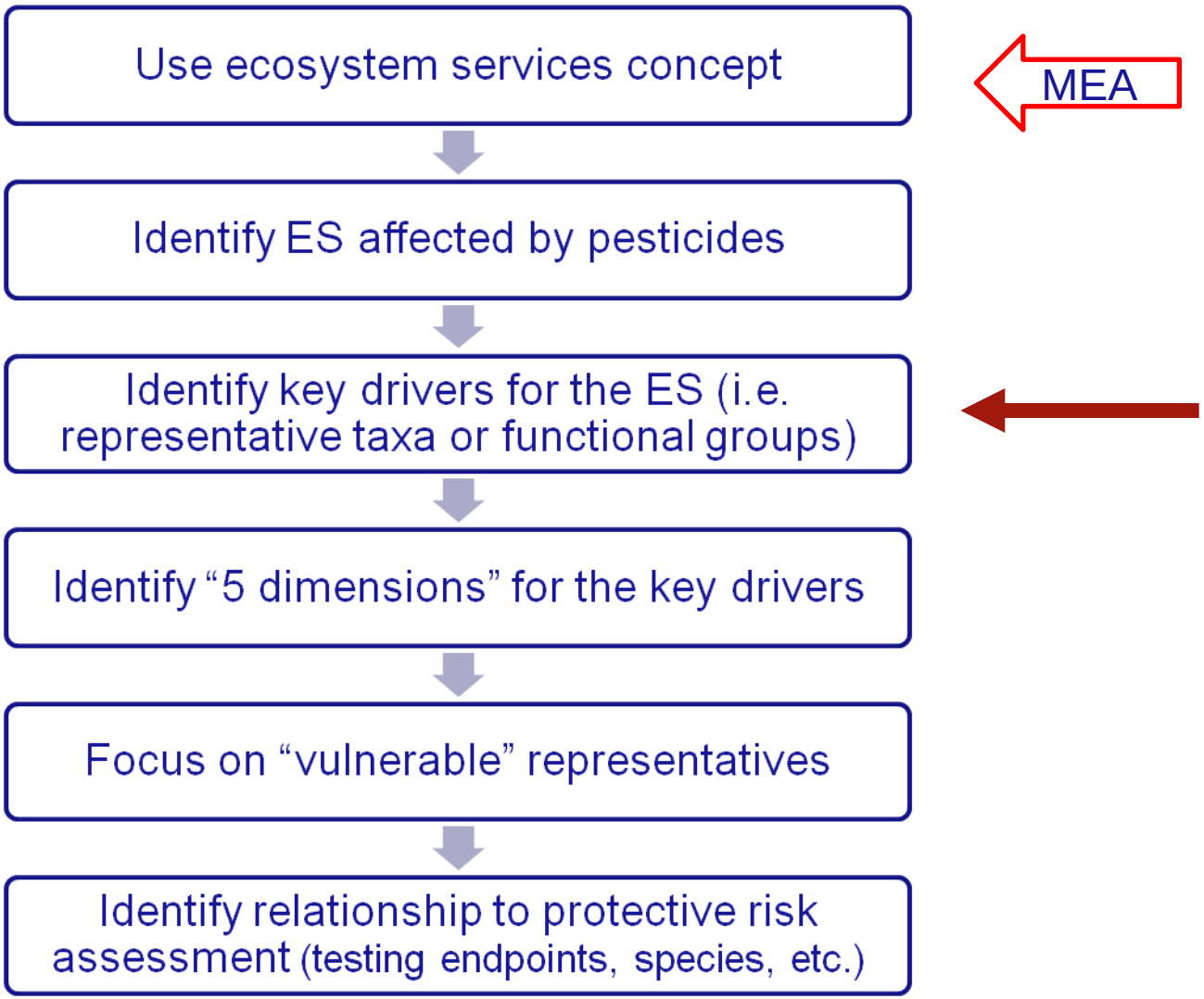
The development of specific protection goals for aquatic organisms in edge-of-field surface waters

Steps in the procedure to develop SPGs and RA schemes



Aquatic key drivers (key SPUs)

- Microbes
  - aquatic bacteria and fungi
- Algae
  - Green algae, diatoms, blue-greens and others
- Aquatic Non-target vascular plants
  - *Lemna*, *Myriophyllum*
- Aquatic invertebrates
  - Crustaceans, insects and non-arthropods
- Aquatic vertebrates (aquatic and terrestrial)
  - Fish, amphibians

