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# Identifying biotic determinants of historic American eel (*Anguilla rostrata*) distributions

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using **MAXENT LOGIC** to identify **abiotic & biotic** determinants

Taylor E. Woods & Dr. Daniel J. McGarvey  
Virginia Commonwealth University- Center for Environmental Studies

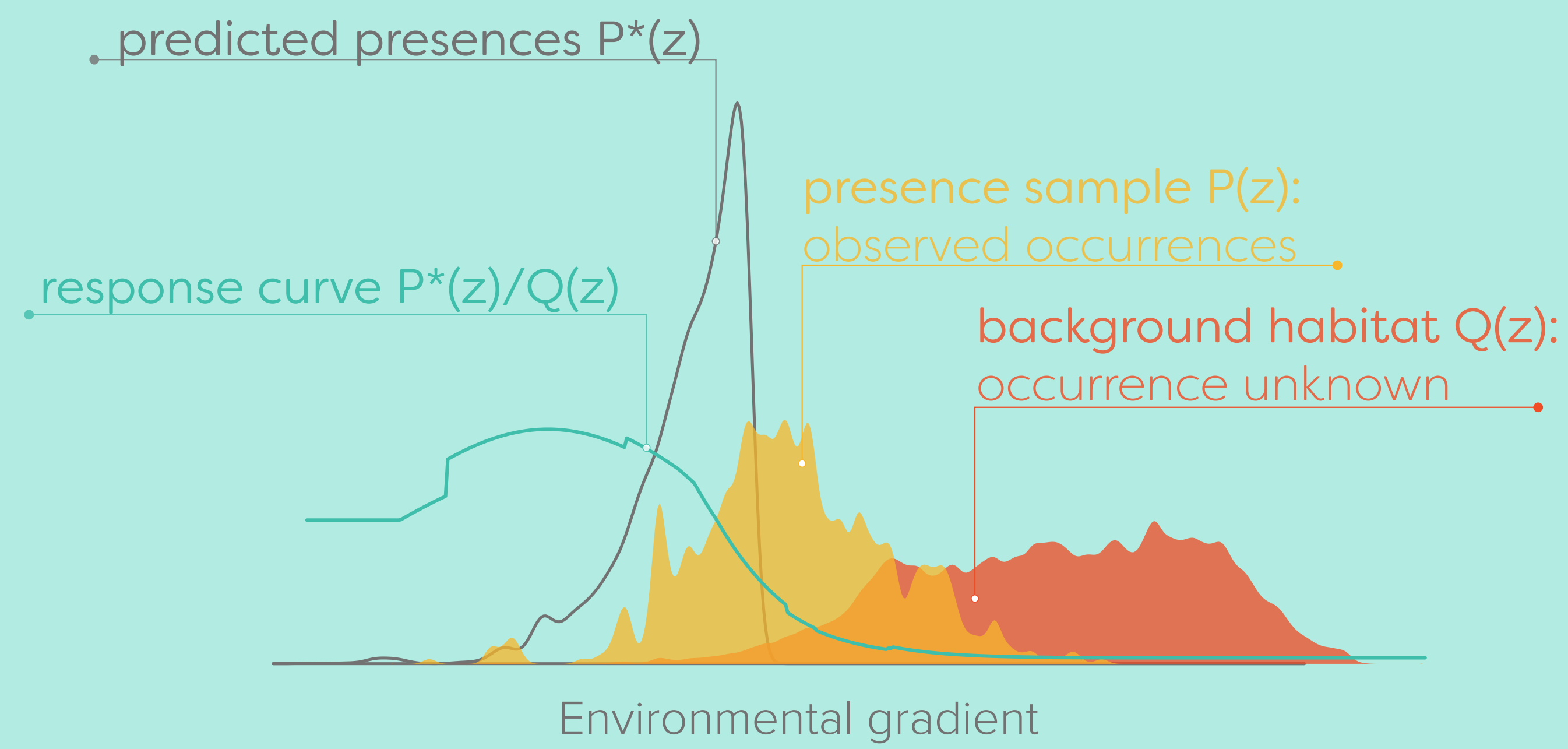
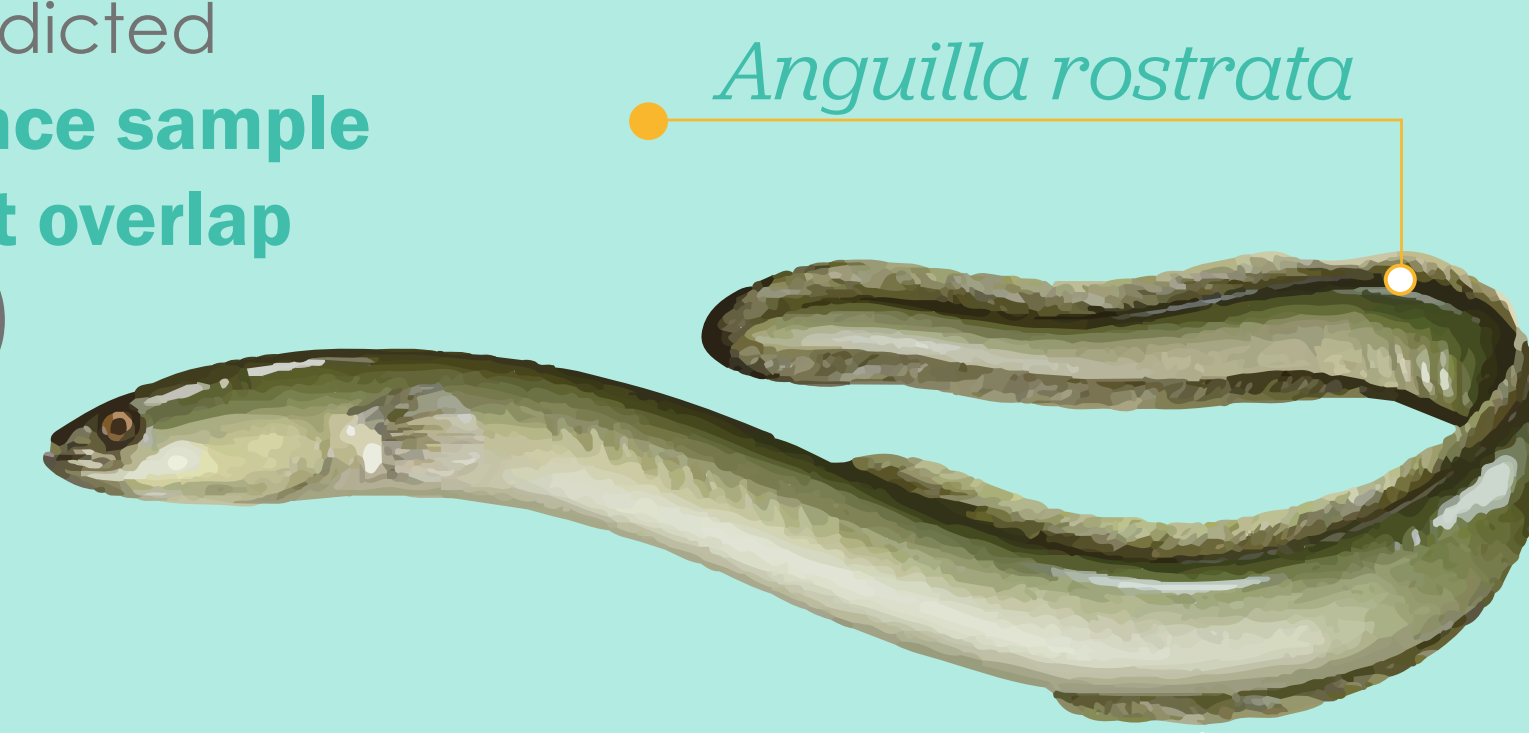
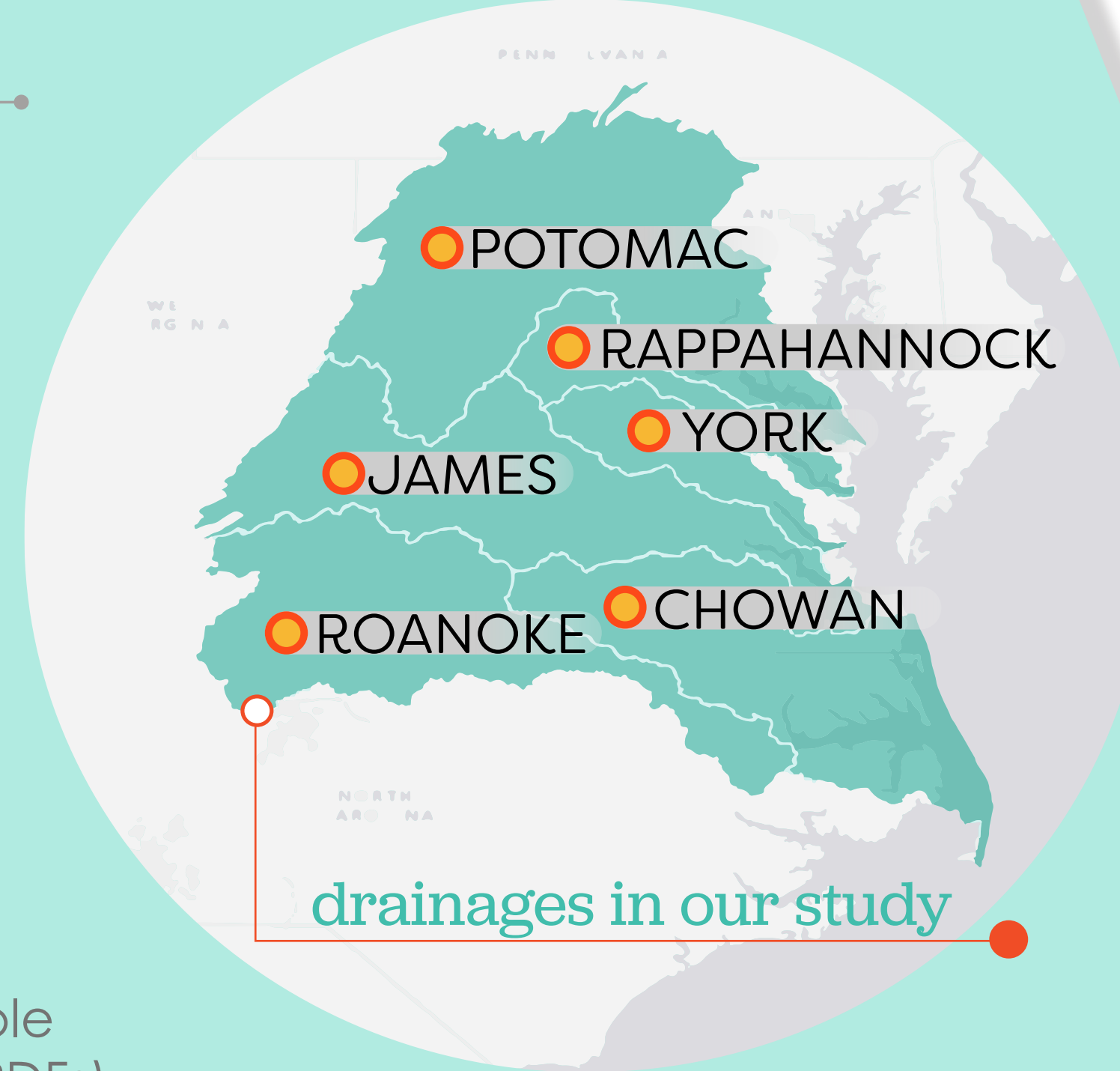
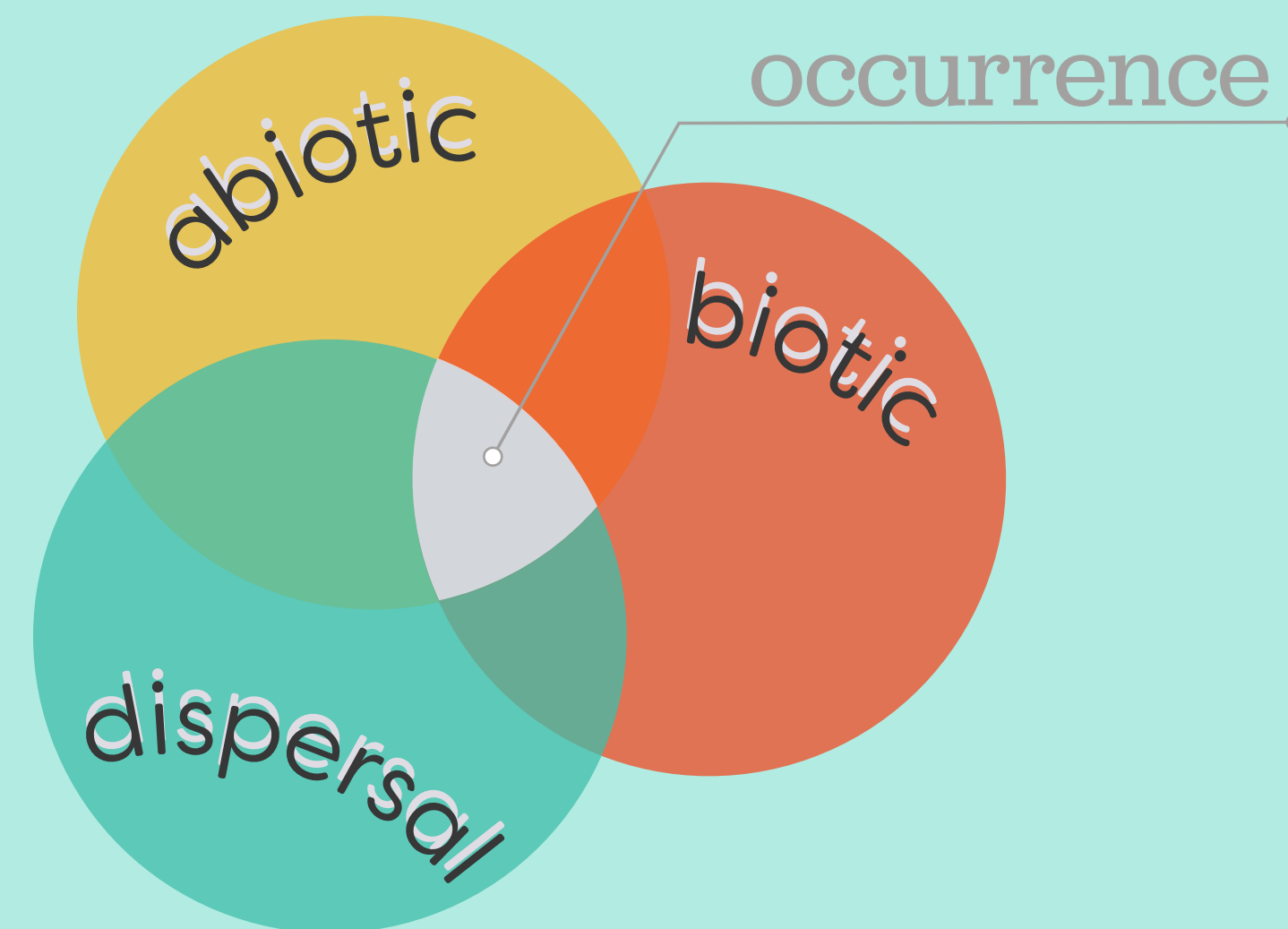
of historic



