De rol van laterale connectiviteit in uiterwaardherstel voor riviervis

Twan Stoffers – Aquacultuur en Visserij groep – Wageningen University and Research

Vissennetwerk – 20 mei 2022

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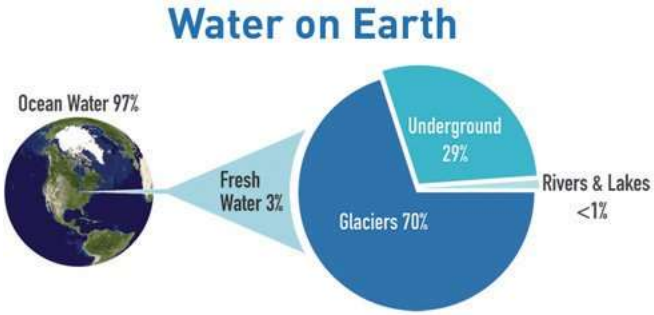
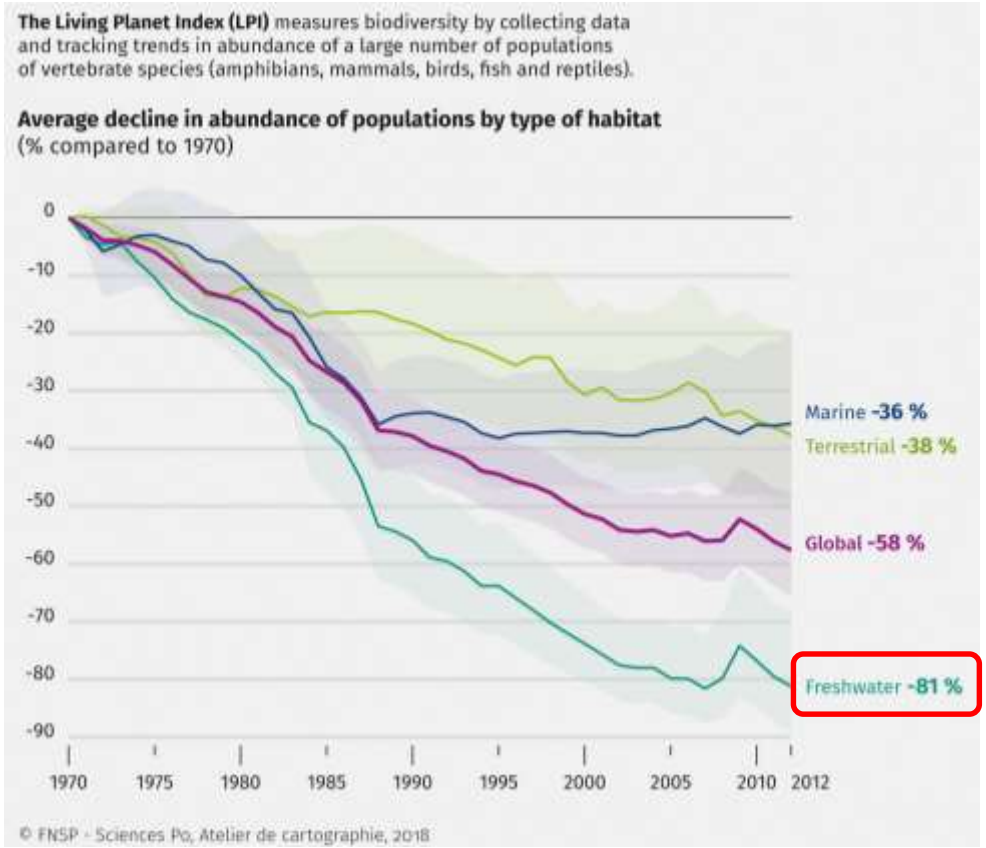
Zoetwater biodiversiteitscrisis



Zoetwater systemen

- <3% van het aardoppervlak
- 10% van alle diersoorten
- 25% van alle gewerfelde dieren
- **>50% van alle vissoorten**



WWF, Living Planet Report 2016, https://wwf.panda.org/lpr

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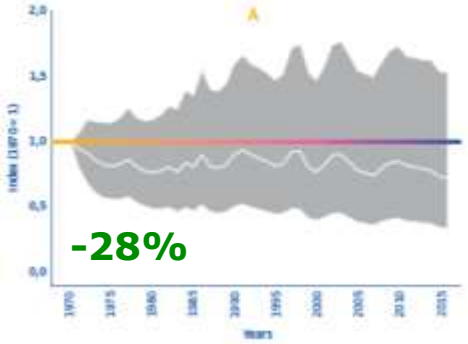
Riviervis in de problemen

Migrerende riviervissen

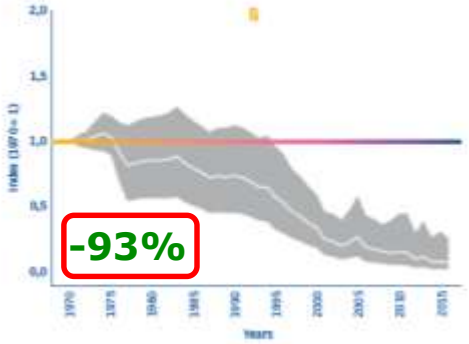
Dichtheden zijn **gemiddeld** met **meer dan 75% gedaald** in de laatste 50 jaar in 1,406 onderzochte populaties van 247 soorten


