



Leibniz-Institute of
Freshwater Ecology and Inland Fisheries

European Catchments under Pressure

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Slovenia, 16 January 2008



Outline

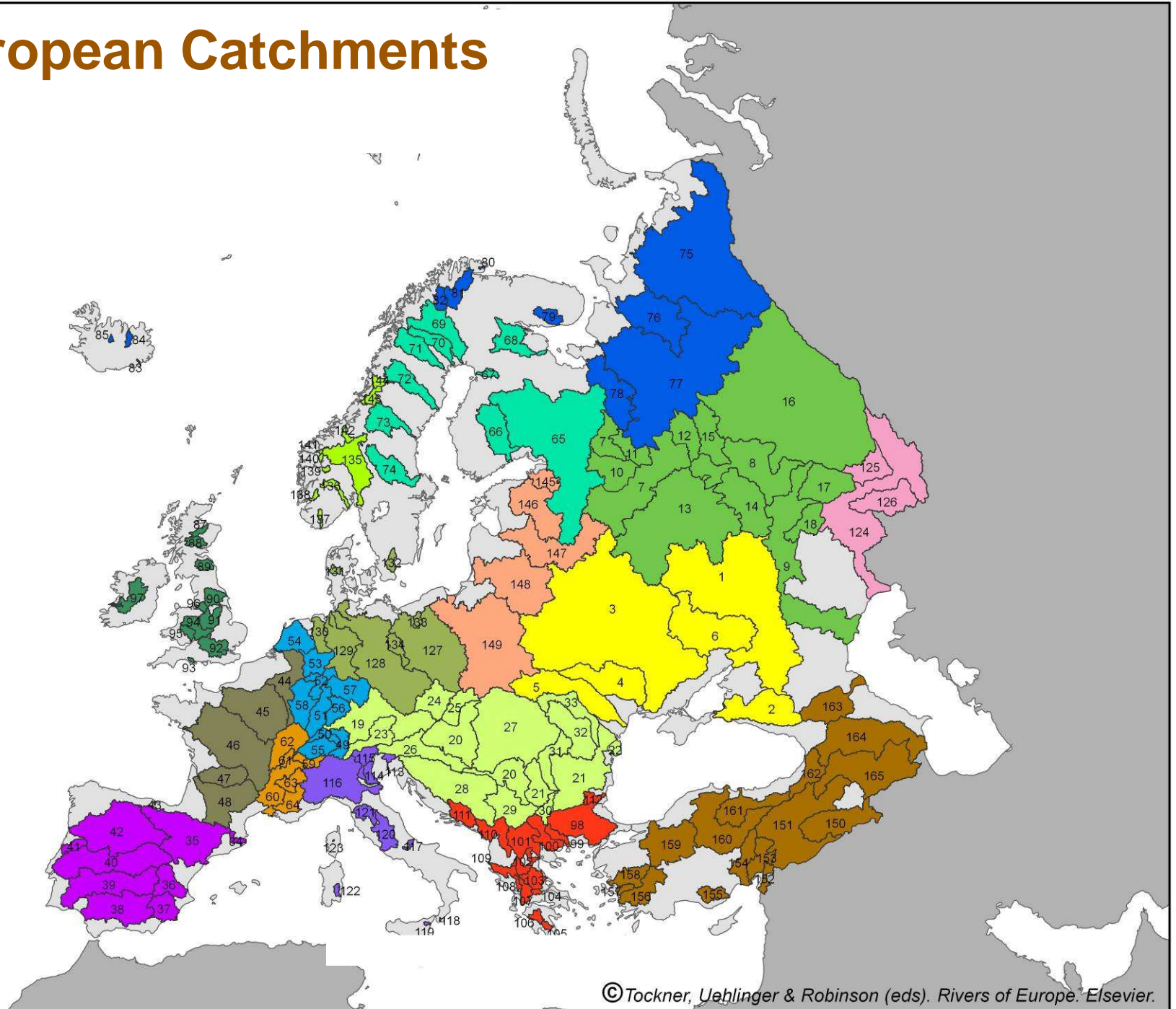
Multiple environmental stressors in European catchments

European catchment freshwater biodiversity

Conservation priority areas and future pressures

Conclusion

European Catchments



**Tockner K., Uehlinger U.
& Robinson C.T. (eds) 2008.
Rivers of Europe. Elsevier.**

J. Brittain

B. Malmqvist

J.H L'Abée-Lund

N.M. Mineeva

C. Soulsby

H. Timm

M. Yarushina

M. Pusch

J.P. Descy

A. Sukhodolov

U. Uehlinger

J.M. Olivier

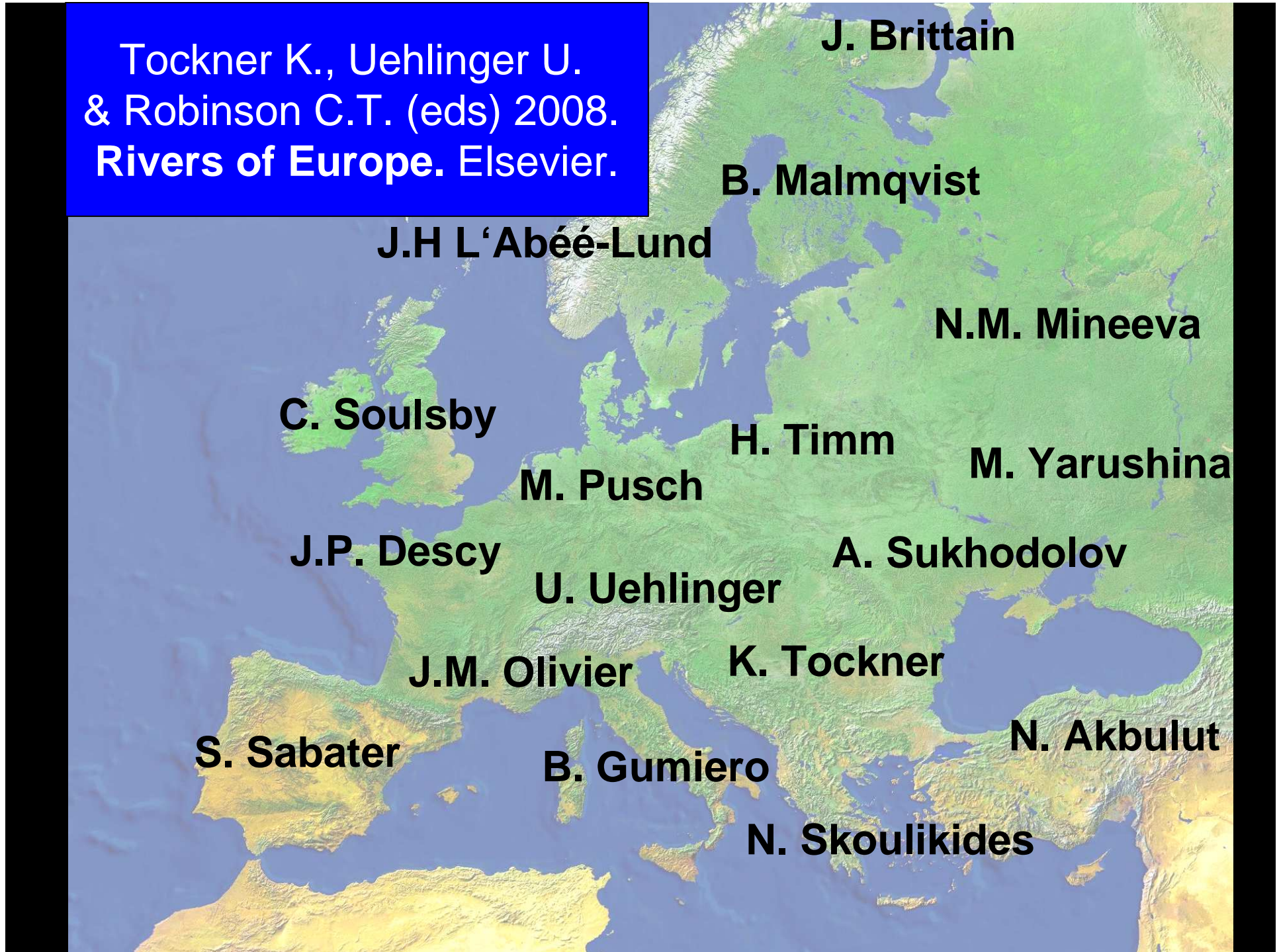
K. Tockner

S. Sabater

B. Gumiero

N. Akbulut

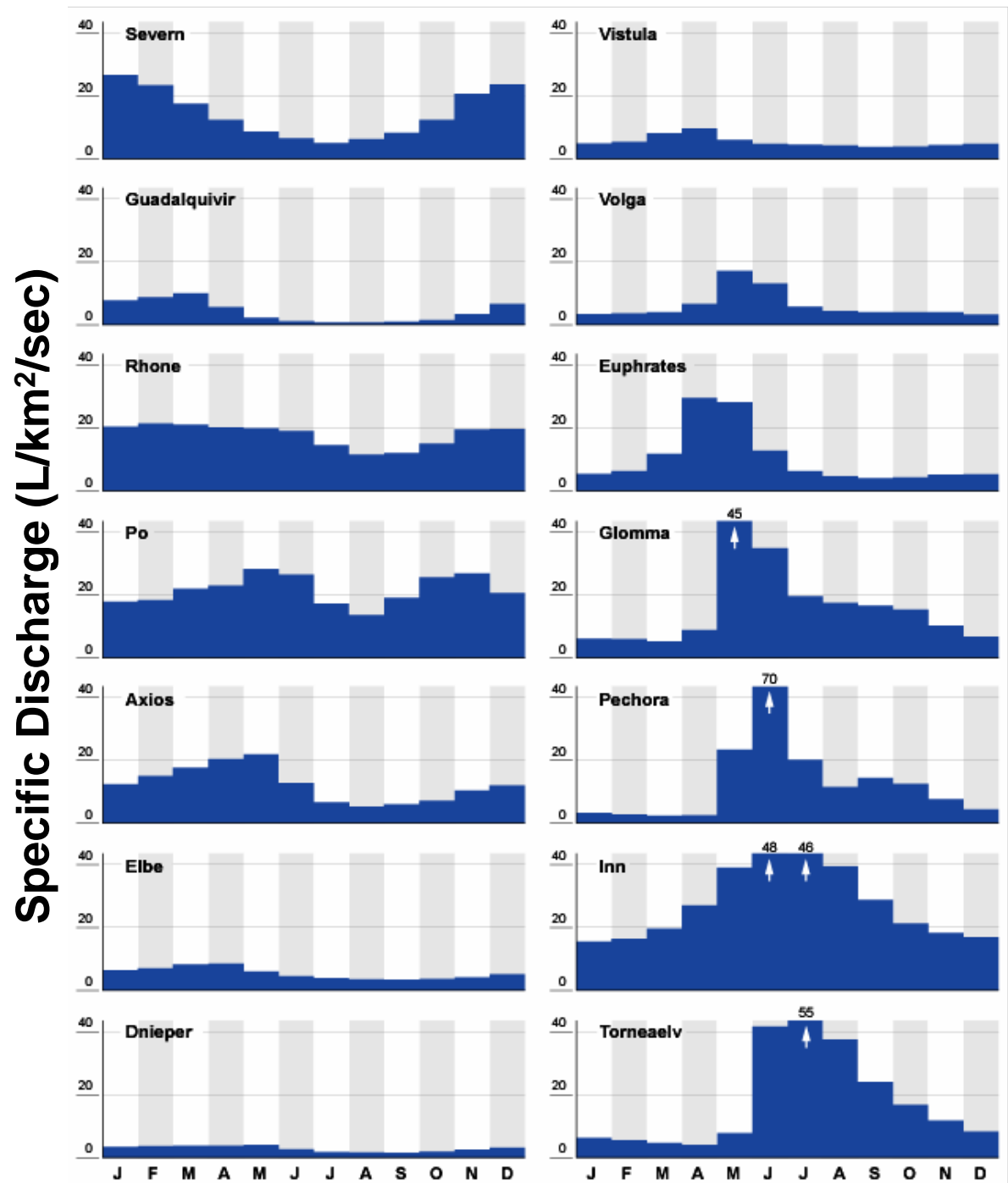
N. Skoulikides



Largest European Catchments

	Area (km ²)	Discharge (km ³ /y)	Relief (m)	Population (People/km ²)	Cropland and Urban (%)	GDP (\$/y)
Volga	1'431'296	261.8	1'536	45	58.5	2'340
Danube	801'093	202.4	3'651	102	65.3	7'007
Dnieper	512'293	42.6	411	64	94.1	1'388
Don	427'495	25.5	804	46	90.6	1'508
N Dvina	354'298	107.5	422	5	10.2	2'873
Pechora	334'367	150.9	1'604	2	0.2	2'928
Neva	281'877	79.1	390	17	25.9	6'181
Ural	252'848	10.6	1'094	15	61.6	2'205
Kura	193'802	17.1	4'816	74	58.6	1'267
Vistula	192'980	32.9	2'316	127	90.8	3'789
Rhine	185'263	73.0	3'786	313	76.4	31'822
Elbe	148'242	22.4	1'456	164	83.6	14'068

