

Hambäck, P. A., Gilbert, J., Schneider, K., Martinson, H. M., Kolb, G. and Fagan, W. F. 2009. Effects of body size, trophic mode and larval habitat on Diptera stoichiometry: a regional comparison. – *Oikos* 118: 615–623.

Appendix 1

Table S1. Diptera analyzed for nitrogen, carbon and phosphorus content. Species are classified whether they primarily feed on living plants, animals (predation and parasitism) or detritus (including fungi and bacteria).

Family	Species	Larval trophic mode	Adult trophic mode ^a	Larval diet ^a	Larval habitat	Body wgt (mg)	% C	% N	% P	C:N	C:P	N:P
Acroceridae	<i>Acrocera globulus</i>	predator	nectarivore	spiders (N+)	terrestrial	4.09	--	--	0.56	--	--	--
Anthomyiidae	<i>Delia floralis</i>	herbivore	nectarivore	roots	terrestrial	2.56	47.0	12.1	0.65	4.53	212.1	46.8
Asilidae	<i>Philoniscus albiceps</i>	predator	predator	insect larvae (N+)	terrestrial	4.70	48.5	10.5	0.49	5.39	288.2	53.4
Bibionidae	<i>Bibio</i> sp. 1	detritivore	nectarivore	plant detritus	terrestrial	0.68	--	--	1.22	--	--	--
Bibionidae	<i>Bibio</i> sp. 2	detritivore	nectarivore	plant detritus	terrestrial	3.08	--	--	0.57	--	--	--
Bibionidae	<i>Bibio</i> sp. 3	detritivore	nectarivore	plant detritus	terrestrial	1.88	48.1	12.3	--	4.56	--	--
Bombyliidae	<i>Bombylius major</i>	predator	nectarivore	insect larvae (N+)	terrestrial	22.08	--	--	0.61	--	--	--
Bombyliidae	<i>Hemipenthes maurus</i>	predator	nectarivore	insect larvae (N+)	terrestrial	1.46	44.9	11.2	0.92	4.69	142.2	30.3
Calliphoridae	<i>Bellardia</i> sp.	predator	detritivore	earth worms	terrestrial	5.27	--	--	0.46	--	--	--
Calliphoridae	<i>Calliphora vicina</i>	predator	detritivore	carion	terrestrial	30.63	45.5	11.1	0.73	4.78	181.7	38.0
Calliphoridae	<i>Lucilia</i> sp.	predator	detritivore	carion	terrestrial	15.5	48.1	12.2	0.75	4.60	187.0	40.7
Calliphoridae	<i>Melanomyia nana</i>	predator	nectarivore	isopods (N-)	terrestrial	1.05	40.21	9.97	--	4.71	--	--
Calliphoridae	<i>Protocalliphora azurea</i>	predator	detritivore	vertebrate	terrestrial	32.09	--	--	0.39	--	--	--
Chironomidae	<i>Chironomus</i> sp.	detritivore	nothing	microorganisms	aquatic	0.74	43.9	9.3	0.91	5.52	140.0	25.54
Chironomidae	<i>Dicortendipes</i> sp.	detritivore	nothing	microorganisms	aquatic	0.33	--	--	0.91	--	--	--
Chloropidae	<i>Chlorops</i> sp.	herbivore	nectarivore	grass stem	terrestrial	0.64	46.38	11.7	--	4.61	--	--
Chloropidae	<i>Dicaeus</i> sp.	herbivore	nectarivore	grass stem	terrestrial	0.53	--	--	0.47	--	--	--
Chloropidae	<i>Elachiptera cornuta</i>	herbivore	nectarivore	grass stem	terrestrial	0.22	--	--	0.94	--	--	--
Chloropidae	<i>Oscinella</i> sp.	herbivore	nectarivore	grass stem	terrestrial	0.27	--	--	1.50	--	--	--
Chloropidae	<i>Platycephala umbraculata</i>	herbivore	nectarivore	grass stem	terrestrial	1.53	43.77	10.0	0.99	5.08	129.1	25.40
Chloropidae	<i>Thaumatomyia</i> sp.	predator	nectarivore	aphids (N-)	terrestrial	0.70	40.08	9.06	0.89	5.16	131.8	25.54
Conopidae	<i>Myopa testacea</i>	predator	nectarivore	Hymenoptera (N+)	terrestrial	5.99	--	--	0.56	--	--	--
Culicidae	<i>Aedes</i> sp.	detritivore	blood	microorganisms	aquatic	0.56	48.65	9.18	1.73	6.19	82.19	13.29
Culicidae	<i>Anopheles</i> sp.	detritivore	blood	microorganisms	aquatic	0.94	47.63	10.1	1.54	5.52	90.08	16.32
Dolichopodidae	<i>Dolichopus plumipes</i>	predator	predator	soil insects (N+)	terrestrial	1.26	47.47	11.0	0.79	5.05	175.4	34.74
Dolichopodidae	<i>Dolichopus</i> sp.	predator	predator	soil insects (N+)	terrestrial	2.08	47.46	10.8	0.93	5.11	149.1	29.18
Empididae	<i>Clinocerinæ</i> sp.	predator	predator	soil insects (N+)	terrestrial	0.17	49.03	11.8	1.13	4.86	126.0	25.94
Empididae	<i>Empis opaca</i>	predator	predator	soil insects (N+)	terrestrial	5.43	--	--	0.57	--	--	--
Empididae	<i>Empis stercorea</i>	predator	predator	soil insects (N+)	terrestrial	1.94	46.02	11.9	1.09	4.50	122.0	27.31
Empididae	<i>Empis livida</i>	predator	predator	soil insects (N+)	terrestrial	4.61	44.17	9.85	0.61	5.23	212.5	40.62