European sturgeon *(Acipenser sturio)*

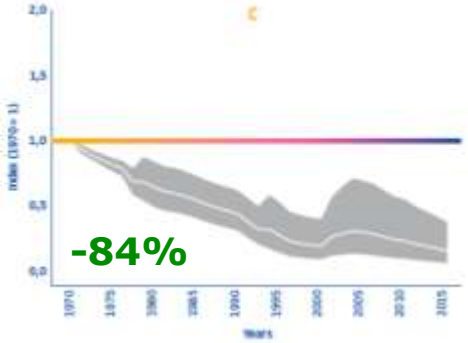
Noord-Amerika



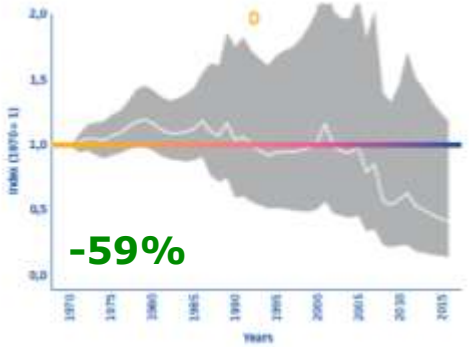
Europa



Latijns Amerika en Caribbean



Azië-Oceanië



Deinet *et al.*, 2020

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Onze rivieren

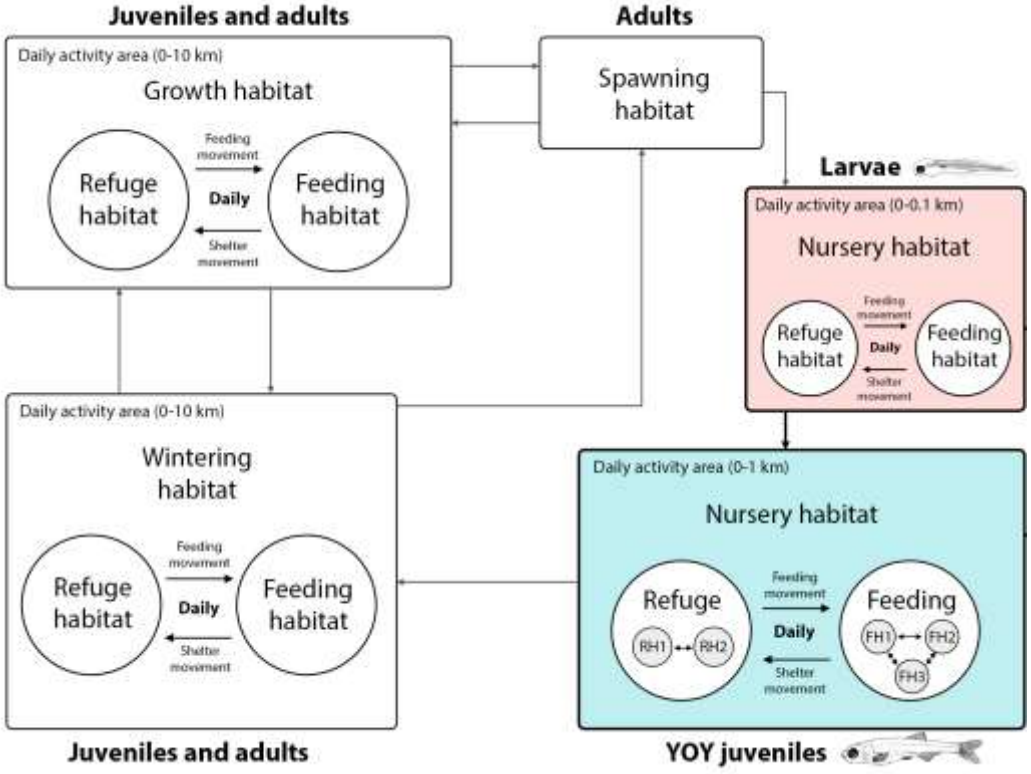
Rivieren zijn de meest gemodificeerde zoetwatersystemen in de wereld

Gemodificeerd voor waterveiligheid, energieproductie, irrigatie, scheepvaart

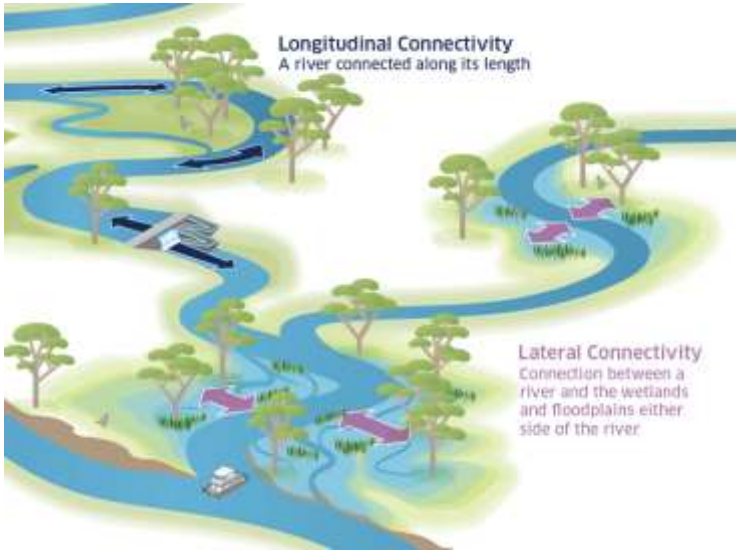
Dit heeft geresulteerd in → verminderde longitudinale en laterale connectiviteit

Waal, Nijmegen, NL (Foto: Johan Roerink)

Waarom is connectiviteit belangrijk?



Stoffers *et al.*, 2022



Bescherming en herstel van kraamkamerhabitat is essentieel voor het herstel van riviervisgemeenschappen!

