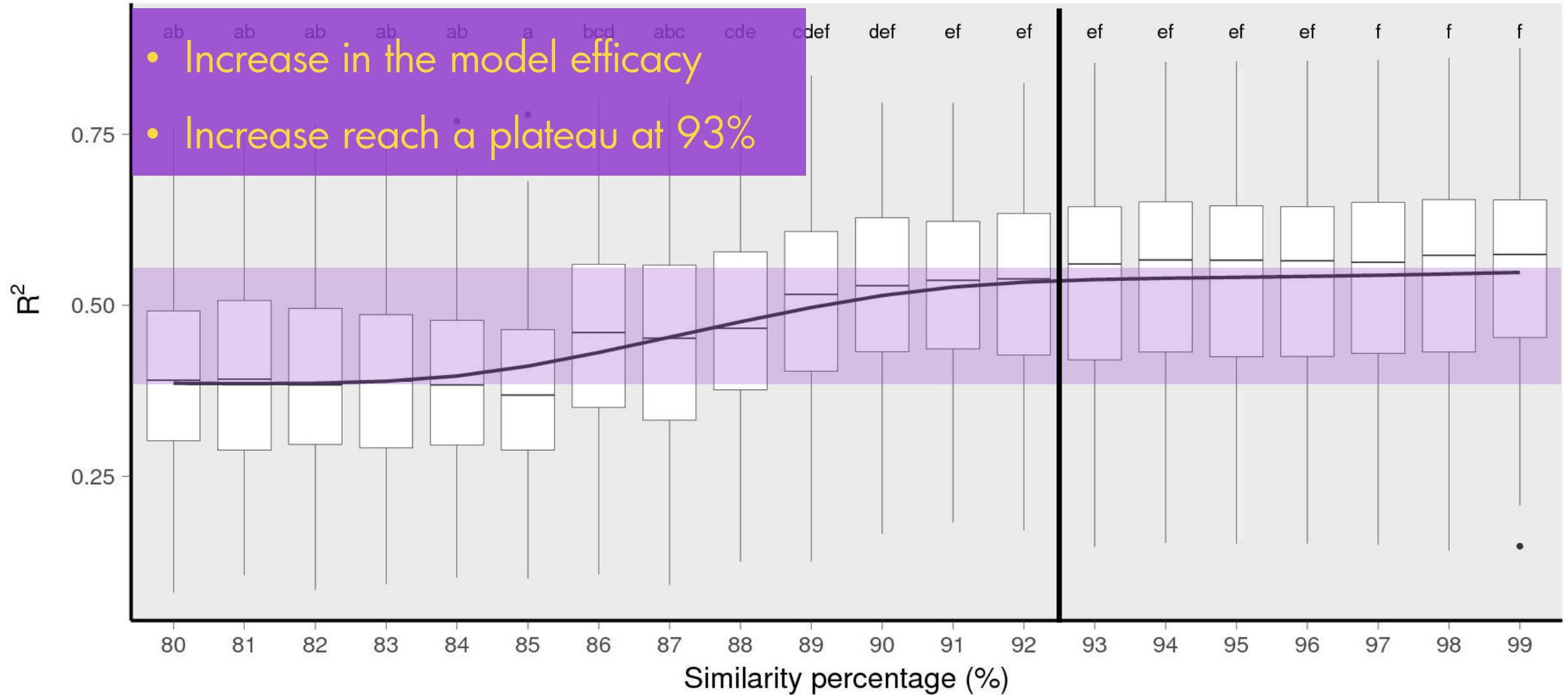
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