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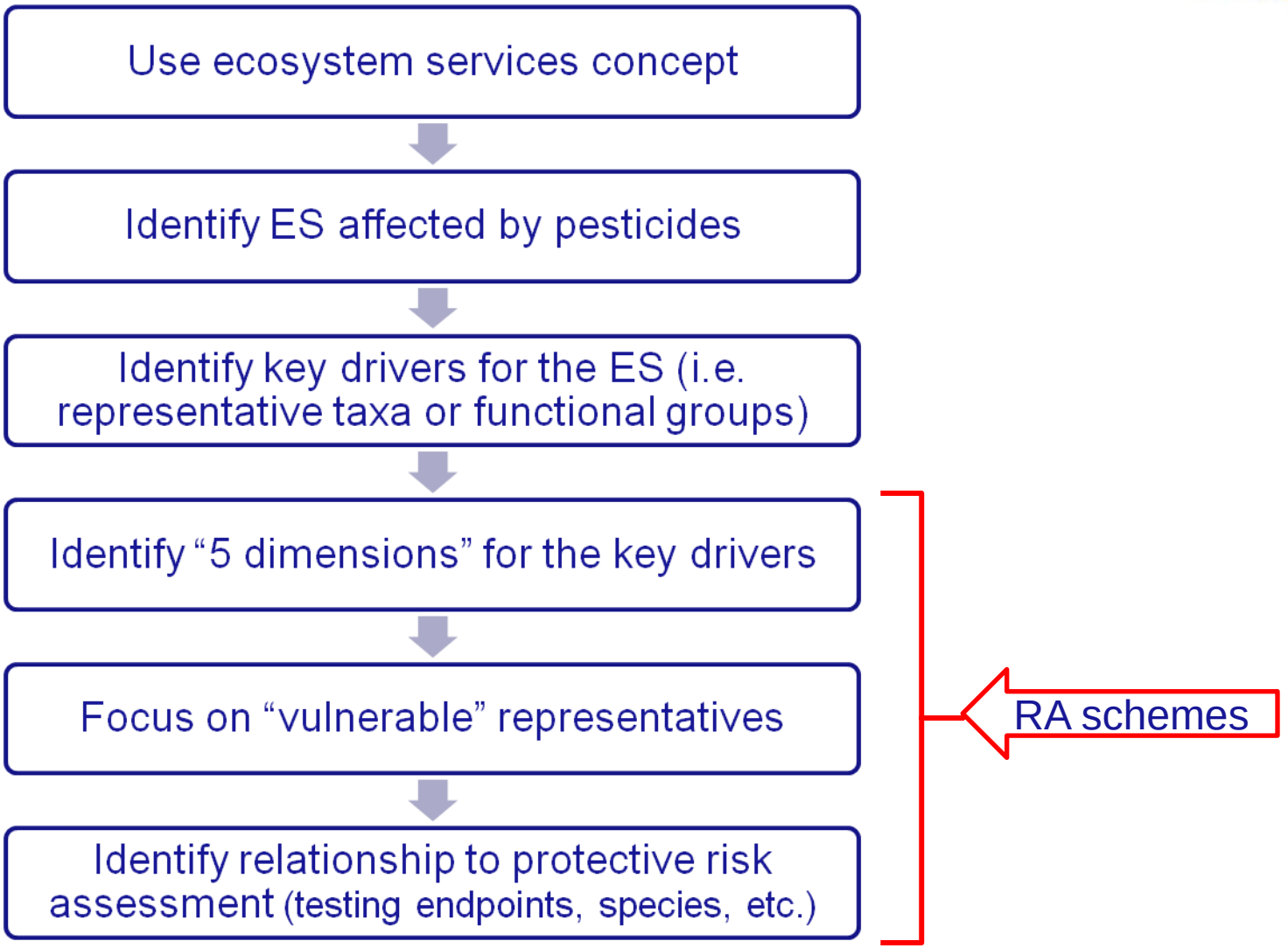
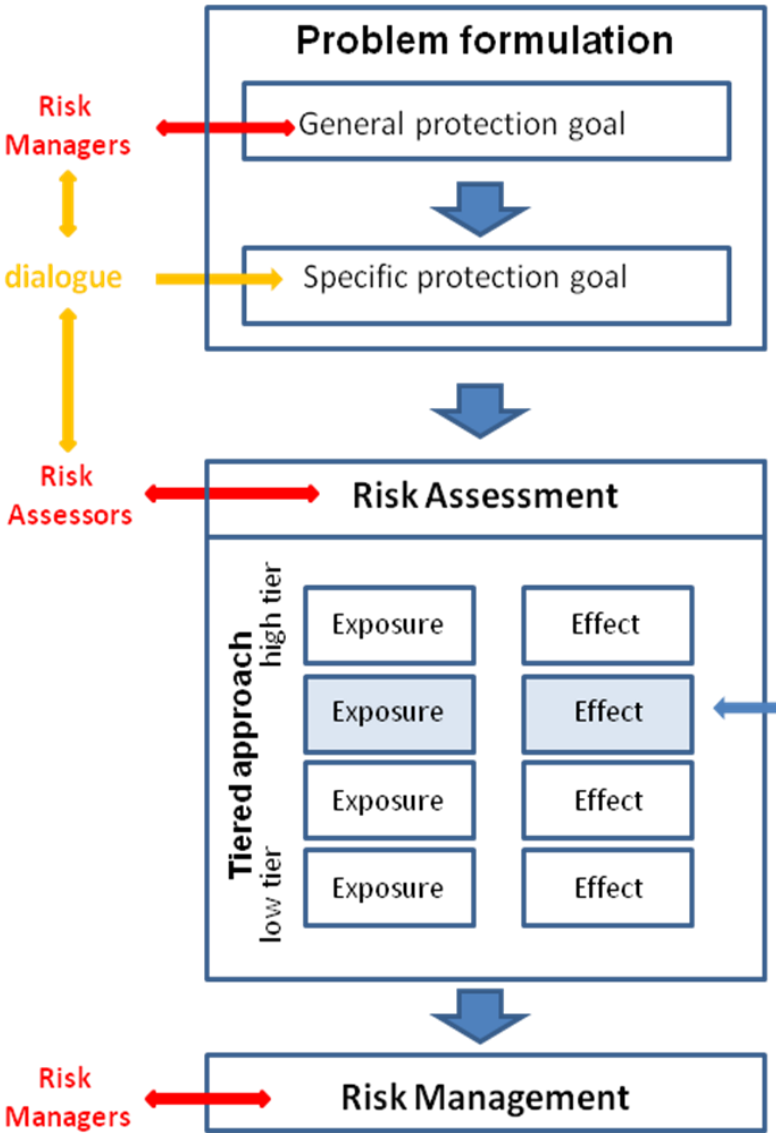


