From Nutrient Limitation to Recreation: Putting Ecology into Ecosystem Services

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OpenNESS www.openness-project.eu

Freshwater services

Provisioning
- FOOD
- FRESH WATER
- WOOD AND FIBER
- FUEL
- ...

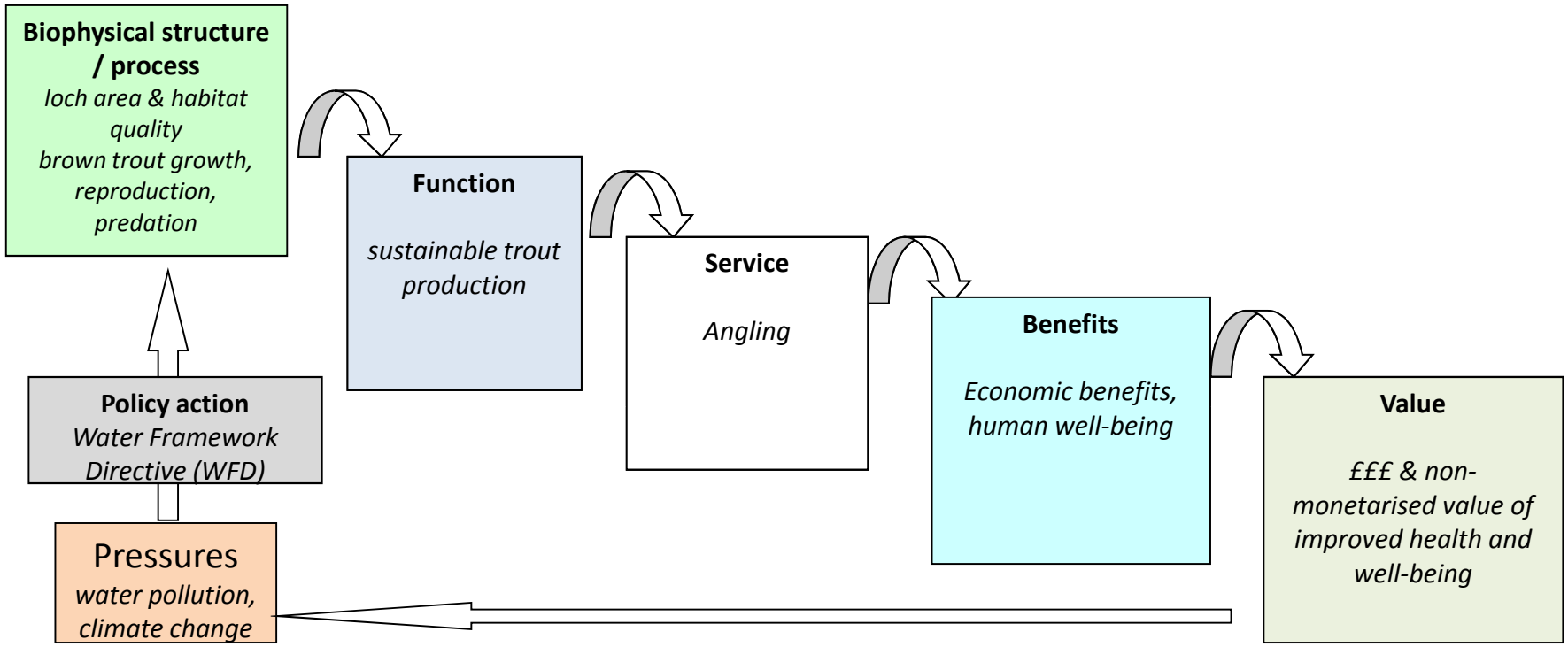
Regulating
- CLIMATE REGULATION
- FLOOD REGULATION
- DISEASE REGULATION
- WATER PURIFICATION
- ...

Supporting
- NUTRIENT CYCLING
- SOIL FORMATION
- PRIMARY PRODUCTION
- ...

Cultural
- AESTHETIC
- SPIRITUAL
- EDUCATIONAL
- RECREATIONAL
- ...

What is the relationship between freshwater biodiversity and the services and benefits provided by freshwaters?