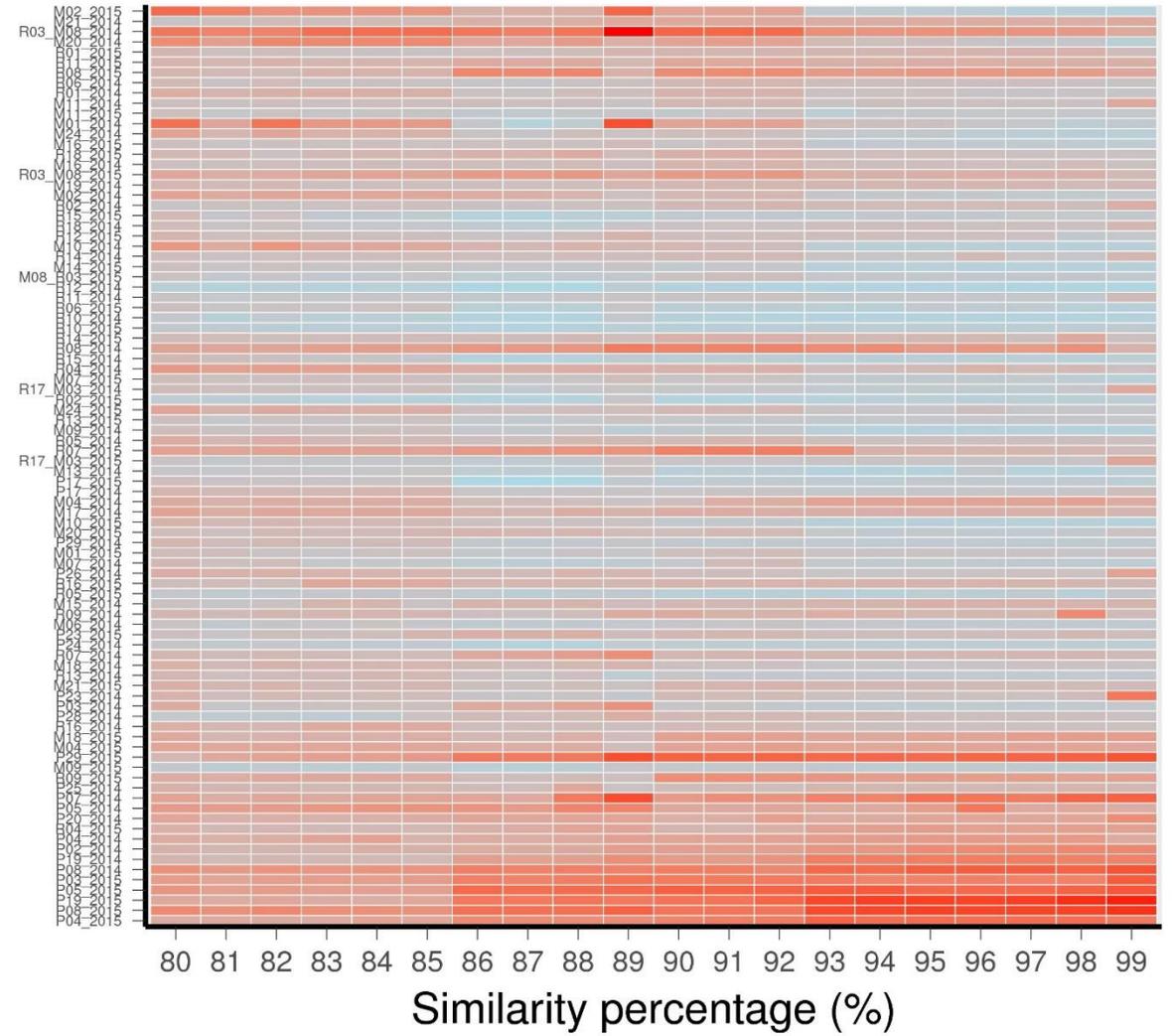
Index testing



