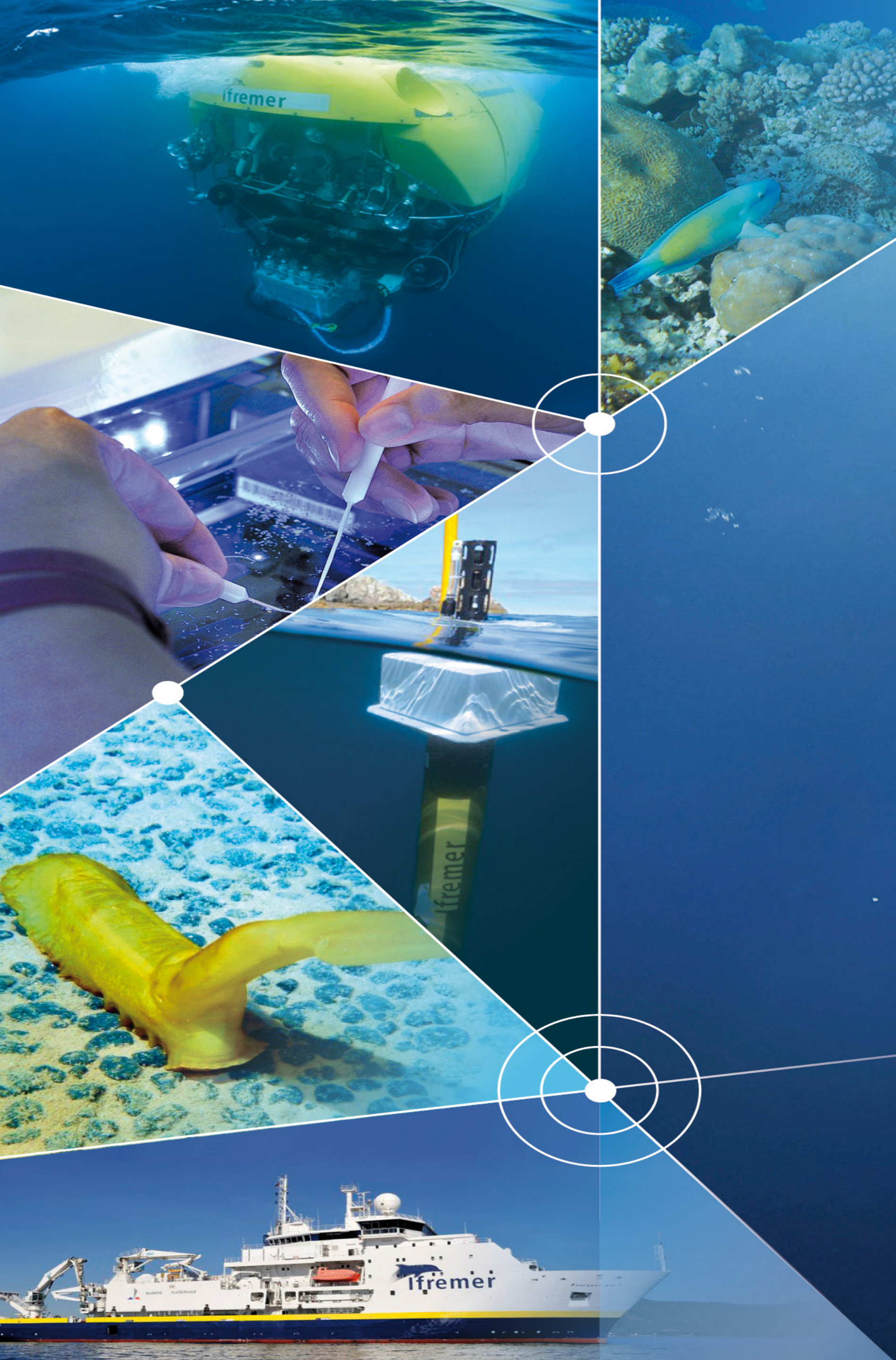

TRAIT-BASED APPROACHES IN AQUATIC ECOLOGY

AURÉLIEN BOYÉ (LEBCO/DYNECO)

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- Definitions of traits : functional ? Biological ? Ecological ?
- Traits : which one ?
- Measuring, coding and analysing traits : some references
- Traits to do what ?

Definitions of traits : functional ? Biological ? Ecological ?

Term	Definitions	References	Examples
Trait	**Any morphological, physiological or phenological feature measurable at the individual level, from the cell to the whole-organism level, without reference to the environment or any other level of organization.**	(Violle et al. 2007)	
	A well-defined, measurable property of organisms, usually measured at the individual level and used comparatively across species.	(McGill et al. 2006)	
Functional trait	**Any trait that impacts fitness indirectly via its effects on growth, reproduction and survival.**	(Violle et al. 2007)	
	Morphological, biochemical, physiological, structural, phenological, or behavioral characteristics that are expressed in phenotypes of individual organisms and are considered relevant to the response of such organisms to the environment and/or their effects on ecosystem properties.	(Díaz et al. 2013)	
	Characteristics of an organism that are considered relevant to its response to the environment and/or its effects on ecosystem functioning.	(Díaz and Cabido 2001)	
	Components of an organism's phenotype that influence ecosystem level processes.	(Petchey and Gaston 2006)	
	Any trait that strongly influences organismal performance.	(McGill et al. 2006)	
	Any trait directly influencing organismal performance.	(Mouillot et al. 2013)	
Performance trait	Any functional trait directly influencing organismal performance	(Violle et al. 2007)	Somatic biomass, reproductive output, such as offspring biomass or number, and survival.

LIMNOLOGY and OCEANOGRAPHY

ASLO

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Functional trait-based approaches as a common framework for aquatic ecologists

Séverine Martini,[1,2*] Floriane Larras,[3,†] Aurélien Boyé,[4,†] Emile Faure,[1,5,†] Nicole Aberle,[6] Philippe Archambault,[7] Lise Bacouillard,[8] Beatrix E Beisner,[9] Lucie Bittner,[5,10] Emmanuel Castella,[11] Michael Danger,[10,12] Olivier Gauthier,[4] Lee Karp-Boss,[13] Fabien Lombard,[1,10] Frédéric Maps,[7] Lars Stemmann,[1] Eric Thiébaut,[8] Philippe Usseglio-Polatera,[12] Meike Vogt,[14] Martin Laviale,[12,‡] Sakina-Dorothée Ayata[1,5,‡]

Biological traits	Traits that describe the biological attributes of the species.	(Mondy and Usseglio-Polatera 2014)	For instance, for freshwater invertebrates: size, life span, number of reproductive cycle per year, type of aquatic stages, reproduction strategy, and dispersal strategy, resistance forms, respiration mode, locomotion or substratum relation, and feeding mode.
Ecological traits	Traits that refer to habitat or environmental requirements.	(Beauchard et al. 2017)	
	Traits that describe the species-habitat relationships.	(Mondy and Usseglio-Polatera 2014)	For instance for freshwater invertebrates: altitudinal, substratum, temperature and salinity

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Term	Recommended definitions	References	Examples
Trait	Any morphological, physiological or phenological feature measurable at the individual level, from the cell to the whole-organism level, without reference to the environment or any other level of organization.	Violle et al. (2007)	
Functional trait	Any trait that impacts fitness indirectly via its effects on growth, reproduction and survival.	Violle et al. (2007)	
Realized trait	Trait actually measured in situ or in the laboratory	Reu et al. (2011)	
Potential trait	Trait described from the literature, usually at the species level, and ideally covering a large variety of environmental conditions.	Reu et al. (2011)	
Life history traits	Traits referring to life history	Litchman and Klausmeier (2008)	Type of reproduction (sexual vs. asexual) or the ability to form resting stages.
Morphological trait	Traits related to the morphology of organisms	Litchman and Klausmeier (2008)	Cell size, cell shape.
Physiological trait	Traits related to the physiology of organisms	Litchman and Klausmeier (2008)	Nutrient acquisition, response to light.
Behavioral trait	Traits related to the behavior of organisms	Litchman and Klausmeier (2008)	Motility.

Martini et al. 2020 (Limnol. Oceanog.)

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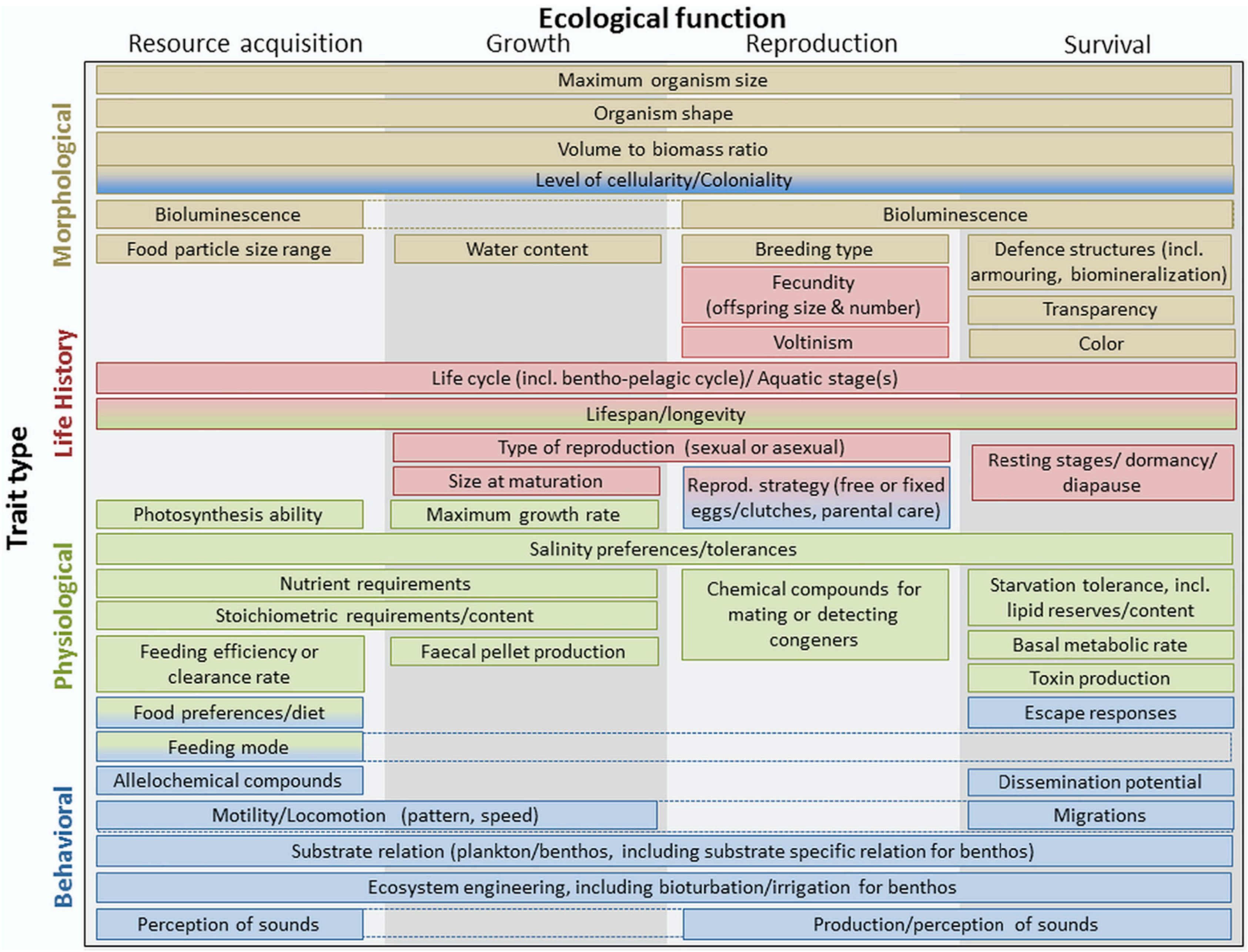
Traits : which one ?



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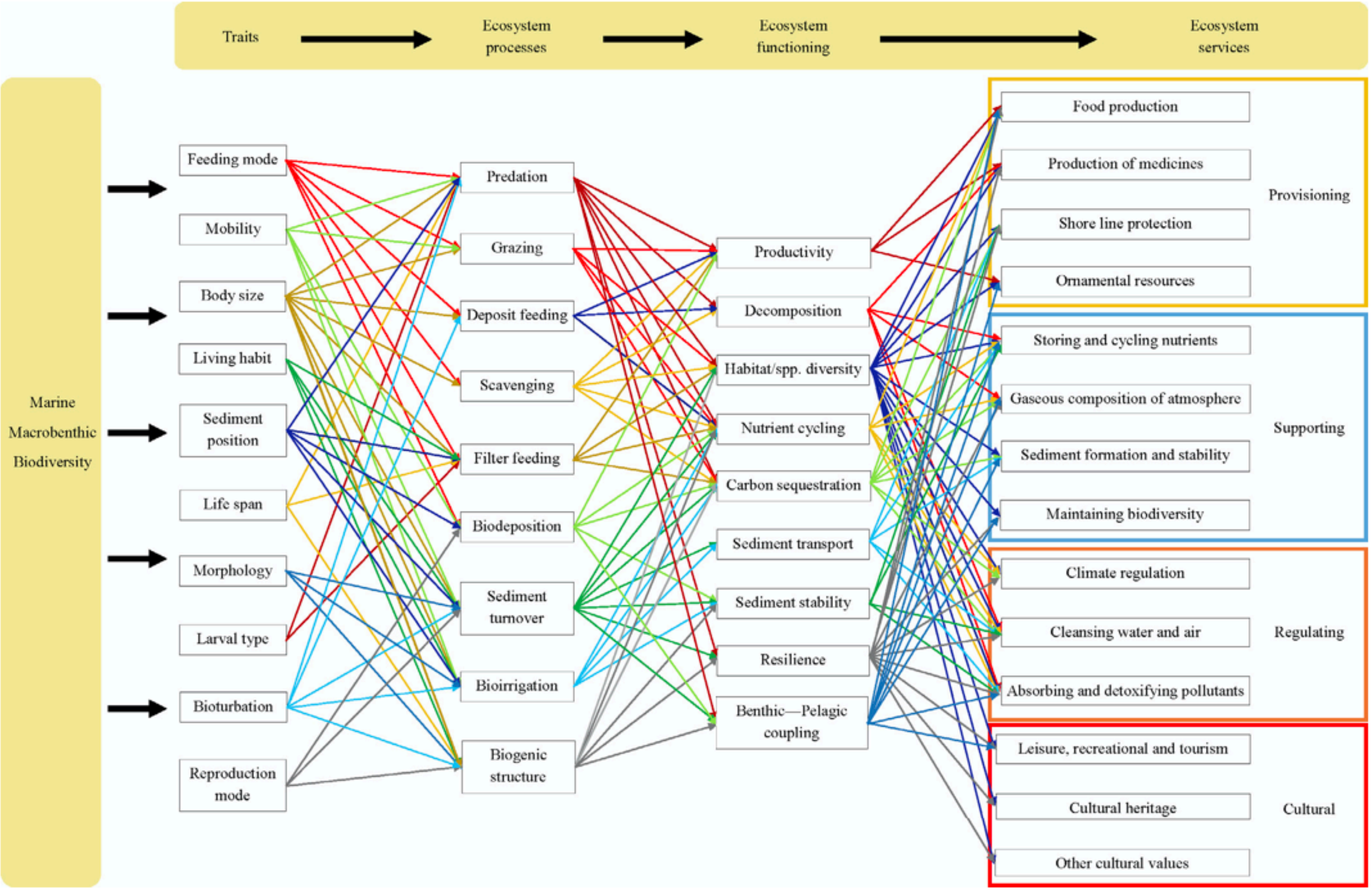

Lam-Gordillo et al. 2020 (Ecol. Indic.)