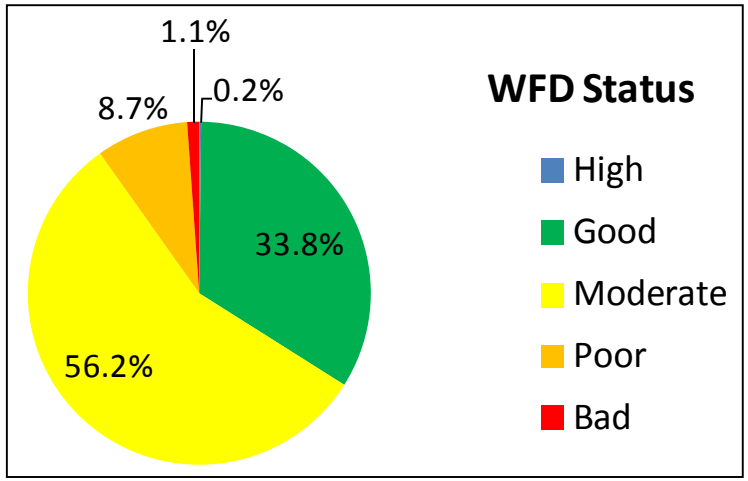
Ecosystem Services Cascade Model



(Source: Potschin and Haines-Young, 2011) *annotated for recreational angling*

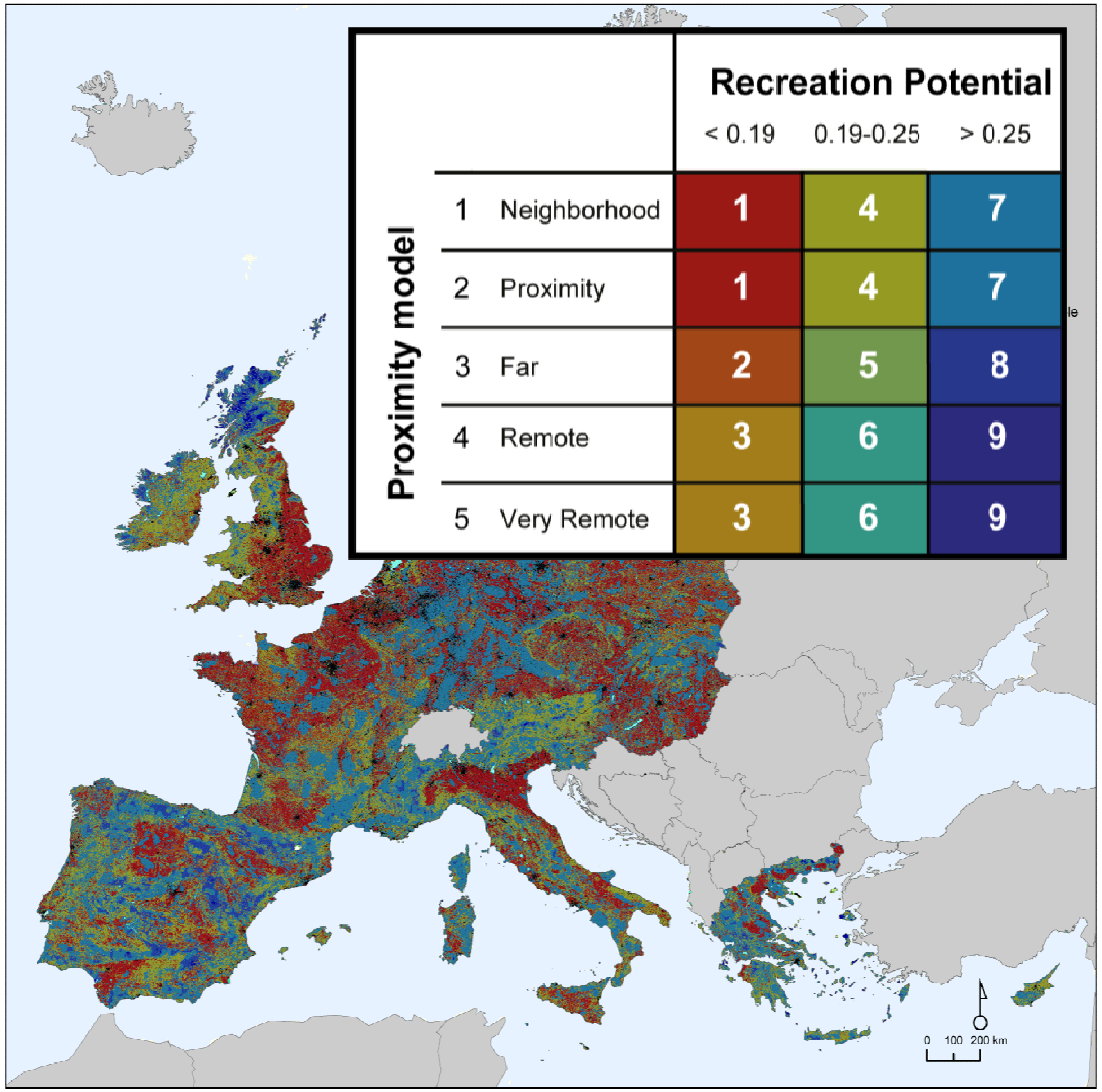
Challenges

- WFD monitoring provides data on quality of *natural capital* but not ecosystem services
- Models developed for quantifying regulatory & cultural services lack biodiversity data



Can we use WFD (biodiversity) data to better quantify/map services?

Recreation at EU scale (PEER PRESS)



1. Potential (Asset)

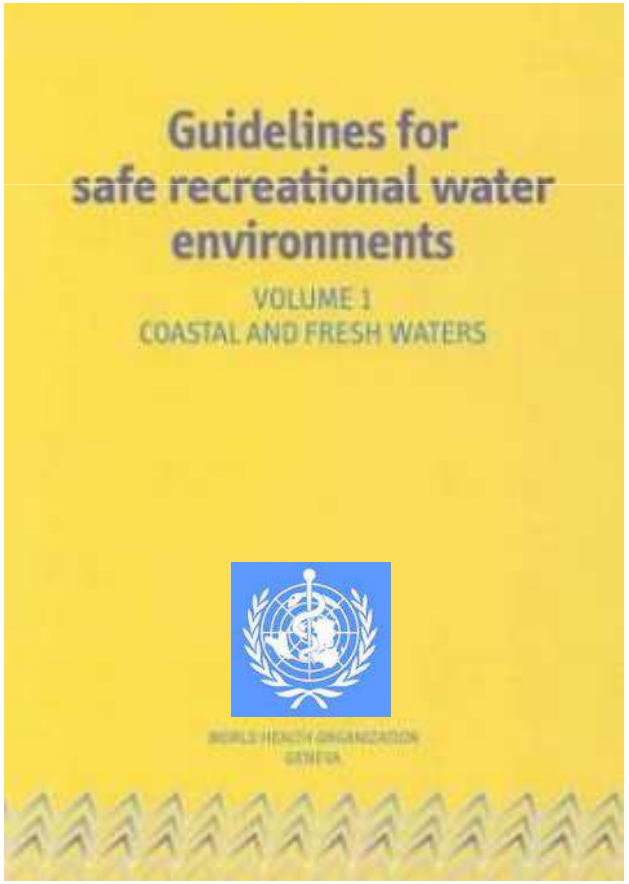
- Naturalness
- Protected areas
- Presence of water