Index testing

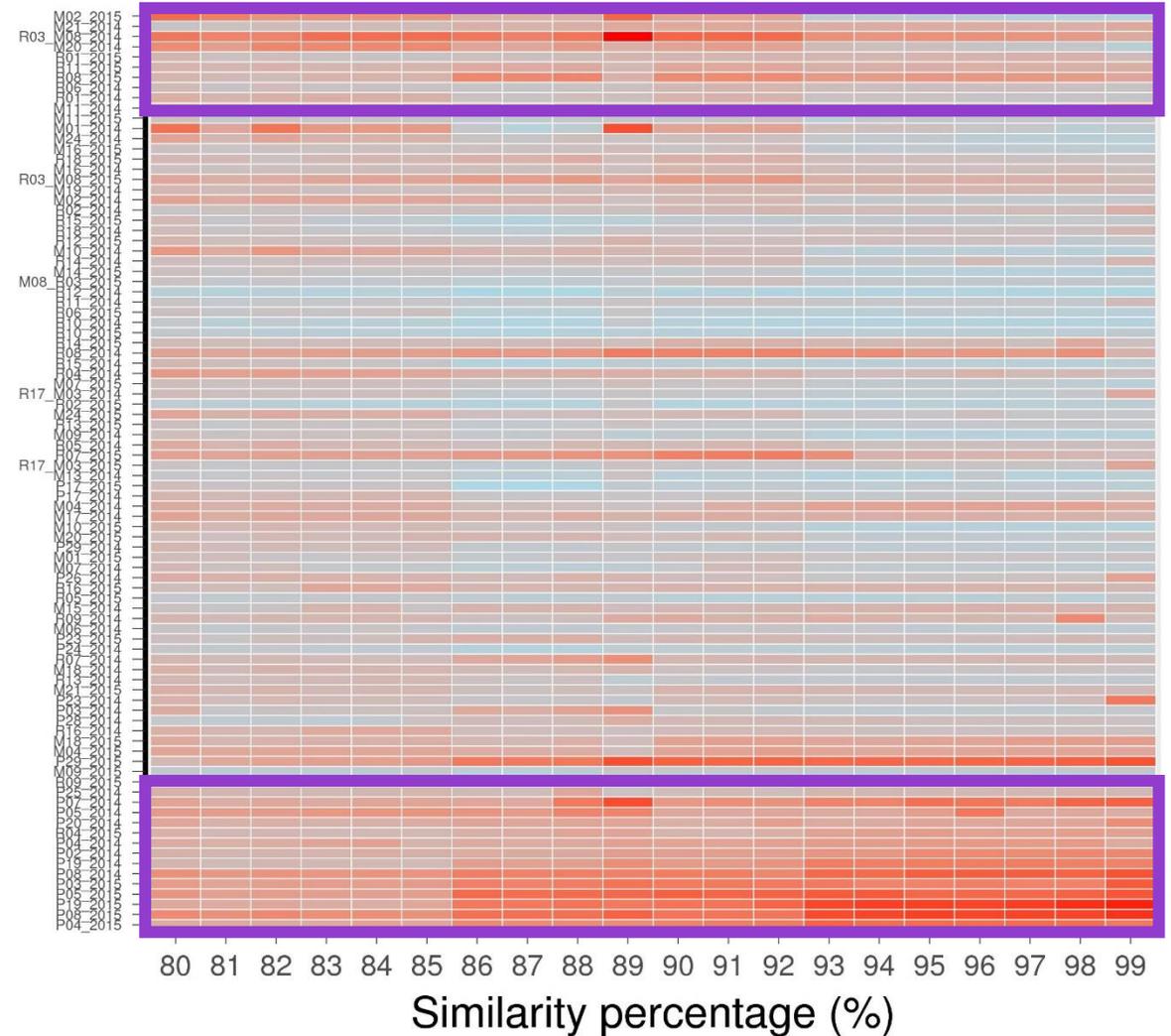


Index stability

