Traits Gap Analysis – North Carolina

The North Carolina traits table contains information for 797 operational taxonomic units (OTUs). The majority of the OTUs were at the genera- or genera-group level (97%), 2% family-level and the remaining were order-level or higher. 263 families and 72 higher taxonomic groups (generally order-level) are represented in the North Carolina dataset. The source of the majority of non-temperature traits information was the Poff et al. 2006 traits matrix (**Table 1**). This was mainly supplemented by the USGS traits database (Vieira et al. 2006). Most of the temperature trait information was derived from the maximum likelihood calculations on a subset of North Carolina data. Gaps in temperature trait information were mainly filled using the Traits Matrix (Poff et al. 2006), the USGS traits database (Vieira et al. 2006) and the EPA's 1970s publications. The EPA's 1970s publications were also an important supplemental source of information for rheophily. Most of the habit and functional feeding group information was taken from the Poff et al. traits 2006 matrix and was supplemented mostly by Wadeable Streams Assessment (WSA), Rapid Bioassessment Protocol (RBP2) and the USGS traits database data (Vieira et al. 2006).

Trait information was available for approximately 25-40% of the OTUs (**Table 2**). Exceptions were the habit and functional feeding group traits, for which 61 and 68% of the OTUs had information, respectively. Numerical temperature optima information was available for about 30% of the taxa and categorical temperature optima information (based on rankings and literature) was available for 44% of the taxa. Because of the type of data that was available for the maximum likelihood analysis (=categorical abundance data), less temperature tolerance information could be generated so there were fewer numerical temperature tolerance values and 36% of the taxa had categorical temperature tolerance (ranking) information.

Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa generally had more trait information than other taxa (**Table 3**). Habit and FFG is available for over 90% of the EPT taxa, categorical temperature trait information is available for about 93% of the EPT taxa and other trait information is available for 79-88% of the EPT taxa. A large number of taxa in the North Carolina dataset are EPT taxa: 62 are Trichopterans, 57 are Ephemeropterans and 41 are Plecopterans. Dipterans (197 taxa), Odonates (46 taxa), and Coleopterans (67 taxa) are also well-represented in the dataset. For the Dipterans, habit and FFG information is available for 80-85% of the taxa, temperature trait information, 43%, and other trait information, 20%. For the Coleopterans, habit and FFG information is available for 91-94% of the taxa, temperature trait information, 49%, and other trait information, 29%. Habit and FFG information is available for 89-96% of the Odonates, while other trait information is available for 65-72% of the taxa. No trait information is available for 37 taxa; most of these OTUs occur in low abundances and are represented by few taxa. In terms of overall abundance in the North Carolina database, the largest number of individuals are Dipterans (overall abundance equals 29%), followed by Ephemeropterans (20%), Trichopterans (16%), Coleopterans (8%), Odonates (7%) and Plecopterans (6%). Bassomatophora, Megaloptera, Haplotaxida, Veneroida, Lumbriculida, Amphipoda and Decapoda have overall abundances of 1-2%. The remaining 784 OTUs have overall abundances of less than 1%.

SOURCES

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Table 1. Summary of the sources that were used to derive trait information for the North Carolina traits table. The values equal the # of taxa that the source provided information on. NA equals the number of taxa for which no trait information was available.

Traits			Sources						
Life history	**Poff et al. 2006**	**Vieira et al. 2006**	**Zheng (NC) 2008**	**EPA 1970s**	**VT DEC**	**WSA**	**RBP2 1999**	**USEPA Draft 1990**	**NA**
Voltinism	205	85							507
Development	214	11							572
Synchronization of emergence	214								583
Adult life span	212	36							549
Adult ability to exit	214								583
Ability to survive desiccation	214								583
Mobility									
Dispersal (adult)	208	28							561
Adult flying strength	214								583
Occurrence in drift	214								583
Maximum crawling rate	214								583
Swimming ability	214								583
Morphology									
Attachment	214								583
Armoring	203	104							490
Shape	214								583
Respiration	214								583
Size at maturity	203	114							480
Resource acquisition/preference									
Rheophily	208	63		65	4				457
Habit	179	173				127	4		314
Functional feeding group	184	169				151	23	15	255
Temperature									
Temperature optimum			233						564
Temperature tolerance			0						797
Rank of temperature optimum	93	20	233	8					443
Rank of temperature tolerance	93	20	166	8					510
Rank of temp optimum-tolerance	93	20	166	8					510
Tolerance						410	9	18	360

Table 2. Number and percentage of the 797 total taxa (at the established OTU level) in the North Carolina database that have trait information.

Traits	# of taxa with trait information	% of taxa with trait information
Life history		
Voltinism	290	36.4
Development	225	28.2
Synchronization of emergence	214	26.9
Adult life span	248	31.1
Adult ability to exit	214	26.9
Ability to survive desiccation	214	26.9
Mobility		
Dispersal (adult)	236	29.6
Adult flying strength	214	26.9
Occurrence in drift	214	26.9
Maximum crawling rate	214	26.9
Swimming ability	214	26.9
Morphology		
Attachment	214	26.9
Armoring	307	38.5
Shape	214	26.9
Respiration	214	26.9
Size at maturity	317	39.8
Resource acquisition/preference		
Rheophily	340	42.7
Habit	483	60.6
Functional feeding group	542	68
Temperature		
Temperature optimum	233	29.2
Temperature tolerance	0	0
Rank of temperature optimum	354	44.4
Rank of temperature tolerance	287	36
Rank of temperature optimum-tolerance	287	36
Tolerance	437	54.8

Table 3. Percentage of taxa within each order (or in some cases, higher taxonomic level) that have life history traits information in the North Carolina traits table.

