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### ► To cite this version:

Severine Martini, Floriane Larras, Aurélien Boyé, Emile Faure, Nicole Aberle, et al.. Functional trait-based approaches as a common framework for freshwater and marine ecologists. 11th Symposium for European Freshwater Sciences (SEFS), Jun 2019, Zagreb, Croatia. hal-03232606

**HAL Id: hal-03232606**

**<https://hal.univ-lorraine.fr/hal-03232606v1>**

Submitted on 21 May 2021

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# Functional trait-based approaches as a common framework for freshwater and marine ecologists

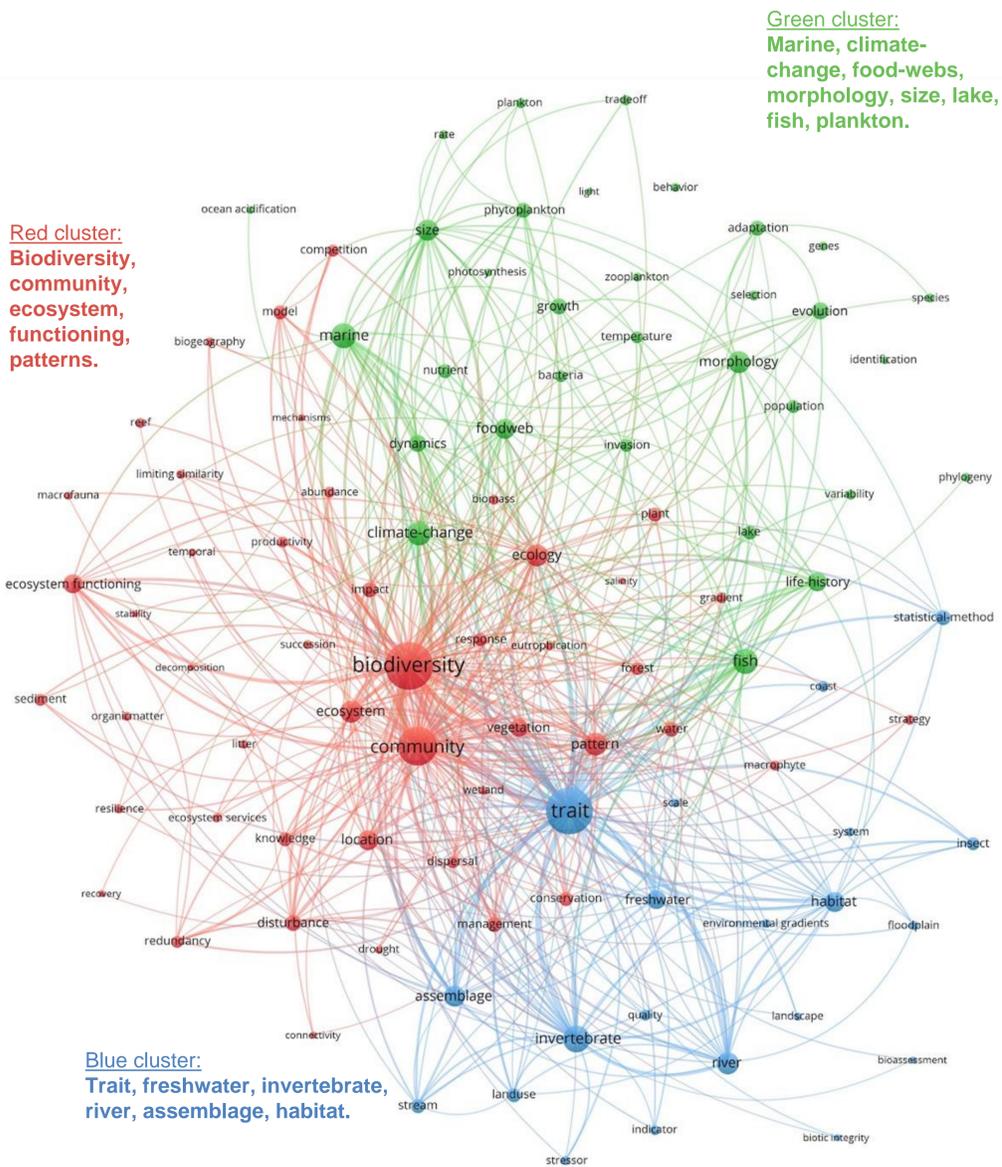
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## Context and objectives