Rivierherstel in Nederland

Rivier-uiterwaard herstelprojecten → minder herstel van de visgemeenschappen dan verwacht

→ Belangrijk om een beter inzicht te krijgen in de kraamkamereisen van jonge vis

1) Habitat eisen
2) De rol van connectiviteit
3) Ruimtelijke schaal van habitatgebruik
4) Organisatie van essentiële microhabitats

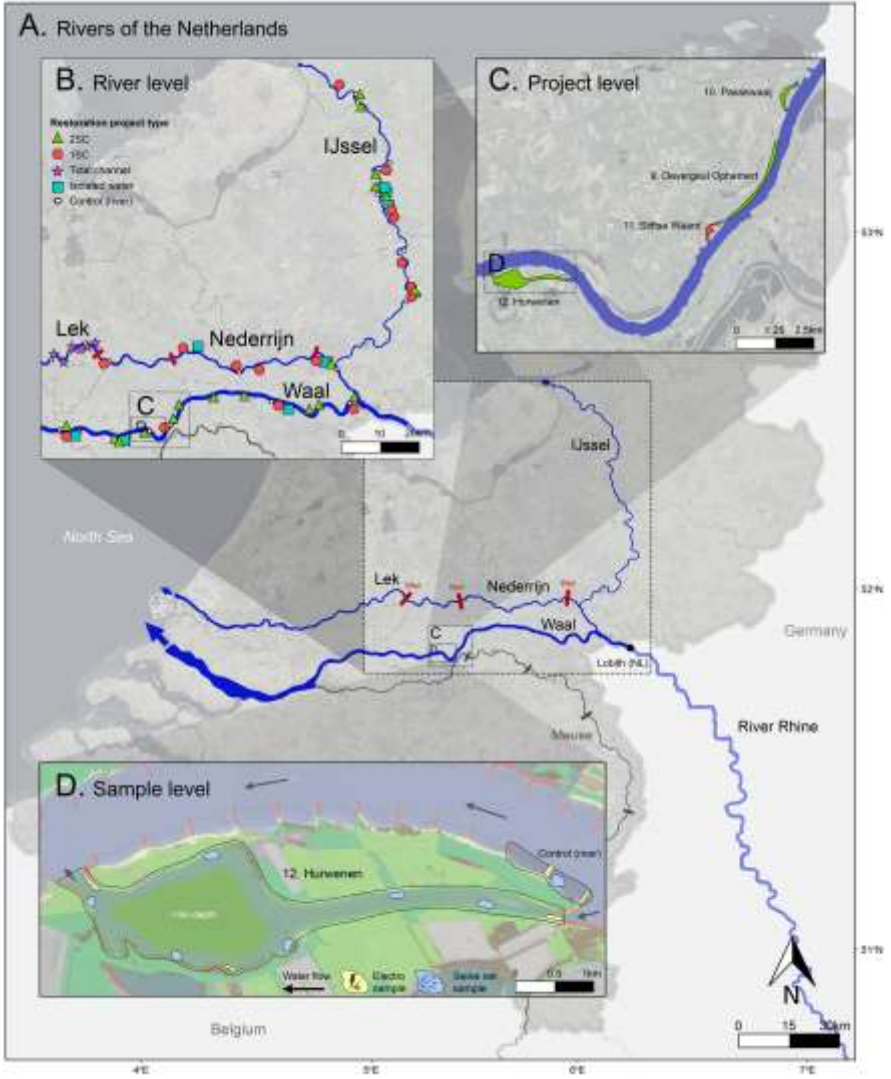
Is anders voor verschillende levensfases en vissoorten!

Onderzoeksopzet

Doel: kennis van het ecologisch functioneren van herstelprojecten als kraamkamer voor vissen

Design: grootschalige evaluatie van 46 rivierherstelprojecten

Focus: 3 relevante ruimtelijke schalen, habitat heterogeniteit, laterale connectiviteit



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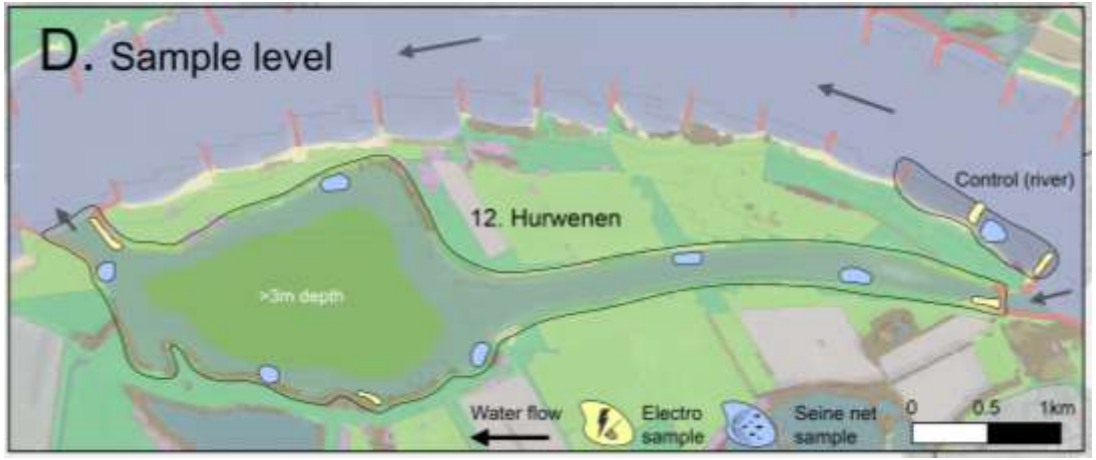
Onderzoeksopzet