distributions

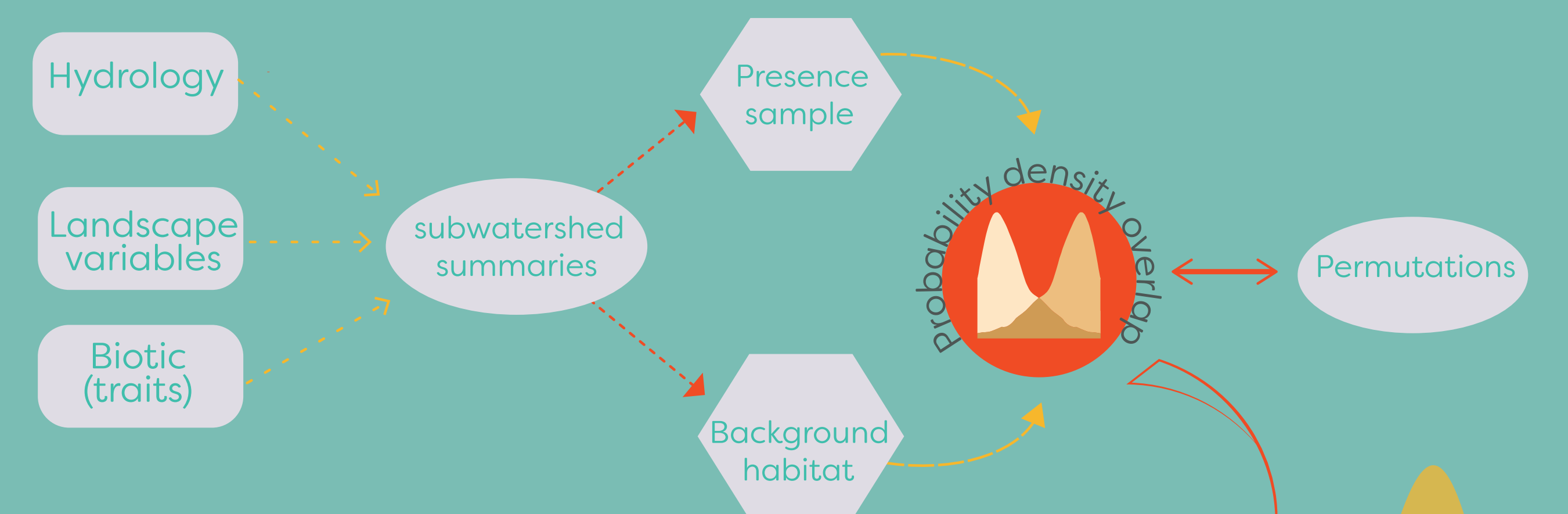
## INTRODUCTION

Traditionally, ecologists studying large scale patterns in species distributions emphasize abiotic variables over biotic interactions. Noting that both abiotic & biotic variables likely determine distributions of all organisms, many ecologists now aim for a more **comprehensive view of species distributions**, inclusive of both abiotic and biotic components (Soberón 2007)