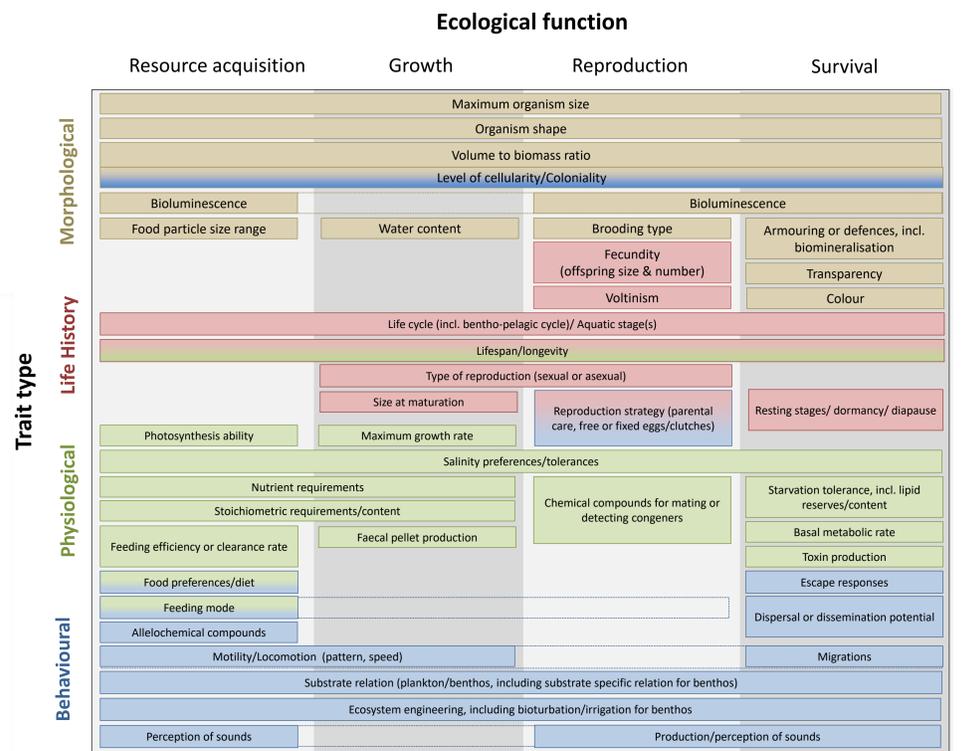
Aquatic ecologists face a common challenge: identifying the **general rules of the functioning of aquatic ecosystems** and developing a more predictive ecological understanding. However, freshwater and marine ecologists traditionally form two distinct scientific communities. A **common framework** is needed to transcend fields specificities and taxonomy by providing sharable tools.

**Our goal is to advocate the use of functional trait-based approaches as a common framework for aquatic ecologists.**

**Functional traits** are morphological, physiological or phenological feature measurable at the individual level, from the cell to the whole-organism level, which impacts fitness indirectly via its effects on growth, reproduction and survival (Violle et al. 2007, Oikos).



**Figure 1: Network map representing the keywords used in publications related to trait-based approaches in aquatic ecology.** The co-occurrence network is based on the top 100 keywords used in 2,476 articles extracted from Web of Science. It highlights the topics for which functional-trait approaches have been used. Three clusters are identified and underline the need of more interactions between freshwater and marine ecology.



**Figure 2: Unified typology of aquatic functional traits.** This typology focuses on the key traits that transcend the taxonomic peculiarities of the different aquatic ecosystems. They are classified by type and ecological function as in Litchman & Klausmeier (2008, *Annu. Rev. Ecol. Evol. Syst.*).

## New tools for functional trait-based approaches



**EMPIRICAL:** traits measured in situ and in the laboratory. Recently, several databases became available, but often focusing on a limited number of organisms and traits.



**IMAGING/ACOUSTIC:** behaviour and traits with morphological or acoustic signature, measured automatically with high frequency. Opportunities from artificial intelligence recognition and classification.



**OMICS:** give access to structures and functions at different molecular levels.



**MODELING:** simulation of the distribution and dynamics of traits, in relation with biogeography, biogeochemical cycles or impact of human pressures.

## Opportunities and common challenges for aquatic ecologists

- ⇒ **Studying functional diversity over various spatio-temporal scales:** Using functional traits as a common currency among marine ecologists, these approaches could revealing hidden patterns of diversity.
- ⇒ **Trait-based monitoring, conservation, and management of aquatic ecosystems:** functional traits provide integrative tools for biomonitoring, ecological quality assessment of aquatic ecosystems, and biodiversity conservation in the context of global changes.
- ⇒ **Disentangling food web structures and trophic interactions:** functional traits provide new insights for studying biotic interactions, trophic structures, and relationship between diversity and ecosystem functioning.