- 2 bemonsteringstechnieken
- Juli 2017-2020
- Young-of-the-year visgemeenschap
- Habitat

1253 samples



Onderzoeksopzet

Visgemeenschap responses

- Dichtheid

- Soortenrijkdom

Ecologische gildes


Eurytopics → Generalisten, tolereren een breed scala van habitats


Rheophilics → Specialisten, houden van stromend water

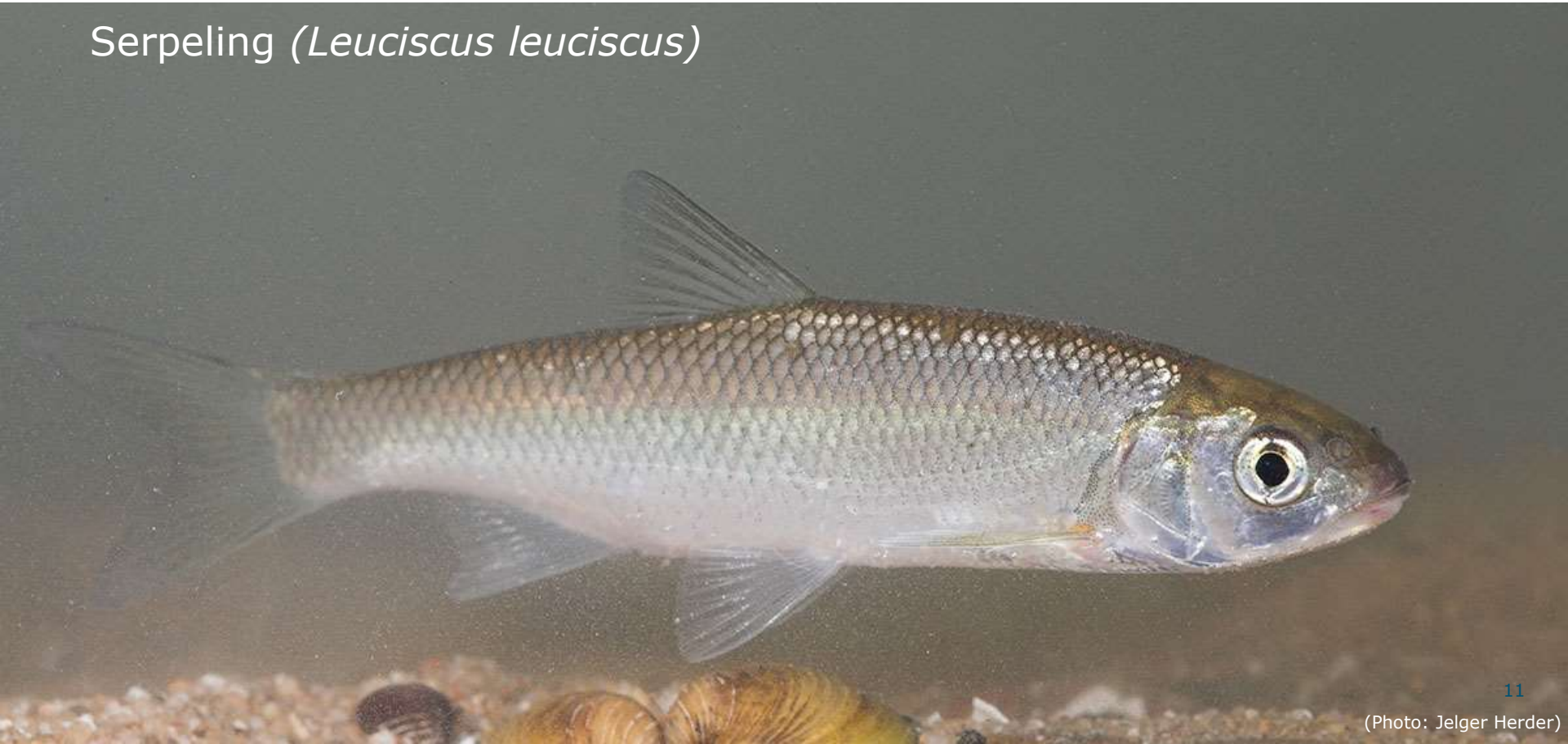

Limnophilics → Specialisten, houden van stilstaand water

Ecologische gilde - Eurytopen

(Photo: Jelger Herder)