SPGs and tiered risk assessment schemes

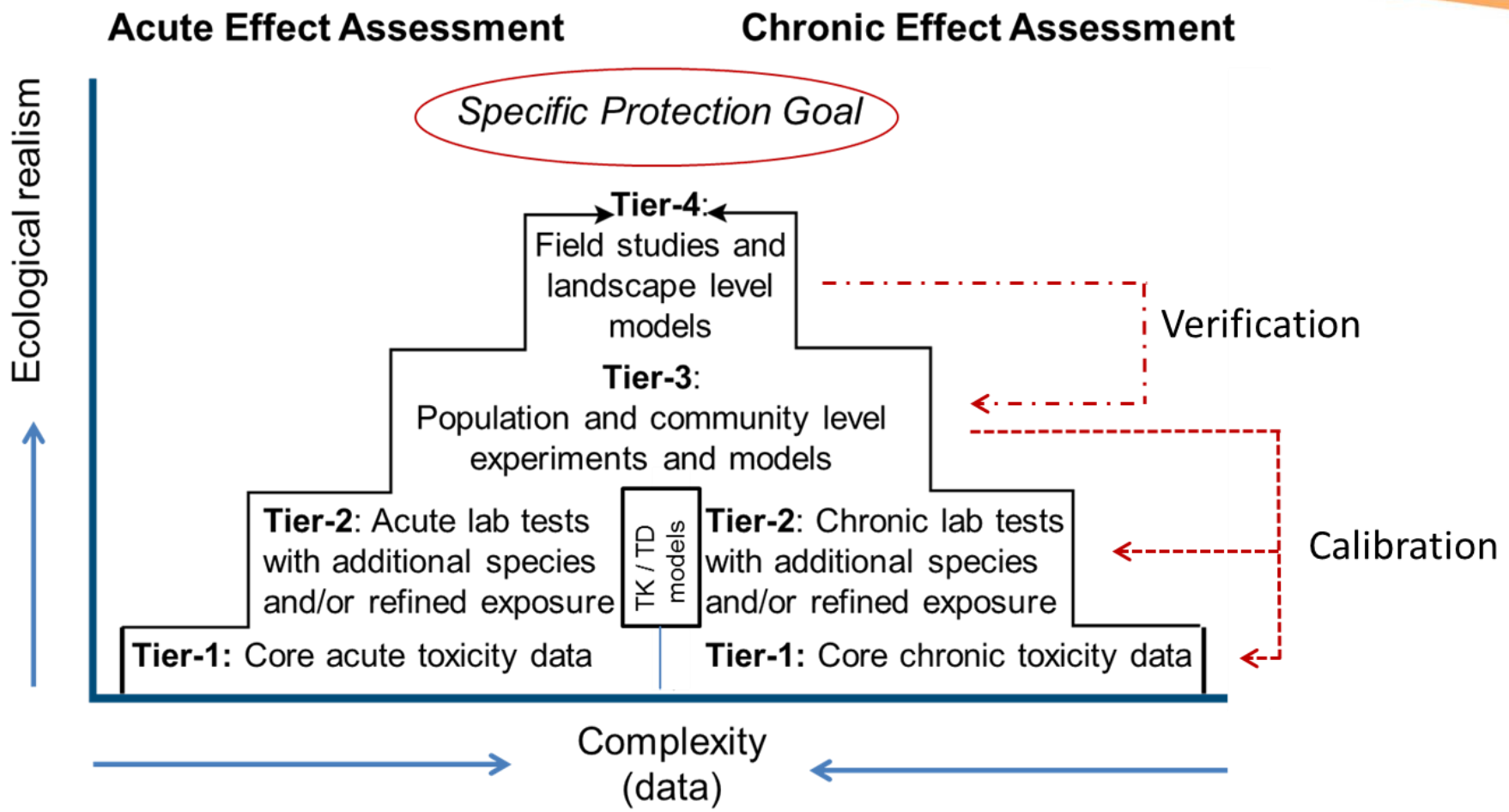


After SPGs are clear, **tiered risk assessment schemes** can be developed that are:

- Appropriately protective
- Internally consistent
- Cost-effective
- More accurate and precise when going from lower to higher tiers

For each SPG a **reference tier** needs to be identified based on the most practical and sophisticated experimental/modeling risk assessment method.

SPGs and tiered risk assessment schemes



In the EFSA Aquatic Guidance Document, mesocosm studies are considered a suitable (surrogate) reference tier

Multi-dimensional nature of SPG

The 5 dimensions that can be used to develop specific protection goals for the key drivers (taxa) of concern

Degree of certainty

Ecol. entity:	ind. – (meta)popul. – functional gr. – community – ecosystem