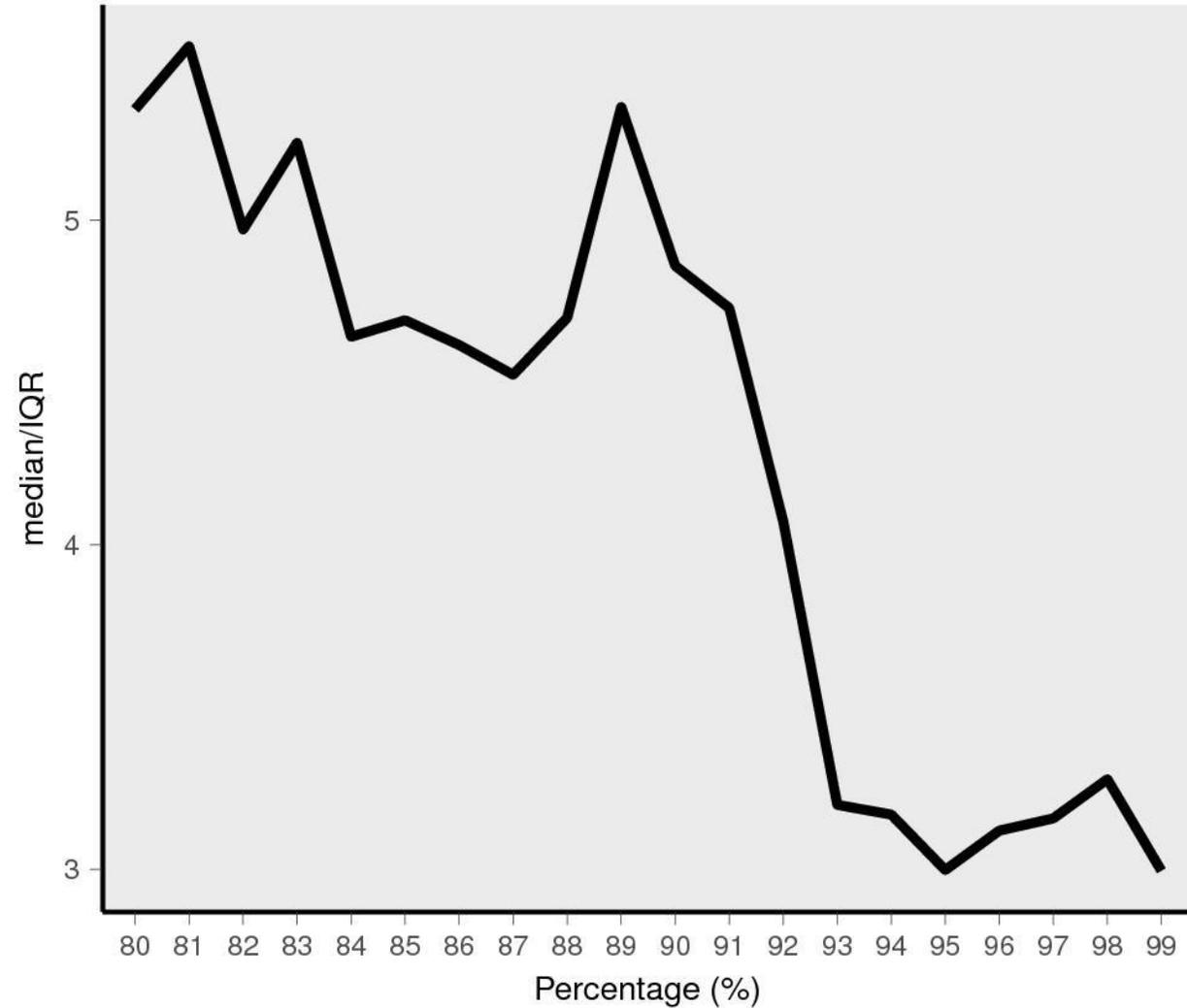
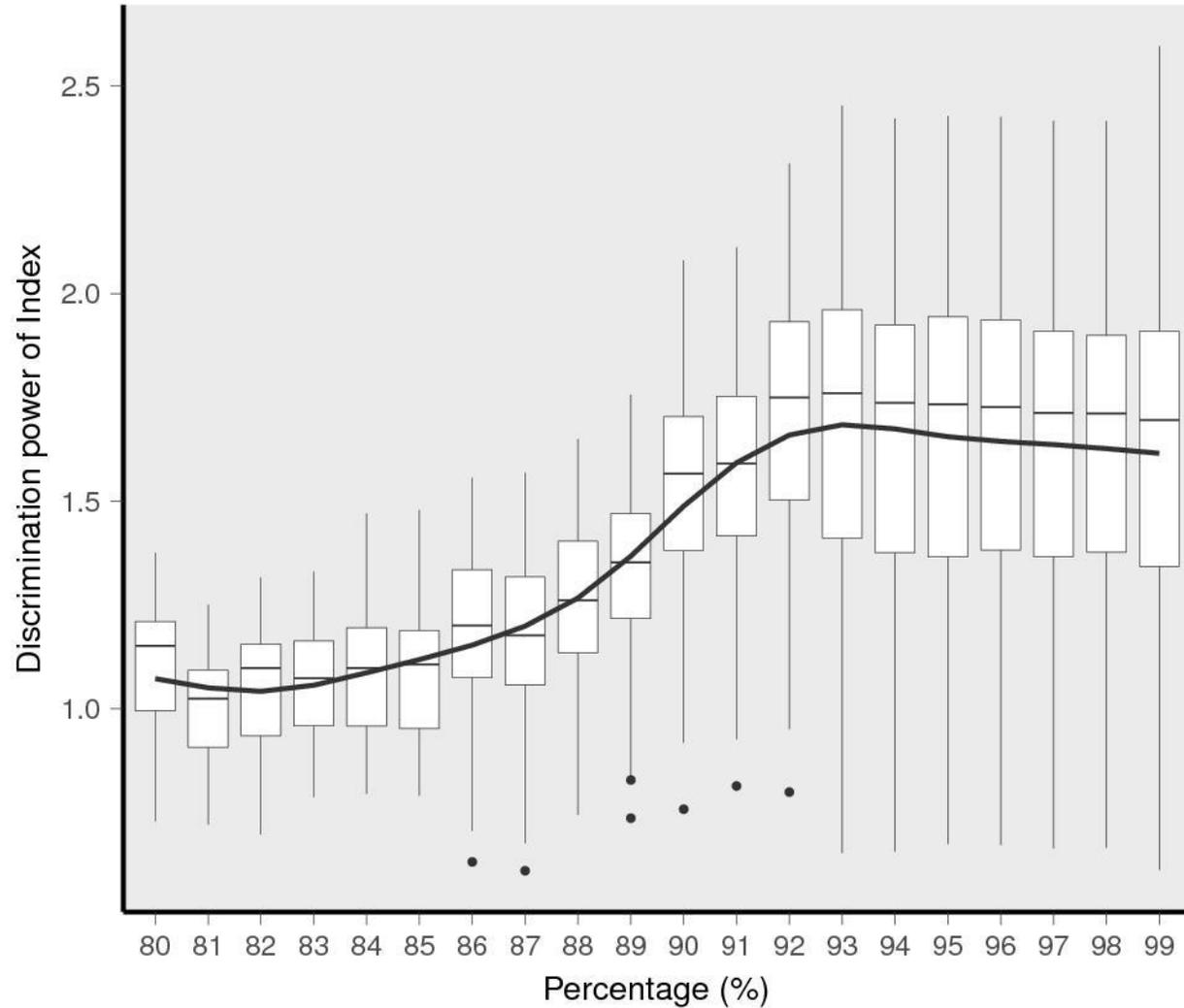