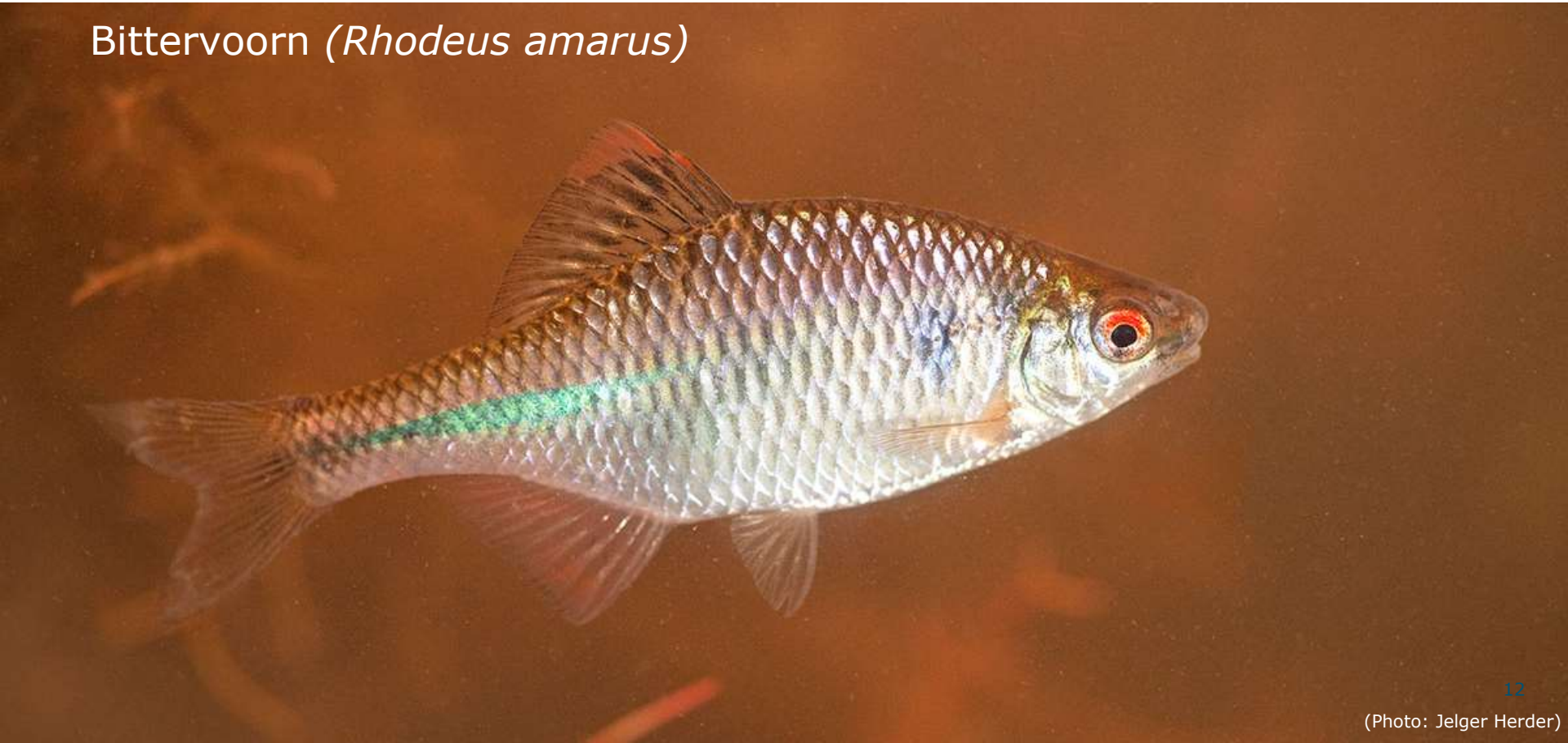
Ecologische gilde - Reofielen

Serpeling *(Leuciscus leuciscus)*



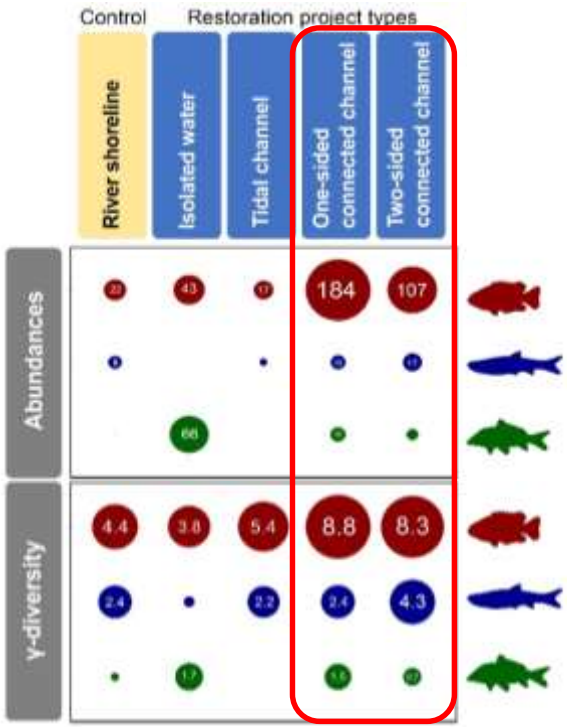
(Photo: Jelger Herder)

Ecologische gilde - Limnofielen

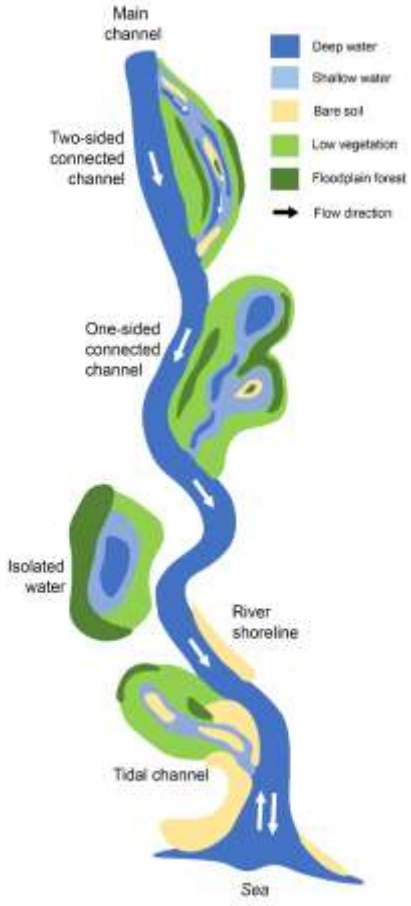


(Photo: Jelger Herder)