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The traits you want *vs* the traits you have

Global Ecology and Biogeography, (Global Ecol. Biogeogr.) (2012) **21**, 922–934

RESEARCH PAPER

Extensive gaps and biases in our knowledge of a well-known fauna: implications for integrating biological traits into macroecology

Elizabeth H. M. Tyler[1,2,3]*, Paul J. Somerfield[4], Edward Vanden Berghe[5], Julie Bremner[6], Emma Jackson[7], Olivia Langmead[7], Maria Lourdes D. Palomares[8] and Thomas J. Webb[1]*

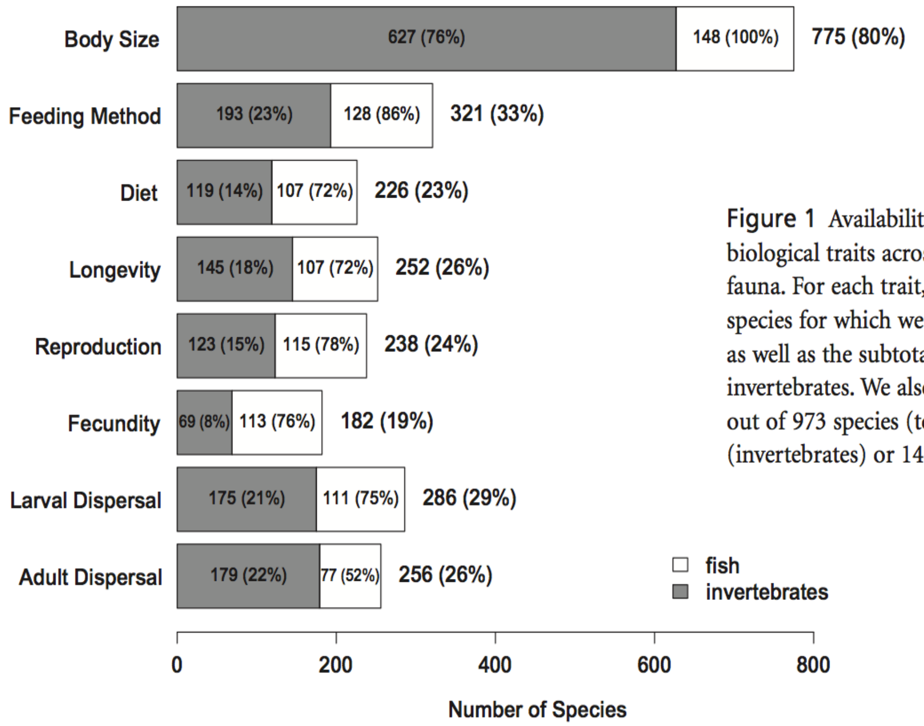

Figure 1 Availability of data on eight key biological traits across the UK marine fauna. For each trait, the total number of species for which we have data is given, as well as the subtotals for fish and invertebrates. We also give percentages, out of 973 species (total), 825 species (invertebrates) or 148 species (fish).

Table 3 Completeness of traits in BIOTIC. The completeness of trait information for species in BIOTIC (*Marshall et al., 2006*).

Trait	No. species	Percentage of species (*n* = 685)
Body-size	664	96.93
Mobility	407	59.42
Sociability	395	57.66
Feeding method	392	57.23
Habit	369	53.87
Fragility	366	53.43
Flexibility	363	52.99
Developmental mechanism	340	49.64
Regeneration	330	48.18
Reproductive type	322	47.01
Dependency	315	45.99
Growth form	302	44.09
Substratum	296	43.21
Food type	288	42.04
Distribution in UK	283	41.31
Depth range	283	41.31
Global distribution	282	41.17
Environmental position	282	41.17
Life-span	276	40.29
Reproductive season	272	39.71
Fertilization type	258	37.66
Reproductive frequency	254	37.08
Reproductive location	247	36.06
Maturity	236	34.45
Migratory	232	33.87
Larval settling time	230	33.58
Biological zone	221	32.26
Dispersal potential (Adult)	215	31.39
Salinity	212	30.95
Physiography	206	30.07
Dispersal potential (Larvae)	166	24.23
Wave exposure	166	24.23
Bioturbator	158	23.07
Egg size	158	23.07
Fecundity	155	22.63
Larval settlement period	148	21.61
Tidal strength	138	20.15
Generation time	136	19.85
Growth rate	115	16.79
Height	96	14.01
Biogeography	93	13.58
Toxic	50	7.30
Host	6	0.88

Costello et al. 2015 (PeerJ)

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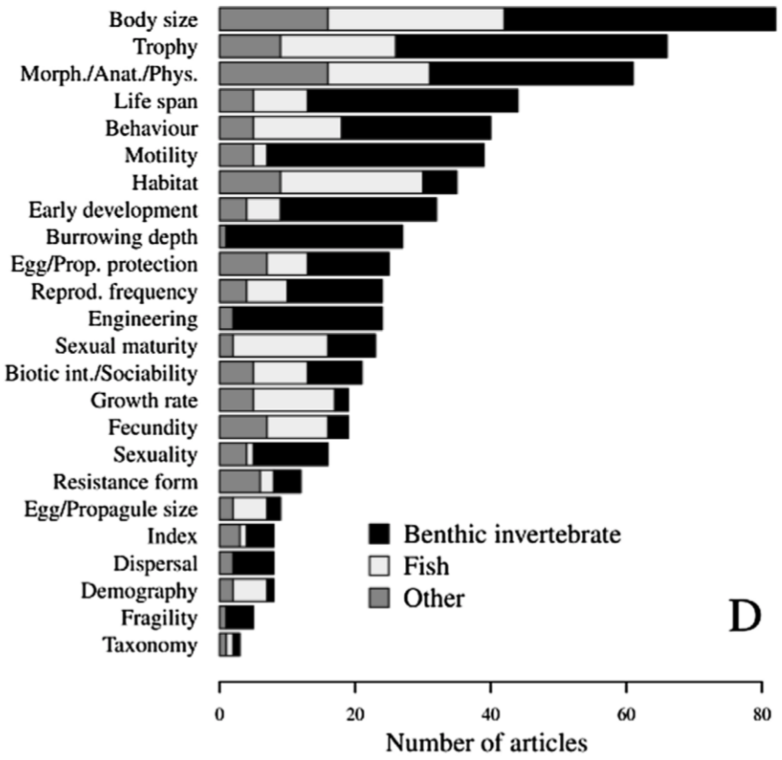
The traits you want *vs* the traits you have



Beauchard et al. (2017) *Ecological Indicators*

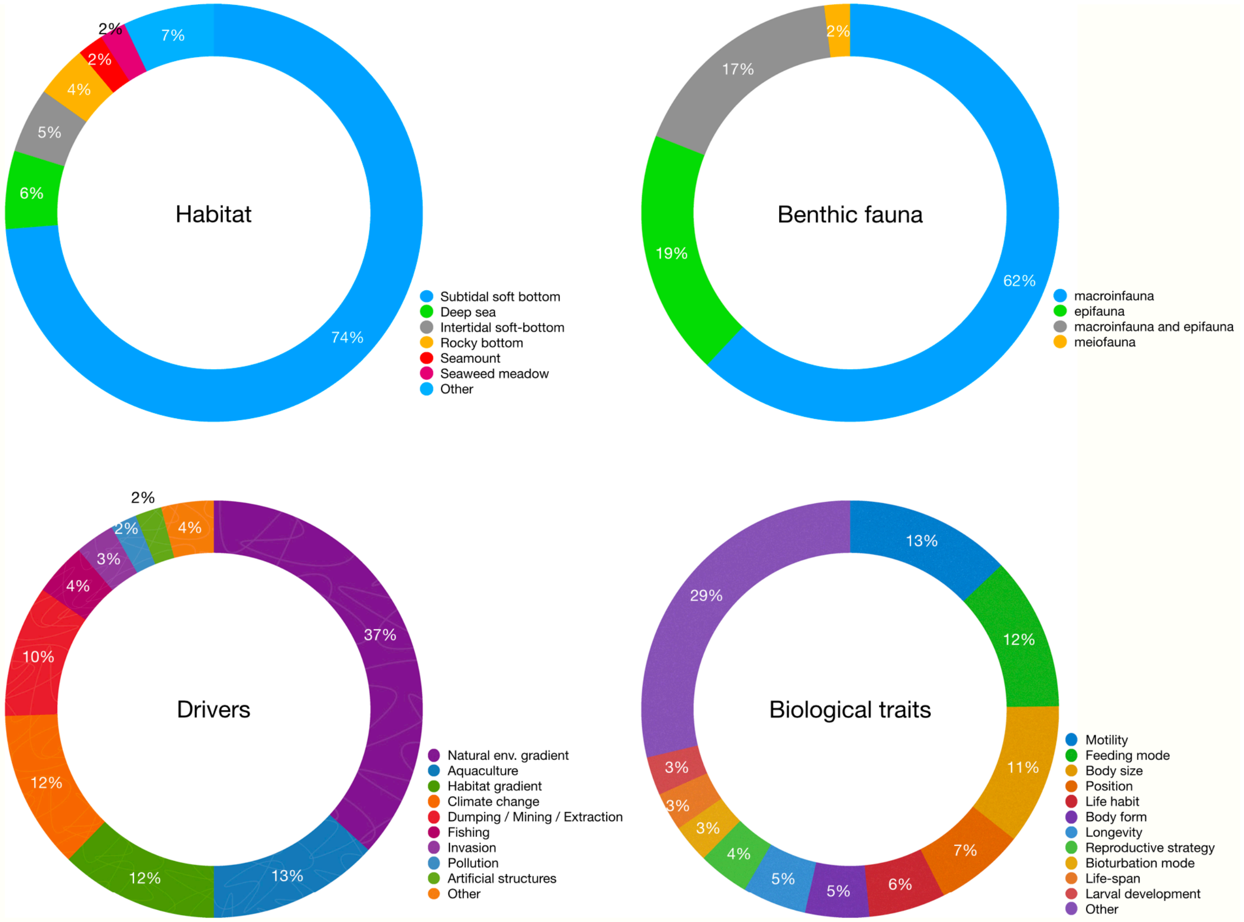


FIGURE 1 The literature on biological traits, as a summary of 90 published papers from 2003 to 2021 (Scopus literature database search in 25/12/2021), has widely covered marine habitats and benthic components, natural and anthropogenic drivers of change, and biological traits. The most commonly assessed drivers have been biotic and abiotic natural gradients, aquaculture, and climate change, whereas the most common traits have been the motility, feeding mode, body size, and environmental position

De Juan et al. 2022 (Ecol. Evol.)

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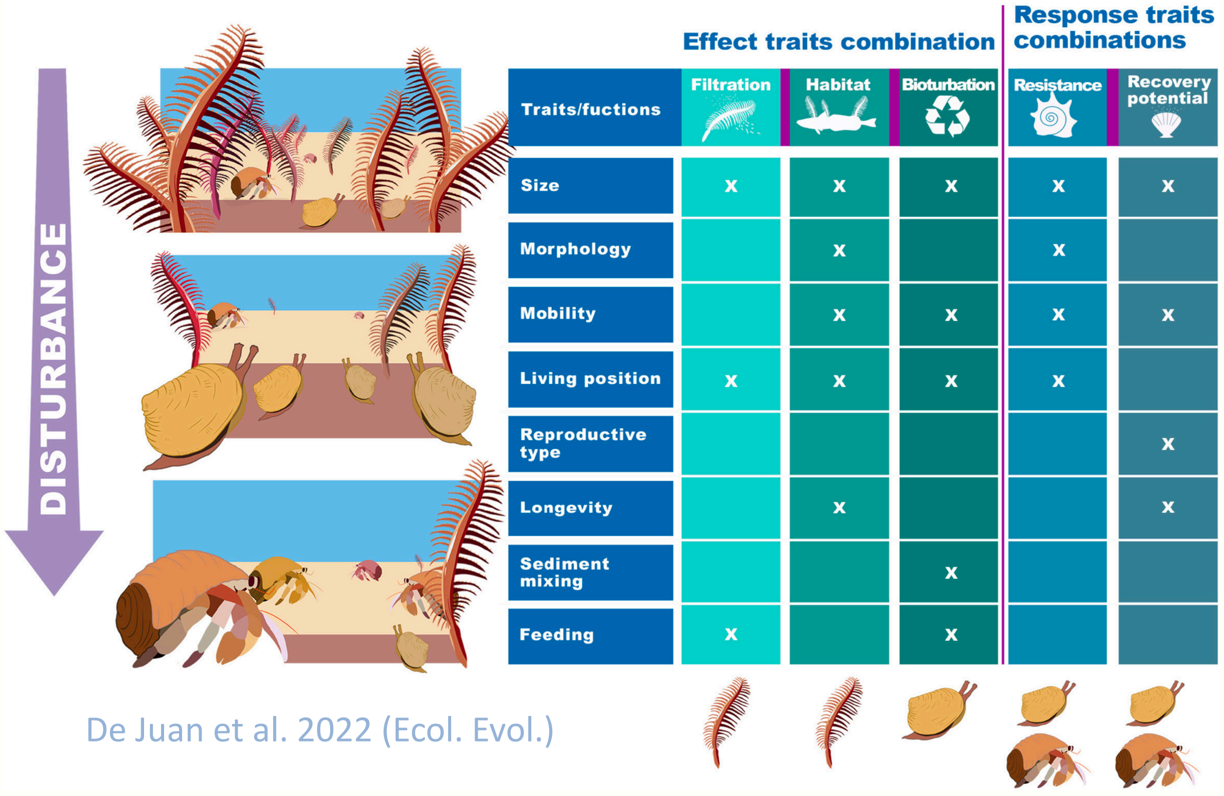
Response and effect traits



Traits/fuctions	Filtration	Habitat	Bioturbation	Resistance	Recovery potential
Size	x	x	x	x	x
Morphology		x		x	
Mobility		x	x	x	x
Living position	x	x	x	x	
Reproductive type					x
Longevity		x			x
Sediment mixing			x		
Feeding	x		x		

De Juan et al. 2022 (Ecol. Evol.)

Effect trait	Traits that determine effects of [organisms] on ecosystem functions.	(Lavorel and Garnier 2002)	
	Traits that are usually relevant at the ecosystem level	(Hébert et al. 2017)	Respiration, excretion, clearance rate.
	Any trait which reflects the effects of [an organism] on environmental conditions, community or ecosystem properties.	(Violle et al. 2007)	
Response trait	Any trait whose value varies in response to changes in environmental conditions	(Violle et al. 2007)	
	Traits associated with the response of [organisms] to environmental factors such as resources and disturbances.	(Lavorel and Garnier 2002)	
	Traits that are usually most relevant at the community level	(Hébert et al. 2017)	Behavior-related traits.

Martini et al. 2020 (Limnol. Oceanog.)

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Response vs effect traits : overlooked but in progress

2. Biological and ecological processes associated to each trait

Table S1 List of traits and associated biological and ecological processes.

Trait	Biological and ecological processes associated
Maximum size (mm)	Resource acquisition, habitat use, species interaction (competition, predation), nutrient cycling, secondary production (Degen et al., 2018; Törnroos & Bonsdorff, 2012)
Feeding method	Resource utilisation, energy transfer, nutrient cycling (Törnroos & Bonsdorff, 2012)
Food size	Resource utilisation, energy transfer, nutrient cycling (Törnroos & Bonsdorff, 2012)
Adult preferred substrate position	Resource acquisition, habitat use, species interaction, nutrient cycling (Norling et al., 2007; Törnroos & Bonsdorff, 2012)
Living habit	Colonisation, recovery dynamics, dispersal, nutrient cycling (Norling et al., 2007; Queirós et al., 2013)
Daily adult movement capacity	Colonisation, recovery dynamics, dispersal (Törnroos & Bonsdorff, 2012)
Bioturbation	Nutrient cycling, sediment oxic-anoxic boundaries and chemical properties (Norling et al., 2007; Queirós et al., 2013) ; species interaction (Bouma et al., 2009)
Sexual differentiation	Recovery dynamics, dispersal, secondary production (Törnroos & Bonsdorff, 2012)
Development mode	Recovery dynamics, dispersal, secondary production (Törnroos & Bonsdorff, 2012)
Reproduction frequency	Recovery dynamics, dispersal, secondary production (Törnroos & Bonsdorff, 2012)
Life span	Secondary production, recovery dynamics, dispersal (Degen et al., 2018)

Boyé et al. 2019 (Div. Distrib.)