Order	# of taxa within each order	Abundance (% of Total)	Other Traits (Avg)	Temp Optima Rank	Habit	FFG	Tolerance
Diptera	197	28.68	20.08	43.1	79.7	85.3	76.1
Ephemeroptera	57	19.75	79.17	93	91.2	93	78.9
Trichoptera	62	15.46	78.53	93.5	96.8	96.8	88.7
Plecoptera	41	5.67	87.96	92.7	90.2	92.7	70.7
Coleoptera	67	7.71	29.1	49.3	91	94	68.7
Odonata	46	7.09	64.81	71.7	89.1	95.7	69.6
Basommatophora	13	2.31	2.4	23.1	84.6	92.3	84.6
Megaloptera	5	2.11	81.25	100	100	100	80
Haplotaxida	34	1.73	0.37	20.6	29.4	70.6	58.8
Veneroida	20	1.75	2.5	10	25	35	25
Lumbriculida	1	1.32	0	100	100	100	100
Amphipoda	25	1.01	3.5	16	16	24	20
Decapoda	24	1.04	3.13	16.7	20.8	16.7	16.7
Neotaenioglossa	11	0.97	0	18.2	9.1	27.3	27.3
Isopoda	13	0.51	5.77	15.4	15.4	46.2	23.1
Mesogastropoda	7	0.5	6.25	14.3	57.1	71.4	42.9
Trombidiformes	1	0.58	0	100	100	100	100
Tricladida	4	0.49	0	0	50	50	25
Rhynchobdellida	7	0.25	8.93	42.9	42.9	100	28.6
Hemiptera	11	0.22	44.89	54.5	100	100	63.6
Unionoida	11	0.2	0	9.1	0	36.4	18.2
Branchiobdellida	2	0.14	3.13	50	0	0	0
Arhynchobdellida	6	0.13	19.79	100	83.3	83.3	16.7
Opisthopora	1	0.11	0	100	0	0	0
Hoplonemertea	2	0.07	0	0	0	50	50
Lepidoptera	2	0.06	50	50	100	100	100
Polychaeta (class)	17	0.01	0	0	0	0	0
Neuroptera	1	0.03	100	100	100	100	100
Aciculata	21	0.02	0	0	0	0	0
Sessilia	2	0.02	0	0	0	50	0
Mytiloida	4	0.01	0	0	0	0	0
Mysida	2	0.01	0	0	0	0	0
Canalipalpata	11	0	0	0	0	0	0
Neogastropoda	8	0	0	0	0	0	0
Proseriata	1	0	0	0	0	0	0
Tanaidacea	2	0	0	0	0	50	0

Table 3. continued…

Order	# of taxa within each order	Abundance (% of Total)	Other Traits (Avg)	Temp Optima Rank	Habit	FFG	Tolerance
Nematoda (phylum)	1	0	0	0	0	100	100
Porifera (phylum)	1	0	0	0	0	100	100
Ostreoida	3	0	0	0	0	0	0
Cheilostomata	3	0	0	0	0	0	0
Hydrobiidae	2	0	0	0	0	0	0
Heteronemertea	1	0	0	0	0	0	0
Heterostropha	5	0	0	0	0	20	0
Myoida	3	0	0	0	0	**0**	0
Ophiurida	2	0	0	0	0	0	0
Polycladida	2	0	0	0	0	0	0
Hydroida	2	0	9.38	0	0	50	50
Leptothecatae	3	0	0	0	0	0	0
Pleurogona	2	0	0	0	0	0	0
Cumacea	1	0	0	0	0	0	0
Gordiida	1	0	0	0	0	0	0
Heteroptera	3	0	35.42	66.7	66.7	100	0
Nudibranchia	2	0	0	0	0	0	0
Ctenostomata	2	0	0	0	0	0	0
Pantopoda	1	0	0	0	0	0	0
Paleonemertea	2	0	0	0	0	0	0
Arcoida	2	0	0	0	0	0	0
Hymenoptera	1	0	0	0	0	0	0
Anthoathecatae	1	0	0	0	0	0	0
Cephalaspidea	1	0	0	0	0	0	0
Actiniaria	1	0	0	0	0	0	0
Apodida	1	0	0	0	0	0	0
Arbacioida	1	0	0	0	0	0	0
Cidaroida	1	0	0	0	0	0	0
Dendrochirotida	1	0	0	0	0	0	0
Echiurida (phylum)	1	0	0	0	0	0	0
Enteropneusta (class)	1	0	0	0	0	0	0
Neoloricata	1	0	0	0	0	0	0
Pholadomyoida	1	0	0	0	0	0	0
Pterioida	1	0	0	0	0	0	0
Temnopleuroida	1	0	0	0	0	0	0