Attribute:	behav. – surv. – repro/growth – abund/biom – process – biodiv.
Magnitude:	negl. effect – small effect – medium effect – large effect
Temporal scale:	days – weeks – months – seasons – years
Spatial scale:	meters – field – edge of field – watershed/landscape

The EFSA Aquatic Guidance document focussed on edge-of-field surface waters (so spatial scale dimension is fixed)

SPG Options

Ecological Threshold Option (ETO)

Accepting only negligible effects on populations of aquatic non-target organisms in edge-of-field

Propagation of effects to the community, ecosystem and landscape will be less likely

All tiers can address ETO

Ecological Recovery Option (ERO)

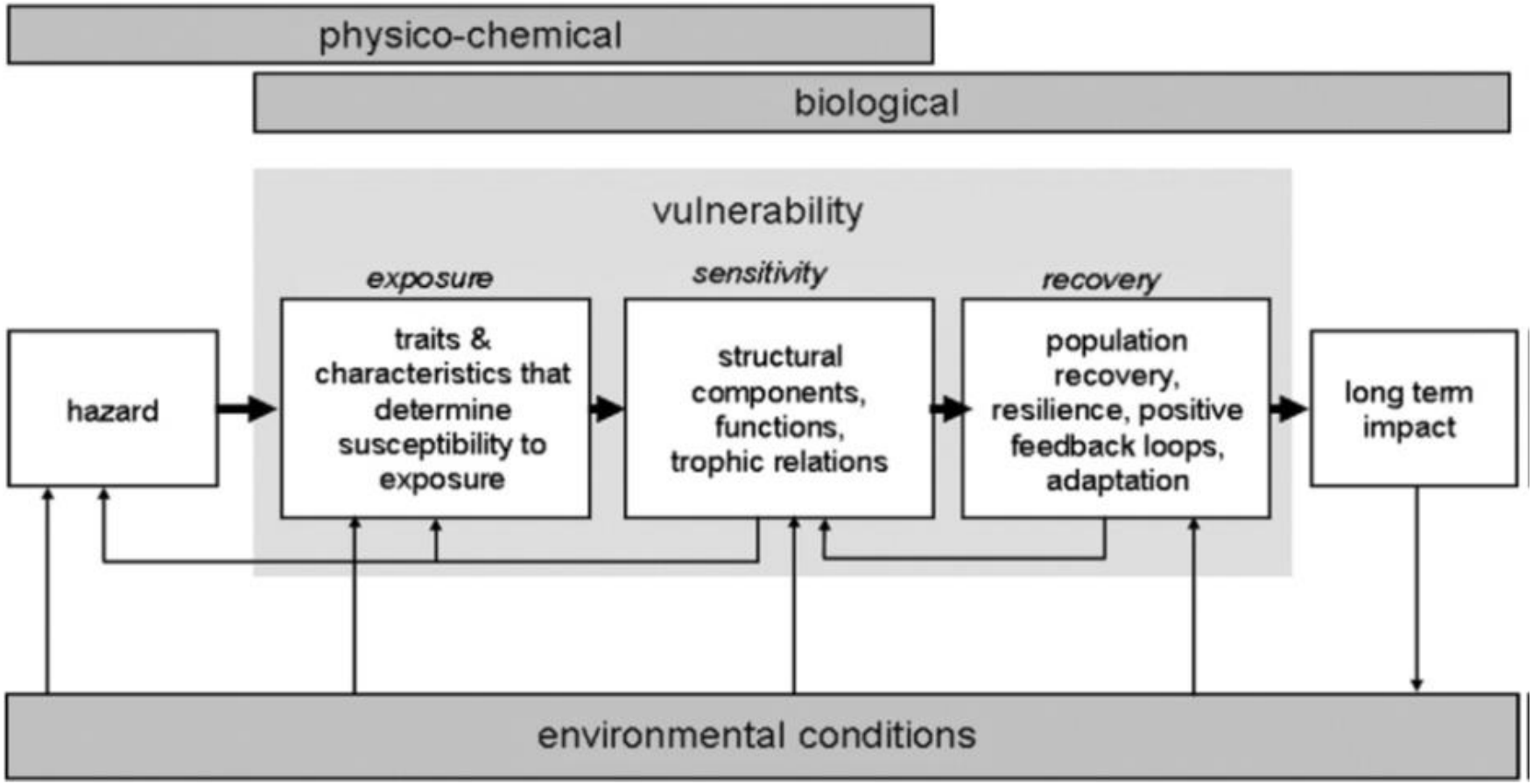
Accepting some population level effects if ecological recovery takes place within an acceptable time