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Response vs effect traits : overlooked but in progress

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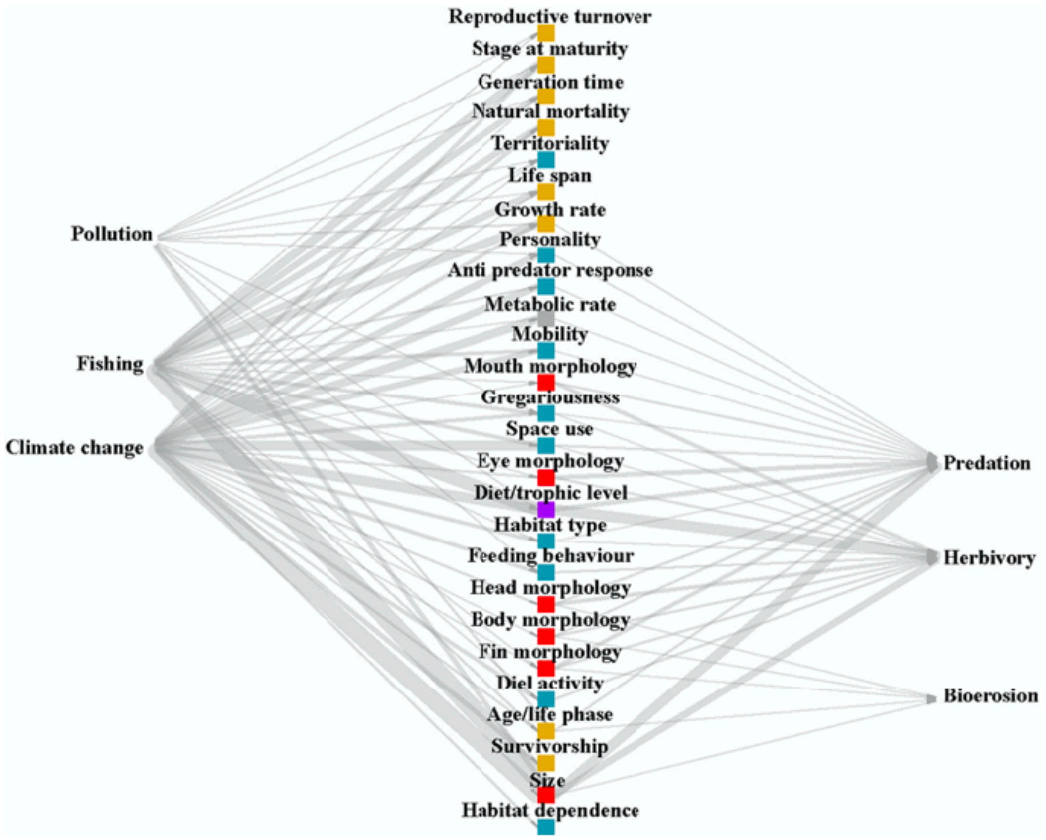
Boyé et al. 2019 (Div. Distrib.)

Response and Effect Traits of Coral Reef Fish

Jeneen Hadj-Hammou [1], David Mouillot [2] and Nicholas A. J. Graham [1]*

Citation:
Hadj-Hammou J, Mouillot D and Graham NAJ (2021) Response and Effect Traits of Coral Reef Fish. Front. Mar. Sci. 8:640619. doi: 10.3389/fmars.2021.640619



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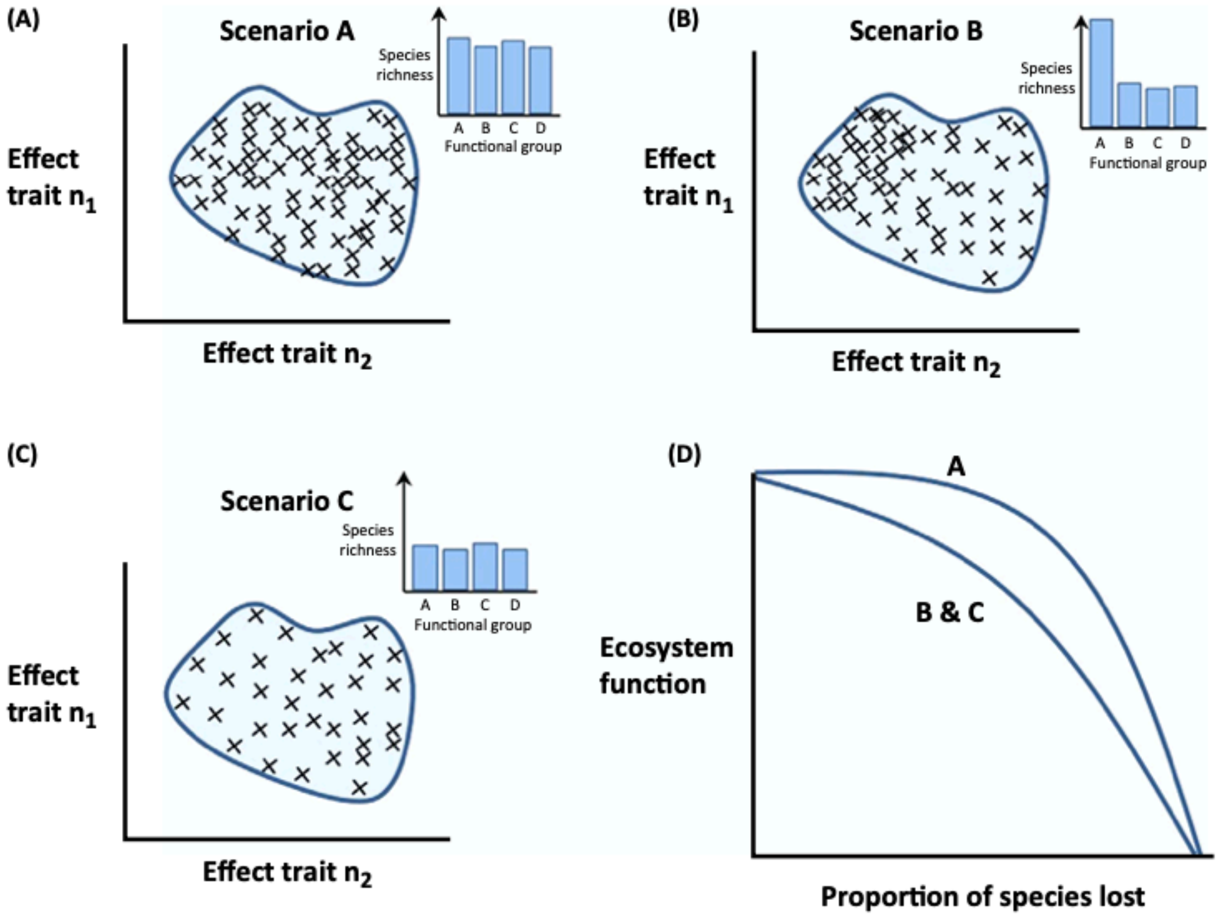
Response vs effect traits : overlooked but in progress



Oliver et al. 2015 (TREE)

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Response vs effect traits : overlooked but in progress

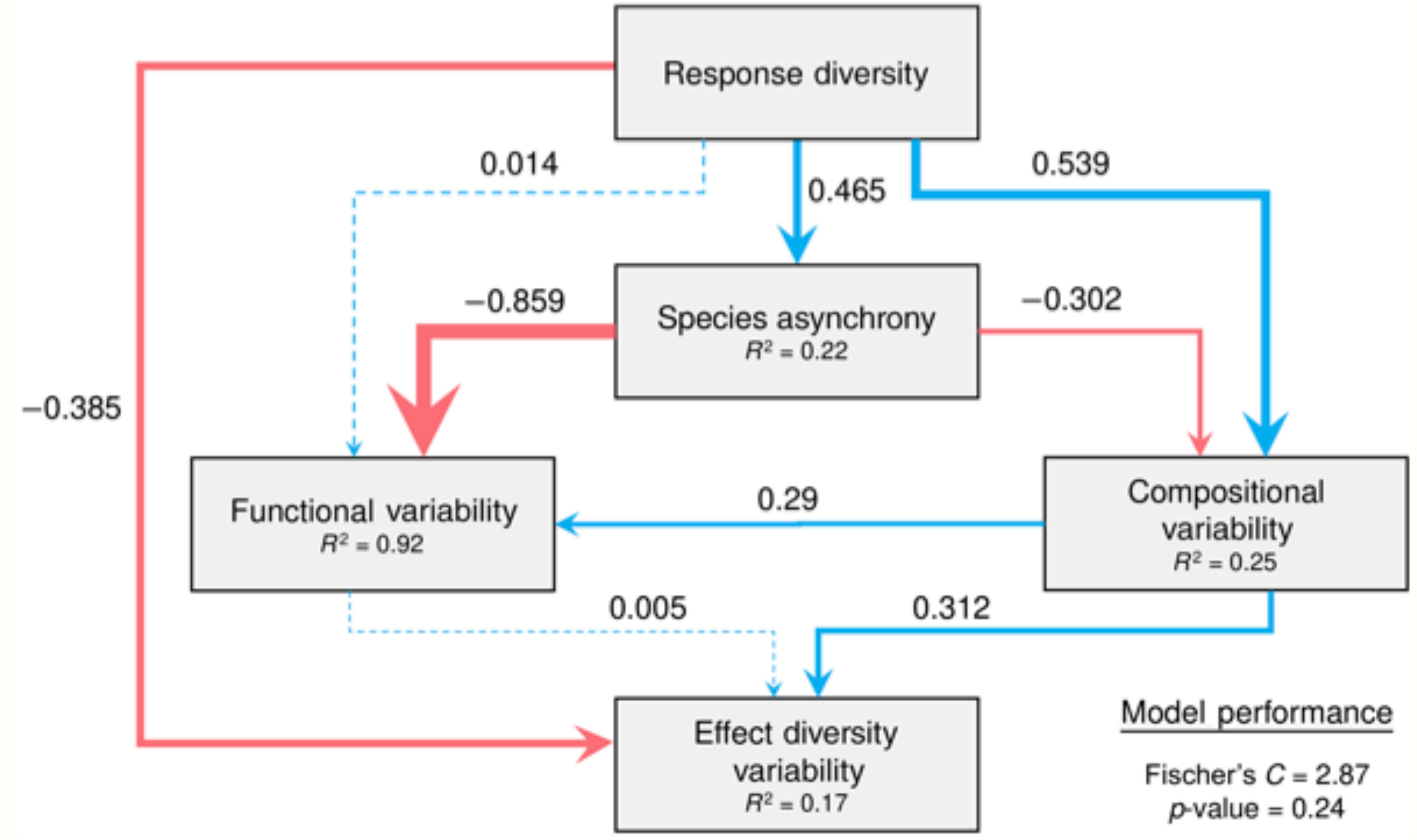
DOI: 10.1111/1365-2656.14010

Journal of Animal Ecology | British Ecological Society

RESEARCH ARTICLE

Response trait diversity and species asynchrony underlie the diversity–stability relationship in Romanian bird communities

Hannah J. White[1] | Joseph J. Bailey[1,2] | Ciortan Bogdan[2,3] | Samuel R. P.-J. Ross[4]



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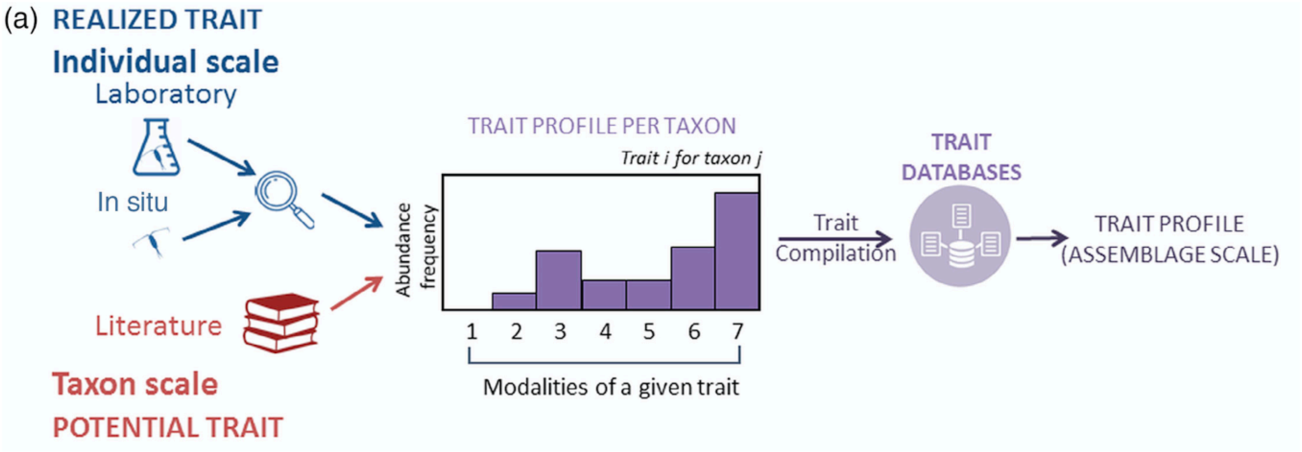
Measuring, coding and analysing traits : some references



Martini et al. 2020 (Limnol. Oceanog.)

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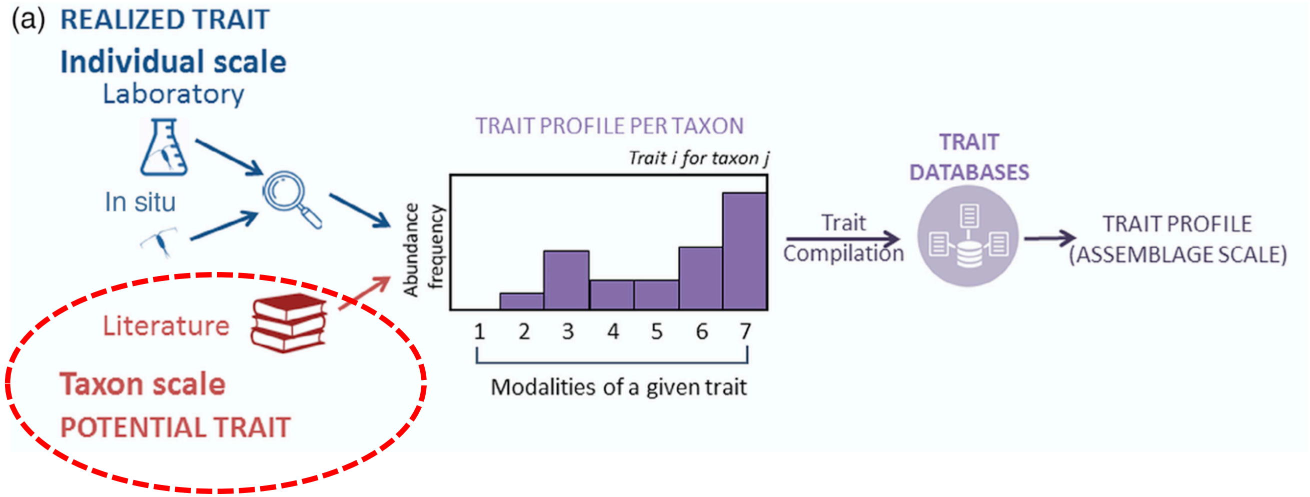

Martini et al. 2020 (Limnol. Oceanog.)