2. Use

- Proximity to population

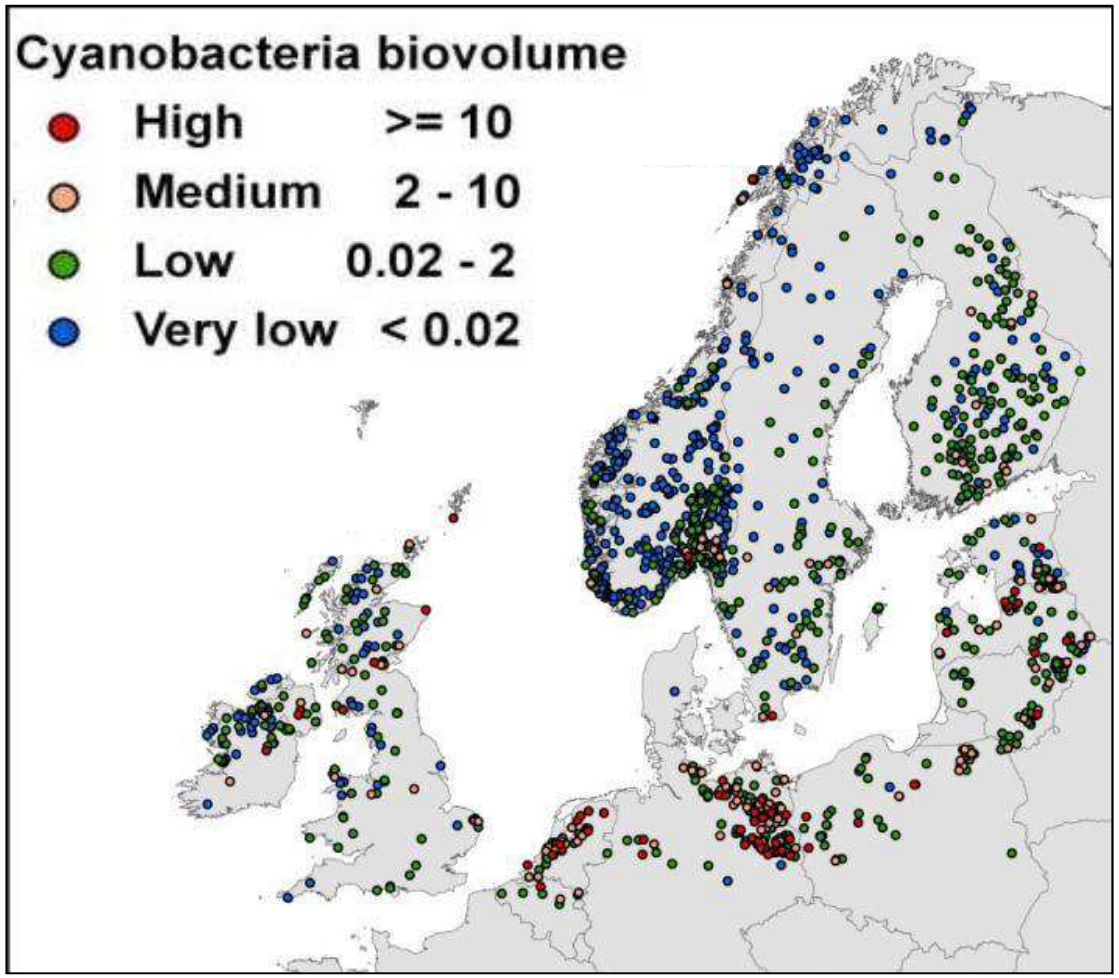
Maes et al, 2012. A spatial assessment of ecosystem services in Europe: Methods, case studies and policy analysis - phase 2. http://www.peer.eu/projects/press-project/

Recreation & Water Quality



HEALTH RISK	cells/ml	Cyanobacteria biovolume
HIGH	scums	
MED	100000	<-- 5-10 mm^3 L^{-1}
LOW	20000	<-- 1-2 mm^3 L^{-1}

Recreational quality of European lakes



Addition of WFD data (algal bloom metric) provides “functional quality” to enhance recreational service map