Specific discharge of selected European rivers



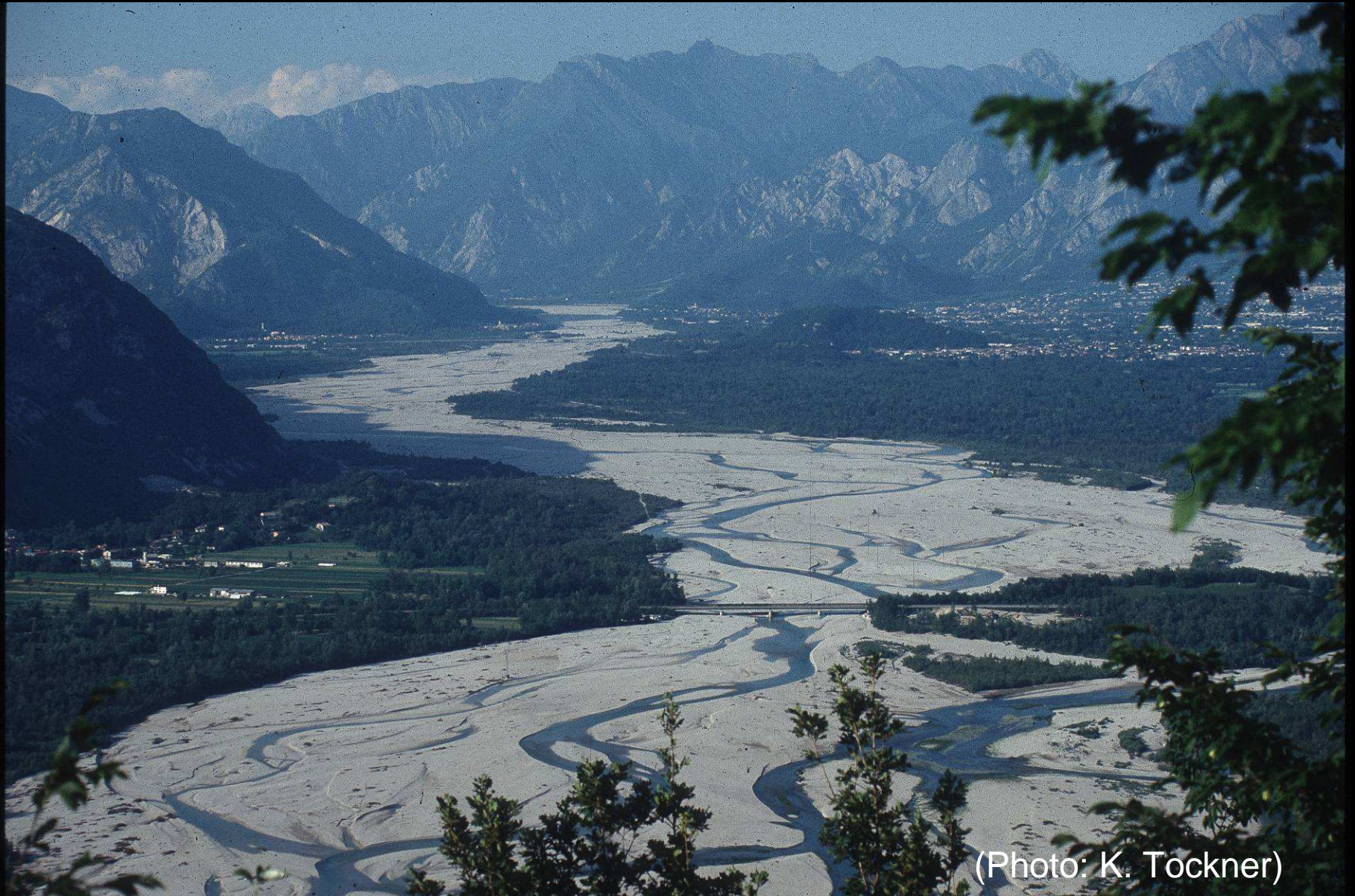
(Tockner *et al.* 2008)

Alta River (Arctic Region)



(Photo: J. Brittain)

Tagliamento River (NE Italy)



(Photo: K. Tockner)

Don River (Steppic Region)



(Photo: A. Soukodolov)

Tigris River (SE Anatolia)



(Photo: N. Akbulut)

Asi River (SE Anatolia)



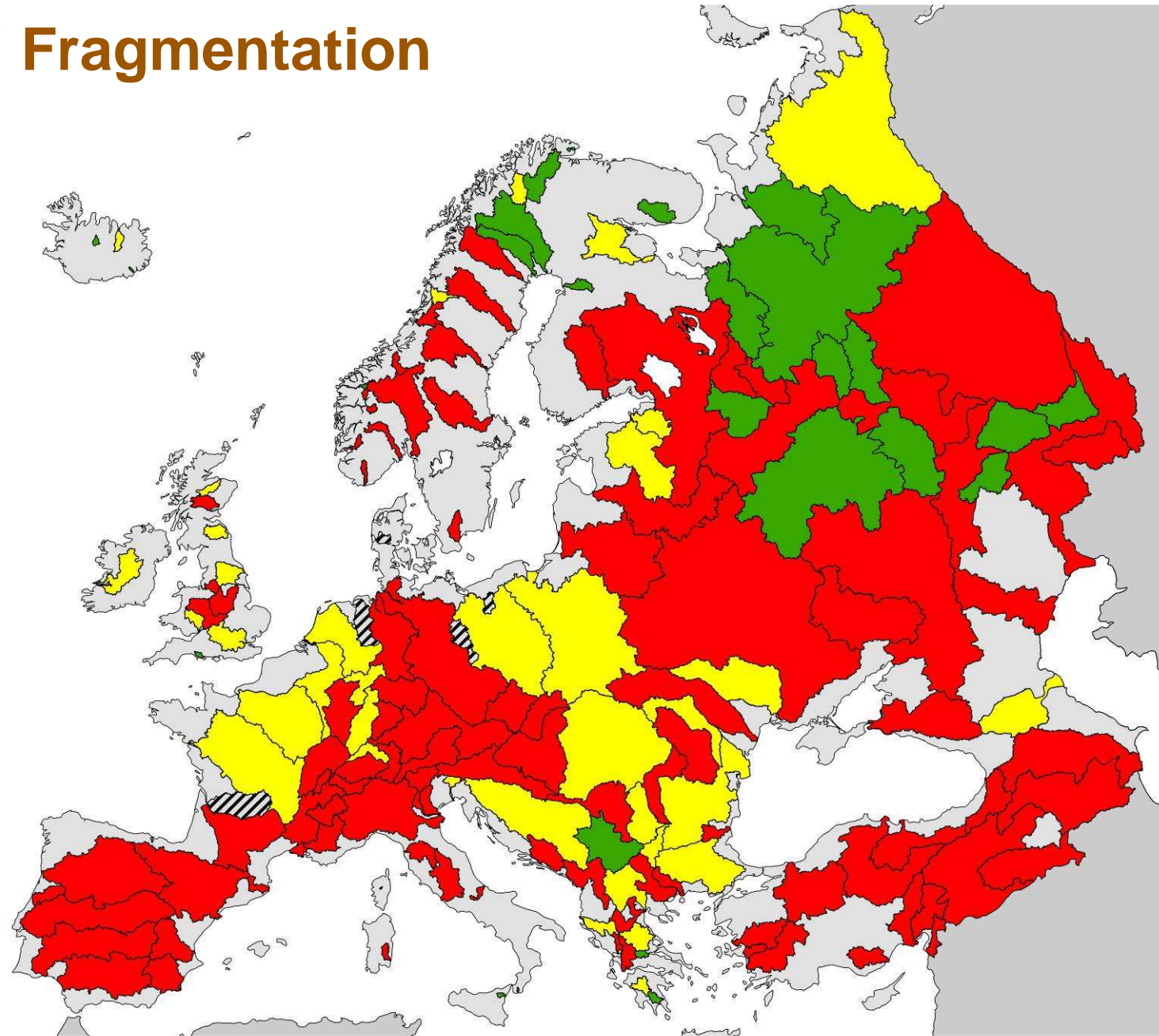
(Photo: Ali Demirsoy)



Human Catchment Pressure Index

- **Catchment Land Use:** Proportion (%) of developed land (cropland & urban area) in the catchment
- **Fragmentation:** Dams and flow regulation (after Nilsson *et al.* 2005)
- **Water Stress:** (Availability/withdrawal of water; 1995 and forecast 2070; HDMC3, after Henrichs & Alcamo 2001)
- **Biotic Pollution:** Proportion (%) of nonnative fish species