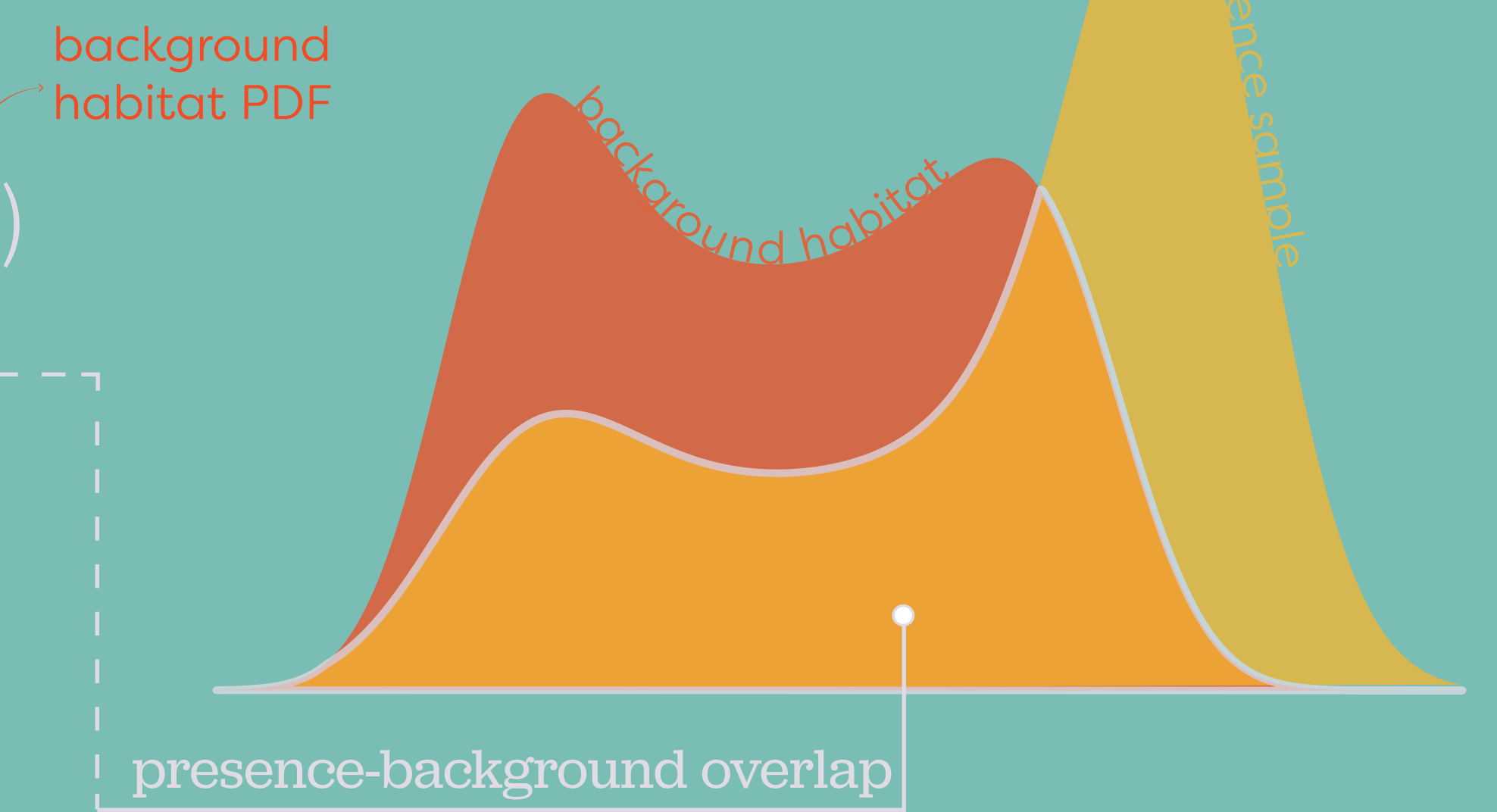


**MaxEnt logic:** comparison of presence sample probability density functions (PDFs) against background habitat PDFs yields highest rate of predicted presences **where presence sample and background habitat overlap least** (Merow et al. 2013)