Index stability

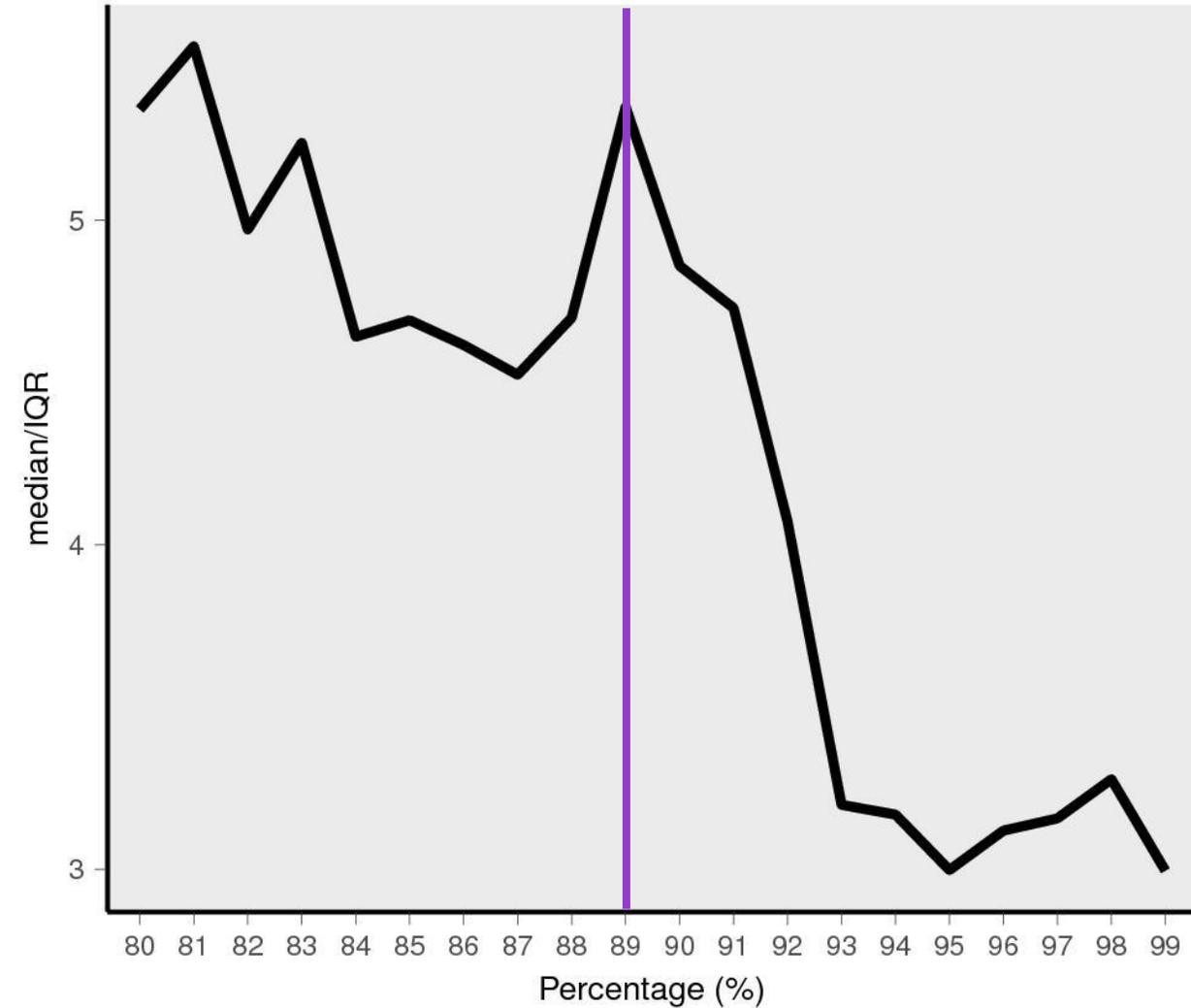
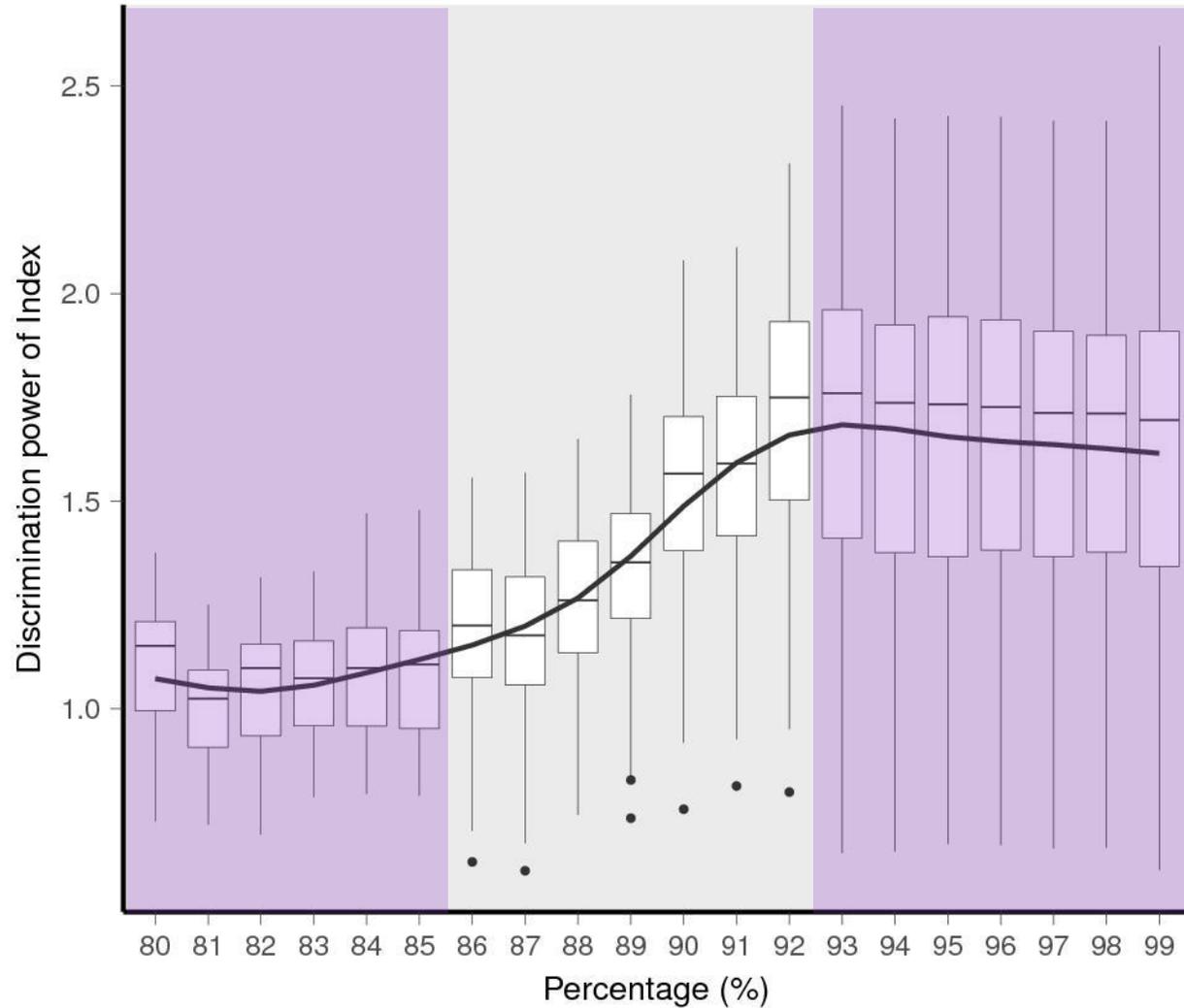
- The two extremities of the gradient (but mainly polluted sites) are more sensitive to randomisation
- This phenomenon increases with the similarity percentage
- Strong negative correlation have been observed between OTU richness and index variability
- This correlation is stronger at higher percentages