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Freshwater Biology (1994) 31, 295–309

A fuzzy coding approach for the analysis of long-term ecological data

FRANÇOIS CHEVENET,* SYLVAIN DOLÉDEC*‡ AND DANIEL CHESSEL†

A. Fuzzy coding

	Life span			
	<2years	2-4years	5-10years	>10years
Acanthocardia echinata	0	0	1	3
Actinauge richardi	0	0	0	4
Adamsia carciniopados	0	1	3	0
Aequipecten opercularis	0	0	4	0
Alcyonidium	0	0	4	0
Alcyonium digitatum	0	0	0	4
Amphiura	0	1	3	2
Anapagurus laevis	1	3	0	0

Frequency distribution by taxon →

	Life span			
	<2 years	2-4 years	5-10 years	>10 years
Acanthocardia echinata	0.00	0.00	0.25	0.75
Actinauge richardi	0.00	0.00	0.00	1.00
Adamsia carciniopados	0.00	0.25	0.75	0.00
Aequipecten opercularis	0.00	0.00	1.00	0.00
Alcyonidium	0.00	0.00	1.00	0.00
Alcyonium digitatum	0.00	0.00	0.00	1.00
Amphiura	0.00	0.17	0.50	0.33
Anapagurus laevis	0.25	0.75	0.00	0.00

Beauchard et al. (2017) *Ecological Indicators*

LIMNOLOGY and OCEANOGRAPHY

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Limnol. Oceanogr. 9999, 2020, 1–30

doi: 10.1002/lno.11655

Functional trait-based approaches as a common framework for aquatic ecologists

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Table 2. Continued

Name of the database	Taxonomic groups of interest and habitats	Reference	Brief description	Web link
Functional traits of marine protists	Marine protists, including fungi.	Ramond et al. (2018)	Provides 30 functional traits for 2007 taxonomic references associated to V4 18S rDNA sequences.	https://doi.org/10.17882/51662
COPEPEDIA/COPEPOD	Marine plankton	O'Brien (2014)	Database of plankton taxa distribution maps, photographs, biometric traits, and genetic markers.	https://www.st.nmfs.noaa.gov/copepod/documentation/contact-us.html
Trait database for marine copepods	Marine pelagic copepods	Brun et al. (2017)	Trait databases providing 9306 records for 14 functional traits of about 2600 species.	https://doi.pangaea.de/10.1594/PANGAEA.862968
Mediterranean copepods' functional traits	Marine copepods present in the Mediterranean Sea	Benedetti (2015, 2016)	Seven functional traits for 191 species.	https://doi.org/10.1594/PANGAEA.854331
Freshwater ecology	European freshwater organisms belonging to fishes, macro-invertebrates, macrophytes, diatoms and phytoplankton	Schmidt-Kloiber and Hering (2015)	Covers environmental preferences, distribution patterns, and functional traits for 20,000 taxa.	https://www.freshwaterecology.info/
Freshwater benthic diatoms	European rivers	Rimet and Bouchez (2012)	Life-forms, cell-sizes and ecological guilds for c.a. 1200 taxa	https://data.inra.fr/dataset.xhtml?persistentId=doi:10.15454/XLQ40G
	Fresh and weakly brackish waters in the Netherlands	Van Dam et al. (1994)	First comprehensive checklist of ecological traits (pH, saprobity…) for 948 diatom taxa	https://doi.org/10.1007/BF02334251
Phytoplankton of temperate lakes	Phytoplankton of temperate lakes	Rimet and Druart (2018)	Database of morphological and physiological traits of more than 1200 taxa.	https://zenodo.org/record/1164834#.XRNrPXvgrOR
Freshwater benthic micro-meiofauna	River benthic micro-meiofauna	Neury-Ormanni et al. (2019)	First integrative database of 23 morphological traits linked to resource acquisition for 35 taxa	https://doi.org/10.1007/s10750-019-04120-0
FishBase	Fishes	Froese and Pauly (2019), Beukhof et al. (2019)	Provides information on 34,100 species, including traits related to trophic ecology and life history.	www.fishbase.org https://doi.org/10.1594/PANGAEA.900866.
The Coral Trait Database	Coral species from the global oceans	Madin et al. (2016))	Includes 68,494 coral observations with 106,462 trait entries of 158 traits for 1548 coral species.	https://coraltraits.org/
FishTraits	Freshwater fishes of the United States	Frimpong and Angermeier (2010)	More than 100 traits are informed for 809 fish species of the United States, including 731 native and 78 exotic species.	http://www.fishtraits.info/

(Continues)

Table 2. Online databases documenting functional traits of aquatic organisms. Databases without a primary focus on traits, but that also provide trait information, are included. A regularly updated version of this list is available at https://github.com/severine13/FonctionalTrait_databases.

Name of the database	Taxonomic groups of interest and habitats	Reference	Brief description	Web link
Traitbank—encyclopedia of life	All taxa across the tree of life, including marine and freshwater organisms	Parr et al. (2014)	Provides traits, measurements, interactions and other facts. Actively growing resource covering all ecosystems (not restricted to aquatic ecosystems).	http://eol.org/info/516
Bromeliad invertebrate traits	Aquatic invertebrates in bromeliads from South America	Céréghino et al. (2018)	12 functional traits of 852 taxa	https://knb.ecoinformatics.org/#view/doi:10.5063/F1VD6WMF
South-east Australian freshwater macroinvertebrate traits	Freshwater macroinvertebrates from South-East Australia	Schäfer et al. (2011)	9 traits, described at the family level for 172 taxa	Supplementary information to the article
EPA freshwater biological traits database	Freshwater macroinvertebrates from North America rivers and streams	U.S. EPA (2012)	Includes functional traits (e.g., life history, mobility, morphology traits) but also ecological and habitat information for 3857 North American taxa.	https://www.epa.gov/risk/freshwater-biological-traits-database-traits
Biological Traits Information Catalogue (BIOTIC)	Benthic marine macrofauna and macroalgae	MARLIN (2006)	Includes 40 biological trait categories.	http://www.marlin.ac.uk/biotic
EMODnet Biology database	European seaweeds	Robuchon et al. (2015)	Functional traits (morphology, life history, ecophysiology) and ecological information (incl. Biogeography) for the 1800 seaweed species listed in Europe.	Ongoing work
Functional traits of marine macrophytes	European marine macrophytes, including seaweeds	Jänes et al. (2017)	Functional traits (morphology, ecophysiology) and ecological information for 68 species.	https://www.datadryad.org/resource/doi:10.5061/dryad.964pf/1
Polytraits	Marine polychaetes	Faulwetter et al. (2014)	47 traits describing morphological, behavioral, physiological, life-history characteristics, as well as the environmental preferences, for a total of 27,198 trait records for 952 species.	http://polytraits.lifewatchgreece.eu/
The Arctic Traits Database	Marine organisms from the Arctic	Degen and Faulwetter (2019)	Traits for 478 species-level taxa.	https://www.univie.ac.at/arctictraits/team
WoRMS Marine Species Traits portal	Marine species	WoRMS Editorial Board (2019)	Provides 10 traits that have been prioritized within EMODnet Biology, as part of the World Register of Marine Species (WoRMS).	http://www.marinespecies.org/traits/index.php

(Continues)

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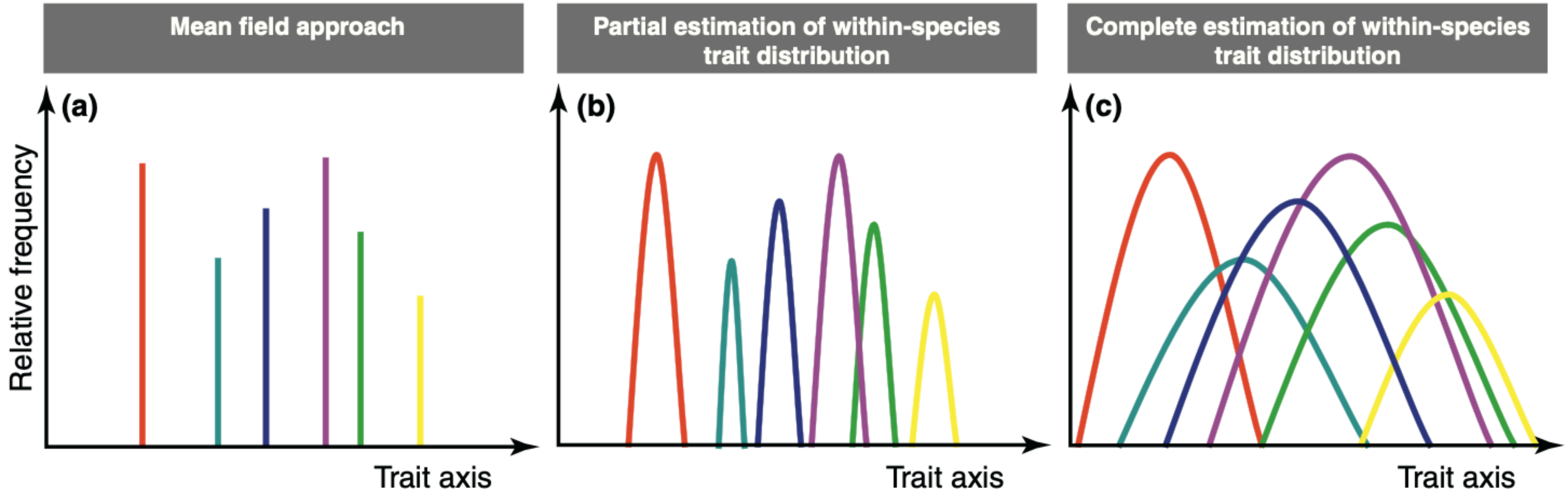
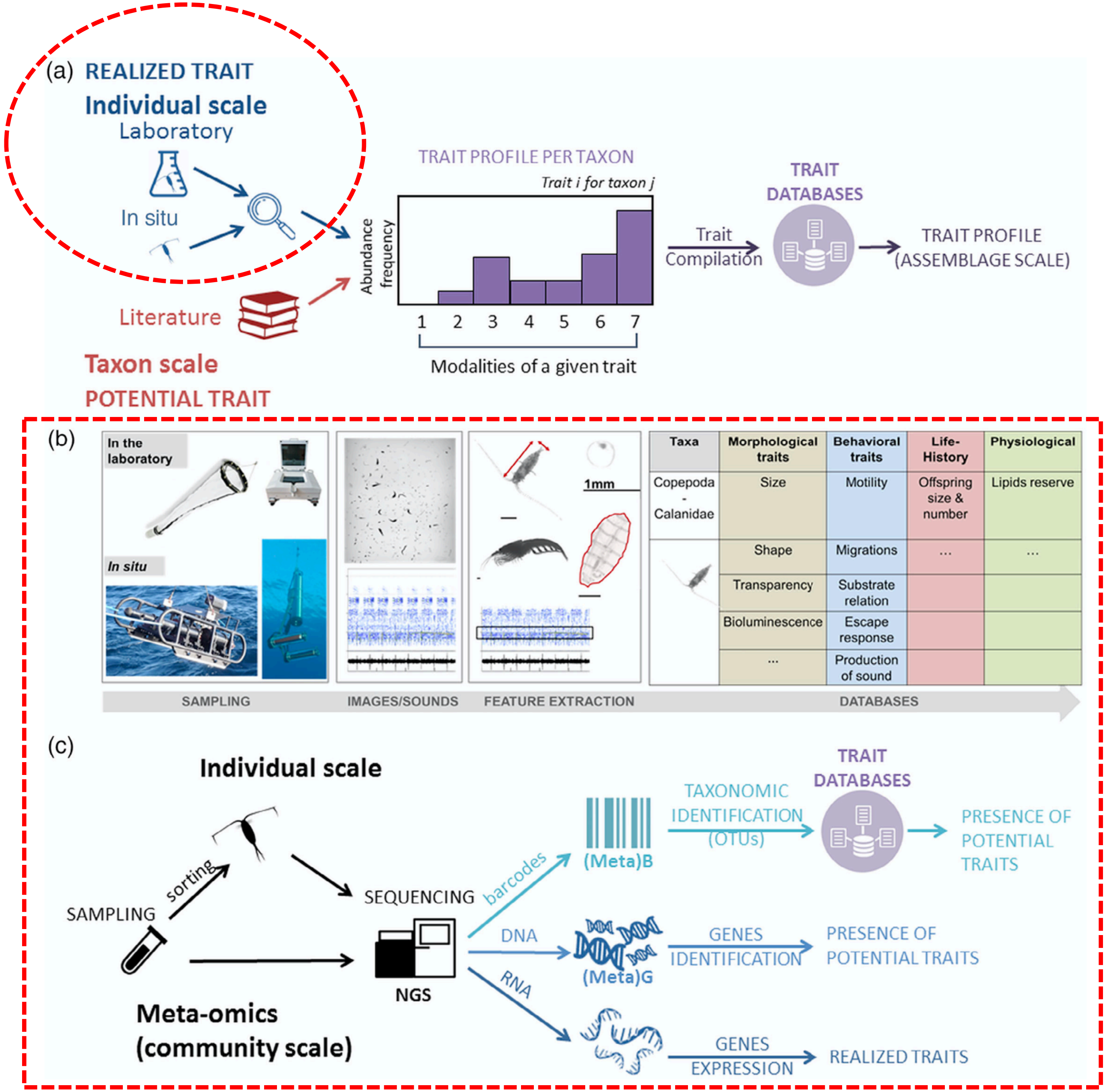
Ifremer

The return of the variance: intraspecific variability in community ecology

Cyrille Violle[1,2], Brian J. Enquist[1,3], Brian J. McGill[4], Lin Jiang[5], Cécile H. Albert[6,7], Catherine Hulshof[1], Vincent Jung[8,9] and Julie Messier[1]





Martini et al. 2020 (Limnol. Oceanog.)