## METHODS



$$ovl := \epsilon \sum_{i=1}^n \min(f_p, f_b)$$



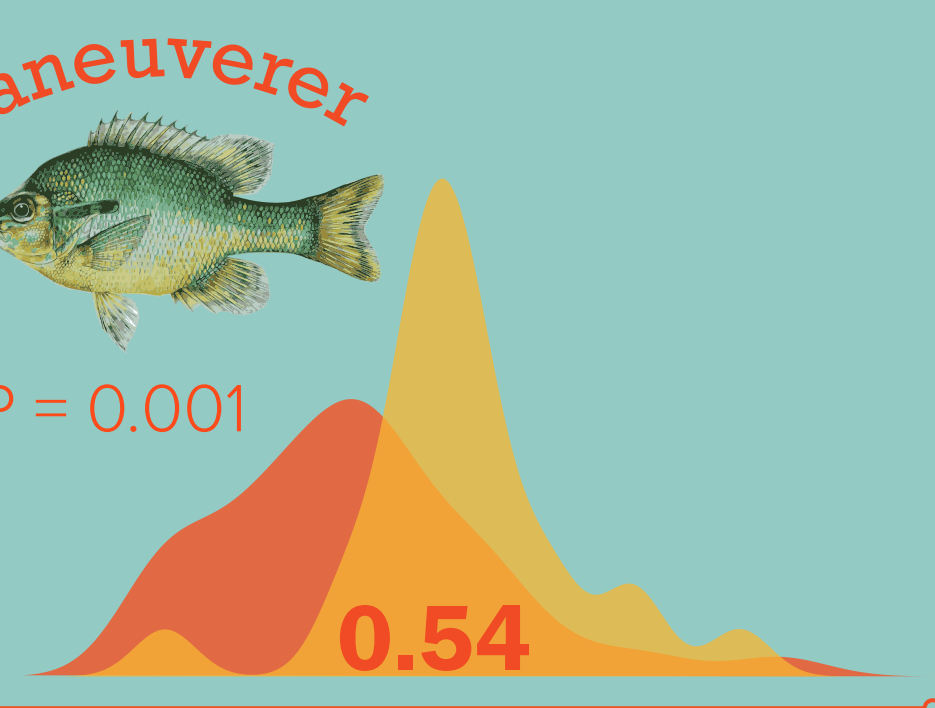
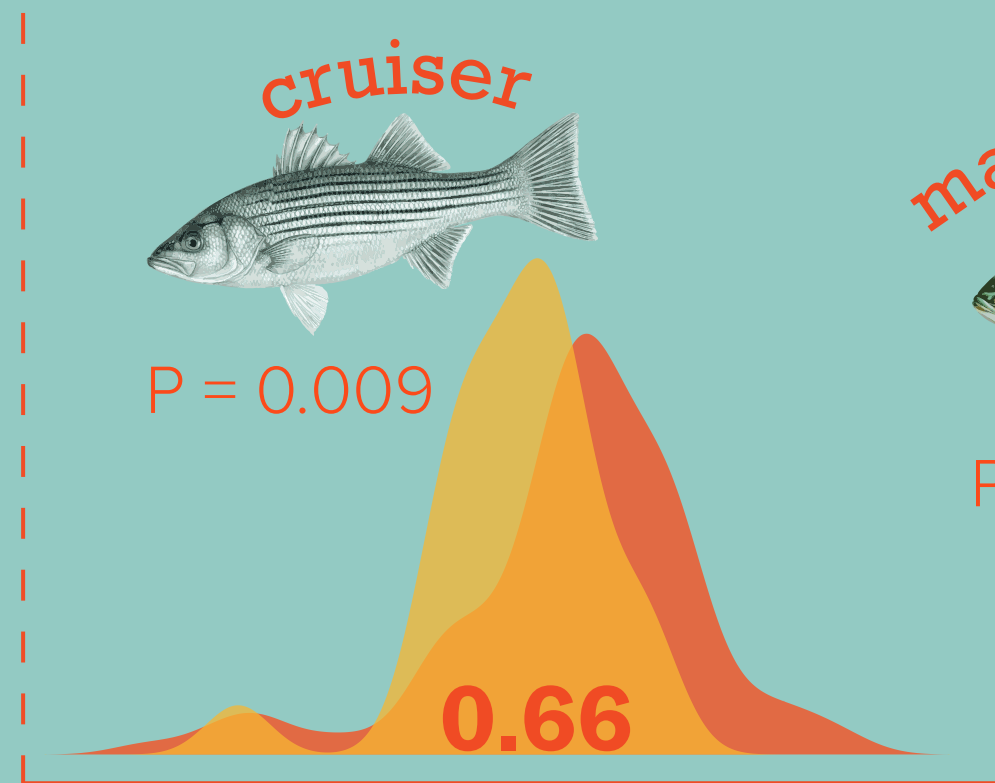
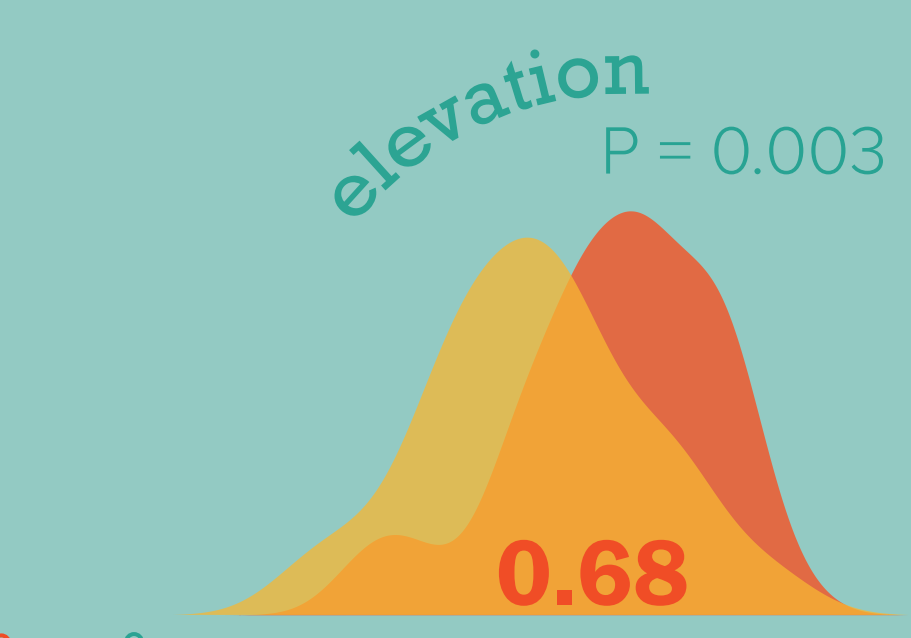