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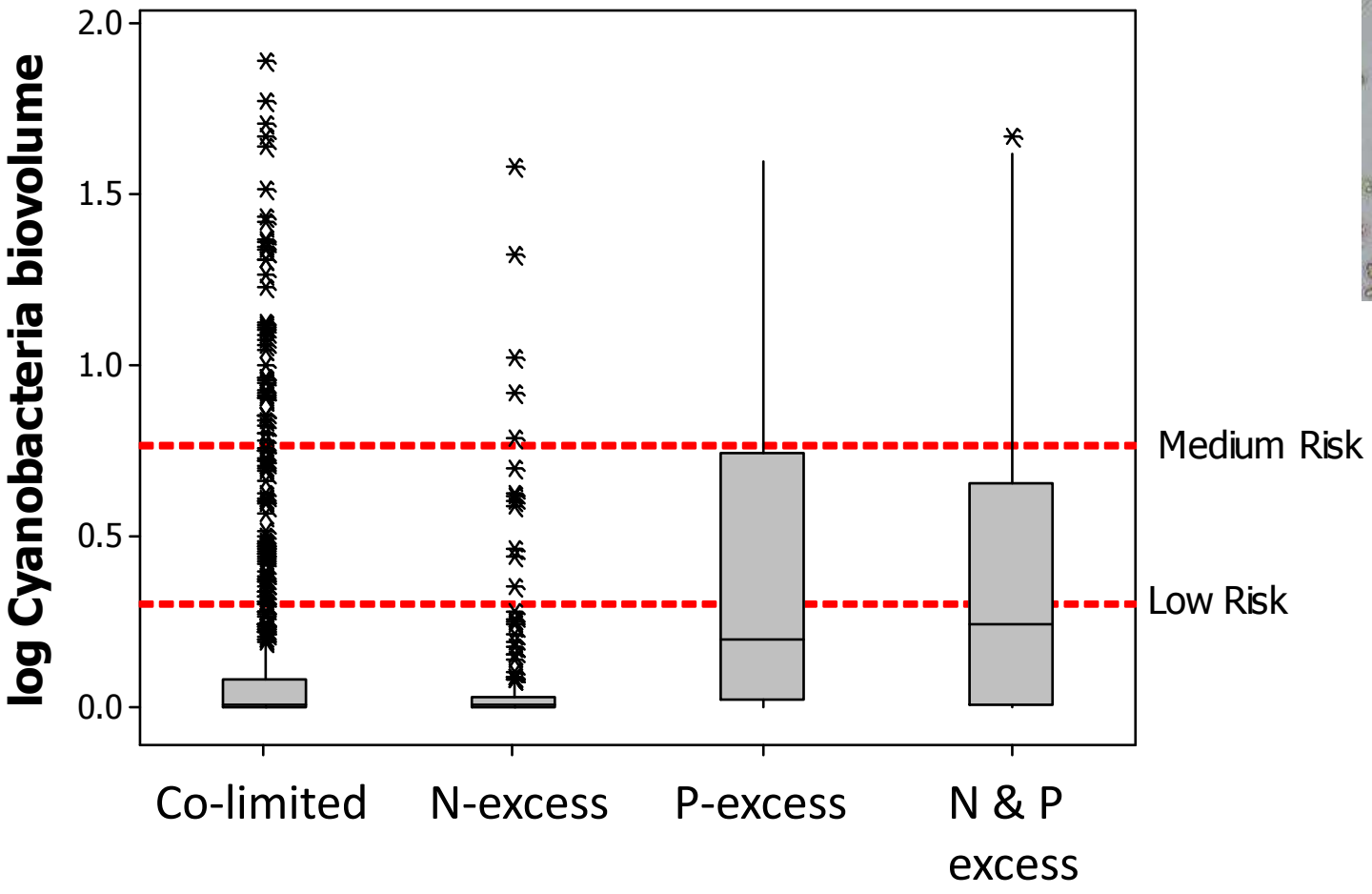
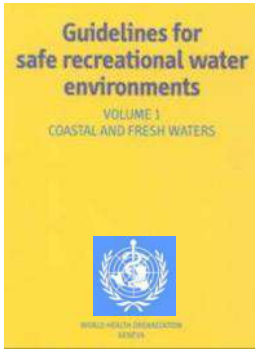
Why do cyanobacteria dominate lakes?