Evaluatie van het herstelprojecten



Stoffers *et al.*, under review



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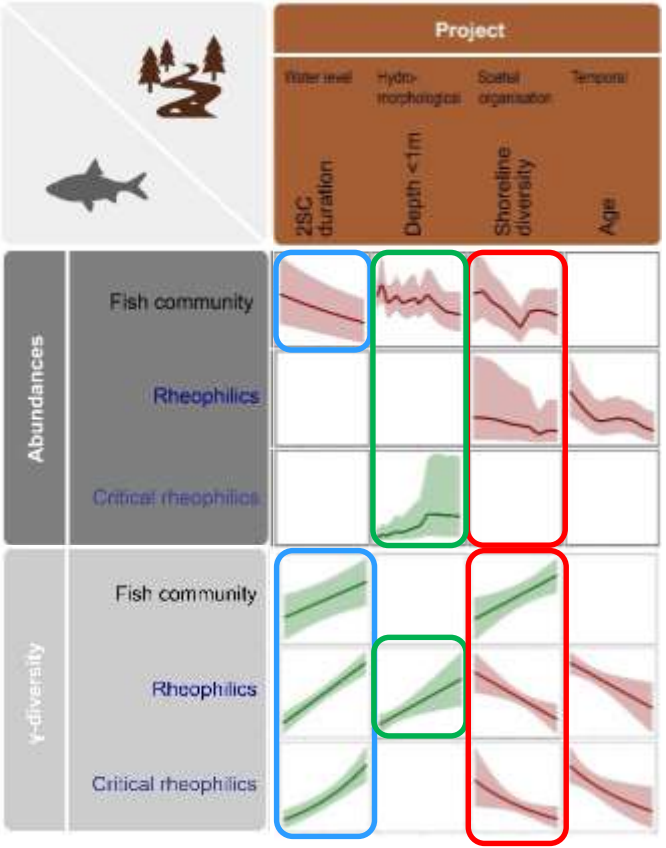
Kraamkamer habitateisen voor vis



Stoffers *et al.*, under review

1) Laterale connectiviteit → sterk positief effect op de soortenrijkdom, niet per sé gunstig voor algehele dichtheden

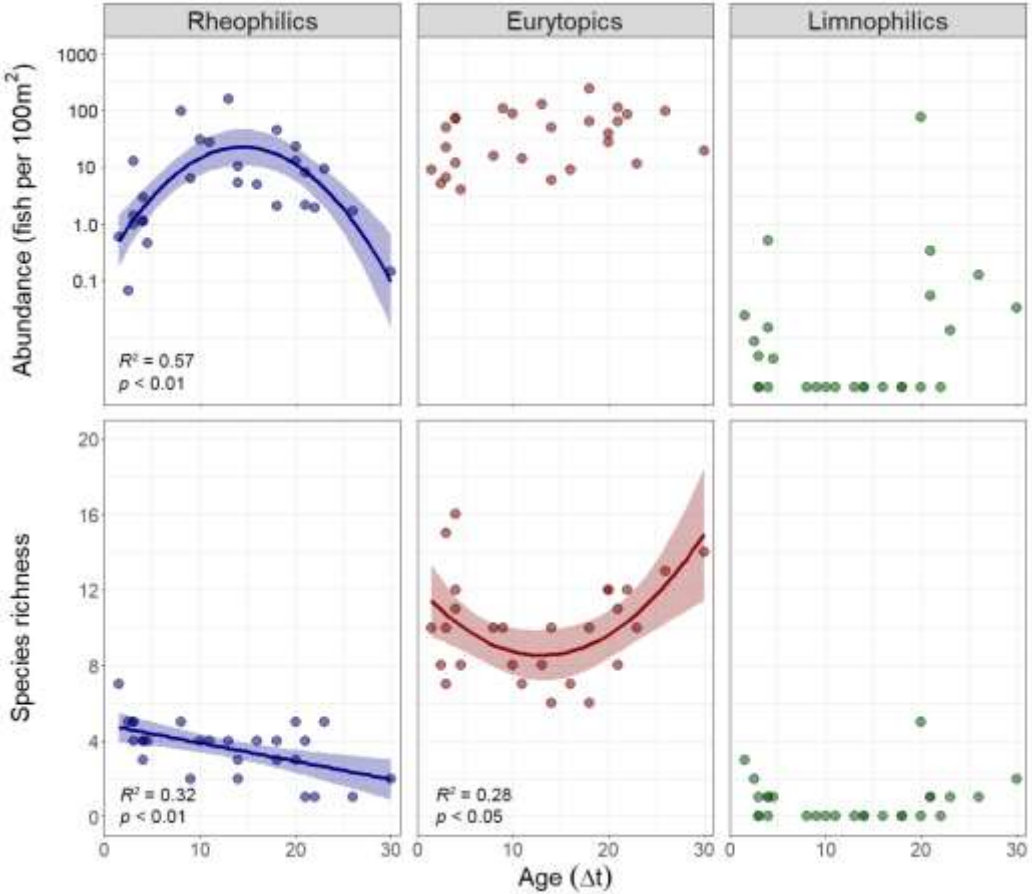
2) Habitat heterogeniteit → positief effect op de algemene soortenrijkdom, negatief verband met dichtheden

3) Waterdiepte → Effecten van habitatvariabelen kunnen verschillen tussen ecologische groepen