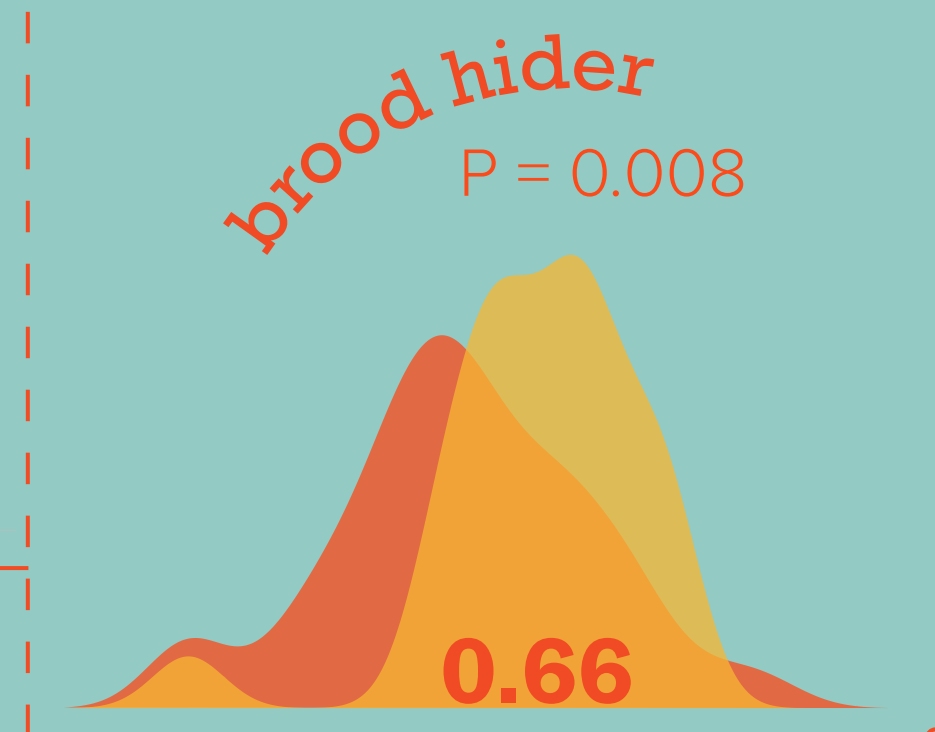
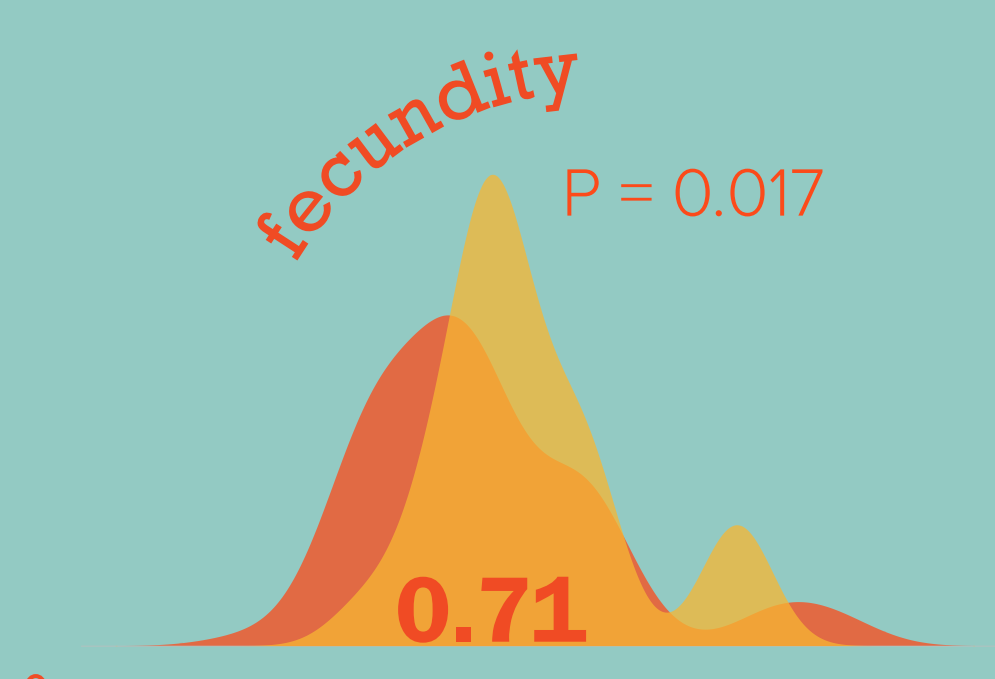
0.0 ← → 1.0  
less presence-background similarity → greater presence-background unison