Cyanobacterial response to nutrient limitation

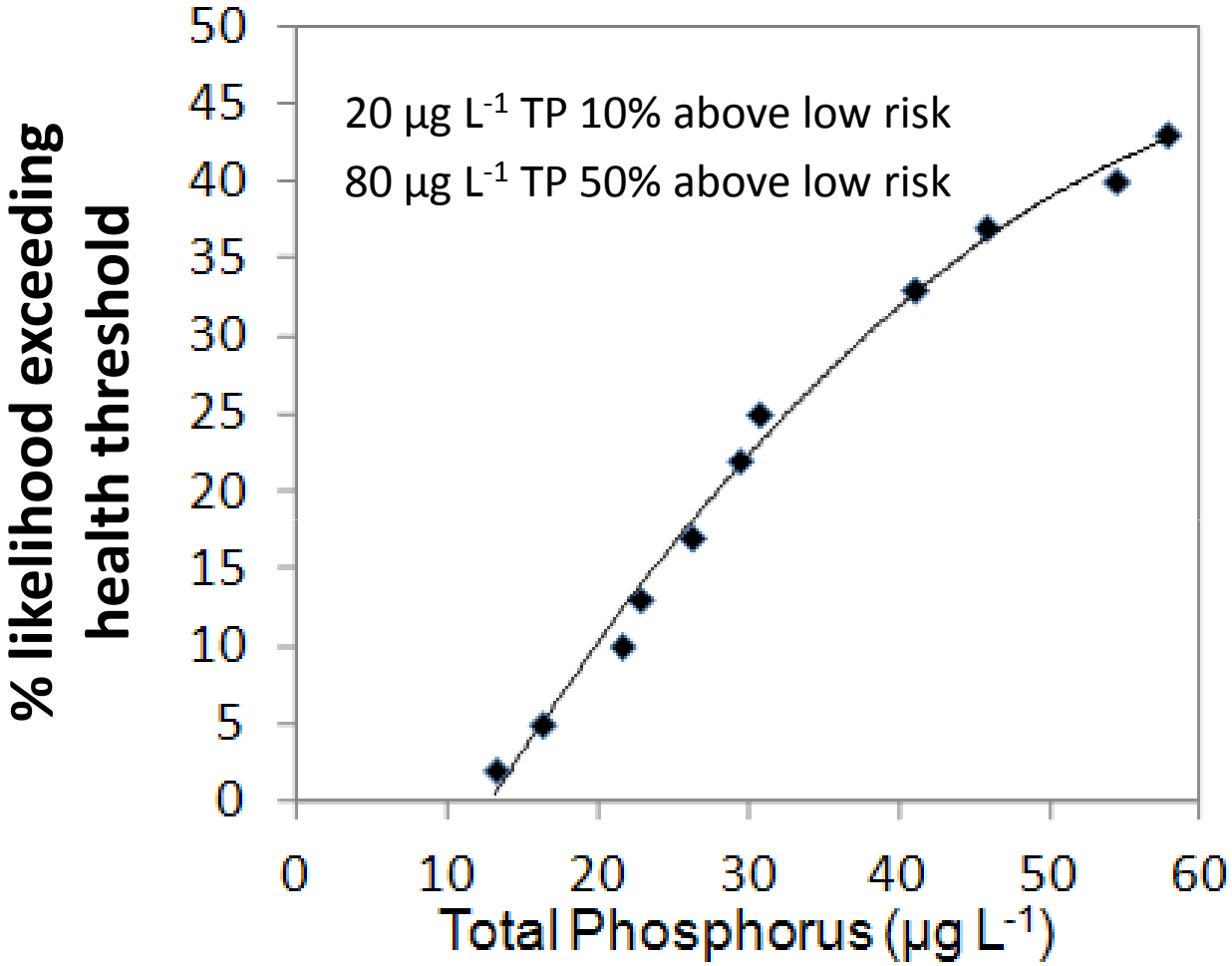




Lakes with excess P have higher cyanobacteria abundance > health risk

WISER

Setting TP standards for recreational service



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WISER

Carvalho et al. 2013.
Sustaining recreational quality of European lakes: minimising the health risks from algal blooms through phosphorus control.
Journal of Applied Ecology, 50, 315-323

Operationalisation of Natural Capital and Ecosystem Services: from concepts to real-world applications

- **EU Framework 7 funding**
- 35 partners
- Coordinator: Eeva Furman (SYKE)
- Start: Jan 2013
- End: Dec 2016

OpenNESS Case-Studies

Aim

Work collaboratively with stakeholders to identify the problems they face in operationalising Natural Capital (NC) and Ecosystem Services (ES) concepts in their specific policy or decision-making context

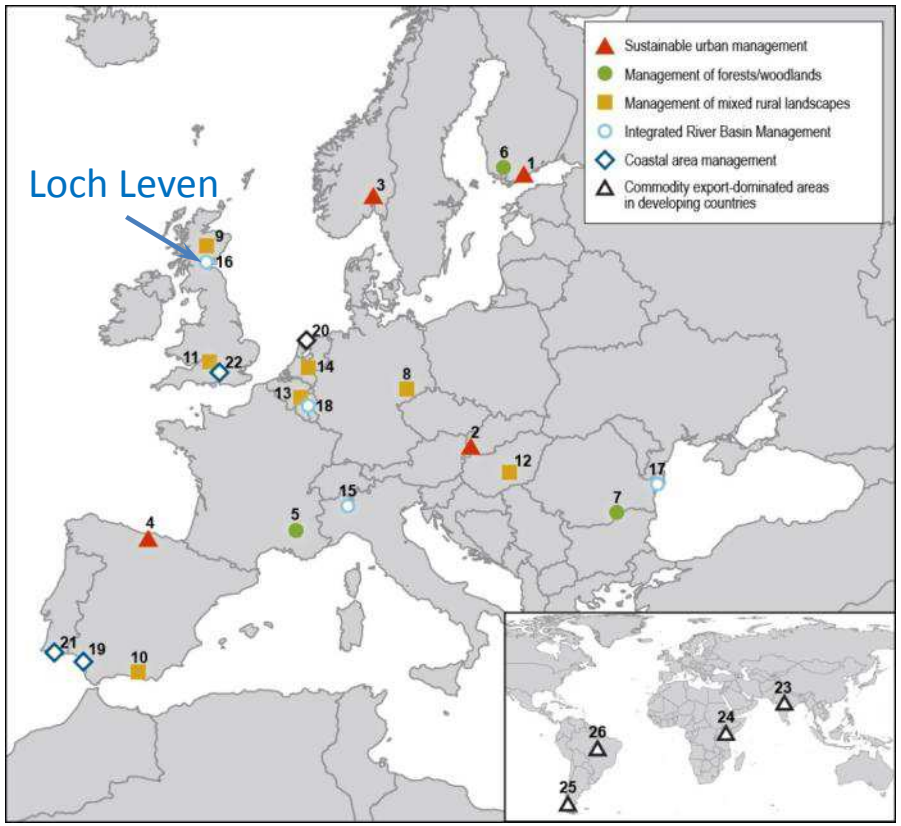
Method

Apply and refine the methods and models developed in the project to the case studies to **test their relevance and usefulness**

Output

Characterise any common lessons that can be learnt on the operational potential of the ES and NC concepts

26 Global Case study sites



Loch Leven case-study

What is the consequences of EU Water Policy (WFD) for the Delivery of Ecosystem Services?

Understand and quantify links between WFD status and the provision and value of ES over recent decades.