Empididae	<i>Empis pennipes</i>	predator	predator	soil insects (N+)	terrestrial	0.42	48.35	13.8	---	4.10	---	---
Empididae	<i>Empis tessellata</i>	predator	predator	soil insects (N+)	terrestrial	2.27	46.98	11.2	---	4.90	---	---
Empididae	<i>Rhampomyia</i> sp.	predator	predator	soil insects (N+)	terrestrial	2.49	---	---	0.77	---	---	---
Empididae	<i>Tachydromia</i> sp.	predator	predator	soil insects (N+)	terrestrial	0.13	---	---	1.16	---	---	---
Empididae	<i>Tachypeza</i> sp.	predator	predator	soil insects (N+)	terrestrial	0.88	---	---	0.79	---	---	---
Ephydriidae	<i>Caenia fumosa</i>	detritivore	detritivore	microorganisms	aquatic	1.13	46.11	6.64	1.11	8.10	120.7	103.47
Hippoboscidae	<i>Ornithomyia chloropus</i>	predator	predator	vertebrates	terrestrial	3.75	47.18	11.1	---	4.94	---	---
Hybotidae	<i>Hybos femoratus</i>	predator	predator	soil insects (N+)	terrestrial	0.44	46.44	11.2	---	4.85	---	---
Lauxaniidae	<i>Lauxania cylindricornis</i>	detritivore	detritivore	microorganisms	terrestrial	0.71	47.36	11.0	1.22	5.00	113.4	22.69
Lauxaniidae	<i>Sapromyza</i> sp.	detritivore	detritivore	microorganisms	terrestrial	0.18	34.75	7.86	1.20	5.16	84.32	16.34
Limoniidae	<i>Epiphagna ocellaris</i>	detritivore	detritivore	plant detritus	aquatic	2.80	47.75	10.3	0.70	5.42	199.3	36.78
Limoniidae	<i>Limonia</i> sp.	detritivore	detritivore	plant detritus	aquatic	1.05	49.55	11.4	0.99	5.08	146.5	28.84
Limoniidae	<i>Limonia quadrimaculata</i>	detritivore	detritivore	plant detritus	aquatic	5.39	---	---	0.43	---	---	---
Limoniidae	<i>Limonia sexpunctata</i>	detritivore	detritivore	plant detritus	aquatic	1.73	---	---	1.00	---	---	---
Limoniidae	<i>Limnophila ferruginea</i>	detritivore	detritivore	unclear	aquatic	2.73	47.66	12.5	1.02	4.43	136.2	30.74
Lonchopteridae	unknown species	detritivore	detritivore	plant detritus	terrestrial	0.28	---	---	0.92	---	---	---
Micropezidae	<i>Calobata</i> sp. 1	detritivore	detritivore	plant detritus	terrestrial	0.47	46.89	9.41	1.30	5.81	104.9	18.04
Micropezidae	<i>Calobata</i> sp. 2	detritivore	detritivore	plant detritus	terrestrial	1.95	44.3	10.9	---	4.75	---	---
Muscidae	<i>Coenosia</i> sp.	predator	detritivore	insects (N+)	terrestrial	0.28	49.96	11.5	0.65	5.08	223.2	43.93
Muscidae	<i>Lispocephala erythroceru</i>	predator	detritivore	insects (N+)	terrestrial	1.16	---	---	1.03	---	---	---
Muscidae	<i>Mesembrina meridiane</i>	detritivore	detritivore	dung	terrestrial	25.75	---	---	0.93	---	---	---
Muscidae	<i>Musca domestica</i>	detritivore	detritivore	dung	terrestrial	8.54	---	---	0.31	---	---	---
Muscidae	<i>Orthellia caesarium</i>	detritivore	detritivore	dung	terrestrial	4.34	---	---	0.76	---	---	---
Muscidae	<i>Phaonia</i> sp.	predator	detritivore	insects (N+)	terrestrial	13.91	45.65	12.3	0.91	4.34	145.7	33.60
Opomyzidae	<i>Opomyza florum</i>	herbivore	nectarivore	grass stem	terrestrial	0.94	51.31	10.3	0.68	5.80	219.3	37.81
Pipunculidae	<i>Unknown species</i>	predator	nectarivore	leafhoppers (N-)	terrestrial	0.80	40.31	7.83	0.86	6.01	136.0	22.64
Psilidae	<i>Psila</i> sp.	herbivore	nectarivore	root	terrestrial	0.40	---	---	1.20	---	---	---
Psychodidae	unknown species	detritivore	nothing	plant detritus	aquatic	0.15	---	---	1.54	---	---	---
Rhagionidae	<i>Chrysopilus auratus</i>	predator	nectarivore	insect larvae (N+)	terrestrial	1.92	---	---	1.05	---	---	---
Rhagionidae	<i>Rhagio notatus</i>	predator	nectarivore	insect larvae (N+)	terrestrial	0.92	43.89	9.53	1.03	5.37	123.8	23.05
Rhinophoridae	<i>Paykullia maculata</i>	predator	nectarivore	isopods (N-)	terrestrial	3.10	40.12	9.01	0.72	5.19	162.6	31.31
Rhinophoridae	<i>Rhinophora lepida</i>	predator	nectarivore	isopods (N-)	terrestrial	2.69	37.07	7.41	0.74	5.84	146.6	25.12
Sarcophagidae	unknown species	predator	detritivore	carion	terrestrial	13.13	---	---	0.87	---	---	---
Scatophagidae	<i>Scatophaga stercoraria</i>	predator	predator	insect larvae (N+)	terrestrial	10.98	44.41	10.7	0.73	4.82	178.0	36.93
Scatopsidae	unknown species	detritivore	nectarivore	plant detritus	terrestrial	0.29	43.61	11.5	0.59	4.41	215.2	48.80
Scianidae	<i>Lycaria scatopsoides</i>	detritivore	detritivore	plant detritus	terrestrial	0.29	48.26	11.3	1.48	4.99	95.28	19.09
Sciomyzidae	<i>Dictya umbrarum</i>	predator	unknown	gastropods	NA	2.49	50.67	11.0	---	5.35	---	---
Sciomyzidae	<i>Pherbina coryleti</i>	predator	unknown	gastropods	aquatic	5.52	---	---	0.28	---	---	---