Focus on vulnerable populations of aquatic organisms

Reasonable option only if recovery is not hampered by multi-stress of pesticides

ERO may be addressed by mesocosm experiments and effect models

ERO and vulnerability



General framework for ecological vulnerability assessment (after De Lange et al. 2010)

Aquatic algae (ecological threshold option)

Specific Protection Goal (SPG) proposal in edge-of-field surface waters

- Tier-1 taxa (green alga; diatom; blue-green)
- Potential vulnerable algae have a low growth rate and limited dispersal ability but most species show large seasonal fluctuations in abundance

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Magnitude:	negligible effect* – small effect – medium effect – large effect
Temp. scale:	days – weeks – months – seasons – > 1 year

* Equivalent to effect class 1 or 2 in a mesocosm study only on a single sample

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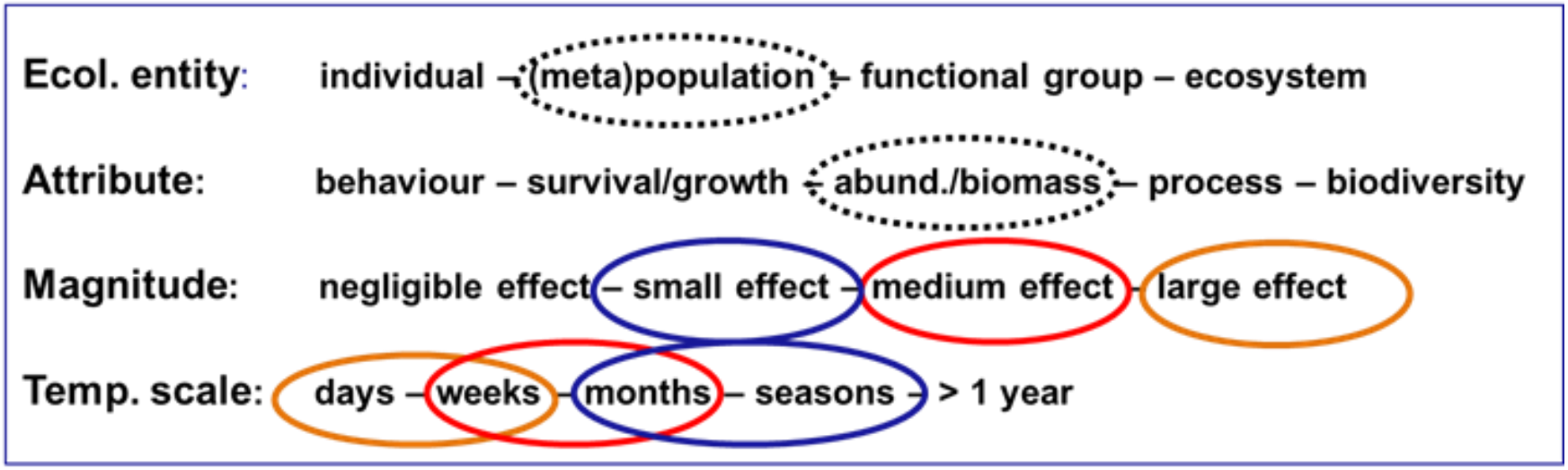

Magnitude and duration of effects cannot be considered in isolation

Aquatic vascular plants (ecological threshold option)

Specific Protection Goal (SPG) proposal in edge-of-field surface waters

- Tier-1 taxa (*Lemna gibba/minor*; *Myriophyllum*)
- Potential vulnerable taxa: Plants with a low growth rate and limited dispersal ability
- Aquatic vascular plants play an important ecological role on which many other water organisms depend (large effects not desirable)