1. Angling
2. Tourism & recreation
3. Downstream water supply
4. Nature conservation

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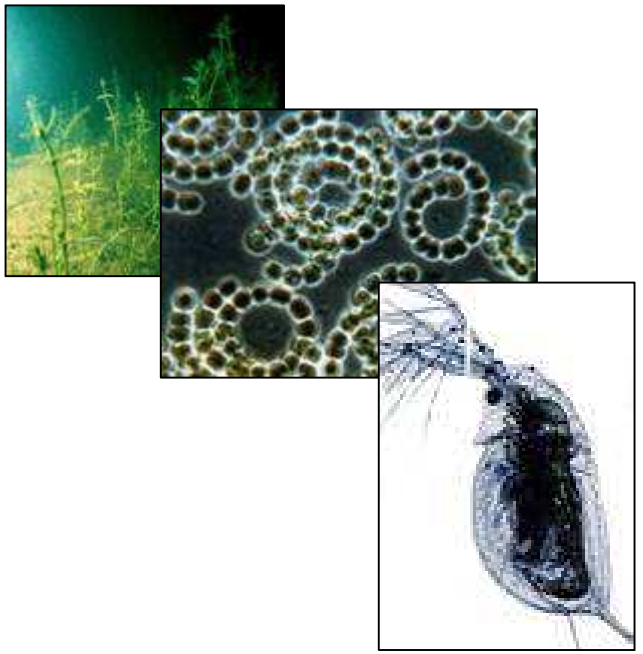
Long-term records collected by CEH

Length of dataset: 45^{+} years (1968 onwards)

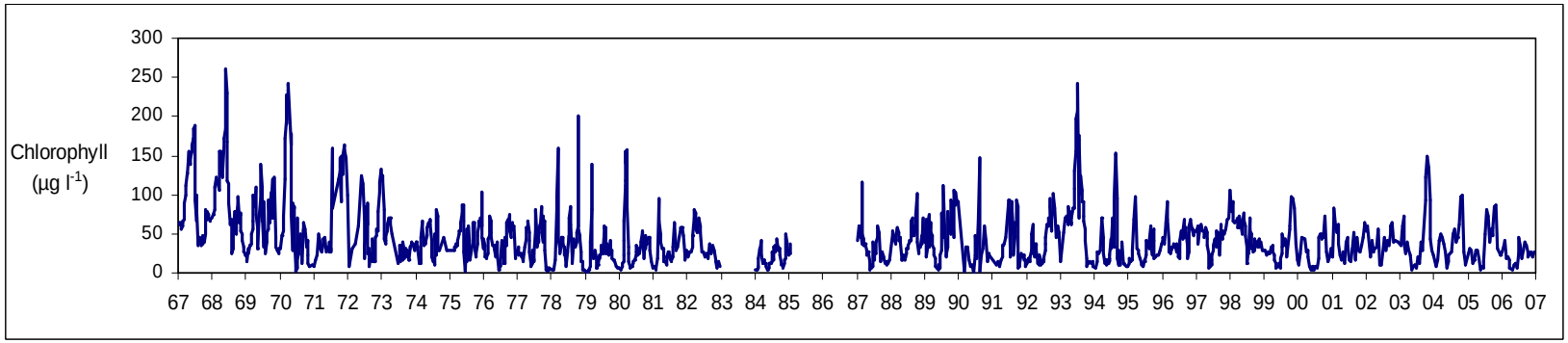
Sampling frequency: fortnightly



150 variables measured, covering…

- Physics (water temperature, water clarity)
- Chemistry (N, P, etc.)
- Biology (phytoplankton, zooplankton, benthic invertebrates, macrophytes)

Nutrient loading data: 1985, 1995, 2005



Key datasets collected by others

- Weather since 1968 (Kinross Estates)

- Palaeo-datasets diatoms, macrofossils 1750 - 2005 (UCL)
- Macrophytes 1821 - 1999 (Various)
- Fish catches daily since 1900 (Kinross Estates)
- Bird counts monthly since 1967 (SNH)

- Angler numbers daily since 1900 (Kinross Estates)
- Water supply daily since 1850 (Tullis Russell)
- Tourist visitor numbers daily since 2001 (Castle Island & RSPB Reserve)
- Recreational users (Heritage Trail) - monthly since 2008

WFD-ES RELATED QUESTIONS

Tourism/Recreation:
What is the value of the loch to local tourism? Is this affected by loch quality (WFD)?

Water supply:
How is this affected by water policy (WFD? Floods?) and climate change? How does it relate to other services?

Nature conservation:
What is the likely impact of WFD? How can other services be best managed to maintain conservation value?

Angling:
How does loch quality (WFD targets) affect angling? How does the fishery affect other services?

EU OpenNESS – Recreation at site scale

Is naturalness of the catchment relevant?

How do people use freshwater landscapes?