Fragmentation



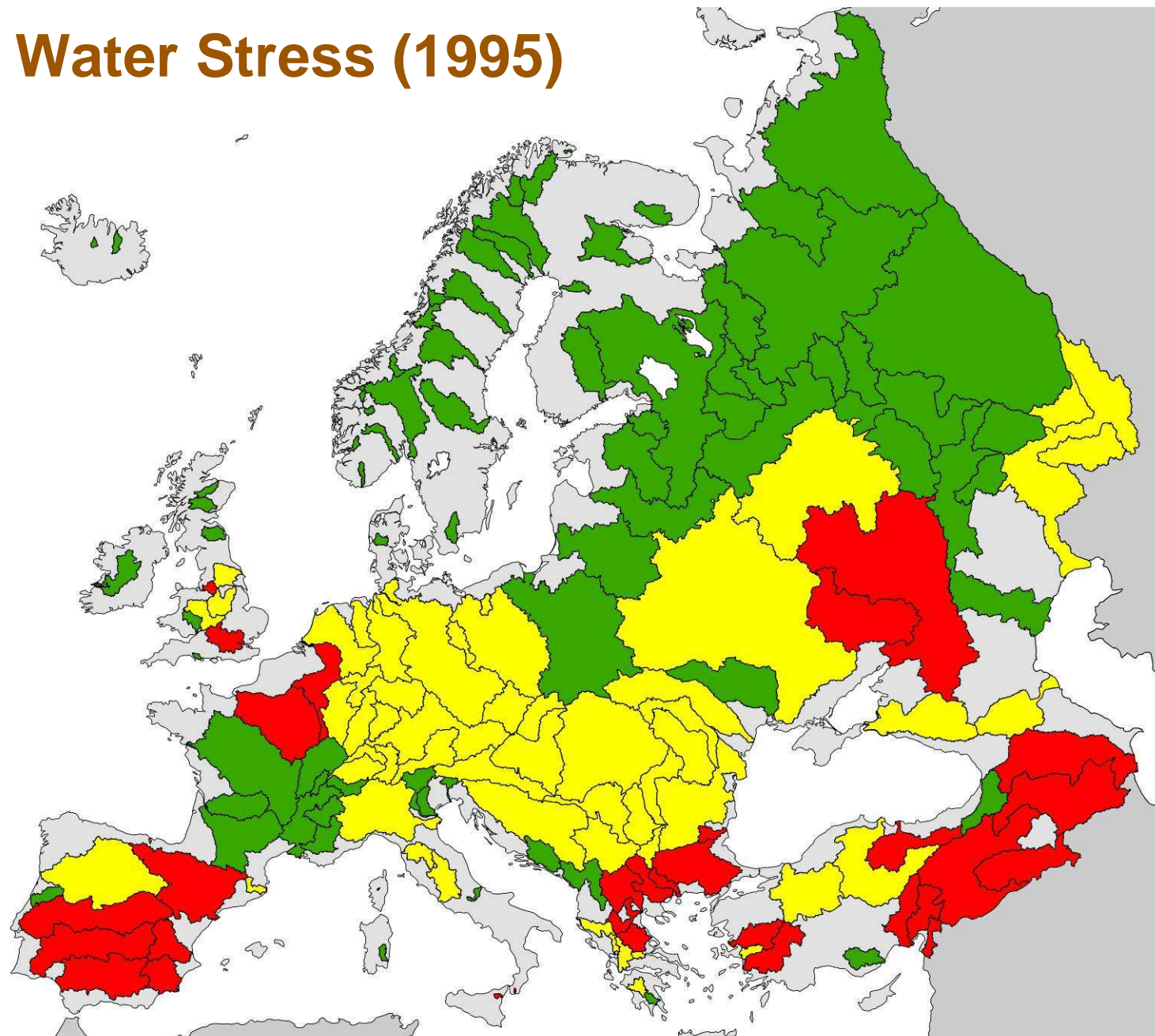
no data

Low

Medium

High

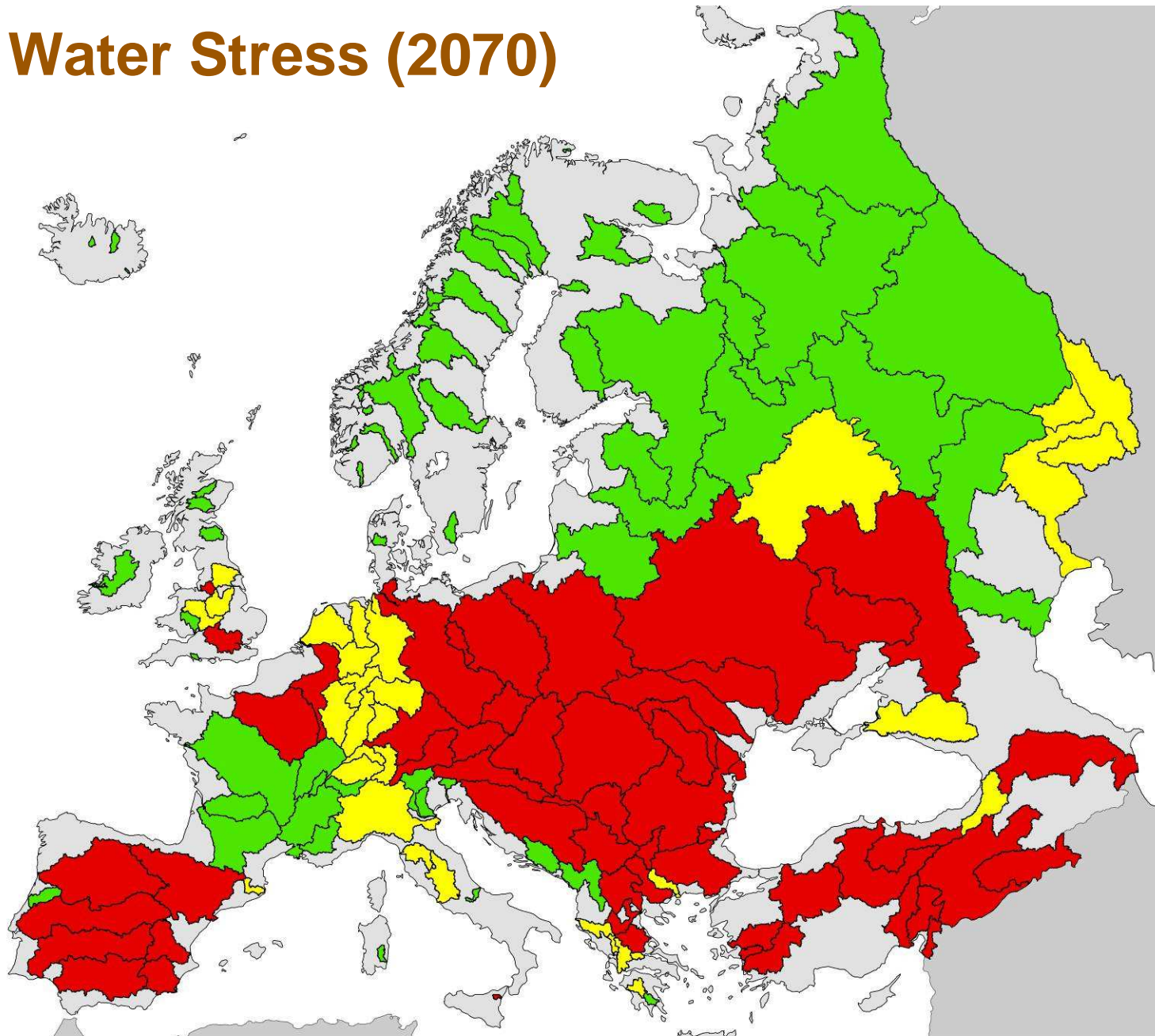
Water Stress (1995)



Low **Medium** **High**

(Data: Henrichs & Alcamo;
General Circulation Model HadCM3)

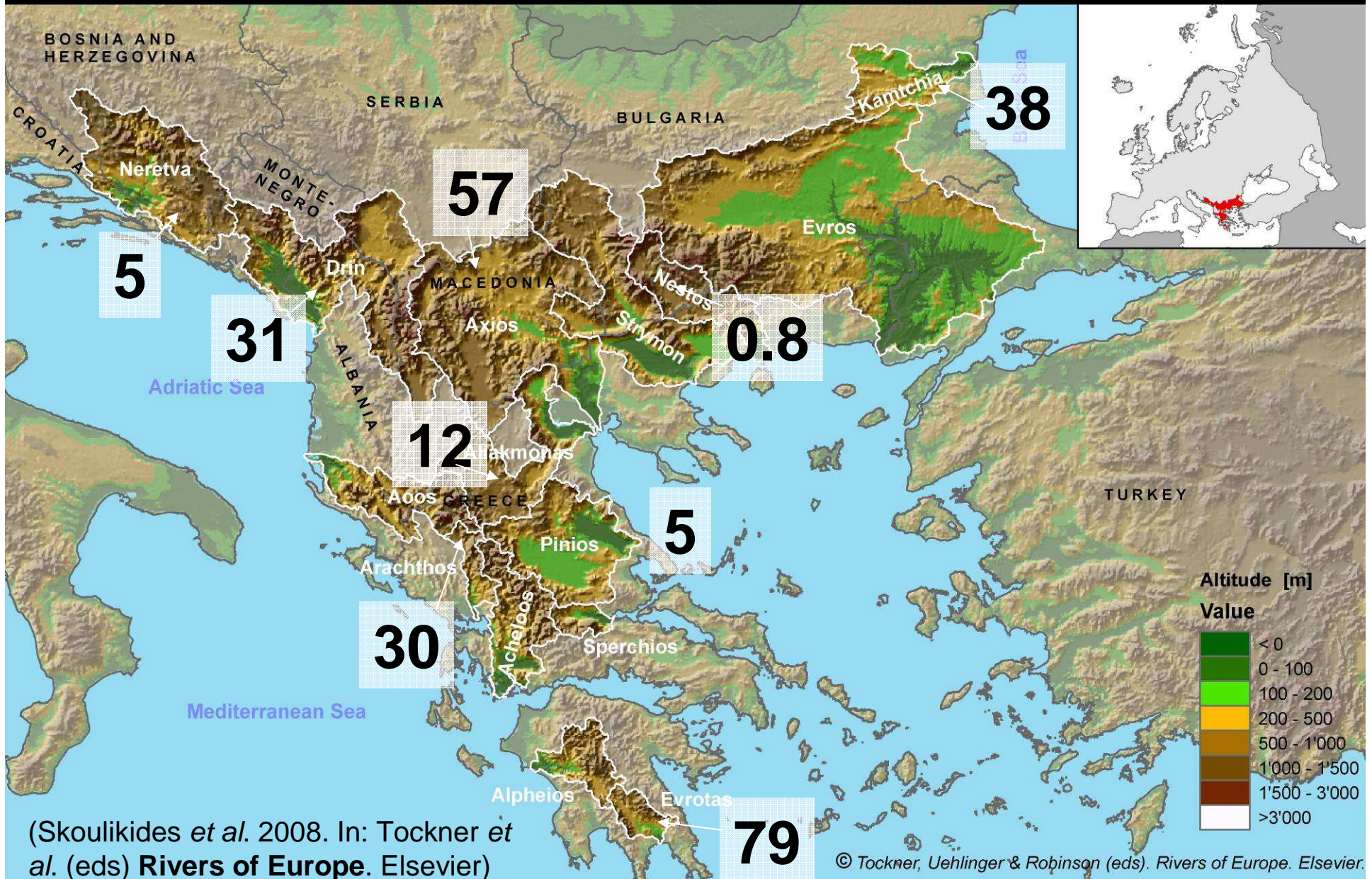
Water Stress (2070)



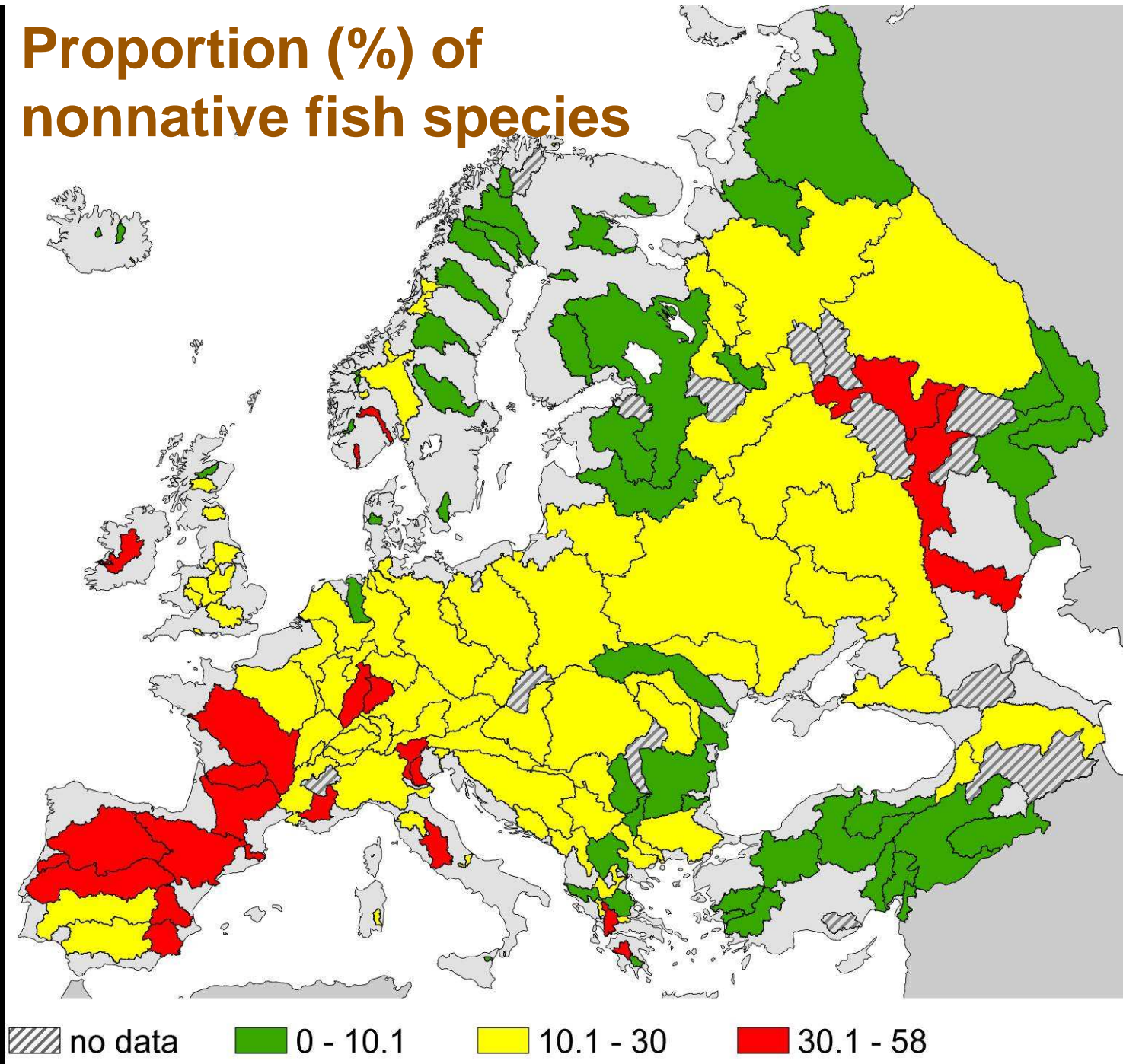
Low **Medium** **High**

(Data: Henrichs & Alcamo;
General Circulation Model HadCM3)