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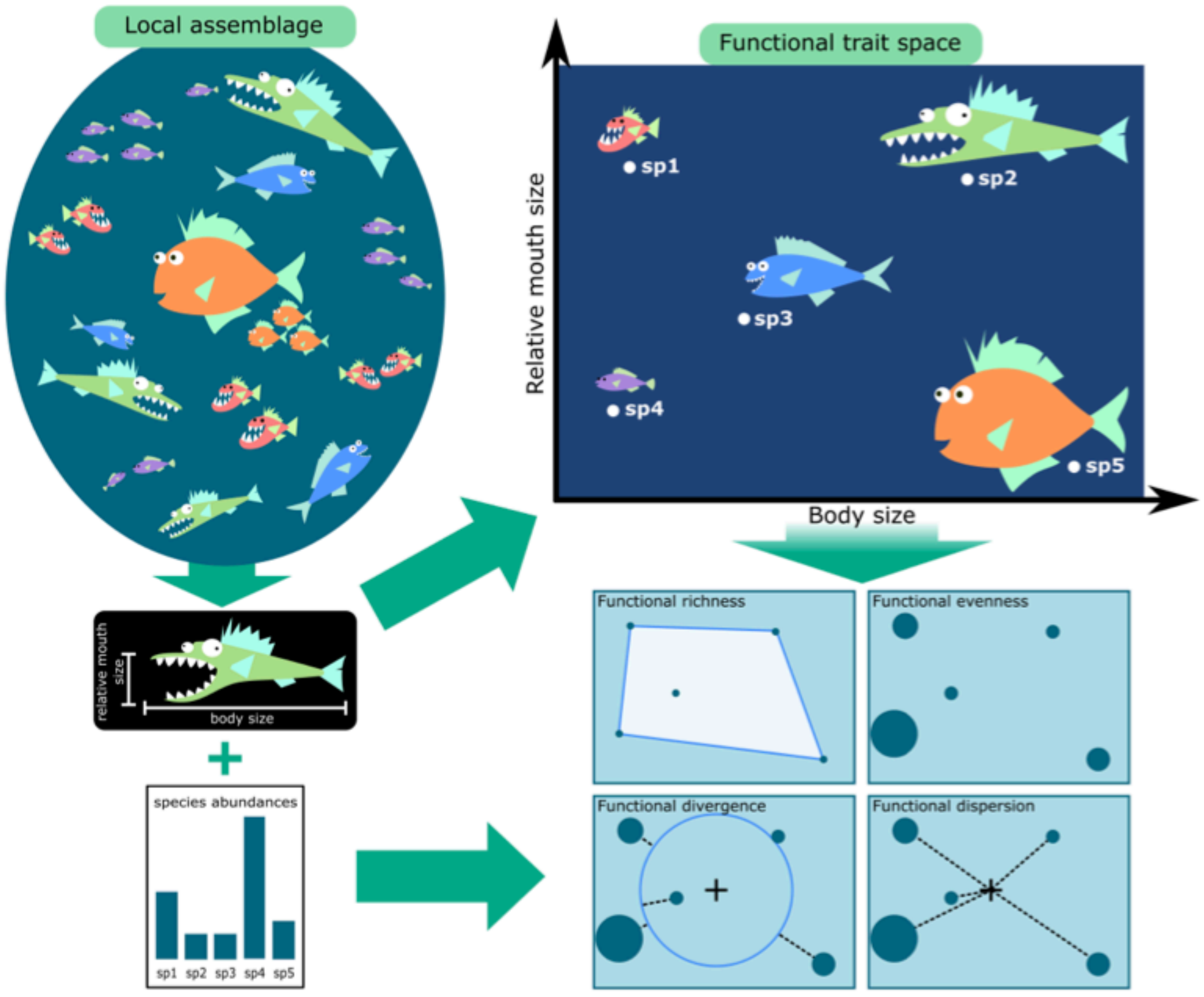
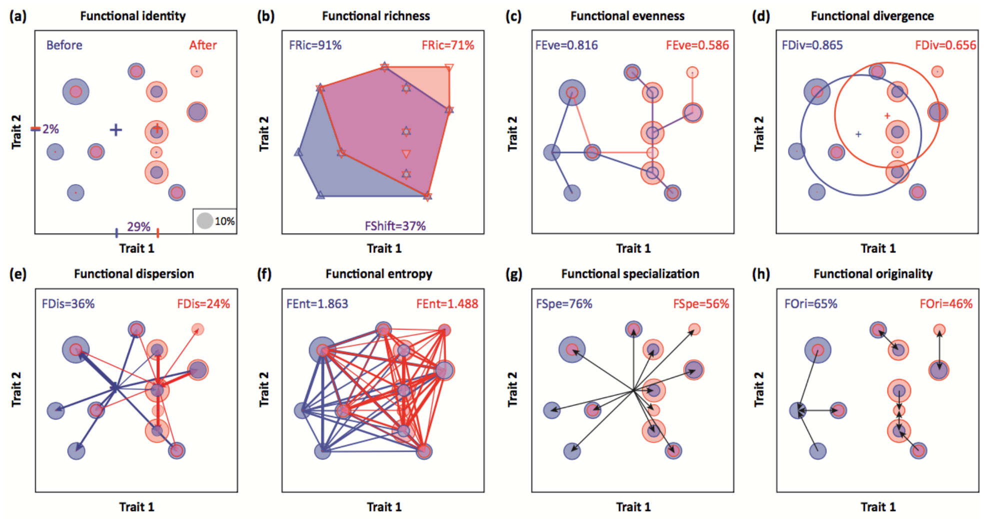
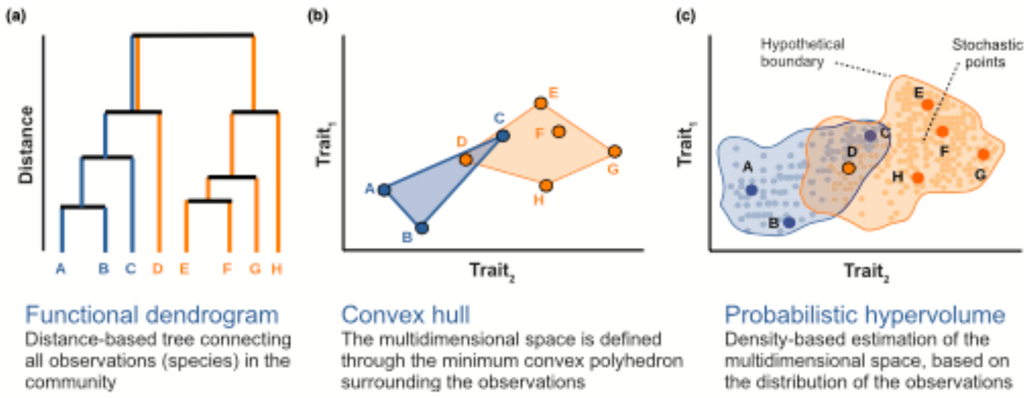


Gusmao, J.B. 2017 (Ph.D)



Mouillot et al. 2013 (TREE)



Mammola et Cardoso 2020 (MEE)

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DOI: 10.1111/1365-2435.13882

Functional Ecology BRITISH ECOLOGICAL SOCIETY

REVIEW

Concepts and applications in functional diversity

Stefano Mammola[1,2] | Carlos P. Carmona[3] | Thomas Guillerme[4] | Pedro Cardoso[1]

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A protocol for reproducible functional diversity analyses

Facundo X. Palacio, Corey T. Callaghan, Pedro Cardoso, Emma J. Hudgins, Marta A. Jarzyna, Gianluigi Ottaviani, Federico Riva, Caio Graco-Roza, Vaughn Shirey, Stefano Mammola

First published: 30 August 2022 | https://doi.org/10.1111/ecog.06287

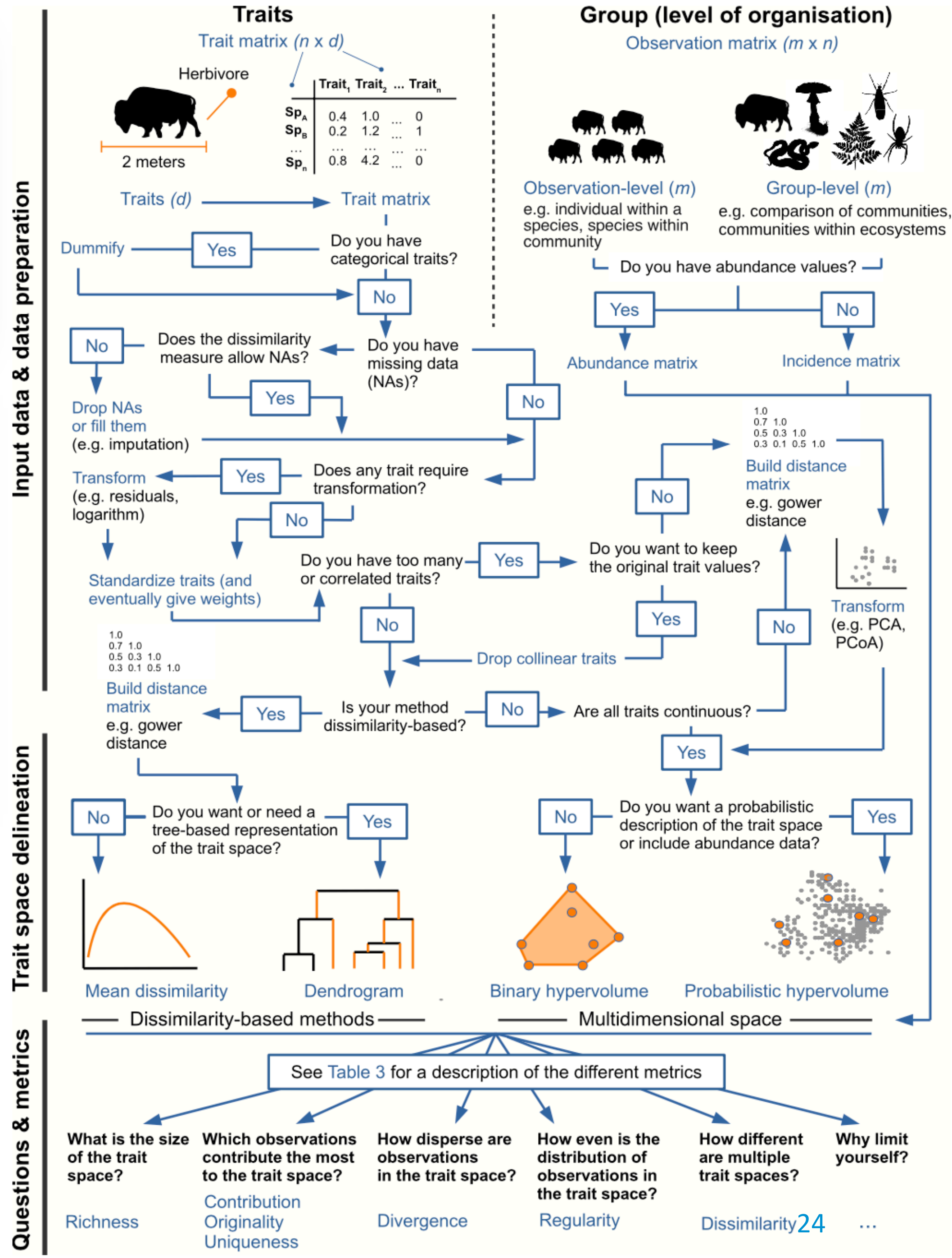
DOI: 10.1111/ele.13778

SYNTHESIS

ECOLOGY LETTERS cnrs WILEY

The dimensionality and structure of species trait spaces

David Mouillot[1,2] | Nicolas Loiseau[1] | Matthias Grenié[3] | Adam C. Algar[4] | Michele Allegra[5] | Marc W. Cadotte[6] | Nicolas Casajus[7] | Pierre Denelle[8] | Maya Guéguen[9] | Anthony Maire[10] | Brian Maitner[11] | Brian J. McGill[12] | Matthew McLean[13] | Nicolas Mouquet[1,7] | François Munoz[14] | Wilfried Thuiller[9] | Sébastien Villéger[1] | Cyrille Violle[3] | Arnaud Auber[15]



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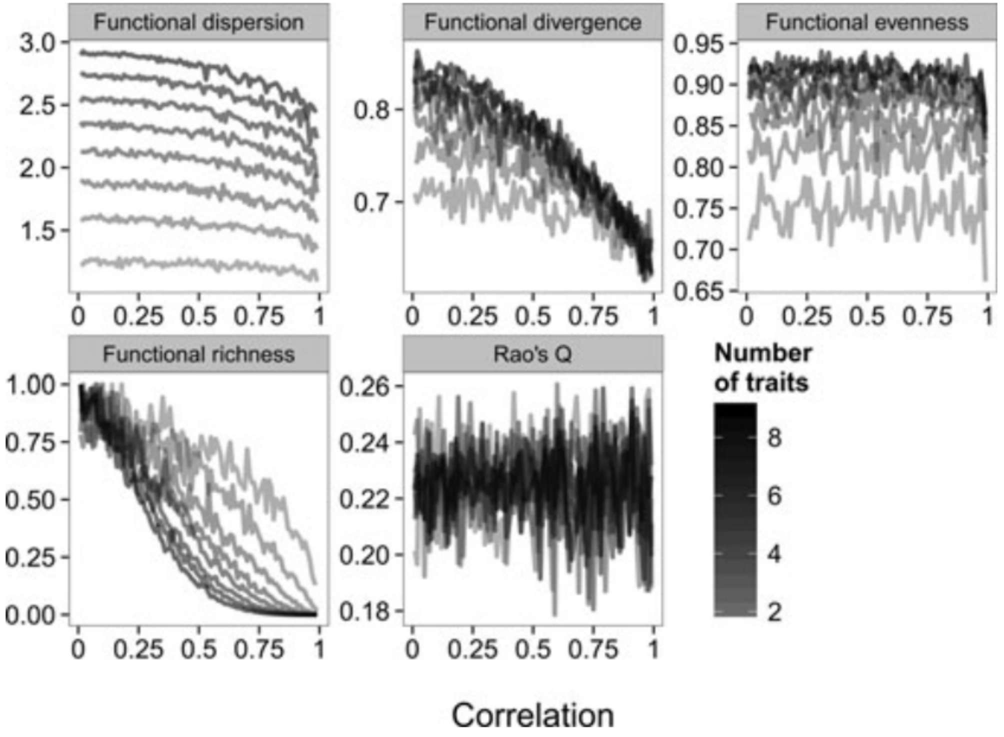
Choices with consequences



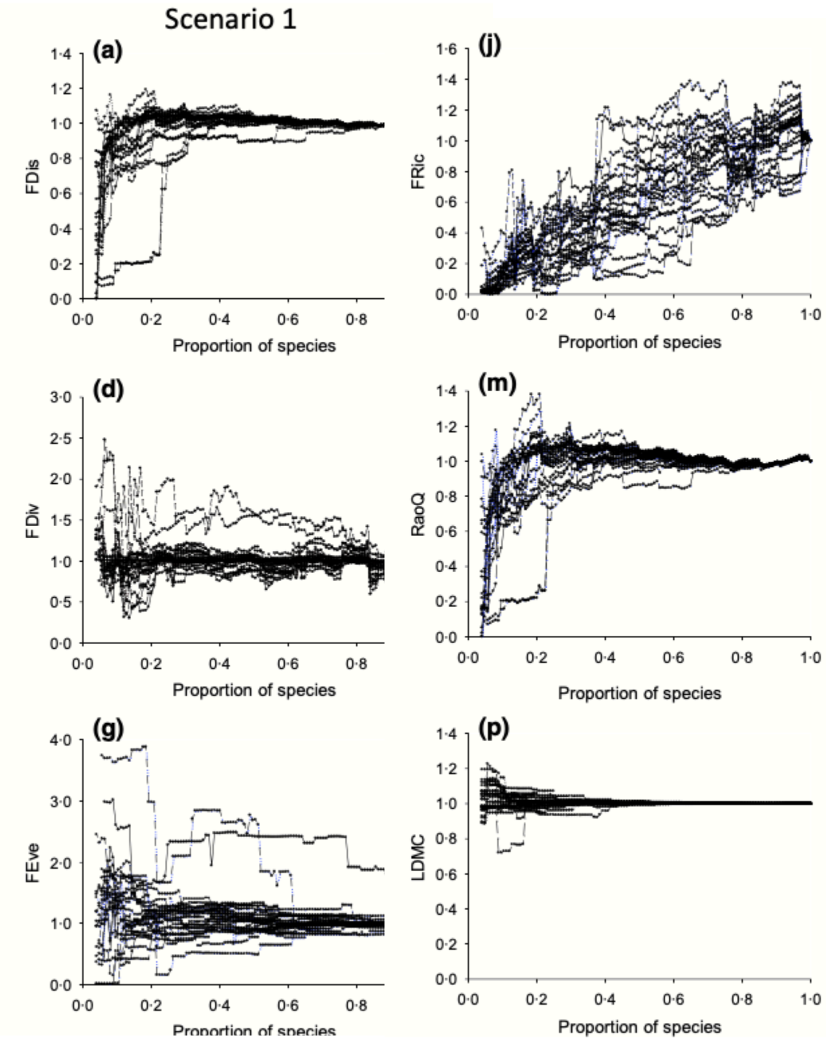
Lefcheck (2015) *Environmental conservation*

Methods in Ecology and Evolution

Methods in Ecology and Evolution 2014, **5**, 9–15 doi: 10.1111/2041-210X.12136

Functional trait metrics are sensitive to the completeness of the species' trait data?

Robin J. Pakeman*



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There will always be missing data

Global Ecology and Biogeography
A Journal of Macroecology

RESEARCH PAPERS | Open Access

Handling missing values in trait data

Thomas F. Johnson, Nick J. B. Isaac, Agustin Paviolo, Manuela González-Suárez

First published: 18 October 2020 | https://doi.org/10.1111/geb.13185 | Citations: 26

Warnings ⚠ and recommendations ✓	
⚠	Carefully select the taxonomic scope of the study, ensuring that species are distributed across the phylogeny and trait space. If any clades or areas of the trait space are nearly or entirely absent, do not draw inferences about them and exclude them from the study to prevent severe biases.
✓	Report which species/clades are included in the study and which species/clades have been removed to limit bias. Provide descriptive statistics or distribution plots for analysed trait values.
⚠	Every imputation approach produced inaccurate values, even with as little as 5% missing data. Slope errors consistently exceeded 0.1 when > 40% of the values were missing or when a severe bias was present.
⚠	Imputation is not always the best approach. Complete-case analysis performs better than the tested imputation methods in some cases.
✓	If using imputation, *Rphylopars* is the best approach for handling missing continuous data, resulting in smaller overall imputation and slope errors.
✓	If using *Rphylopars* or *BHPMF*, do not include the response in the imputation. If using *Mice*, including the response is beneficial.
✓	Include phylogenetic information when using imputation if possible. If a phylogeny is unavailable but a taxonomy is available, use *BHPMF*. If there is no phylogeny or taxonomy information, use *Mice* random forest or the observation-only *BHPMF*.
✓	To assist in detecting biases and the subsequently high imputation and slope errors, assess phylogenetic clustering, in addition to the change in the mean and change in the slope before and after imputation.
✓	Report the amount of missing information that was imputed and where this information falls on the phylogeny, trait and response (if applicable).