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Helen Woods

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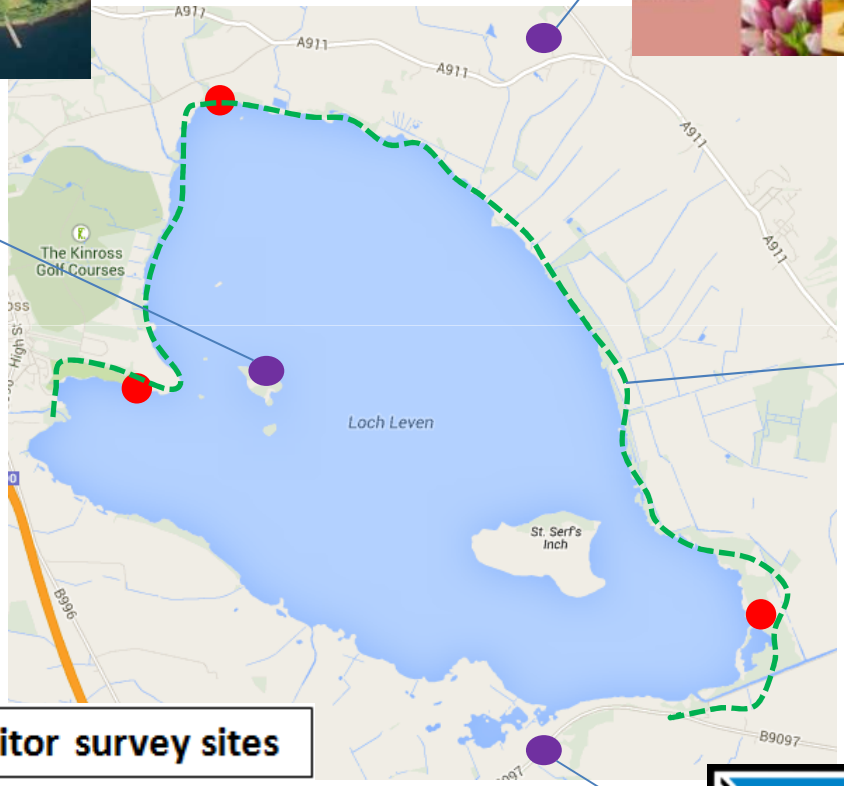
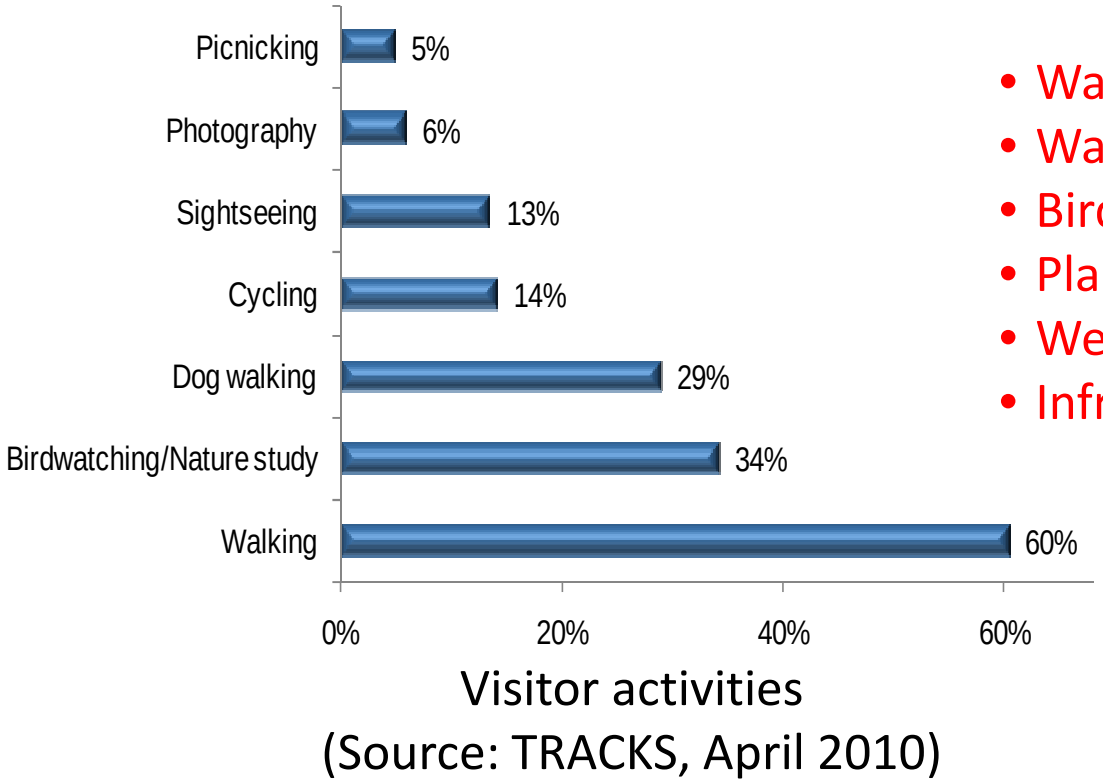
Grazia Zulian