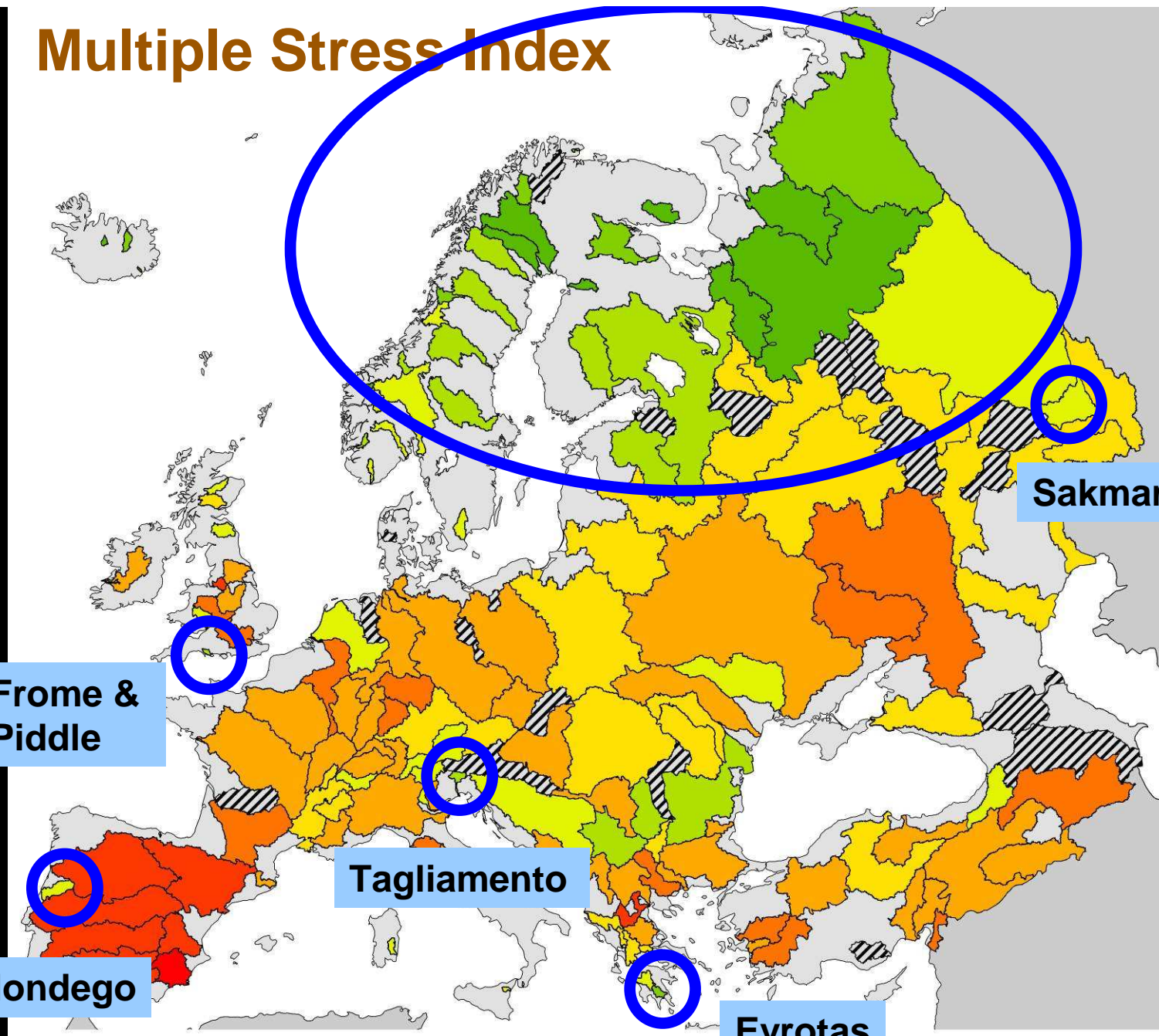
Balkan Rivers: Decrease (%) of total annual discharge since 1970