Permanente laterale connectie is belangrijk

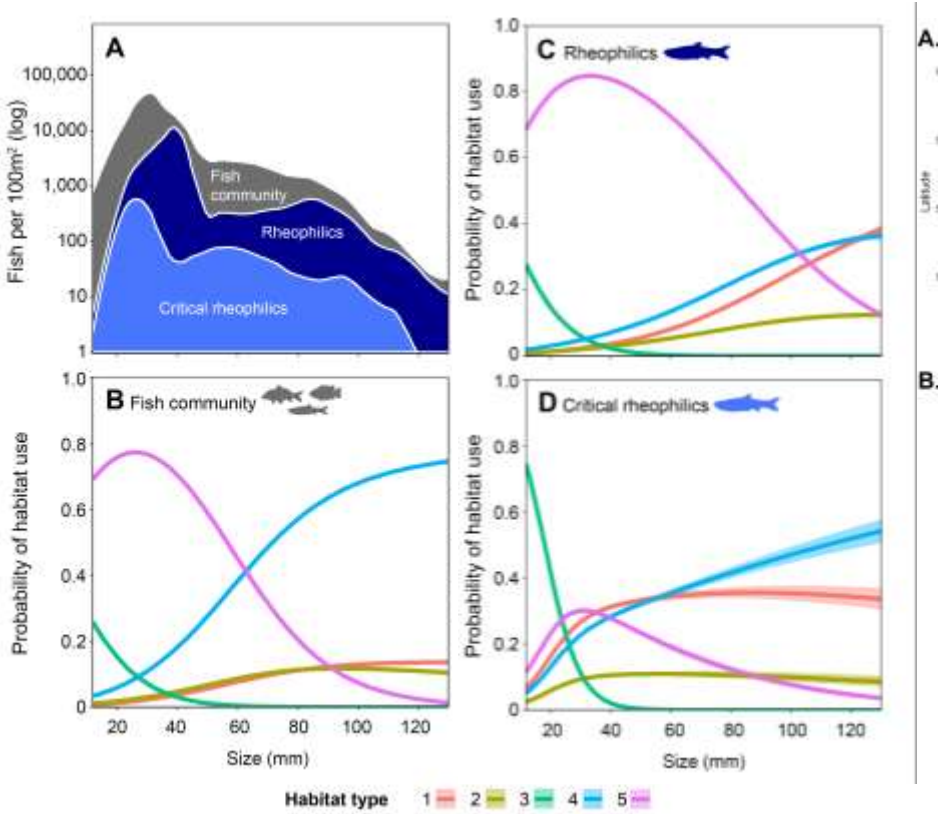
Aantallen

Soortenrijkdom



Stoffers *et al.*, 2021

Habitatgebruik verandert!



Stoffers *et al.*, in prep

Niet één standaard ontwerp voor rivierherstel

1) **Herstel van uiterwaarden werkt**, maar de inspanningen blijven beperkt tot de grenzen van de gewijzigde dynamische krachten van gereguleerde rivieren

2) Binnen een rivier zijn meerdere soorten complementaire herstelprojecten essentieel om de biodiversiteit van zoetwatervissen te herstellen

3) Een essentieel element voor succes is dat deze projecten een permanente laterale verbinding met de rivier moeten **behouden**

→ eind van het groeiseizoen trekken met name de reofielen naar de rivier, kritische soorten al eerder

Meer weten? Zondag as. 9:30uur RTL7 **VisTVXL**

Bedankt voor het luisteren!

Contactgegevens

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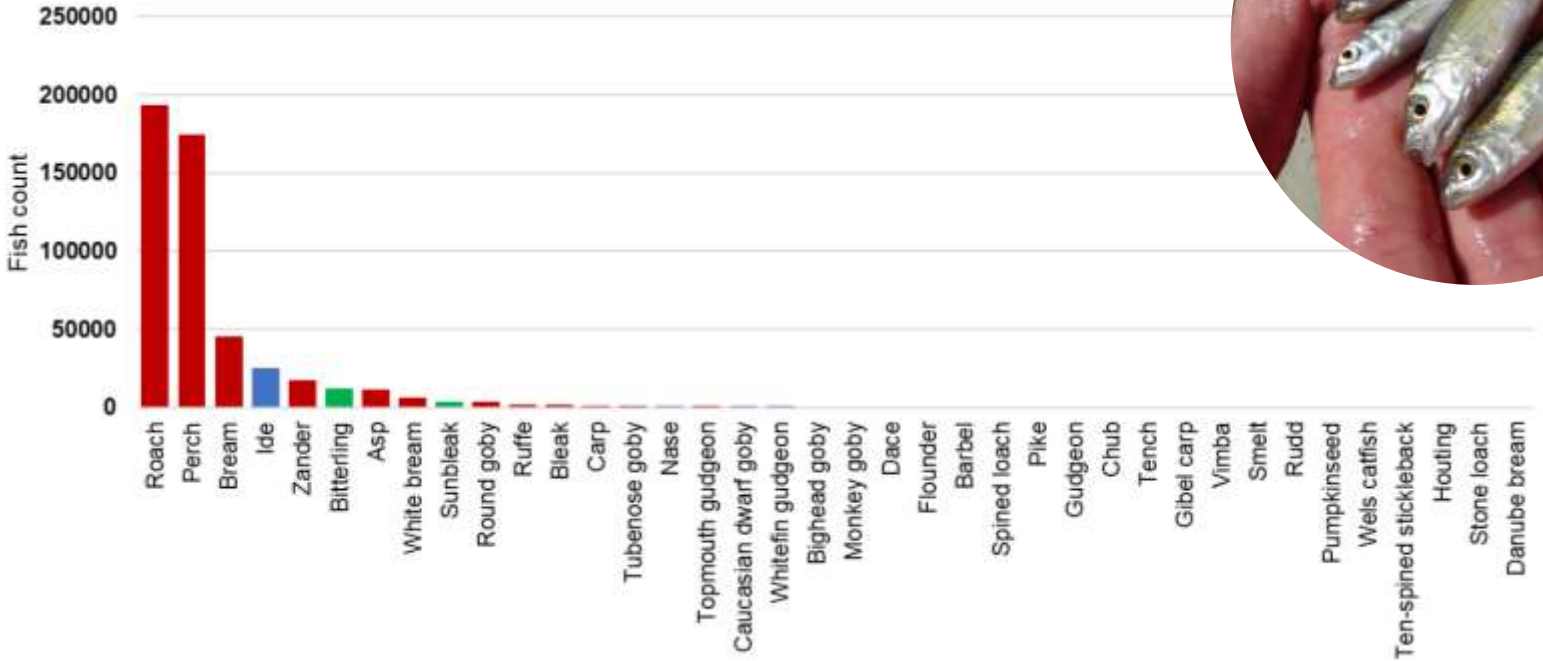
Some numbers