Loch Leven: tourism & recreational opportunities



Visitor survey sites

Recreational Use & Biodiversity

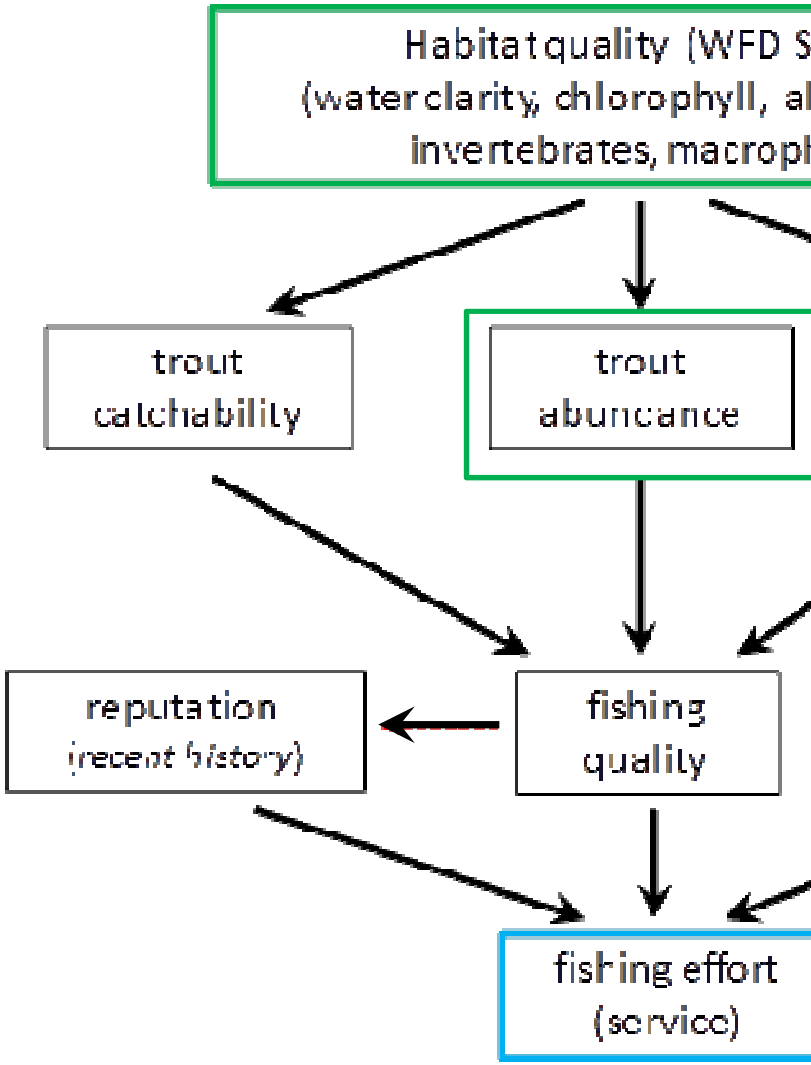


Visitor activities
(Source: TRACKS, April 2010)

- Water quality – algal blooms
- Water level – boat access to island
- Birds – over-wintering, breeding
- Plants - emergent/flowering
- Weather
- Infrastructure – trail, bird hides

Angling

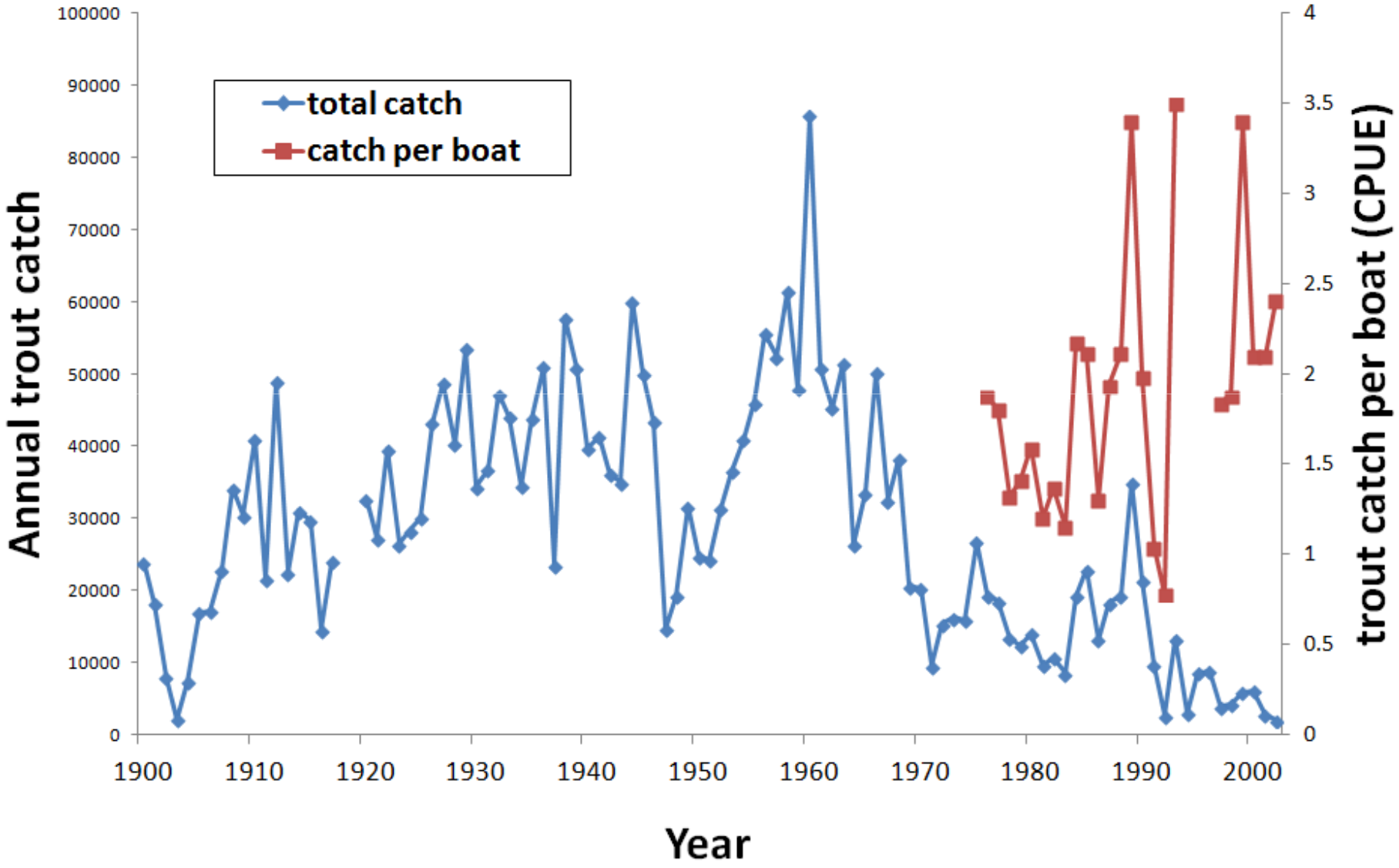
Ian Winfield



Fish Habitat Quality
including upstream spawning habitat

Fish stock quality

Fishing effort



Future

More case-studies of links between freshwater biodiversity (WFD status) and different ecosystem services

Improved measures of regulatory & cultural services

- using WFD data in novel ways
- functional quality based on habitat/species effect traits

Tools appropriate for freshwaters

- linear landscape features

MARS PROJECT
Managing Aquatic ecosystems and water Resources under multiple Stress

http://www.mars-project.eu/

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