Proportion (%) of nonnative fish species



Multiple Stress Index



Sakmara

Frome & Piddle

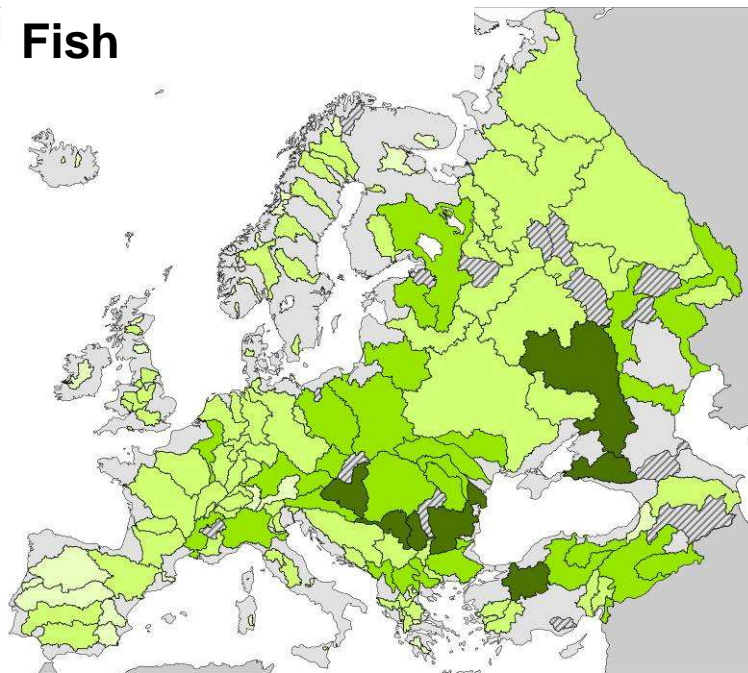
Tagliamento

Mondego

Evrotas

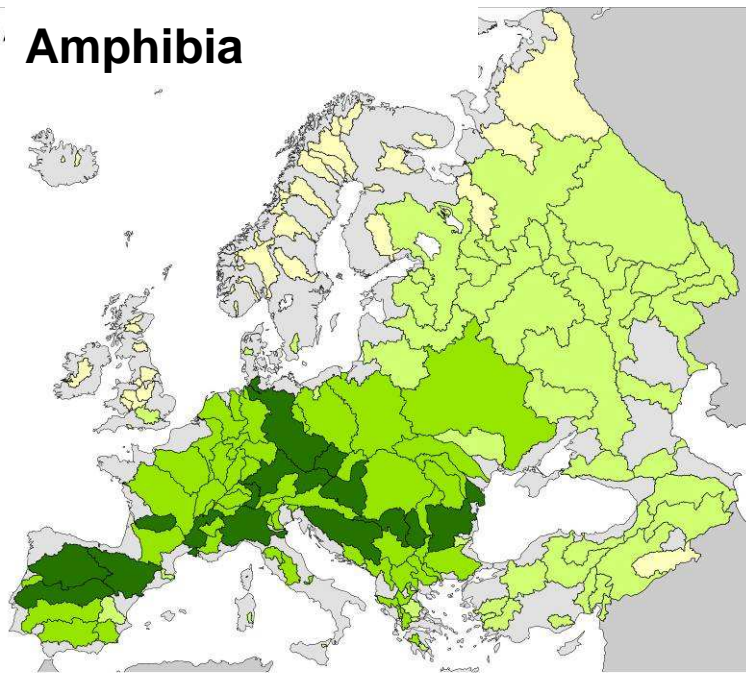


Fish



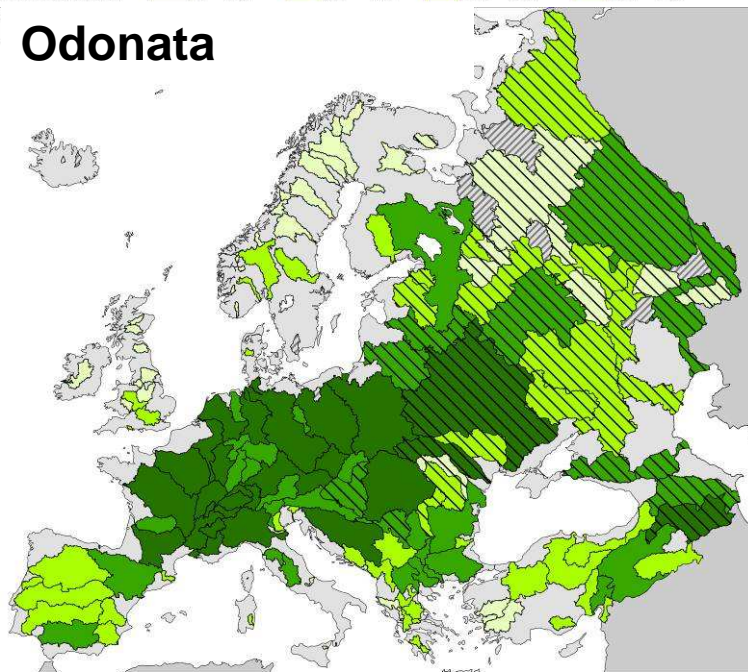
no data 1 - 20 21 - 40 41 - 60 61 - 70

Amphibia



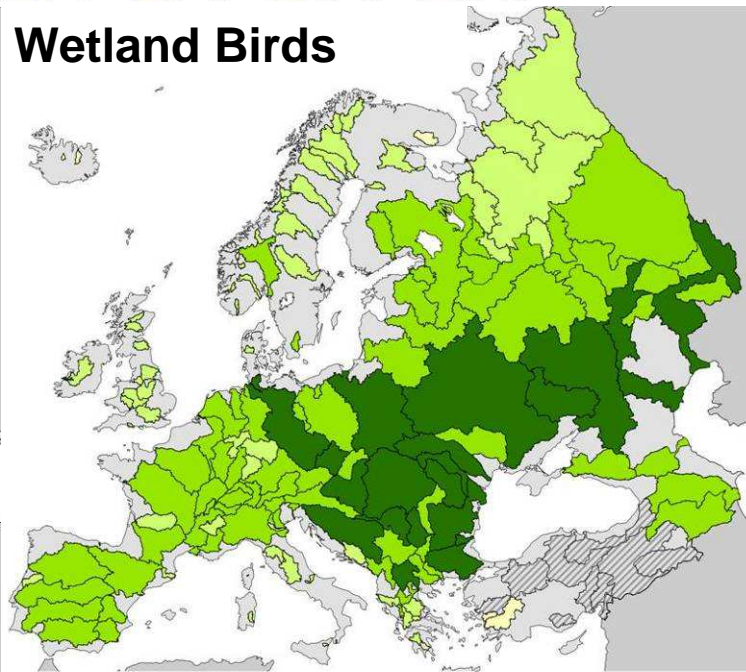
1 - 5 6 - 12 13 - 18 19 - 25

Odonata



no data 0 - 25 26 - 50 51 - 65 66 - 79 scarce data

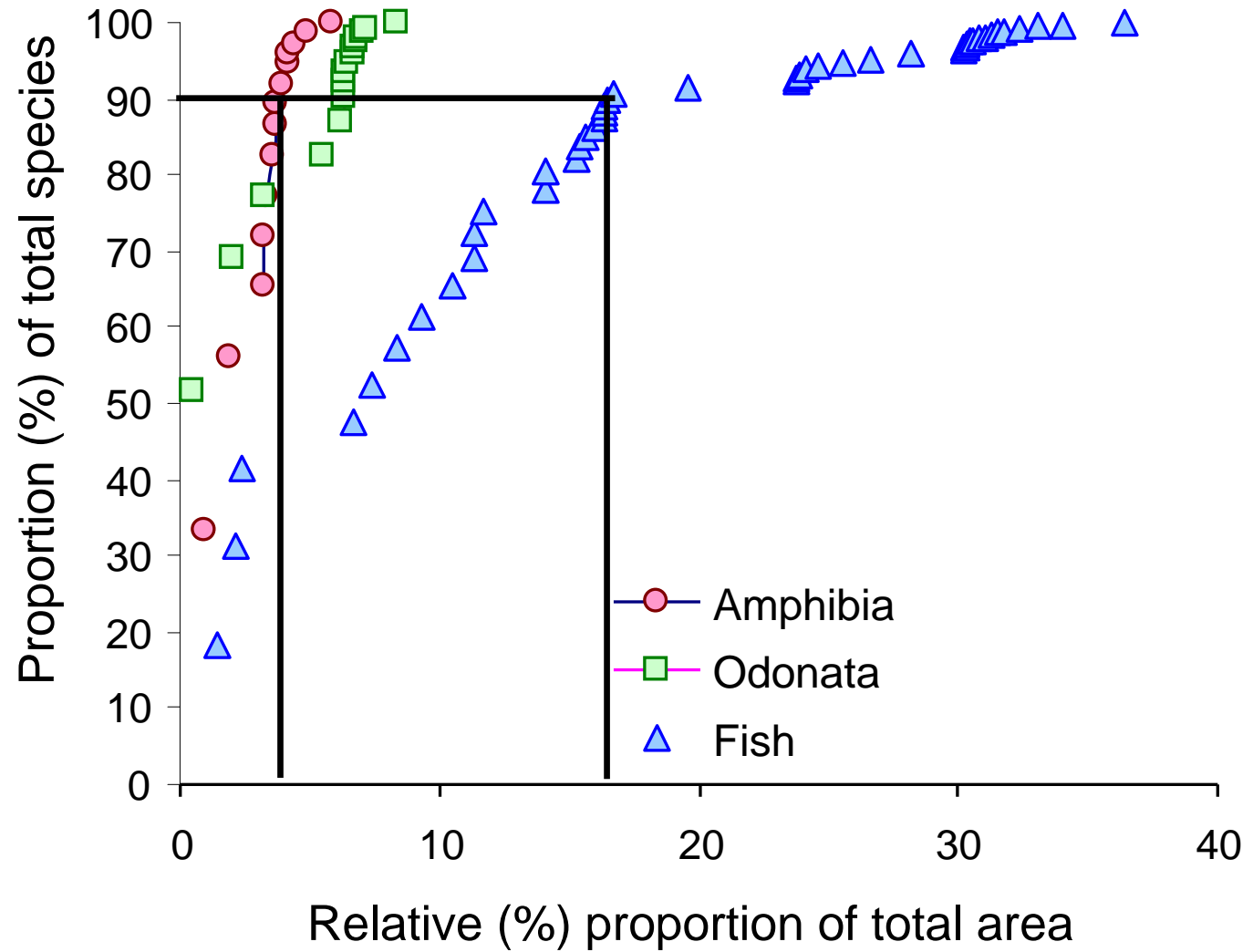
Wetland Birds



no data 1 - 20 21 - 45 46 - 65 66 - 80

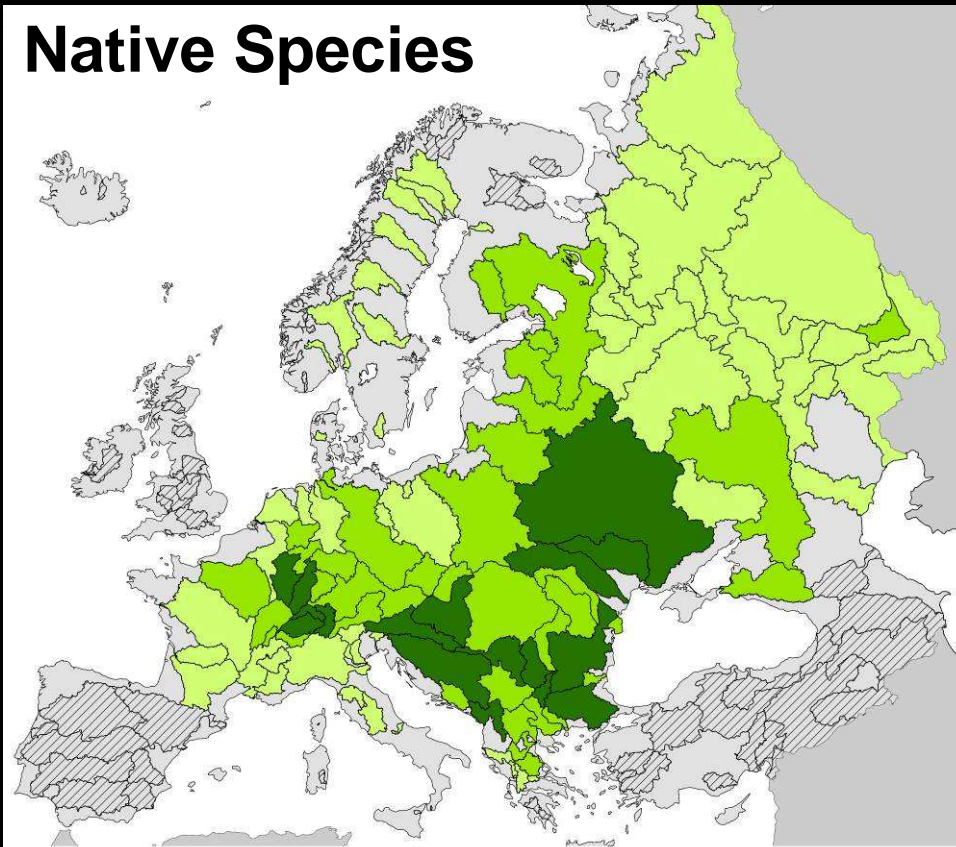


Cumulative area and species (total Europe)

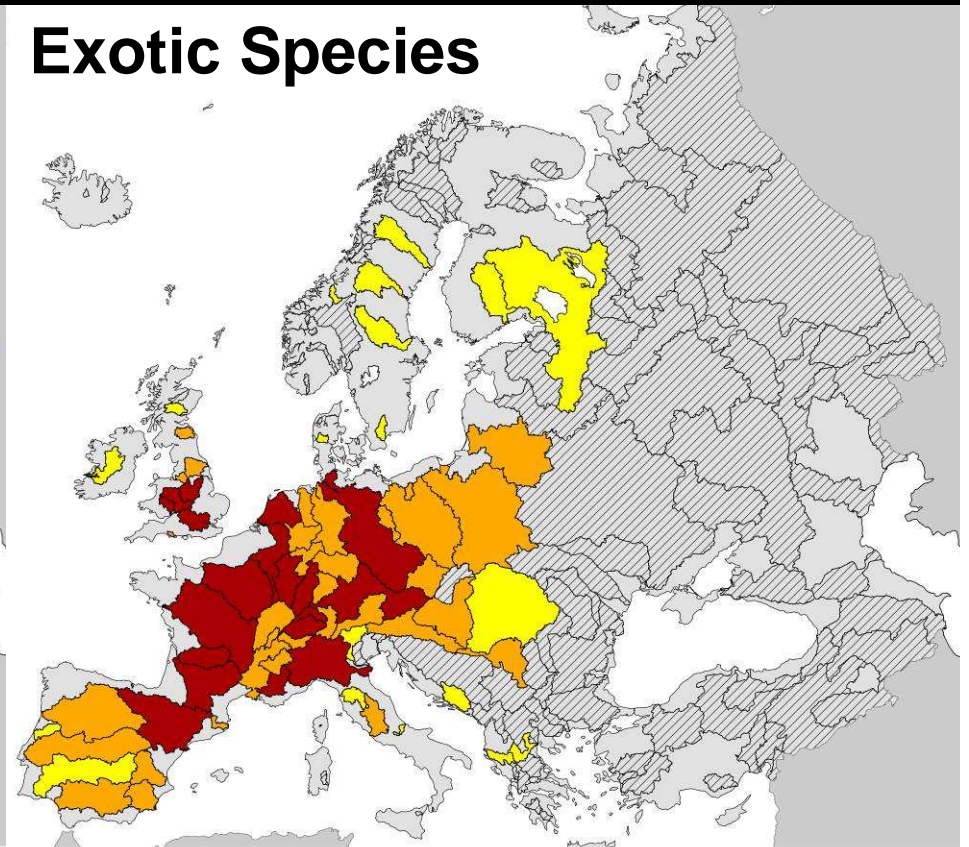


Example Crayfish

Native Species



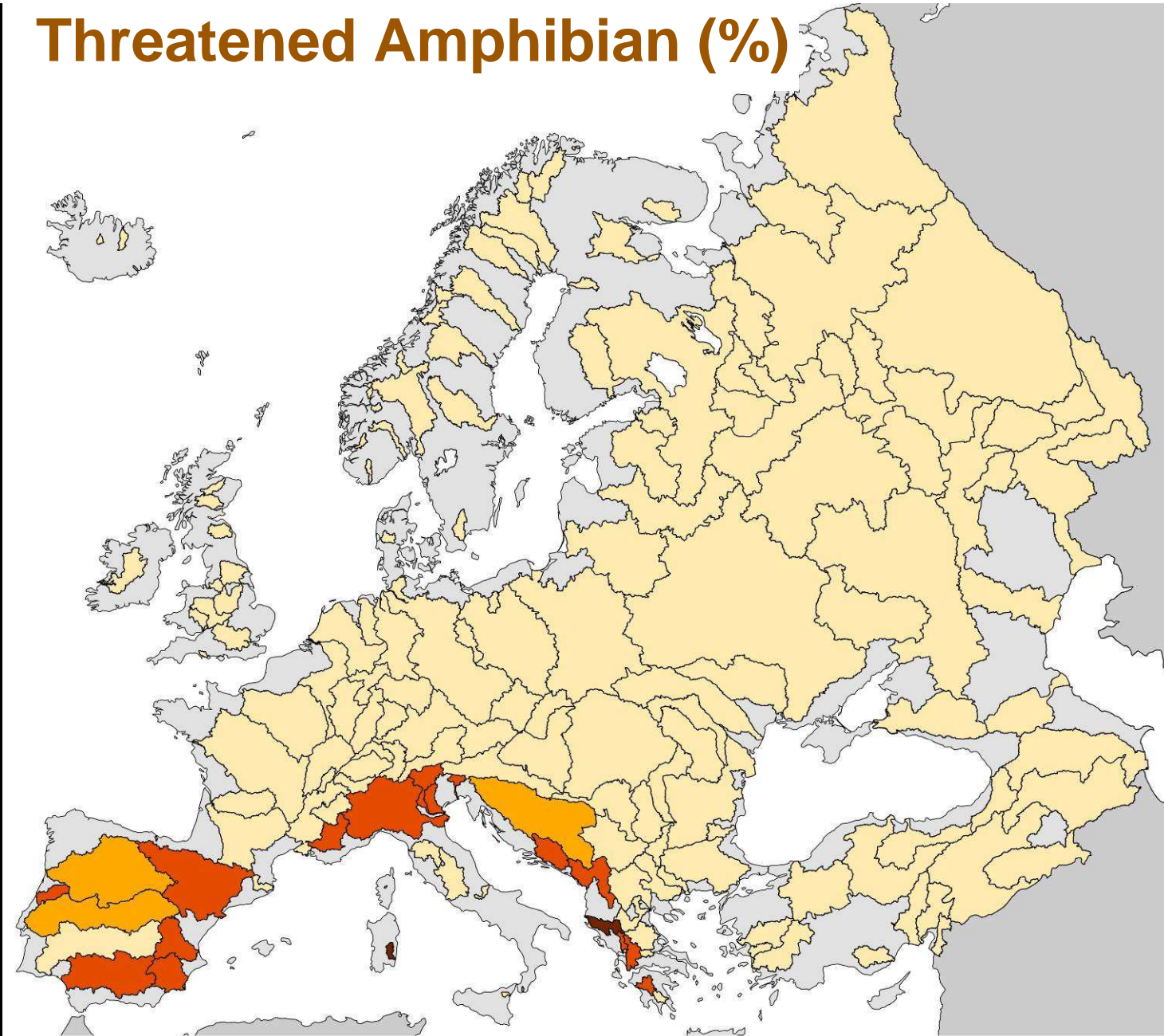
Exotic Species



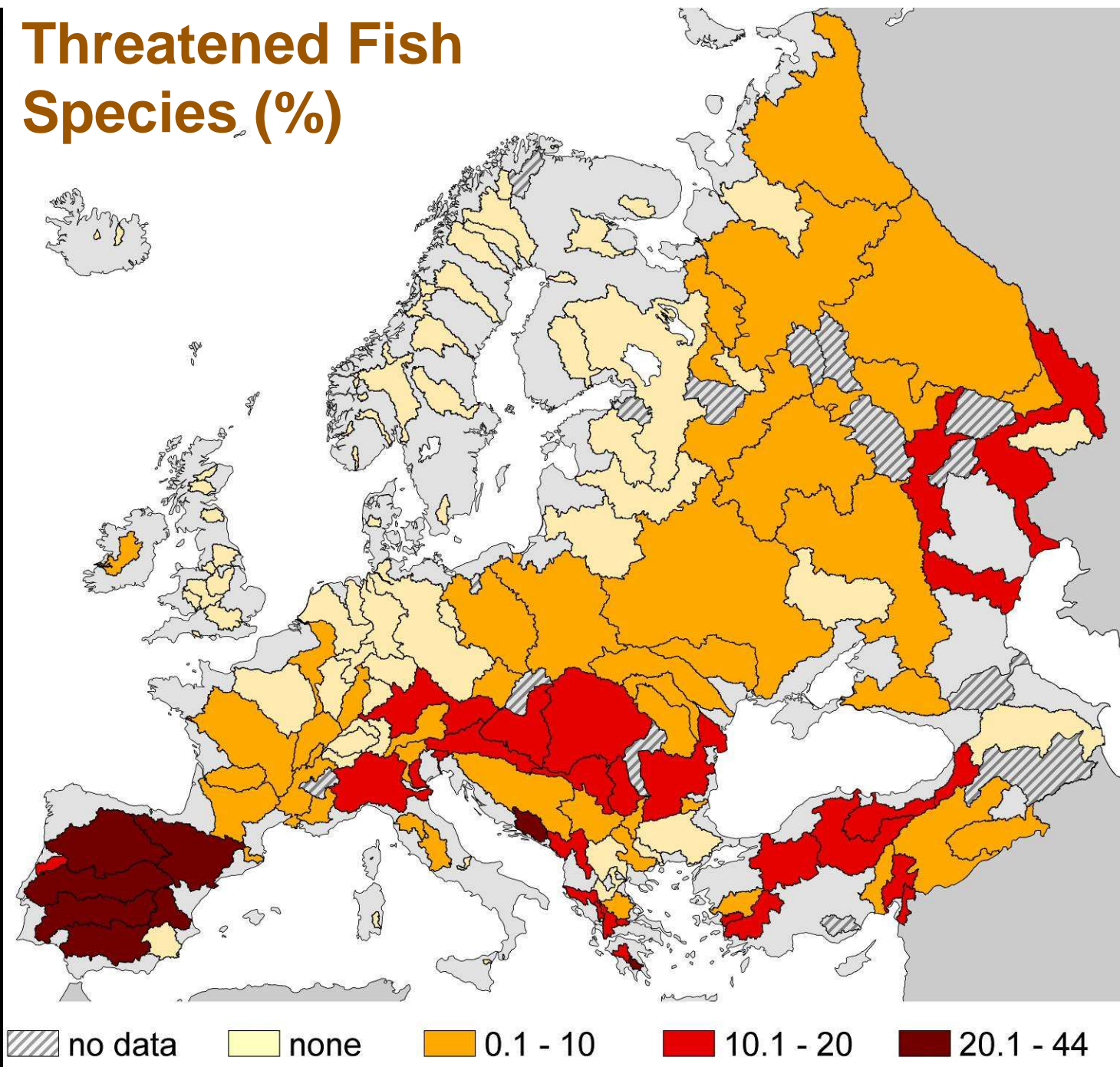
Legend for Native Species: none/no data 1 Species 2 Species 3 Species