## biotic interactions (functional traits)

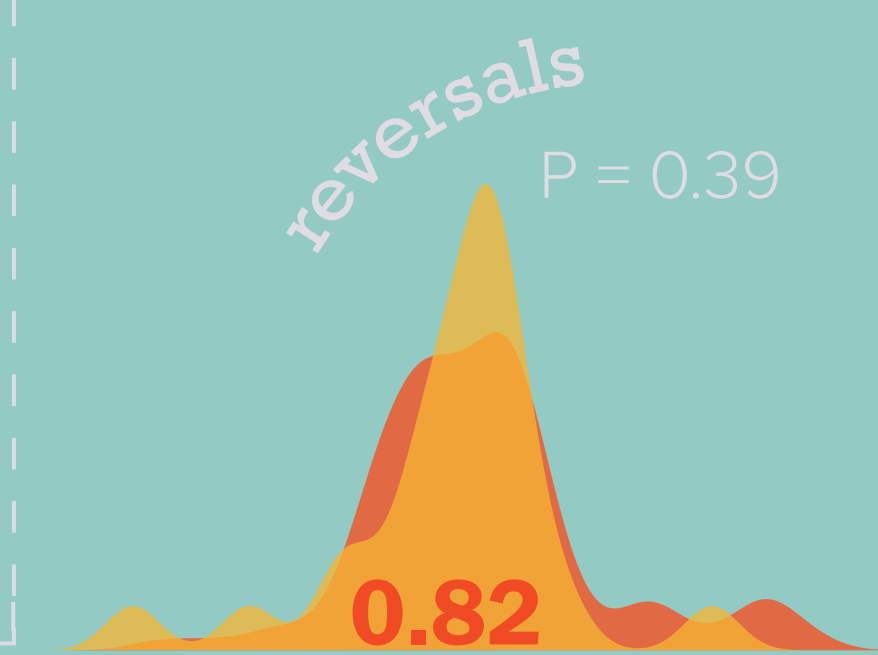
## landscape variables

## hydrology

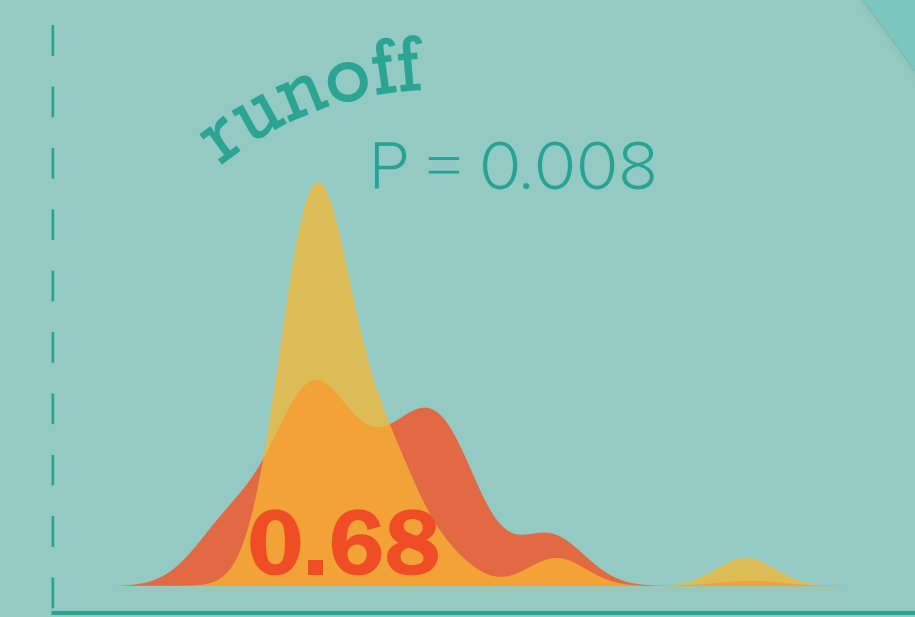
Many traits were **significant determinants of eel distributions**. Presence-background overlaps showed eels tended to co-occur with a **distinct suite of traits**.



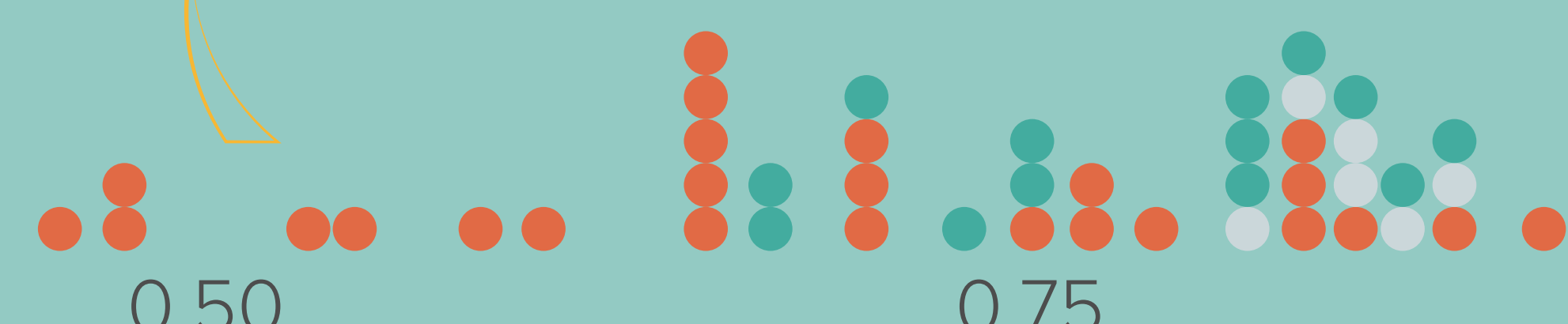
Hydrologic variables showed **large presence-background overlap**, indicating flows may be weak determinants of historic eel distributions.



**Dam density overlapped least** across all variables. Higher presence sample dam density restricted eels to **lower gradients**, observed in elevation and runoff.



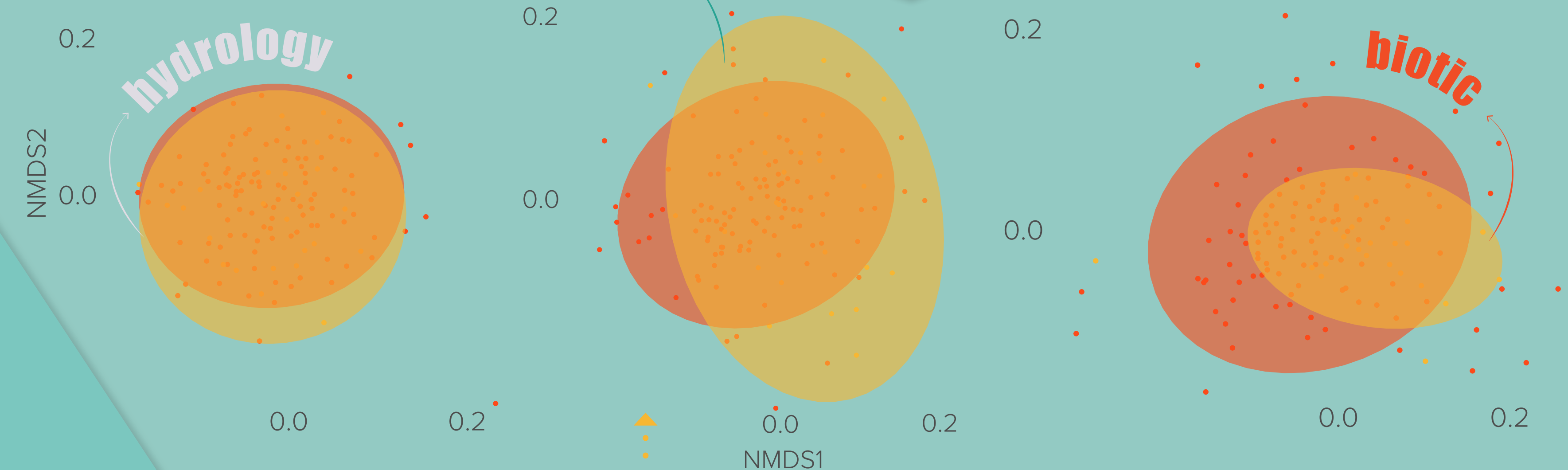
presence-background **overlap results for all variables** in our analysis