- Sampled over 43 hectares of potential nursery habitat
- Recorded 508,284 YOY fishes
- 37 unique species



Study design

Habitat variables

3 spatial scales

Table 2. General habitat characteristics per spatial scale that were used for floodplain restoration project evaluation.

Scale	Category	Variable name	Abbreviation	Description	Type of variable	Levels	Data source
General	Geographical	River	River	Branch of the river Rhine	Class	4 classes: (1) Waal, (2) IJssel, (3) Nederrijn, (4) Lek	General information
	Temporal	Year	Year	Sampling year	Class	4 classes: (1) 2017, (2) 2018, (3) 2019, (4) 2020	General information
Sample	Water quality	Conductivity	Cond	Electrical conductance of the water at sampling site	Numeric	Range: 241-1343 mS·cm-1	Field measurements
		Turbidity	Turbidity	Water turbidity at sampling site	Numeric	Range: 1-392 Nephelometric Turbidity Units (NTU)	Field measurements
		Chlorophyll	Chlorophyll	Chlorophyll concentration of the water at sampling site	Numeric	Range: 0.3-150.0 µg·L-1	Field measurements
		O2	O2	Dissolved oxygen concentration of the water at sampling site	Numeric	Range: 4.69-21.34 mg·L-1	Field measurements
		Shade	Shade	Percentage of sampling area that is covered in shade from woody shoreline vegetation	Ordinal	5 classes: (1) 0-20%, (2) 21-40%, (3) 41-60%, (4) 61-80%, (5) 81-100%	Field observation
	Hydro-morphological	Depth	Depth	Maximum depth at sampling site	Numeric	Range: 0.1-4.3 m	Field measurements
		Substratum	Substr	Dominant substratum type at sampling site based on particle size	Ordinal	5 classes: (1) clay/silt (<0.06mm), (2) fine sand (0.06-0.85mm), (3) coarse sand (0.85-2mm), (4) gravel (2-65mm), (5) cobbles/boulders (>65mm)	Field observation
		Organic matter	OrgMatter	Percentage of bottom covered by a layer of organic matter (leaves, branches, etc.) at sampling site	Ordinal	5 classes: (1) 0-20%, (2) 21-40%, (3) 41-60%, (4) 61-80%, (5) 81-100%	Field observation
		Macrophytes	Macrophytes	Presence of macrophytes and/or submerged shoreline vegetation at sampling site	Ordinal	5 classes: (1) 0-20%, (2) 21-40%, (3) 41-60%, (4) 61-80%, (5) 81-100%	Field observation
	Spatial organisation	Shoreline diversity 50m	ShoreDiv50	Number of shoreline habitat types within a radius of 50m from sampling site	Numeric	Range: 0-8 habitat types	GIS analysis*
		Shannon index 50m	Shannon50	Shannon-Wiener diversity index of shoreline habitat within a radius of 50m from sampling site	Numeric	Range: 0.00-0.36	GIS analysis*
Project	Hydro-geographical	2SC duration	2SCduration	Percentage of time that restoration project was two-sided connected with main channel, within a period of 6 months prior to sampling	Numeric	Range: 0-100%	River water level data**
		Submerged woody vegetation	SubWVegDur	Percentage of time that woody shoreline vegetation (>2m) of restoration project was submerged, within a period of 6 months prior to sampling	Numeric	Range: 0-41%	River water level data**
	Hydro-morphological	Depth <1m	Depth1m	Percentage of shallow water habitat in restoration project with <1m depth at median river discharge	Numeric	Range: 1-100%	GIS analysis*
	Spatial organisation	Shoreline diversity	ShoreDiv	Total number of shoreline habitat types in restoration project	Numeric	Range: 3-12 habitat types	GIS analysis*
		Shannon diversity	Shannon	Shannon-Wiener diversity index of shoreline habitat in restoration project	Numeric	Range: 0.09-0.29	GIS analysis*
	Temporal	Age	Age	Age of restoration project	Numeric	Range: 0-30 years	General information
River	Geographical	River shorelength	Shorelength	Total available shoreline habitat at restoration project side of the main channel within a 5km radius from restoration project center	Numeric	Range: 19.2-51.1 km	GIS analysis*

* GIS analysis with river, restoration project, and shoreline habitat (ecotope) and bathymetry maps at Rijkswaterstaat (41). See Geerling, *et al.* (42) for Shannon diversity calculations
** Daily river water levels of the lower river Rhine, calibrated with satellite images for connectivity check of each restoration project)

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Study design

Habitat variables

Habitat heterogeneity

				vegetation at sampling site		41-60%, (4) 61-80%, (5) 81-100%	
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