Legend for Exotic Species: none/no data 1 Species 2-3 Species 3-6 Species

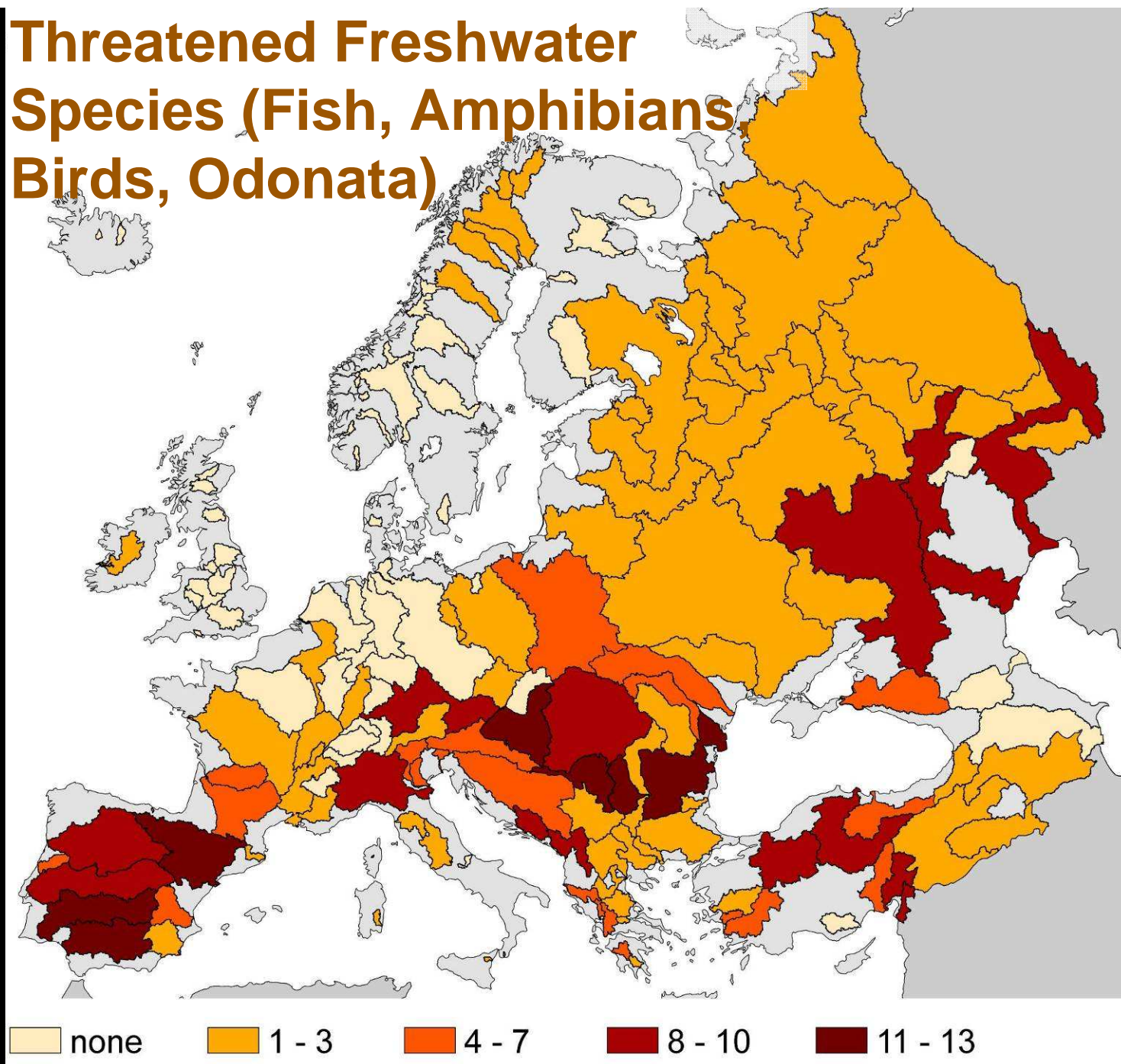
Threatened Amphibian (%)



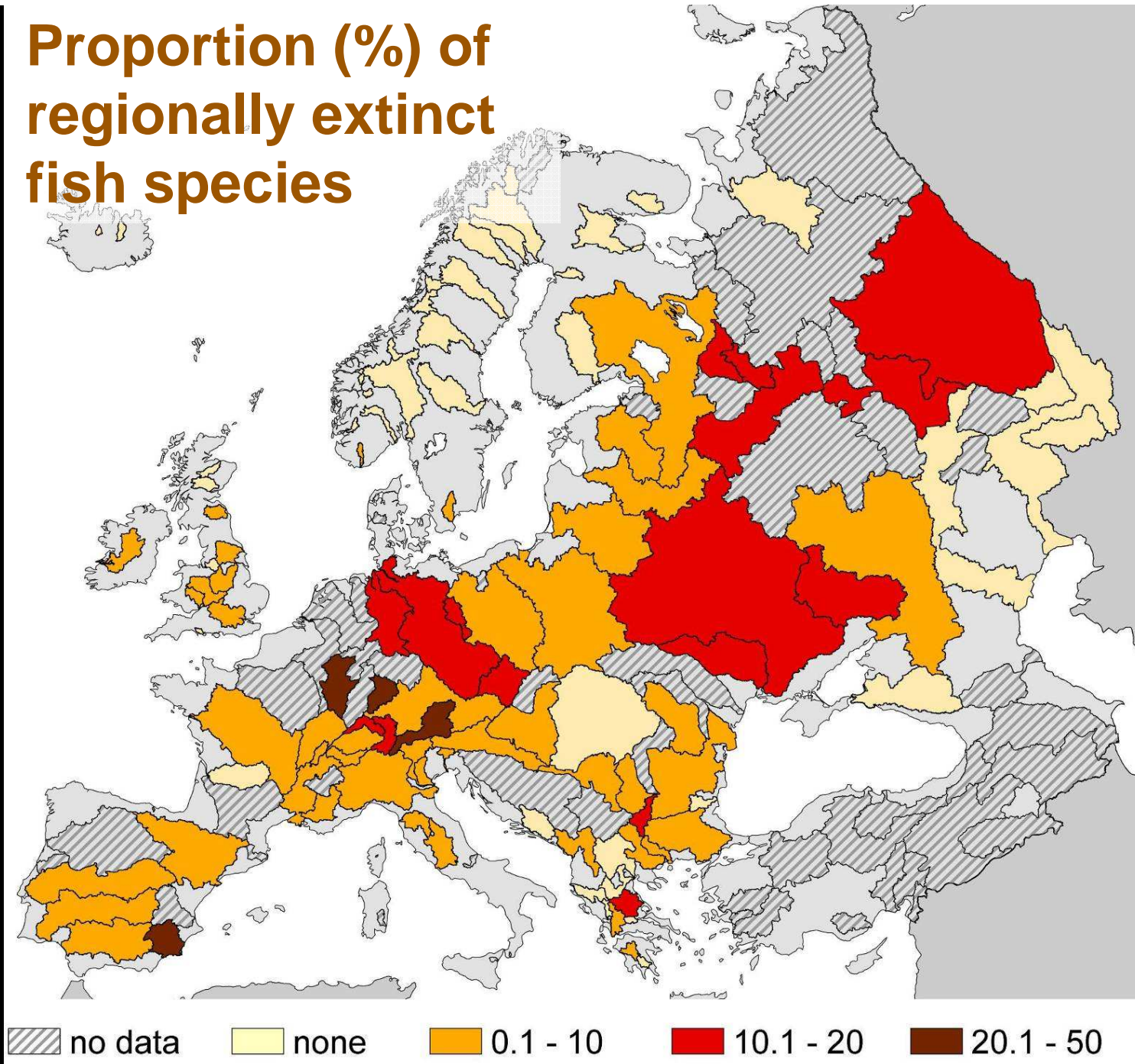
Threatened Fish Species (%)



Threatened Freshwater Species (Fish, Amphibians, Birds, Odonata)



Proportion (%) of regionally extinct fish species



Number of catchments, from which species disappeared

<i>Acipenser sturio</i>	27
<i>Petromyzon marinus</i>	9
<i>Huso huso</i>	9
<i>Acipenser gueldenstaedtii</i>	8
<i>Acipenser stellatus</i>	8
<i>Alosa alosa</i>	7
<i>Salmo salar</i>	7
<i>Alosa fallax</i>	6

(F. Peter *et al.* unpubl. data)

**The salmon returns
to the Elbe River**
(www.smul.sachsen.de)

**„The sturgeon should again
swimm in the Odra River“**
(National Geographic)



Der Elblachs

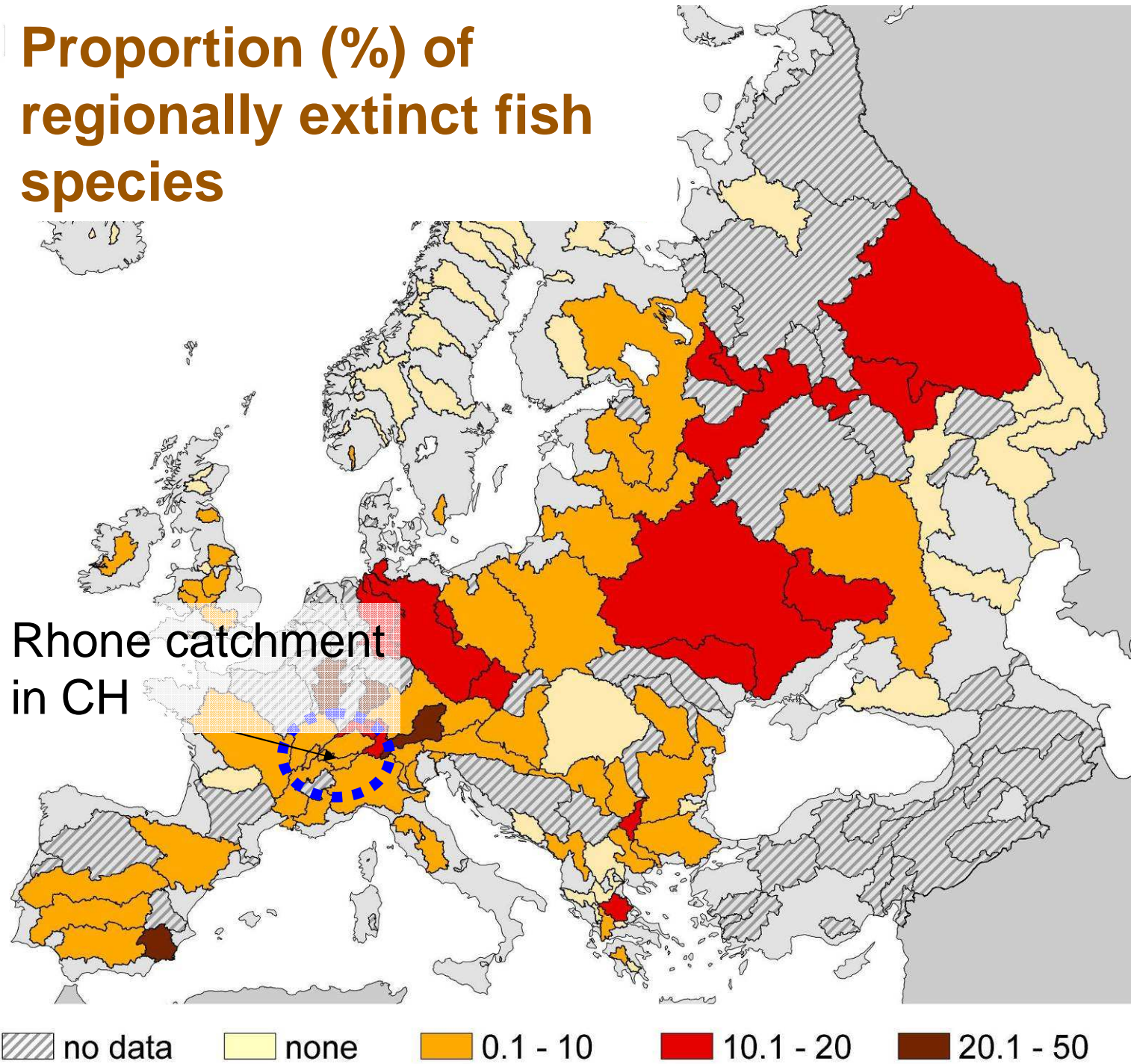
Ergebnisse der Wiedereinbürgerung
in Sachsen