0.00 0.25 0.50 0.75 1.00  
**DECREASING PRESENCE-BACKGROUND SIMILARITY**

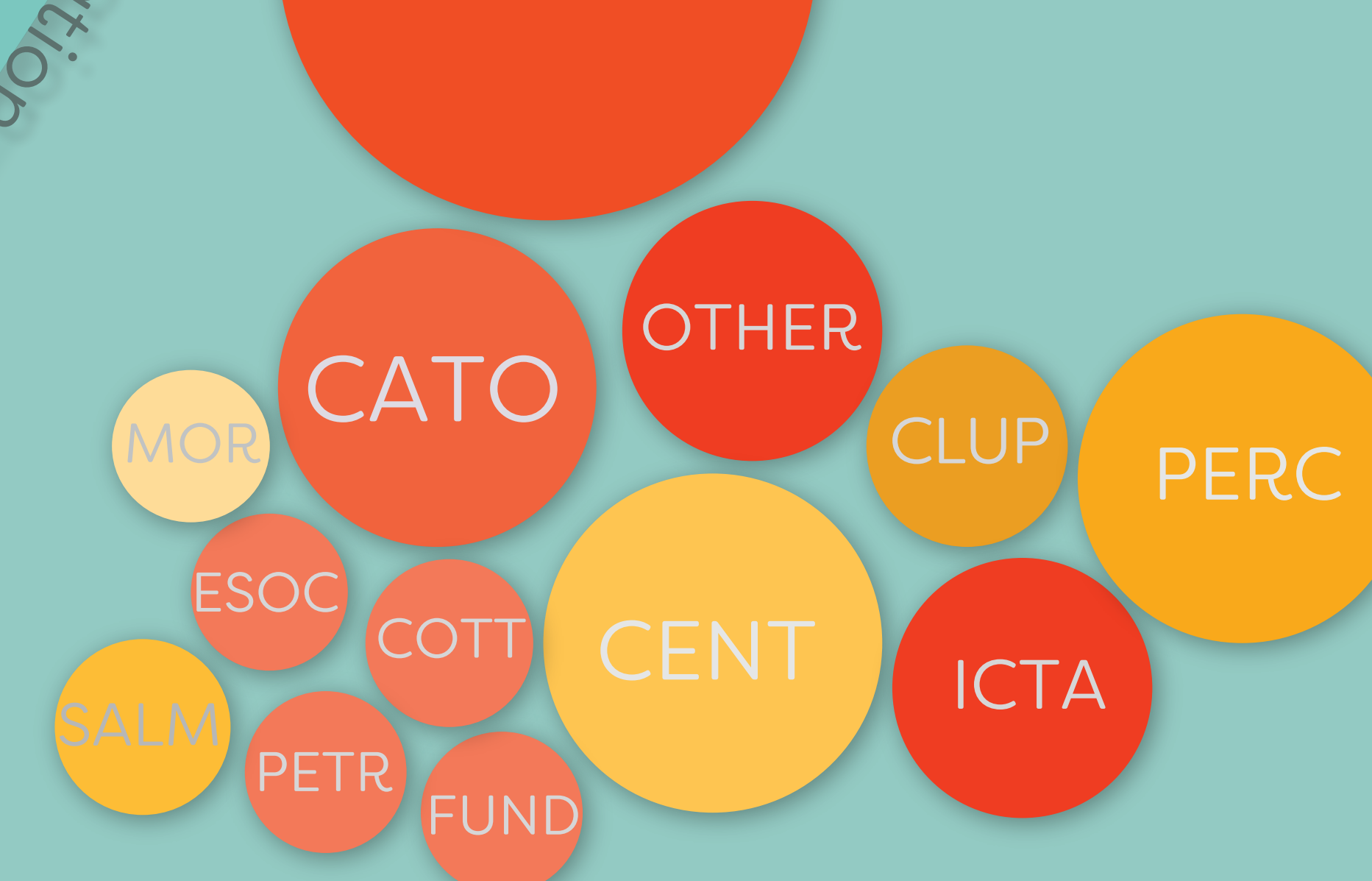
## RESULTS

## landscape variables



**NMDS ordination plots** showed presence-background overlap across all variables, for each class of data. We observed **minimum overlap in the biotic class**.

## CYPR



## family-level species count

FAMILY	SPP.	ABBR.
Cyprinidae	43	CYPR
Centrarchidae	17	CENT
Percidae	16	PERC
Catostomidae	15	CATO
Ictaluridae	10	ICTA
Clupeidae	6	CLUP
Salmonidae	4	SALM
Cottidae	3	COTT
Esocidae	3	ESOC
Fundulidae	3	FUND
Petromyzontidae	3	PETR
Moronidae	2	MOR
Other*	10	OTHER

\*Other = all families represented by one species

Merow, Cory, Matthew J. Smith, and John A. Silander. 2013. "A Practical Guide to MaxEnt for Modeling Species' Distributions: What It Does, and Why Inputs and Settings Matter." Ecography 36(10):1058-69.  
Soberón, Jorge. 2007. "Grinnellian and Eltonian Niches and Geographic Distributions of Species." Ecology Letters 10(12):1115-23.

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