Sciomyzidae	<i>Tetanocera robusta</i>	predator	unknown	gastropods	NA	4.17	41.37	11.4	0.43	4.25	283.3	66.69
Sciomyzidae	<i>Trypetoptera punctulata</i>	predator	unknown	gastropods	terrestrial	1.46	---	---	0.85	---	---	---
Sepsidae	<i>Sepsis</i> sp.	detritivore	detritivore	plant detritus	terrestrial	0.45	---	---	0.76	---	---	---
Sepsidae	<i>Themira leachii</i>	detritivore	detritivore	dead seaweeds	terrestrial	0.80	---	---	0.97	---	---	---
Stratiomyidae	<i>Chilonomyia</i> sp.	detritivore	nectarivore	microorganisms	terrestrial	3.21	45.46	9.15	---	5.79	---	---
Stratiomyidae	<i>Microchrysa</i> sp.	detritivore	nectarivore	microorganisms	aquatic	0.93	---	---	0.94	---	---	---
Stratiomyidae	<i>Nemotelus pantherinus</i>	detritivore	nectarivore	microorganisms	aquatic	1.14	40.51	10.1	0.87	4.70	136.2	29.00
Syrphidae	<i>Baccha elongata</i>	predator	nectarivore	aphids (N-)	terrestrial	0.74	---	---	1.11	---	---	---
Syrphidae	<i>Cheilosia scutellata</i>	herbivore	nectarivore	fungi	terrestrial	4.19	46.43	12.1	0.64	4.49	212.8	47.37
Syrphidae	<i>Cheilosia variabilis</i>	herbivore	nectarivore	roots	terrestrial	2.39	45.85	9.70	---	5.51	---	---
Syrphidae	<i>Chrysotoxum arcuatum</i>	predator	nectarivore	aphids (N-)	terrestrial	16.42	49.94	8.80	0.60	6.62	244.2	36.90
Syrphidae	<i>Eoseristalis cryptorum</i>	detritivore	nectarivore	plant detritus	aquatic	20.91	48.12	9.89	0.55	5.69	253.8	44.70
Syrphidae	<i>Episyrphus balteatus</i>	predator	nectarivore	aphids (N-)	terrestrial	4.77	---	---	0.49	---	---	---
Syrphidae	<i>Eristalinus sepulchralis</i>	detritivore	nectarivore	plant detritus	aquatic	4.25	49.56	9.75	0.54	5.93	267.2	45.04
Syrphidae	<i>Eumerus strigatus</i>	herbivore	nectarivore	roots	terrestrial	3.33	---	---	0.81	---	---	---
Syrphidae	<i>Metasyrphus</i> sp.	predator	nectarivore	aphids (N-)	terrestrial	3.14	48.04	9.50	---	5.90	214.2	36.31
Syrphidae	<i>Myathropa florea</i>	detritivore	nectarivore	plant detritus	terrestrial	34.23	48.18	10.6	0.64	5.28	219.0	41.50
Syrphidae	<i>Platycheirus fulviventris</i>	predator	nectarivore	aphids (N-)	terrestrial	1.14	48.94	10.5	1.18	5.42	121.0	22.33
Syrphidae	<i>Rhingia campestris</i>	detritivore	nectarivore	dung	terrestrial	6.75	---	---	0.83	---	---	---
Syrphidae	<i>Syrphus ribesii</i>	predator	nectarivore	aphids (N-)	terrestrial	4.98	47.22	7.26	0.63	7.59	217.7	28.70
Syrphidae	<i>Volucella pellucens</i>	predator	nectarivore	Hymenoptera (N+)	terrestrial	30.40	43.58	8.21	0.70	6.20	181.3	29.26
Syrphidae	<i>Xylota florum</i>	detritivore	nectarivore	wood	terrestrial	6.69	42.14	10.4	0.58	4.72	211.4	44.76