Sturgeon programme
at IGB, Berlin

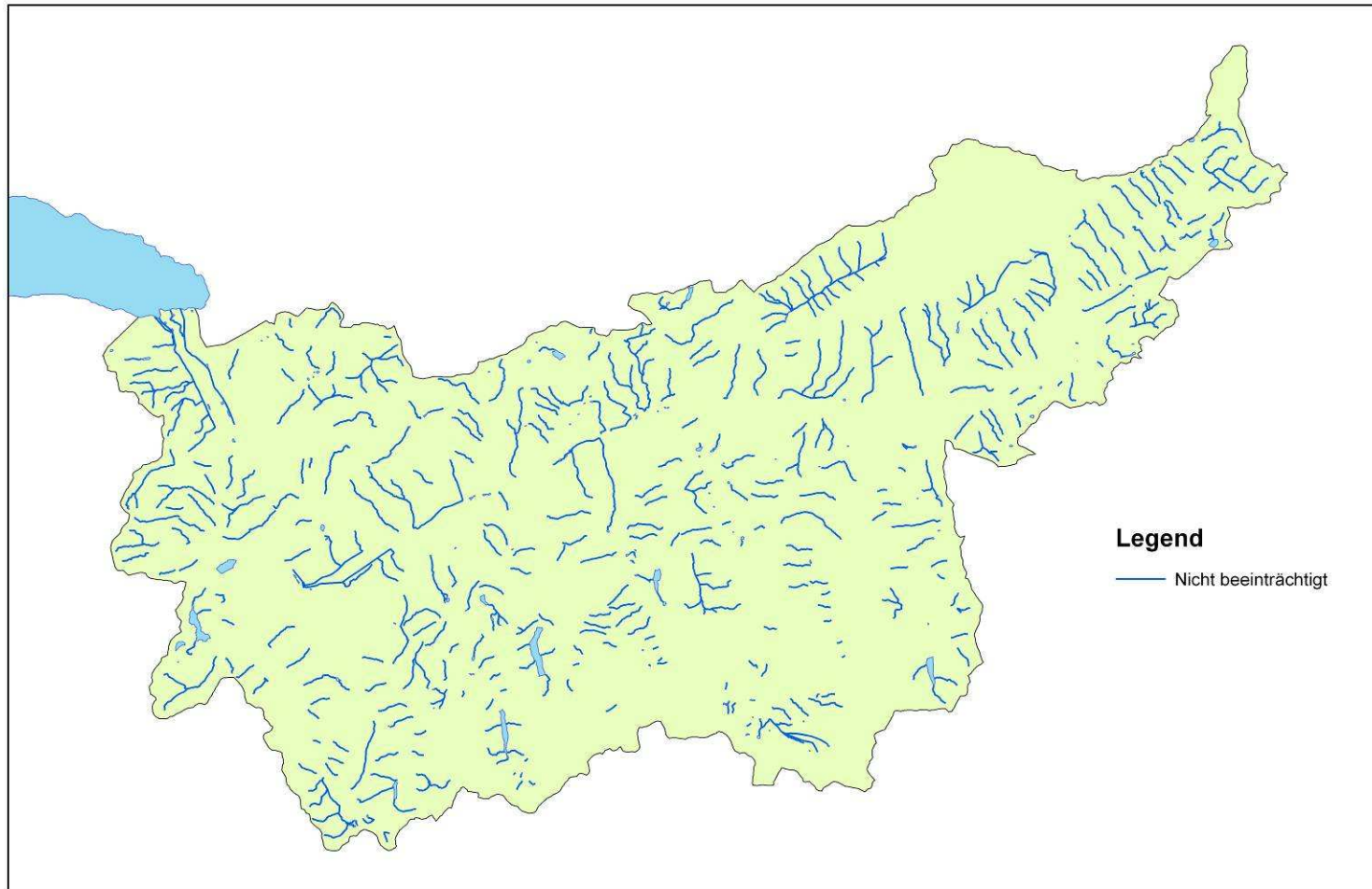


Proportion (%) of regionally extinct fish species



Example Upper Rhone (CH)

(data: Hydrological Atlas CH, BAFU)



eawag
aquatic research ooo

produced by Tonolla



10 5 0 10 Kilometers



Originally: ≥ 19 Species

Today: 5 Species

(Weber & Peter 2007)

Tributaries (e.g. Goldach)

2 Species



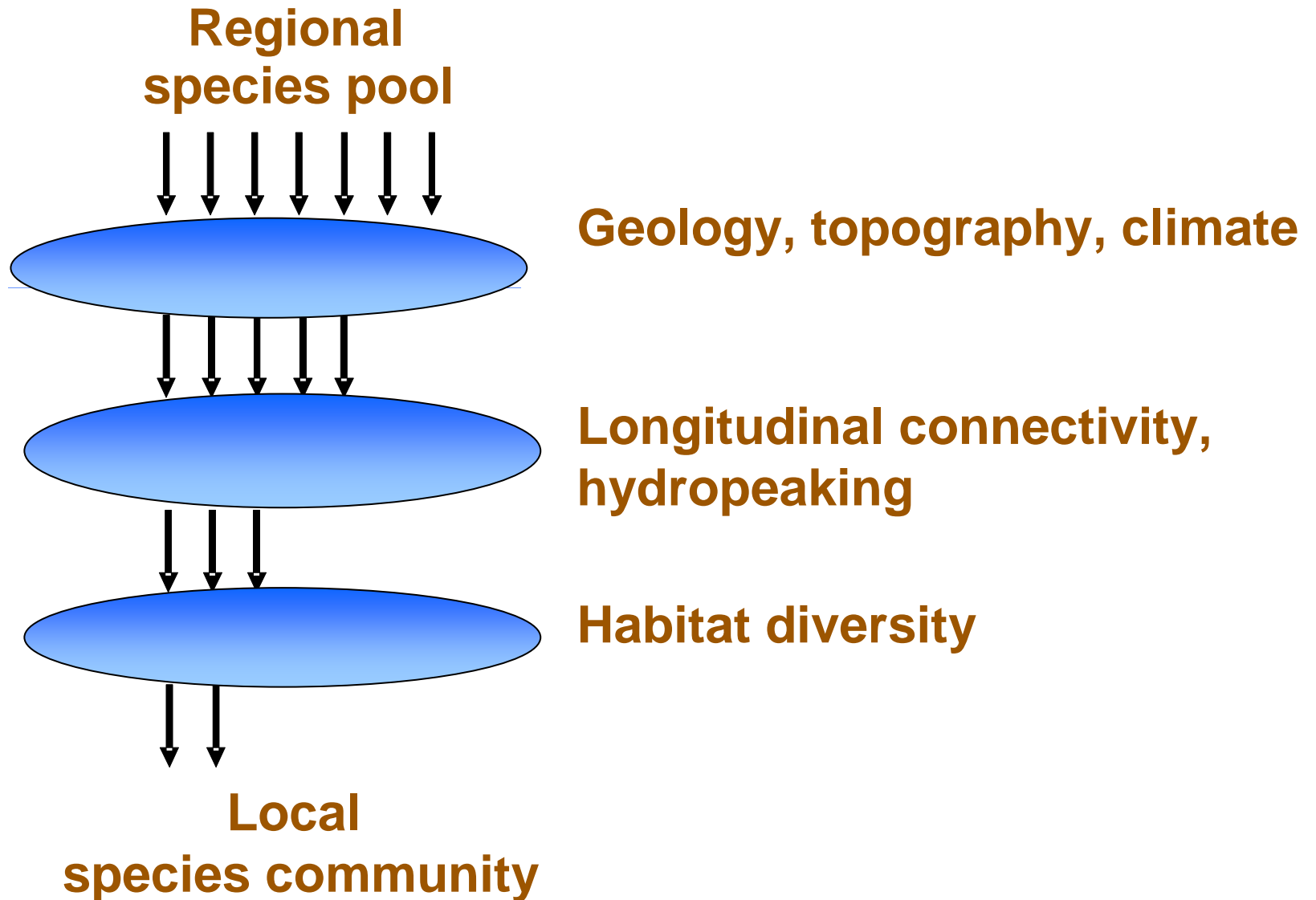
11 Species

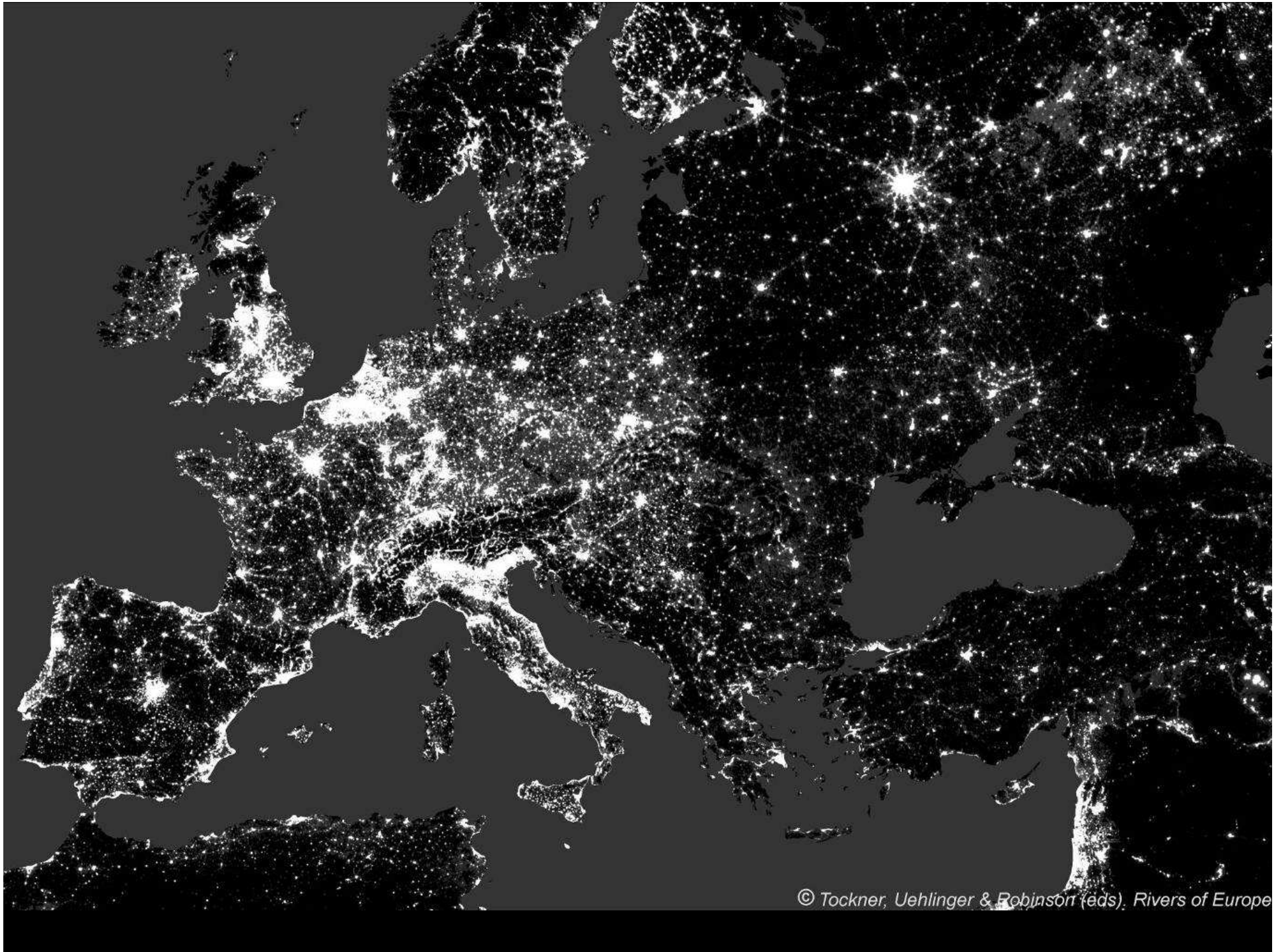


(Armin Peter, unpubl.)