Ecol. entity:	**individual – (meta)population – functional group – ecosystem**
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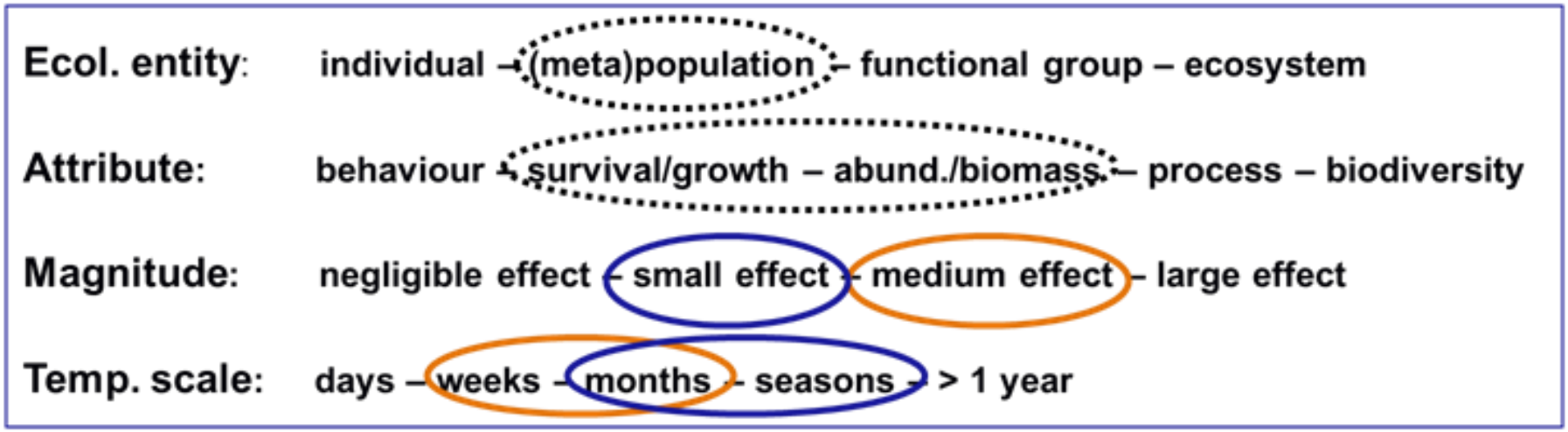

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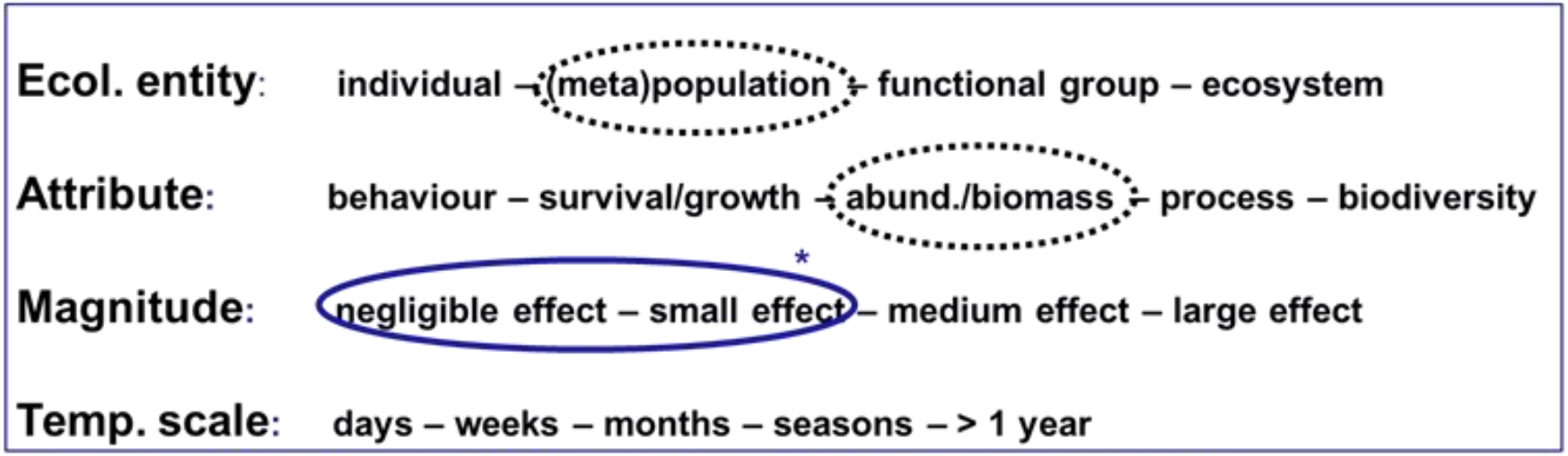
Aquatic invertebrates (ecological threshold option)

