

Tables - Tackling discrepancies in freshwater
invertebrate trait databases: Harmonising across
continents and aggregating taxonomic resolution

Table 1: Excerpt of the comparison of trait definitions between invertebrate trait databases for the traits predator and swimming. The definition is quoted if it enables differences to be identified, otherwise the differences are described. The full version and further information can be found in the supporting information Table S1.

Trait	Freshwater-ecology.info	Tachet	CONUS	Vieira	Australia	New Zealand
Feeding predator	"Eating from prey"	<ul style="list-style-type: none"> Carvers, engulfers & swallowers Piercers (plants & animals) are an additional trait 	Engulfers ("ingest prey whole or in parts") & piercers ("prey tissues and suck fluids")	Predator	Piercer & engulfer	Predator

Locomotion swimming	<ul style="list-style-type: none"> • Passive movement like floating or drifting (trait swimming/scating) • Active movement (trait swimming/diving) 	<ul style="list-style-type: none"> • Surface swimmers (over and under the water surface) • Full water swimmers (e.g. Baetidae). 	"Adapted for "fishlike" swimming"	Swimmer	Distinguishes swimmer and skater	Swimmers (water column)
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Table 2: Traits of harmonised grouping features from six invertebrate trait databases and four geographic regions. The last column indicates traits that were combined for harmonisation (no combining needed if empty).

Grouping feature	Trait	Combined traits
Voltinism	Semivoltine	<1 generation per year
	Univoltine	1 generation per year
	Bi/multivoltine	>1 generation per year
Body Form	Cylindrical	Cylindrical, tubular
	Flattenend	Flattenend, dorsoventrally flattened [†]
	Spherical	Spherical, round (humped)
	Streamlined	Streamlined, fusiform
Size	Small	<9 mm, <10 mm [‡]
	Medium	9 - 16 mm, 10 - 20 mm
	Large	>16 mm, >20 mm
Respiration	Gills	Tracheal gills, gills
	Plastron/Spiracle	Temporary air store, spiracular gills, atmospheric breathers, plant breathers, functional spiracles, air (plants), aerial, plastron/spiracle
	Tegument	Cutaneous, tegument
Locomotion	Burrower	Interstitial, boring, burrowing
	Crawler	Sprawler, walking, climber, clinger, crawler
	Sessile	Attached, sessile
	Swimmer	Skating, diving, planctonic, swimming

Feeding mode	Filterer	Active/passive filterer, absorber, filter-feeder, collector-filterer, filterer
	Gatherer	Deposit-feeder, collector-gatherer, detrivore, gatherer
	Herbivore	Grazer, scraper, piercer herbivore, herbivore, algal piercer, piercer (plants) [§]
	Parasite	
	Predator	Piercer (animals) [§] , predator
	Shredder	Miner, xylophagus, shredder, shredder detrivore
Oviposition	Aquatic eggs	Eggs attached to substrate/plants/stones, free/fixed eggs/clutches
	Ovoviviparity	
	Terrestrial eggs	Terrestrial clutches, terrestrial

† The trait "bluff (blocky)" occurred in the Vieira database and was newly classified by expert knowledge into cylindrical and flattened (Usseglio-Polatera, 2020a).

‡ Reflects the different size classifications by the Vieira and CONUS databases from the other trait databases.

§ The trait piercer was defined in the Tachet database for piercing plants and animals, in contrast to the other databases (Usseglio-Polatera et al., 2000). Taxa exhibiting this trait have been assigned to predators or herbivores based on expert knowledge (Usseglio-Polatera, 2020b).

Table 3: Number (Nr.) of taxa per harmonised dataset and per taxonomic level. Numbers in parenthesis show rounded relative frequencies in percent.

Dataset	Taxa (Nr.)	Aquatic insects (Nr.)	Species	Genus	Family
EUR	4601	3942 (86)	3739 (81)	704 (15)	158 (3)
NA	3753	3305 (88)	2414 (64)	1163 (31)	176 (5)
AUS	1402	1016 (72)	564 (40)	578 (41)	260 (19)
NZ	478	443 (93)	404 (85)	47 (10)	27 (6)

Abbreviations: EUR, Europe; NOA, North America; AUS, Australia; NZ, New Zealand.