A lot of methods are developped around traits

Linked with functional indices and trait spaces

Contents lists available at ScienceDirect

ELSEVIER

Perspectives in Plant Ecology, Evolution and Systematics

journal homepage: www.elsevier.com/locate/ppees

Research article

How to design trait-based analyses of community assembly mechanisms: Insights and guidelines from a literature review

Rémi Perronne[a,b], François Munoz[c,d], Benjamin Borgy[a,e], Xavier Reboud[a], Sabrina Gaba[a,*]

DOI: 10.1111/ddi.12629

WILEY Diversity and Distributions

BIODIVERSITY LETTER

`funrar`: An R package to characterize functional rarity

Matthias Grenié[1] | Pierre Denelle[1] | Caroline M. Tucker[1,2] | François Munoz[3,4] | Cyrille Violle[1]

DOI: 10.1111/ele.14315

ECOLOGY LETTERS cnrs WILEY

LETTER

A trait-based approach to assess niche overlap and functional distinctiveness between non-indigenous and native species

Antoni Vivó-Pons[1] | Mats Blomqvist[2] | Anna Törnroos[3] | Martin Lindegren[1]

But other approaches can benefit from it

ECOGRAPHY

Research

Transferability of trait-based species distribution models

Peter A. Vesk, William K. Morris, Will C. Neal, Karel Mokany and Laura J. Pollock

P. A. Vesk (https://orcid.org/0000-0003-2008-7062) ✉ (pvesk@unimelb.edu.au), BioSciences 2, School of BioSciences, The Univ. of Melbourne, Parkville, VIC, Australia. – W. K. Morris (https://orcid.org/0000-0002-8686-4154) and W. C. Neal, School of BioSciences, The Univ. of Melbourne, Parkville, Australia. – K. Mokany (https://orcid.org/0000-0003-4199-3697), CSIRO Land and Water, Canberra, Australia. – L. J. Pollock (https://orcid.org/0000-0002-6004-4027), Dept of Biology, McGill Univ., Montreal, QC, Canada.

Ecography
44: 134–147, 2021
doi: 10.1111/ecog.05179

The need for reliable prediction of species distributions dependent upon traits has been hindered by a lack of model transferability testing. We tested the predictive capacity of trait-SDMs by fitting hierarchical generalised linear models with three trait and four environmental predictors for 20 eucalypt taxa in a reference region. We used these

CSH Cold Spring Harbor Laboratory

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Essential ingredients in Joint Species Distribution Models: influence on interpretability, explanatory and predictive power

Clément Violet, Aurélien Boyé, Mathieu Chevalier, Olivier Gauthier, Jacques Grall, Martin P. Marzloff

doi: https://doi.org/10.1101/2022.12.19.519605

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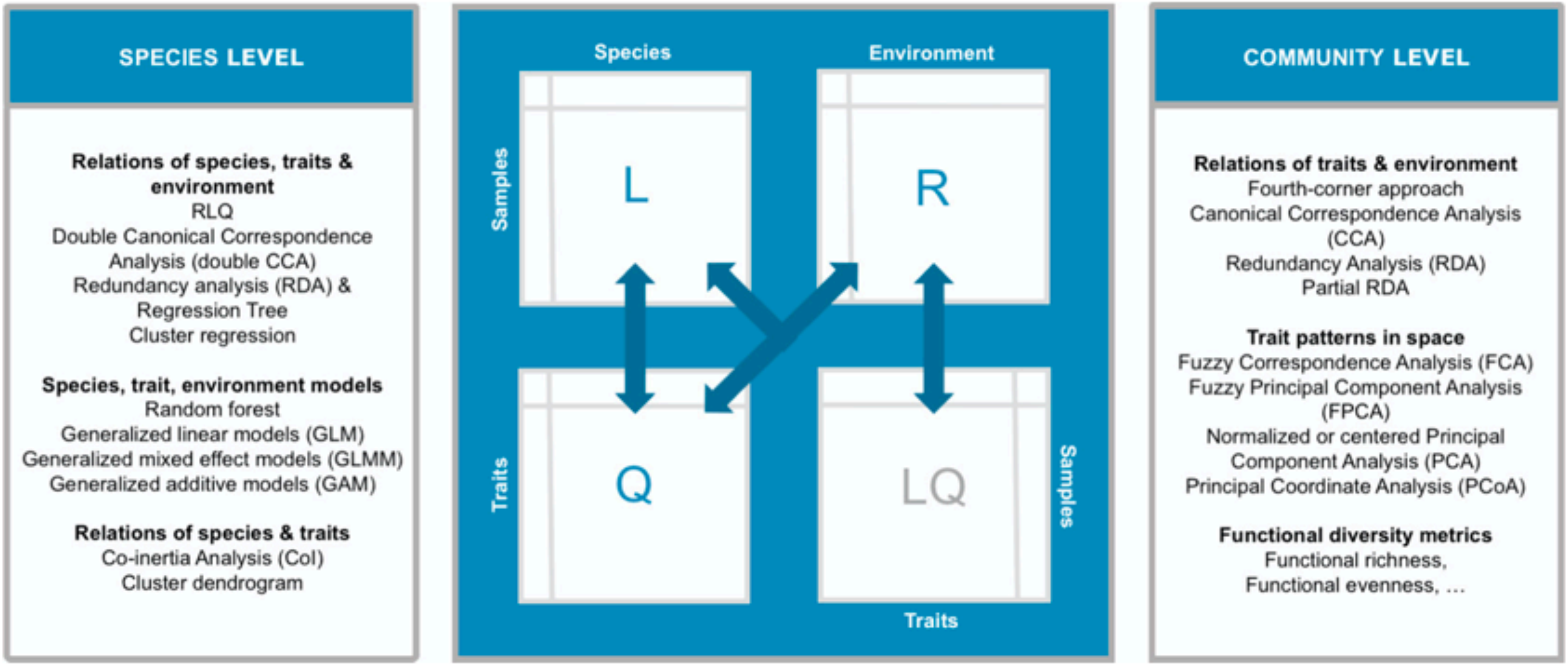
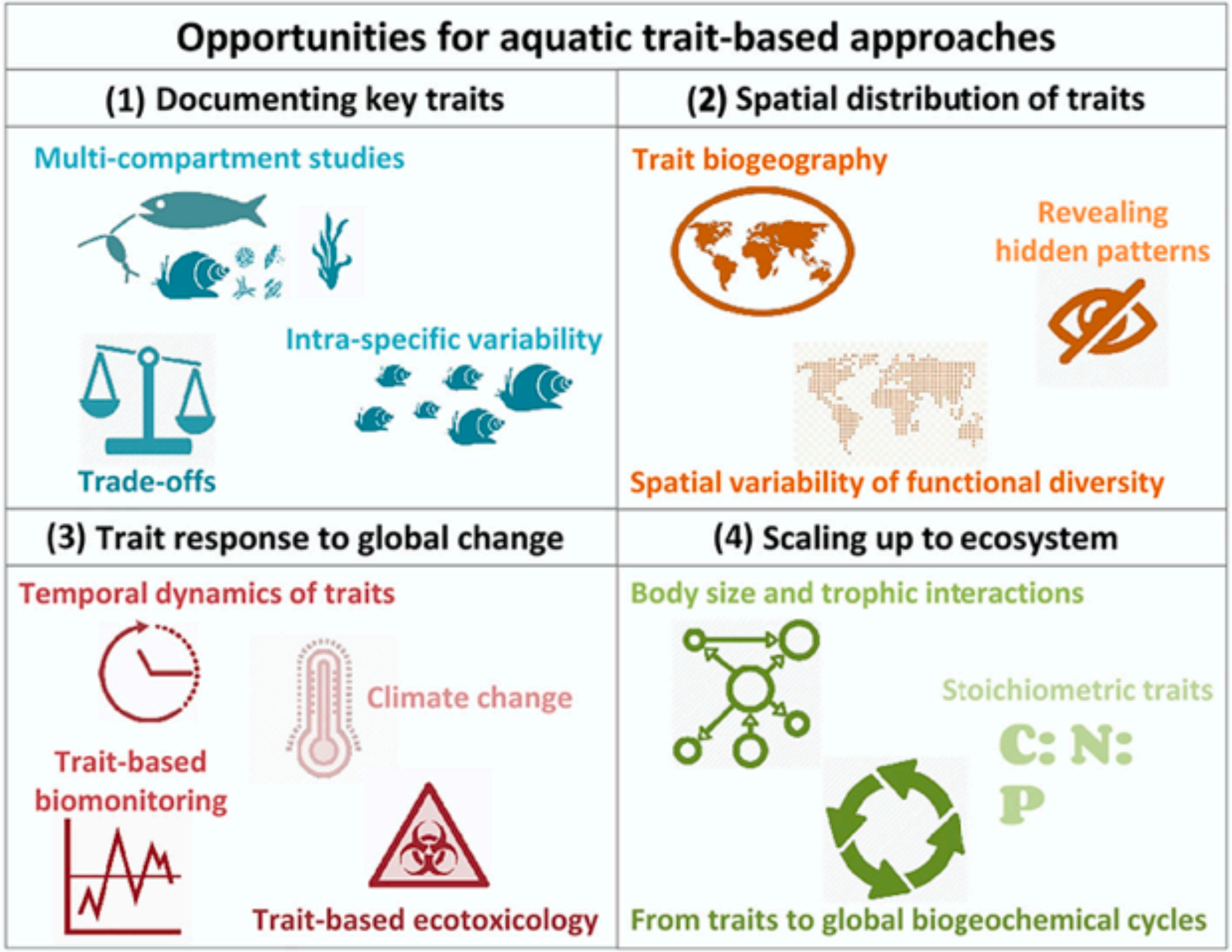
Trait-environment relationships



Degen et al. 2018 (Ecol. Indic.)

Traits to do what ?



Martini et al. 2020 (Limnol. Oceanog.)

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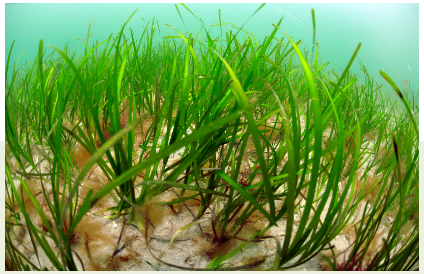
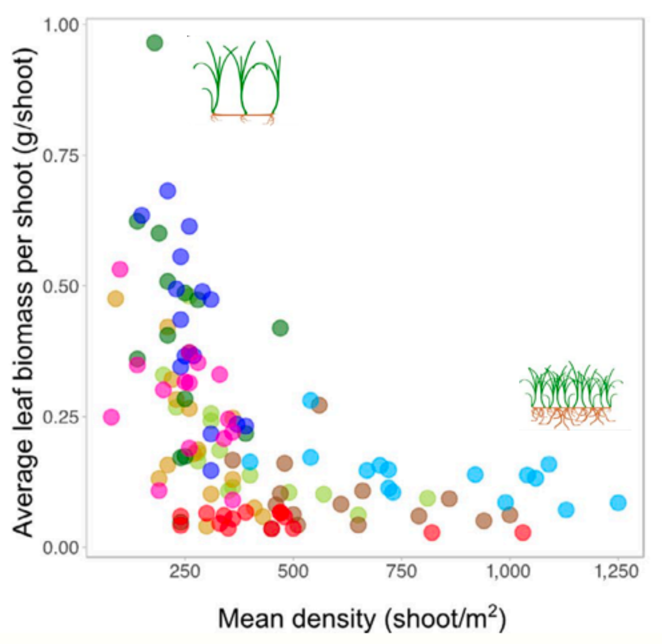
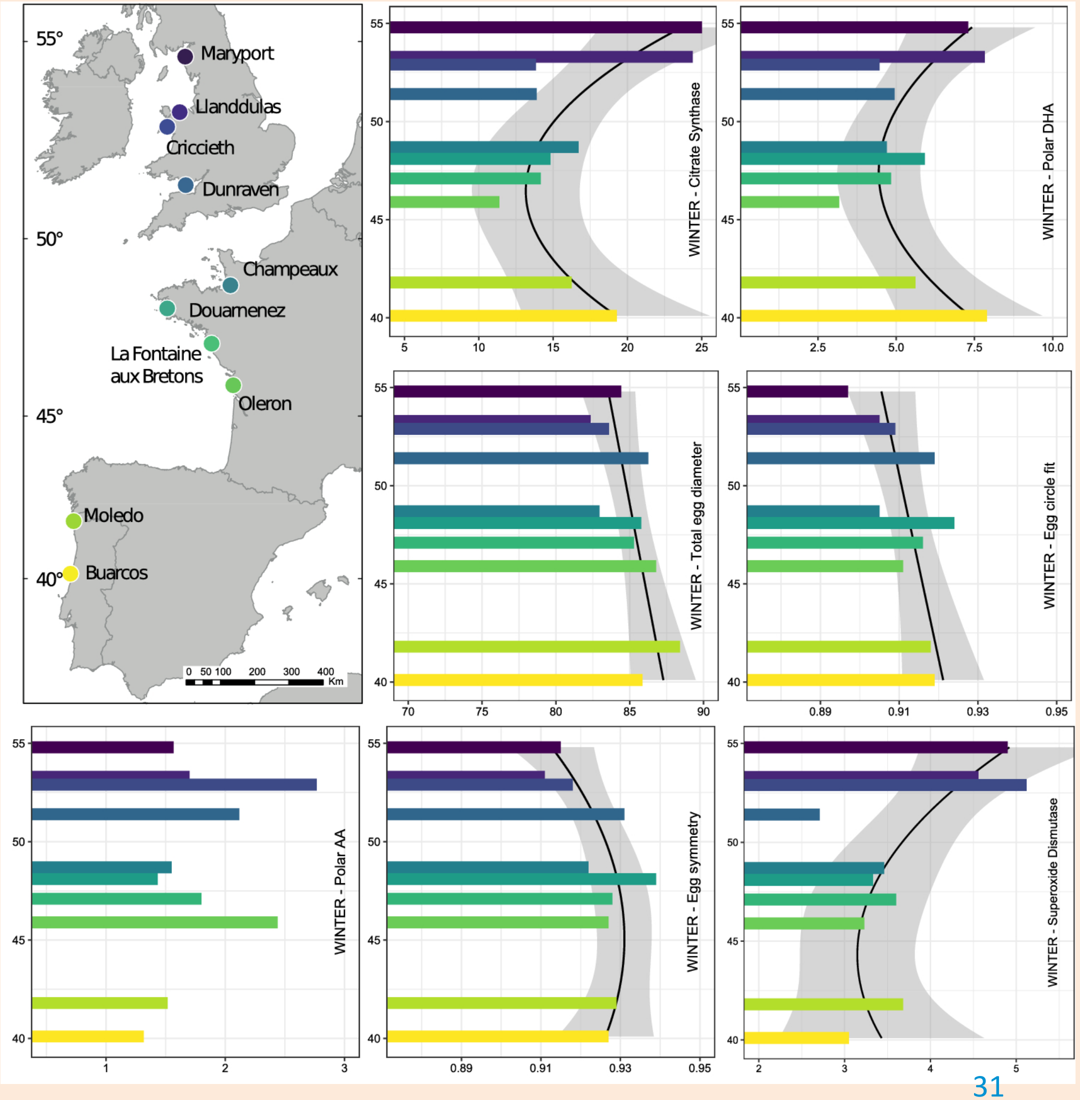
Trait trade-offs and intraspecfic variability





Boyé et al. 2022 (J. Ecol.)

Curd et al. 2021 (Sci. Rep.)