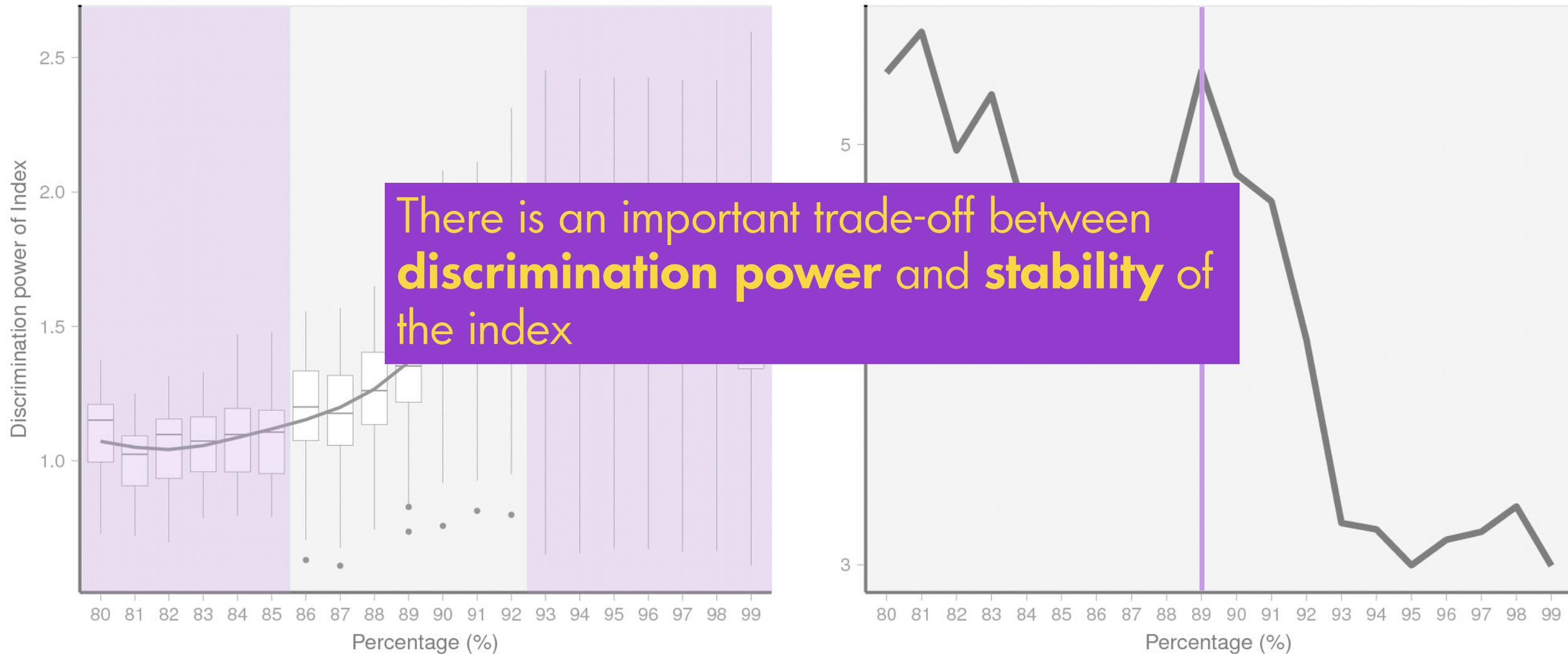
Index's discrimination power and stability



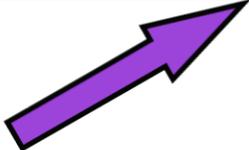
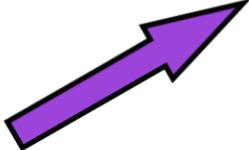
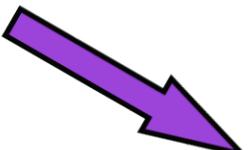
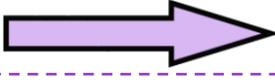
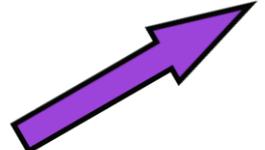
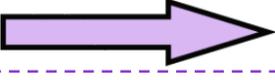
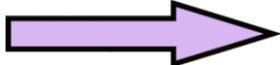
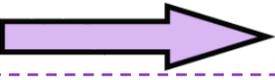
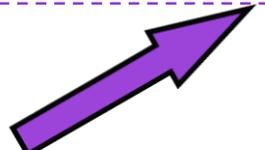
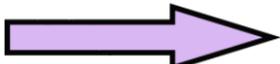
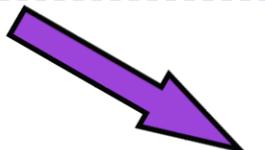
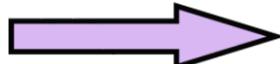
Index's discrimination power and stability