Specific Protection Goal (SPG) proposal in edge-of-field surface waters

- Tier-1 taxa (*Daphnia*; *Americamysis bahia; Chironomus riparius*)
- Potential vulnerable taxa: uni-/semivoltine invertebrates (long life cycles) with a low dispersal ability
- Many invertebrates (but not all) show large seasonal fluctuations in abundance



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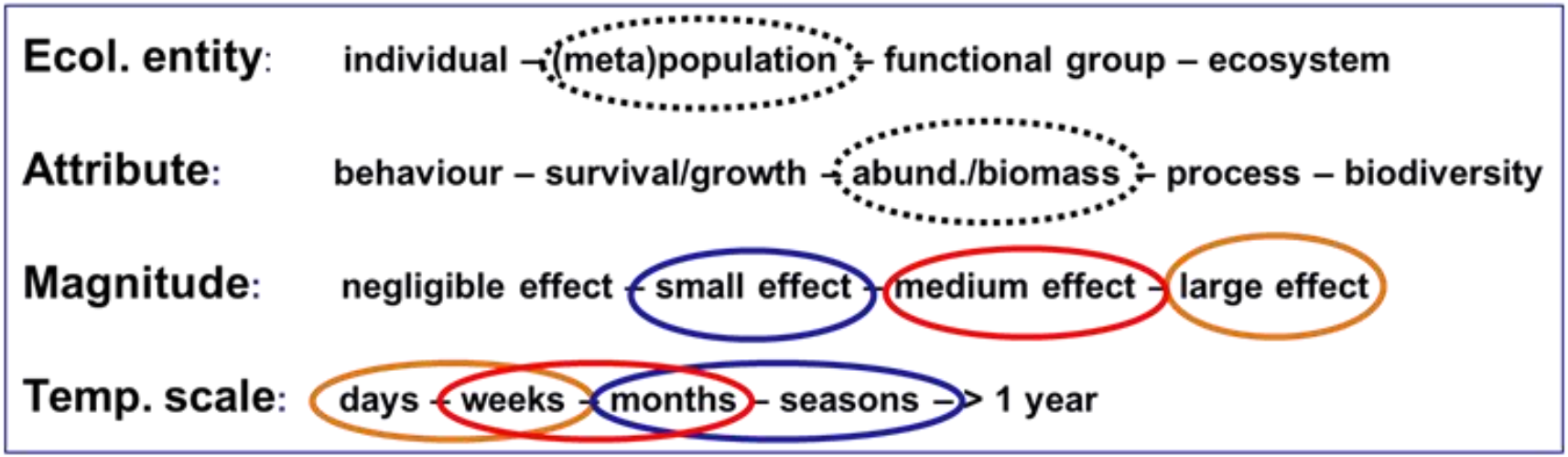

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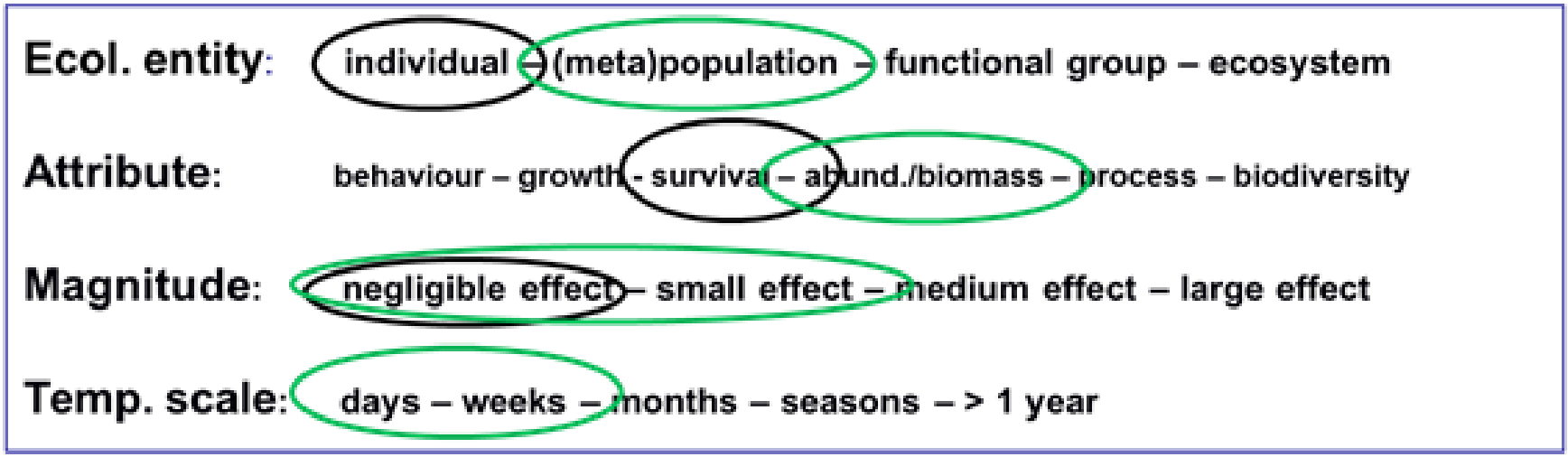
Aquatic vertebrates