Table 4: Rounded percentage of entries that include information for the individual grouping features shown per trait dataset.

Dataset	Body form	Oviposition	Voltinism	Locomotion	Size	Respiration	Feeding mode
EUR	8	15	23	36	11	57	76
NA	28	13	47	52	73	44	63
AUS	4	46	49	39	75	68	99
NZ	100	94	100	99	100	100	99

Abbreviations: EUR, Europe; NA, North America; AUS, Australia; NZ, New Zealand.

Table 5: Number of traits per grouping feature and type of coding of the traits for the grouping features used in this study per database. Oviposition location was used for the New Zealand database.

Grouping feature	freshwater-ecology.info	Tachet	CONUS	Vieira	Australia	New Zealand
Feeding Mode	10 traits;	7 traits; fuzzy [0 - 3]	6 traits; binary	8 traits; binary	16 traits [†] ; binary, proportional fuzzy [0 - 3]	6 traits; fuzzy [0 - 3]
	10 point assignment system					
Voltinism	6 traits;	3 traits; fuzzy [0 - 3]	3 traits; binary	3 traits; binary	7 traits; binary, proportional fuzzy [0 - 3]	3 traits; fuzzy [0 - 3]
	single category assignment system					
Locomotion	6 traits;	8 traits; fuzzy [0 - 5]	10 traits; binary	9 traits; binary	9 traits; binary, fuzzy [0 - 3]	4 traits; fuzzy [0 - 3]
	10 point assignment system					
Respiration	7 traits; binary	5 traits; fuzzy [0 - 3]	3 traits; binary	8 traits; binary	10 traits; binary, proportional fuzzy [0 - 3]	4 traits; fuzzy [0 - 3]
Reproduction/ Oviposition	9 traits; binary	8 traits; fuzzy [0 - 3]	10 traits; binary	10 traits; binary	13 traits [‡] ; binary	4 traits; fuzzy [0 - 3]
Size	-	7 traits; fuzzy [0 - 3]	3 traits; binary	3 traits; binary	9 traits; binary, continuous, fuzzy [0 - 3]	5 traits; fuzzy [0 - 3]

Body Form	-	-	4 traits; binary	4 traits; fuzzy [0 - 3]	4 traits; fuzzy [0 - 3]
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† Some of the feeding mode traits used in the Australian database were similar (e.g. trait *Shredder*, *Shredder*, *Detritivore*, and *Collector*, *Shredder*).

‡ Not all traits were considered because trait information was partly presented as comments to describe other traits or due to incomplete information.

Table 6: Percentage of differing cases, minimum, maximum, mean, and standard deviation of absolute differences between trait affinities assigned at family level by experts and aggregated trait affinities from five different aggregation methods.

Data origin	Comparison to traits at family level	Differing cases [%]	Min. differences	Max. differences	Mean abs. differences	SD abs. differences
AUS	<i>direct_agg_median</i>	16.53	0.01	1.00	0.45	0.27
	<i>direct_agg_mean</i>	23.24	< 0.01	0.99	0.34	0.23
	<i>stepwise_agg_median</i>	17.90	0.01	1.00	0.42	0.26
	<i>stepwise_agg_mean</i>	23.24	< 0.01	0.99	0.33	0.22
	<i>weighted_agg</i>	23.24	< 0.01	1.00	0.34	0.24
NA	<i>direct_agg_median</i>	15.33	0.17	1.00	0.70	0.26
	<i>direct_agg_mean</i>	47.00	< 0.01	1.00	0.30	0.26
	<i>stepwise_agg_median</i>	18.00	0.08	1.00	0.63	0.28
	<i>stepwise_agg_mean</i>	47.00	< 0.01	1.00	0.30	0.27
	<i>weighted_agg</i>	47.00	< 0.01	1.00	0.31	0.28

Abbreviations: Min., Minimum; Max., Maximum; abs., absolute; SD, Standard deviation; AUS, Australia; NA, North America.