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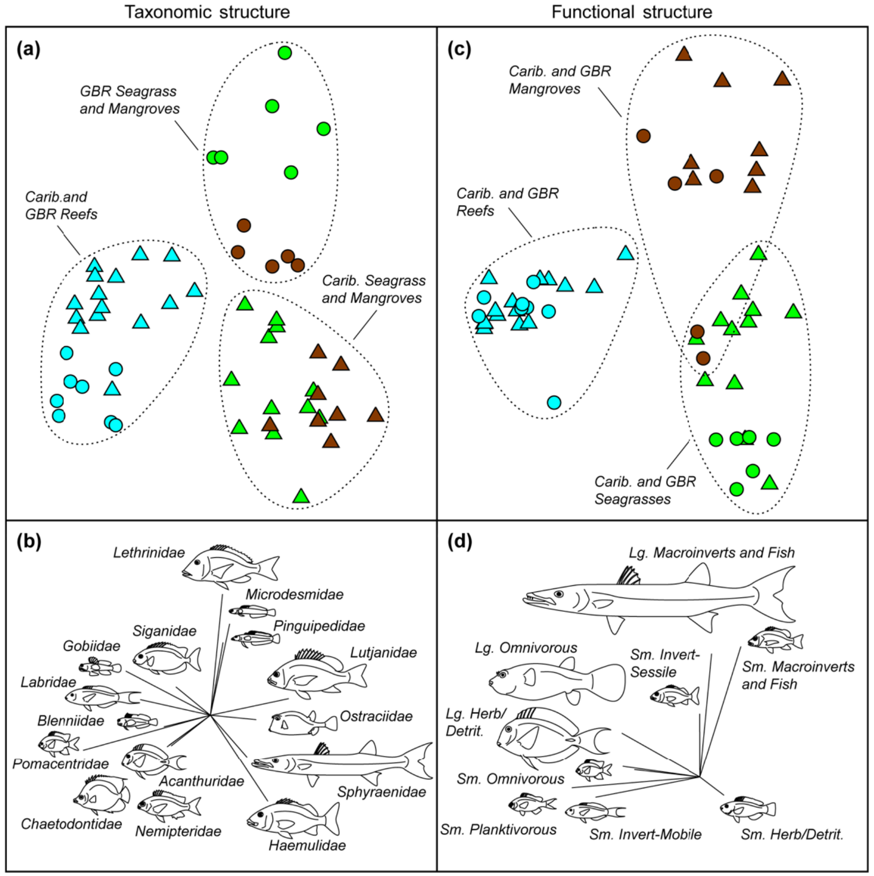
Functional traits provide a “common currency across biological organizational levels and taxonomic groups” (Violle et al. 2014)



Hemingson et Bellwood 2018 (Ecog.)

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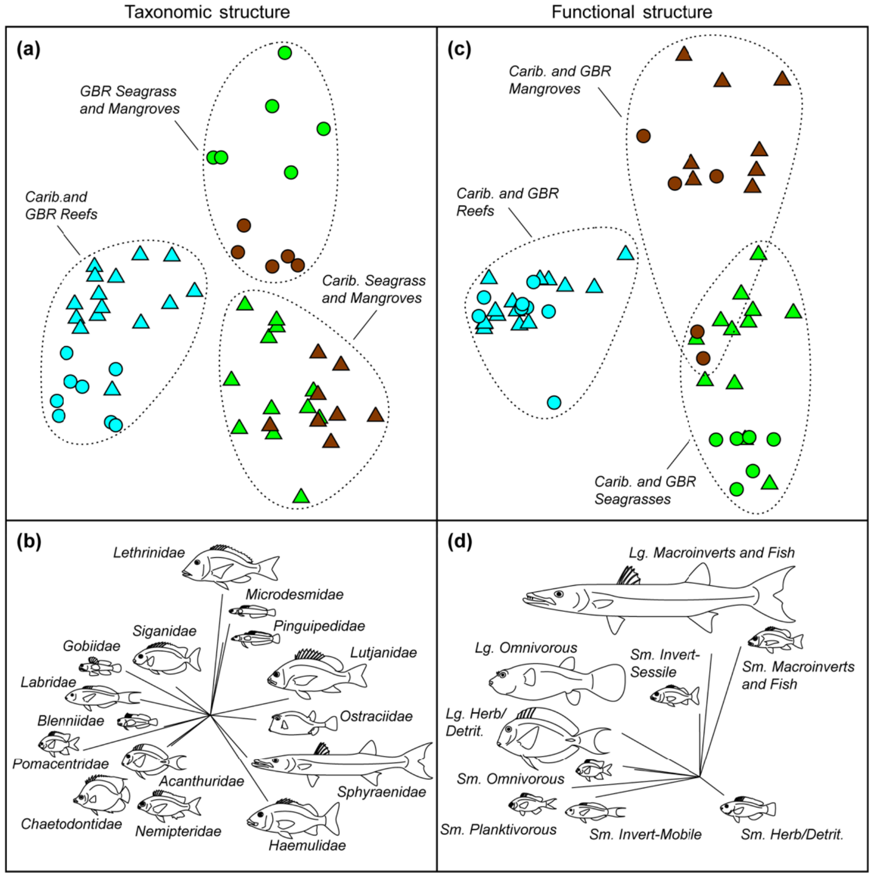
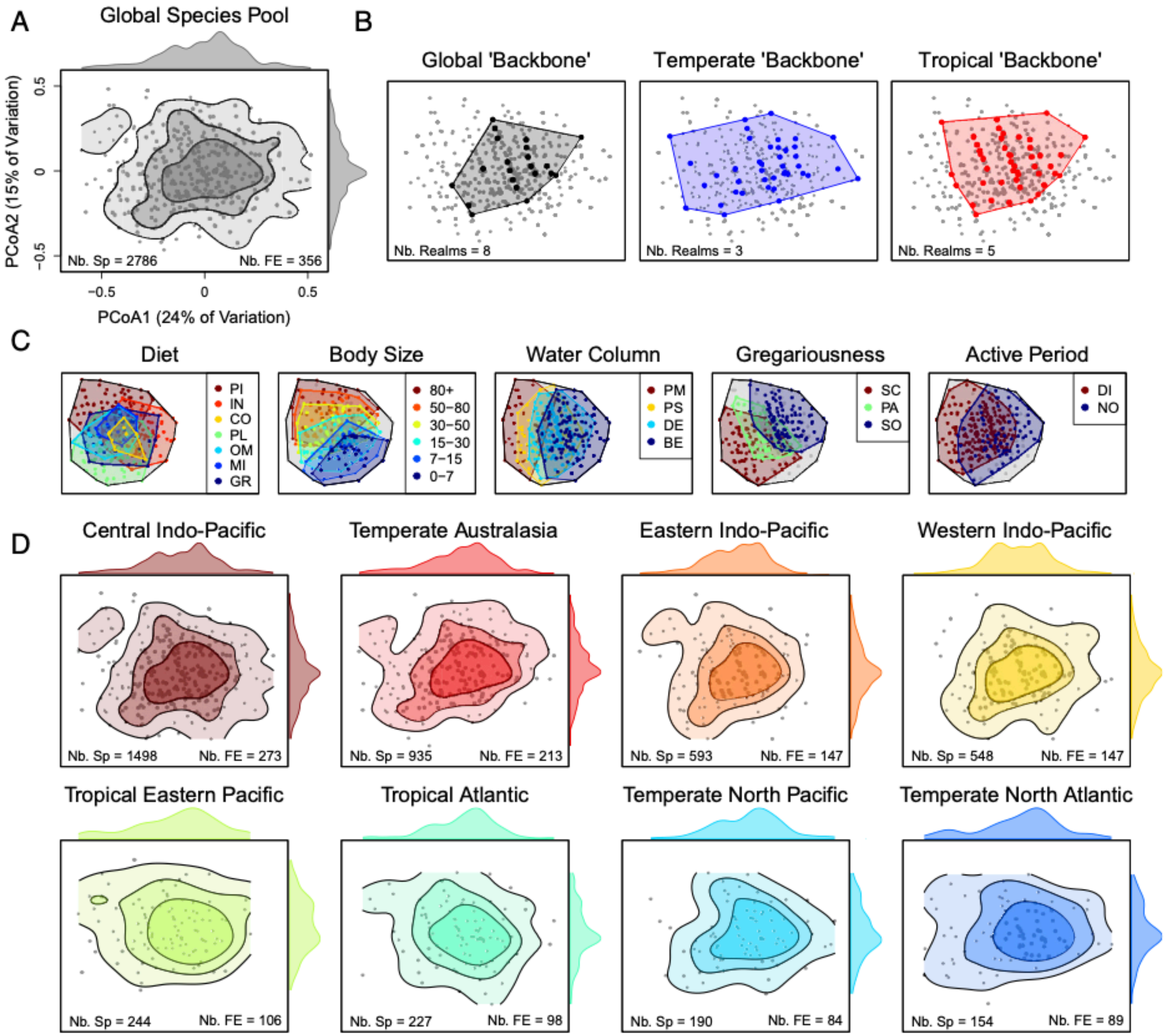


Hemingson et Bellwood 2018 (Ecog.)



McLean et al. 2021 (PNAS)

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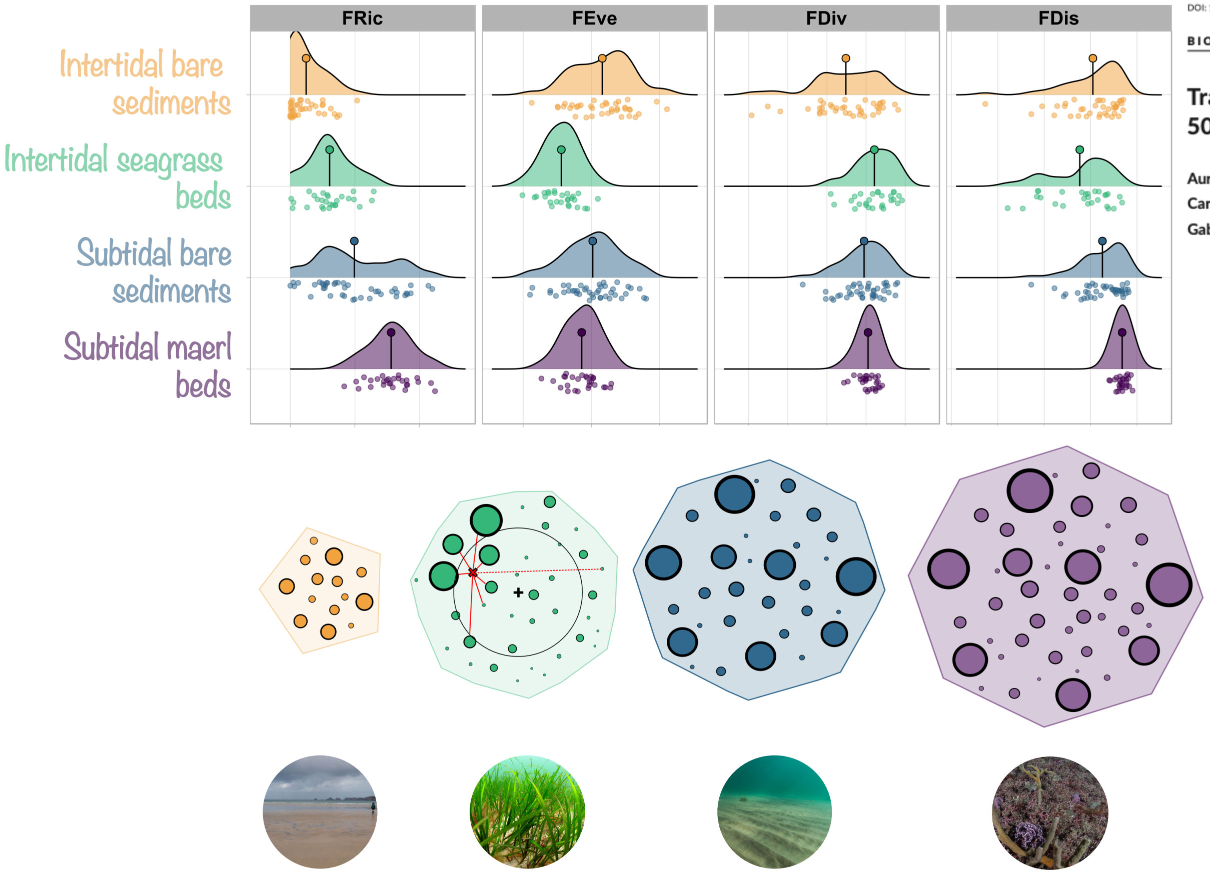
Better understand the functioning and vulnerability of communities



DOI: 10.1111/ddi.12987

BIODIVERSITY RESEARCH

Diversity and Distributions WILEY

Trait-based approach to monitoring marine benthic data along 500 km of coastline

Aurélien Boyé[1,2] | Éric Thiébaut[3] | Jacques Grall[1,4] | Pierre Legendre[2] | Caroline Broudin[5] | Céline Houbin[5] | Vincent Le Garrec[4] | Marion Maguer[4] | Gabin Droual[4] | Olivier Gauthier[1,4]

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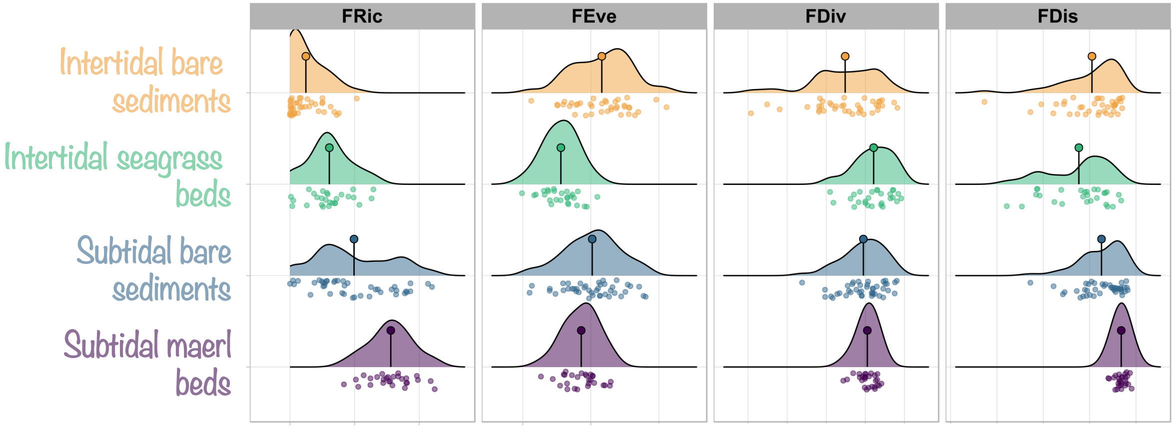

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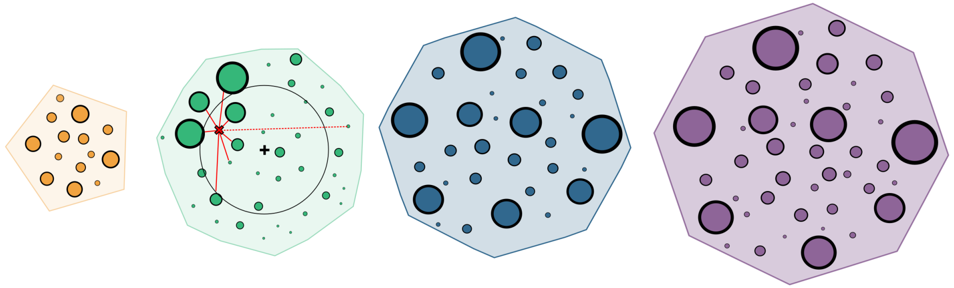

Functional over-redundancy and high functional vulnerability in global fish faunas on tropical reefs

David Mouillot, Sébastien Villéger, Valeriano Parravicini, +7, and David R. Bellwood Authors Info & Affiliations

Edited by Cyrille Violle, Centre National de la Recherche Scientifique, Montpellier, France, and accepted by the Editorial Board January 28, 2014 (received for review September 18, 2013)

September 15, 2014 | 111 (38) 13757-13762 | https://doi.org/10.1073/pnas.1317625111