Specific Protection Goal (SPG) proposal in edge-of-field surface waters

- Tier-1 taxa (e.g. *Oncorhynchus*)
- Potential vulnerable taxa: stickleback ?; aquatic stages of amphibians ?
- **Proposal**: SPG option without suffering and mortality of individuals and negligible to minor population-level effects



Aquatic microbes (proposal A)

Specific Protection Goal (SPG) proposal in edge-of-field surface waters

- **Default**: SPG at the **functional group** level to assure a negligible to small impact on important processes (e.g. litter breakdown)

Ecol. entity:	individual – (meta)population – **functional group** – ecosystem
Attribute:	behaviour – survival/growth – abund./biomass – **process** – biodiversity
Magnitude:	**negligible effect** * – small effect – medium effect – large effect
Temp. scale:	days – weeks – months – seasons – > 1 year

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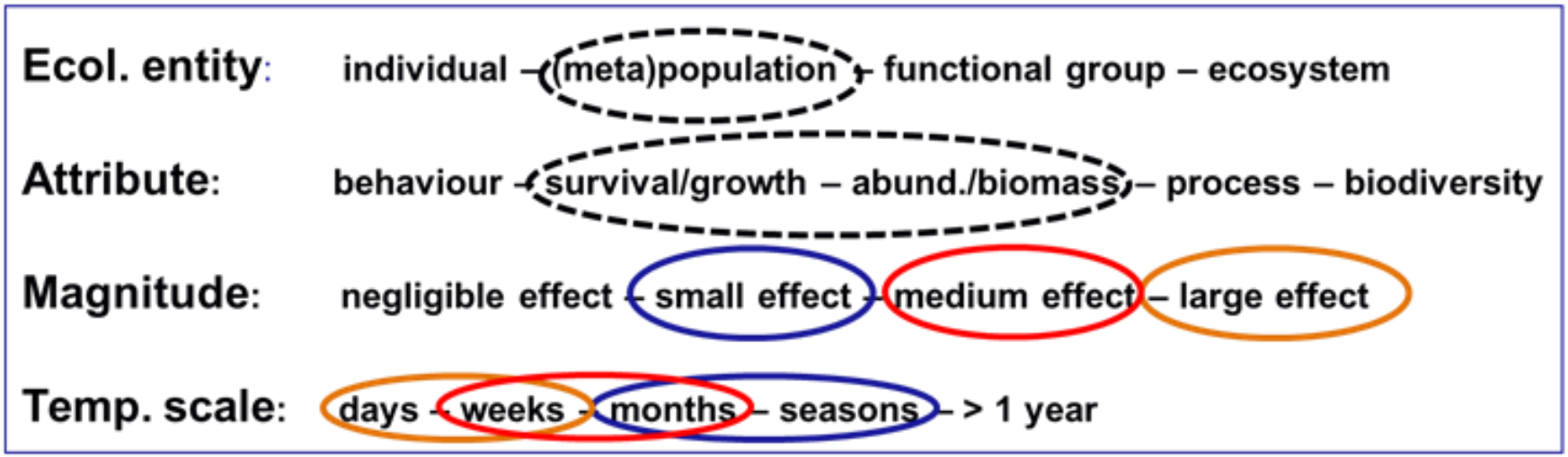
Aquatic microbes (proposal B)

Specific Protection Goal (SPG) proposal in edge-of-field surface waters

- If the PPP has a specific toxic mode-of-action affecting aquatic fungi (e.g triazole fungicides) the SPG should also consider **population level effects**, taking into account **ecological recovery**



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Specific Protection Goals

Ecological threshold option (ETO)

Organism group	Ecological entity	Attribute	Magnitude	Time
Algae	population	abundance/ biomass	negligible effect	not applicable
Aquatic plants	population	survival/growth abundance/ biomass		
Aquatic invertebrates	population	abundance/ biomass		
Vertebrates	individual	survival		
	population	abundance/ biomass		
Aquatic microbes	functional group	Processes (e.g. litter break down)	RA is not developed since Tier-1 data requirements are not defined	

Specific Protection Goals

Ecological recovery option (ERO)

Organism group	Ecological entity	Attribute	Duration and magnitude of effect on sensitive and vulnerable populations
Algae	population	Abundance/ Biomass	Total effect period < 8 weeks (also for repeated applications) Usually not possible for vulnerable populations with long life cycles and low dispersal abilities Not leading to ecologically important indirect effects
Aquatic plants	population	Survival/growth abundance/ Biomass	
Aquatic invertebrates	population	abundance/ biomass	
Vertebrates	No recovery option		

ERO may be addressed by micro-/mesocosm experiments and population models for vulnerable taxa at risk

Thanks !