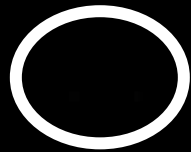
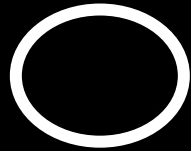
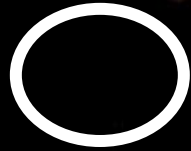
„Environmental Filter“ Concept







What if we woke up one morning only to realize that all of the conservation planning of the last 30 years told only half the story – **the daytime story?** (Rich & Longcore 2004)

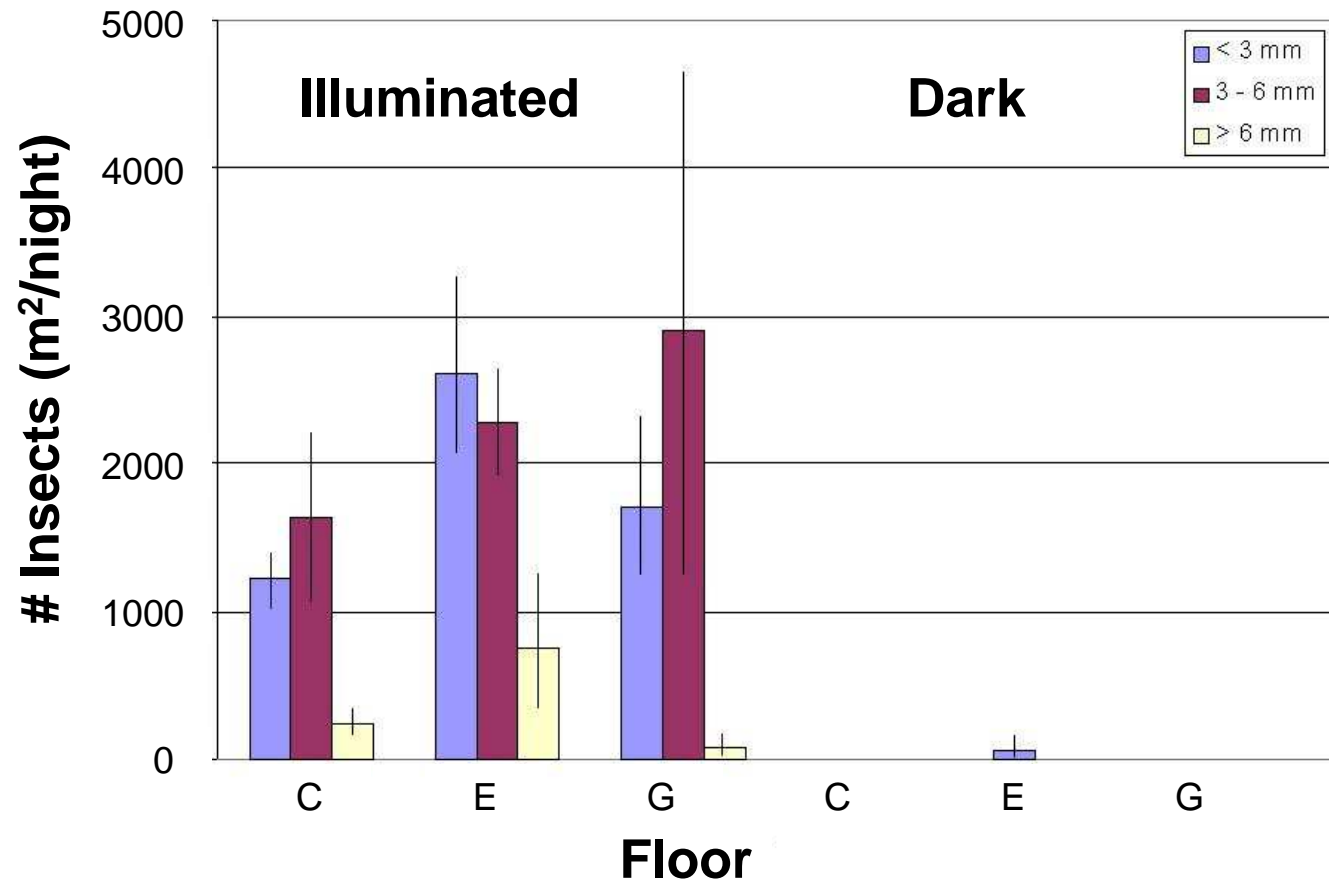


Control

Eawag Office Building at Night (Photo: St. Huber, 20.9.2007)



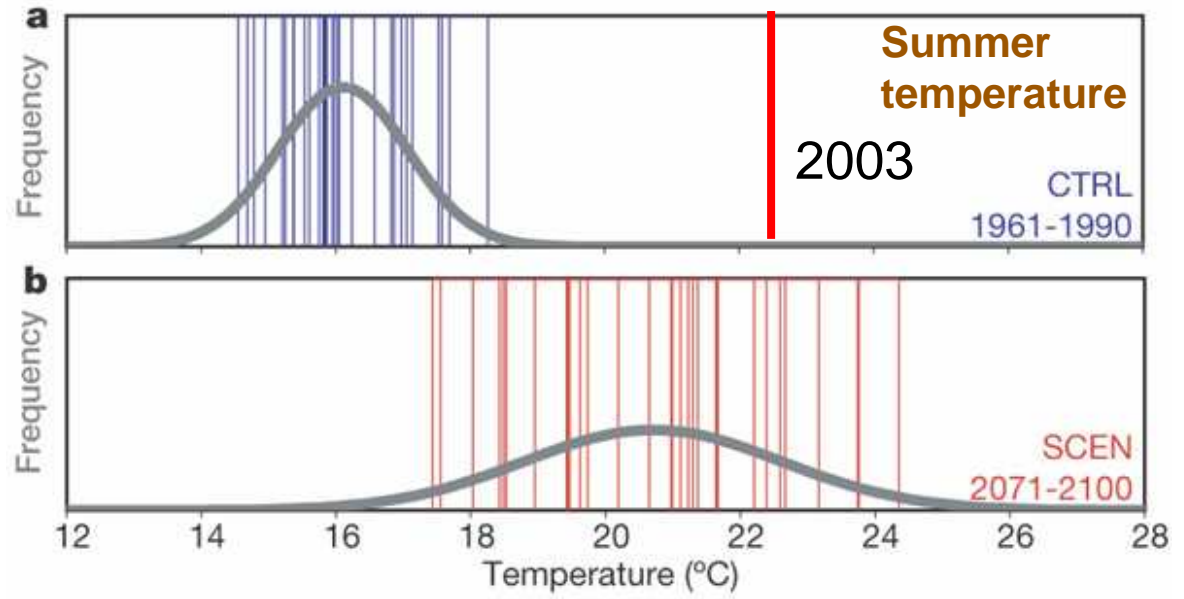
Eawag office building: Number of insects caught per m²: 5 (C), 15 (E), 25 (G) m above ground level



(data: St. Huber)

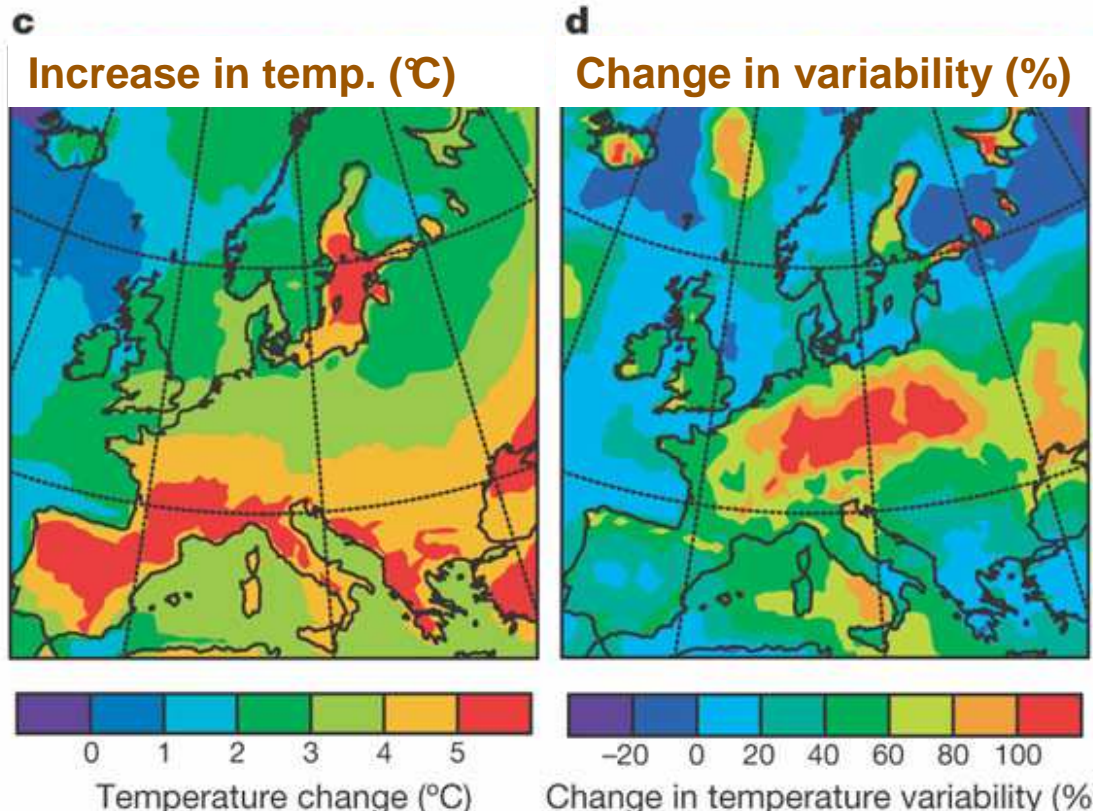
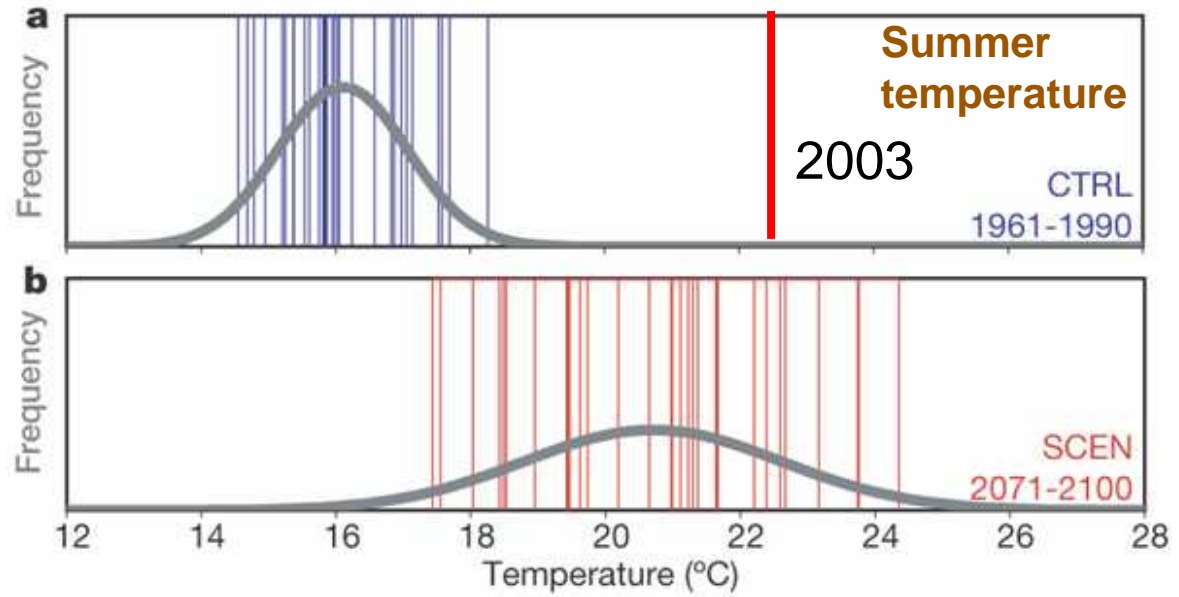


Switzerland





Switzerland



Europe

(Schär *et al.* 2004. Nature)



Conclusion

- Catchment is the basic unit for conservation and management – importance of scale!
- Catchments of the Iberian Peninsula, the Western Balkans, and Anatolia are most threatened (reactive approach)
- Near-natural catchments require highest conservation priority (proactive approach)
- There is an urgent need to establish a European Reference Catchment Network
- Integration of novel aspects in conservation/restoration (e.g. evolutionary potential)
- Focus on key ecosystems and key landscape elements

THANK YOU!