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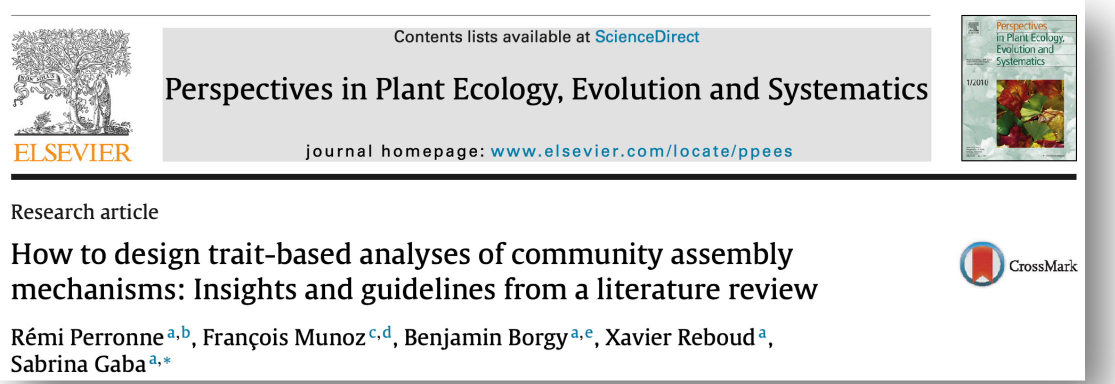
Better understand the functioning and vulnerability of communities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Perspectives in Plant Ecology, Evolution and Systematics

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How to design trait-based analyses of community assembly mechanisms: Insights and guidelines from a literature review

Rémi Perronne[a,b], François Munoz[c,d], Benjamin Borgy[a,e], Xavier Reboud[a], Sabrina Gaba[a,*]


DOI: 10.1111/ddi.12987

BIODIVERSITY RESEARCH

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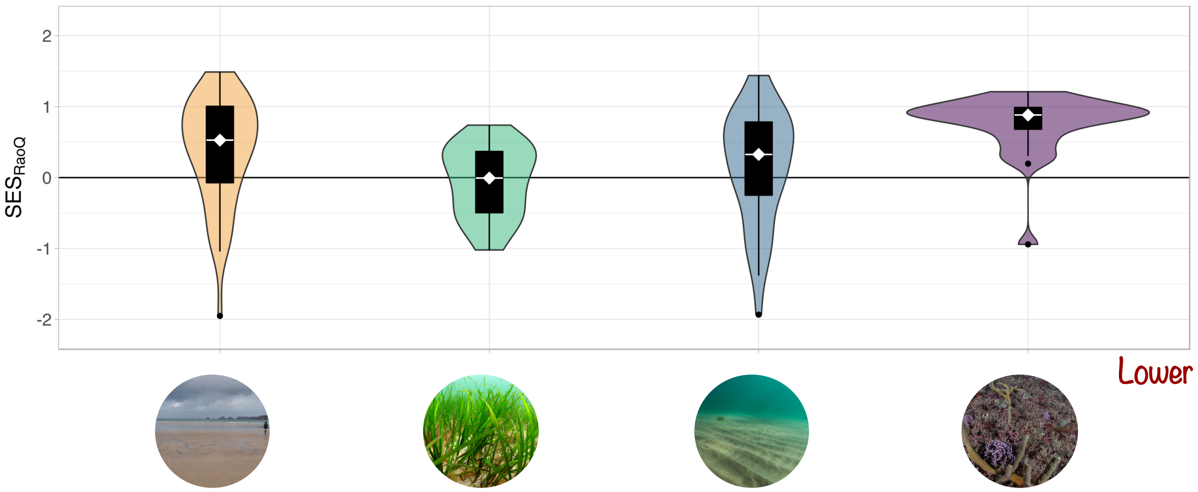
SES : Standardized Effect Size



Higher diversity than expected
competition
fine-scale heterogeneity

environmental filtering
competitive dominance
Lower diversity than expected

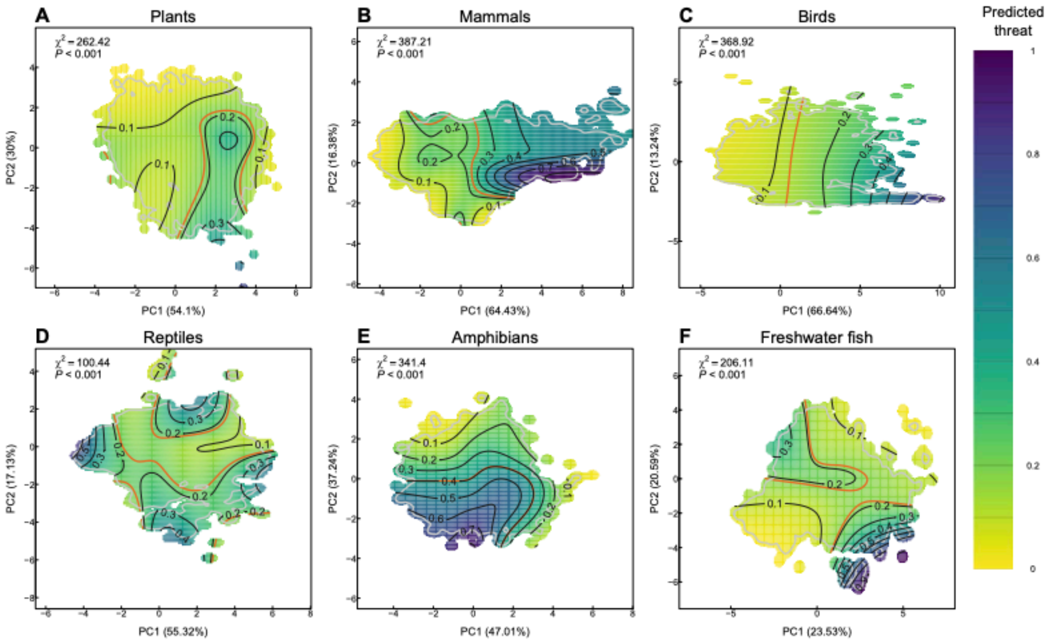
Better understand the functioning and vulnerability of communities

SCIENCE ADVANCES | RESEARCH ARTICLE

ECOLOGY

Erosion of global functional diversity across the tree of life

Carlos P. Carmona[1]*, Riin Tamme[1], Meelis Pärtel[1], Francesco de Bello[2,3], Sébastien Brosse[4], Pol Capdevila[5,6], Roy González-M.[7], Manuela González-Suárez[8], Roberto Salguero-Gómez[5], Maribel Vásquez-Valderrama[9], Aurèle Toussaint[1]



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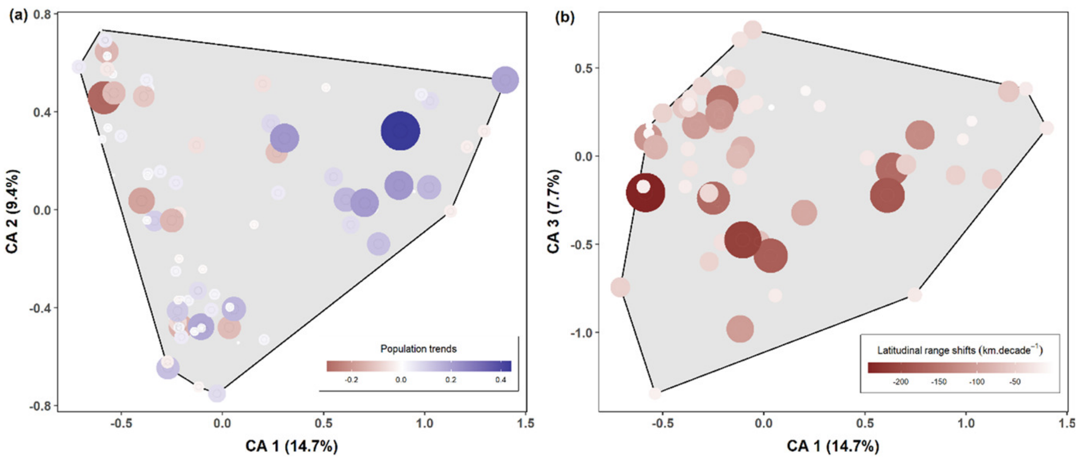
Research | Open Access

Climate and land-use driven reorganisation of structure and function in river macroinvertebrate communities

Théophile L. Mouton, Fabien Leprieur, Mathieu Floury, Fabrice Stephenson, Piet Verburg, Jonathan D. Tonkin

First published: 03 February 2022 | https://doi.org/10.1111/ecog.06148



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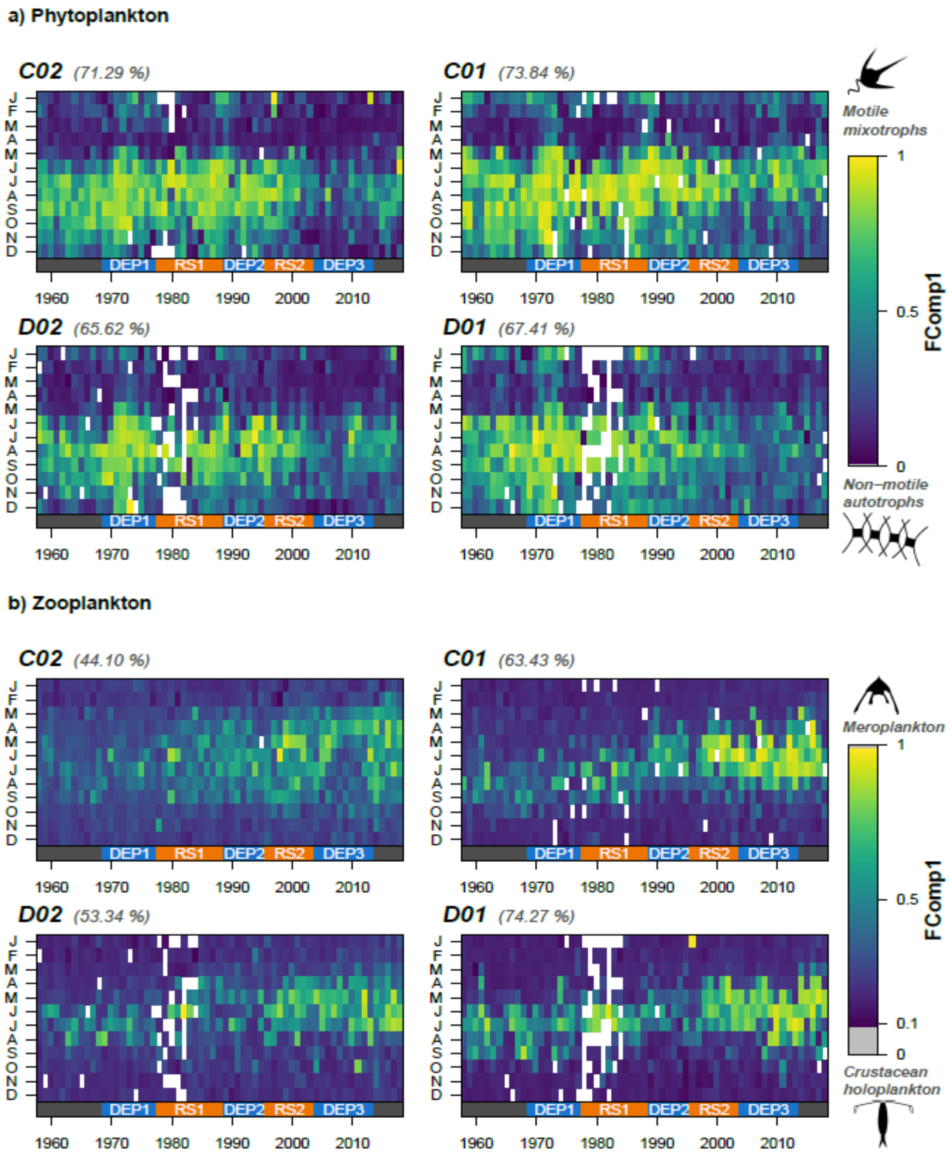
Better understand the functional consequences of biodiversity changes



DOI: 10.1111/geb.13659

Global Ecology and Biogeography
WILEY

RESEARCH ARTICLE

Reinterpreting two regime shifts in North Sea plankton communities through the lens of functional traits

Nicolas Djeghri[1] | Aurélien Boyé[2] | Clare Ostle[1] | Pierre Hélaouët[1]

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Better understand the functional consequences of biodiversity changes

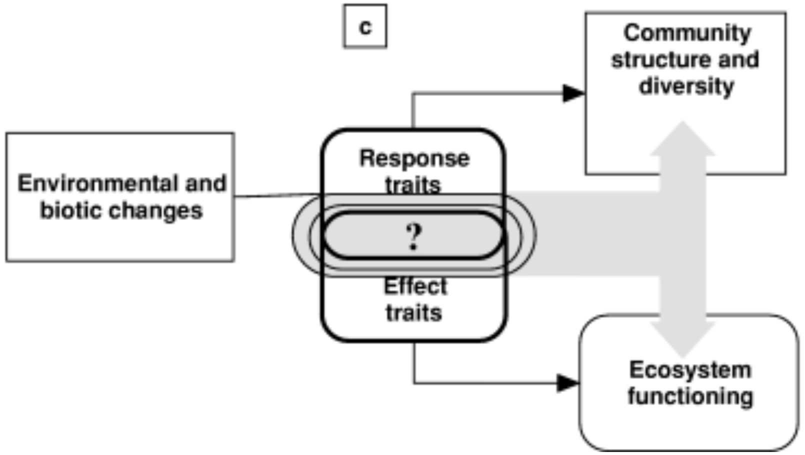
Functional Ecology BRITISH ECOLOGICAL SOCIETY

Free Access

Predicting changes in community composition and ecosystem functioning from plant traits: revisiting the Holy Grail

S. Lavorel, E. Garnier

First published: 23 September 2002 | https://doi.org/10.1046/j.1365-2435.2002.00664.x |



Functional richness outperforms taxonomic richness in predicting ecosystem functioning in natural phytoplankton communities

András Abonyi, Zsófia Horváth, Robert Ptacnik

First published: 20 November 2017 | https://doi.org/10.1111/fwb.13051 |

Functional identity and diversity of animals predict ecosystem functioning better than species-based indices

Vesna Gagic, Ignasi Bartomeus, Tomas Jonsson, Astrid Taylor, Camilla Winqvist, Christina Fischer, Eleanor M. Slade, Ingolf Steffan-Dewenter, Mark Emmerson, Simon G. Potts, Teja Tscharntke, Wolfgang Weisser and Riccardo Bommarco

Published: 22 February 2015 https://doi.org/10.1098/rspb.2014.2620

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Traits in ecology : great promises but great challenges

When do traits tell more than species about a metacommunity? A synthesis across ecosystems and scales

Article *in* The American Naturalist · August 2023
DOI: 10.1086/727471

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Jonathan M Chase
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« We found that patterns of functional diversity explained metacommunity structure and response to environmental variation **in only 25% of the datasets using a multi-trait approach, but up to 59% using a single-trait approach**. Nevertheless, **an average of only 19% […] of the traits showed a significant signal across environmental gradients**. Species-level traits, as typically collected and analyzed through functional diversity patterns, **often do not bring predictive advantages** over what the taxonomic information already holds. »

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Traits in ecology : great promises but great challenges

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New Results

Essential ingredients in Joint Species Distribution Models: influence on interpretability, explanatory and predictive power

Clément Violet, Aurélien Boyé, Mathieu Chevalier, Olivier Gauthier, Jacques Grall, Martin P. Marzloff

doi: https://doi.org/10.1101/2022.12.19.519605

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LIMNOLOGY and OCEANOGRAPHY

ASLO

Limnol. Oceanogr. 9999, 2020, 1–30

doi: 10.1002/lno.11655

Functional trait-based approaches as a common framework for aquatic ecologists

Séverine Martini,[1,2*] Floriane Larras,[3,†] Aurélien Boyé,[4,†] Emile Faure,[1,5,†] Nicole Aberle,[6] Philippe Archambault,[7] Lise Bacouillard,[8] Beatrix E Beisner,[9] Lucie Bittner,[5,10] Emmanuel Castella,[11] Michael Danger,[10,12] Olivier Gauthier,[4] Lee Karp-Boss,[13] Fabien Lombard,[1,10] Frédéric Maps,[7] Lars Stemmann,[1] Eric Thiébaut,[8] Philippe Usseglio-Polatera,[12] Meike Vogt,[14] Martin Laviale,[12,‡] Sakina-Dorothée Ayata[1,5,‡]

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