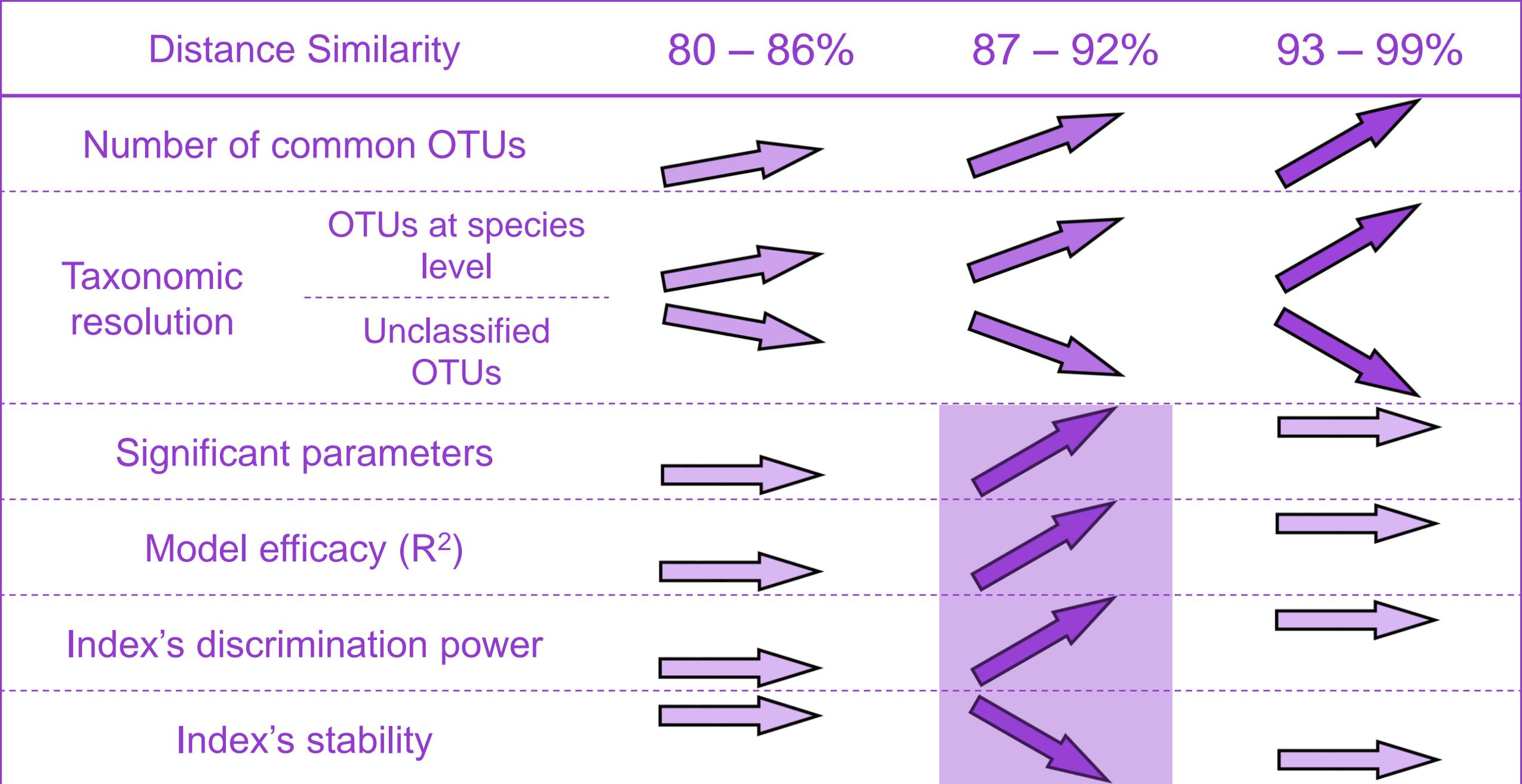


Index's discrimination power and stability



04 Conclusion

Distance Similarity		80 – 86%	87 – 92%	93 – 99%
Number of common OTUs				
Taxonomic resolution	OTUs at species level			
	Unclassified OTUs			
Significant parameters				
Model efficacy (R ²)				
Index's discrimination power				
Index's stability				



Thank you for your attention

*It is hard to explain the huge variety of diatoms
- a microorganism that has 100,000 species -
in terms of natural selection.*

Prof. John Tyler Bonner