Syrphidae	<i>Xylota coeruliventris</i>	detritivore	nectarivore	wood	terrestrial	9.47	---	---	0.38	---	---	---
Tabanidae	<i>Haematopota pluvialis</i>	predator	blood	insect larvae (N+)	terrestrial	3.63	---	---	1.14	---	---	---
Tachinidae	<i>Eriothrix rufomaculatum</i>	predator	nectarivore	insect larvae (N+)	terrestrial	5.06	45.39	10.6	0.76	4.98	174.3	34.99
Tachinidae	<i>Minho rufiventris</i>	predator	nectarivore	insect larvae (N+)	terrestrial	4.04	---	---	0.42	---	---	---
Tephritidae	<i>Tephritis dilacerata</i>	herbivore	nectarivore	seed heads	terrestrial	0.88	52.03	11.2	0.71	5.40	212.9	39.43
Tephritidae	<i>Urophora stylata</i>	herbivore	nectarivore	seed heads	terrestrial	1.41	---	---	1.12	---	---	---
Therevidae	<i>Thereva latistratita</i>	predator	nectarivore	insect larvae (N+)	terrestrial	4.80	45.97	9.32	0.58	5.75	231.7	40.29
Therevidae	<i>Thereva annulata</i>	predator	nectarivore	insect larvae (N+)	terrestrial	6.98	41.81	9.16	0.43	5.33	283.4	53.21
Tipulidae	<i>Nephrotoma maculata</i>	detritivore	nothing	plant detritus	terrestrial	5.15	---	---	0.75	---	---	---
Tipulidae	<i>Tipula luna</i>	detritivore	nothing	plant detritus	terrestrial	30.53	47.41	12.4	0.66	4.46	210.5	47.19
Tipulidae	<i>Tipula lateralis</i>	detritivore	nothing	plant detritus	terrestrial	5.18	---	---	0.61	---	---	---
Tipulidae	<i>Tipula vittata</i>	detritivore	nothing	plant detritus	terrestrial	12.95	---	---	0.72	---	---	---
Tipulidae	<i>Ula macroptera</i>	detritivore	nothing	plant detritus	terrestrial	1.01	---	---	0.96	---	---	---
Uliidae	<i>Ortalis urticae</i>	detritivore	nectarivore	plant detritus	terrestrial	3.27	---	---	0.71	---	---	---

^aDiet information from Oosterbroek, P. 2006. The European families of the Diptera: identification, diagnosis, biology. – KNNV Publishing, Utrecht, NL; Torp, E. 1984. De danske svirvler (Diptera: Syrphidae). – Apollo Books, Copenhagen, DK; Sommaggio, D. 1999. Syrphidae: can they be used as environmental bioindicators? – Agric. Ecosyst. Environ. 74: 343–356

Table S2. Statistical models describing body C:N ratio, for all specimens with (a) coarse trophic mode description ($\alpha = 0.75$) or (b) fine trophic mode description ($\alpha = 0.97$), with phylogenetic information (GLS). Key: Tro, larval trophic mode [Det, detritivore; Det:Plant, feeding on plant material; Det:Microbial, microbial feeder; Herb, herbivore; Pred, predator; Pred:High, predator with high N diet; Pred:Low, predator with low N diet]; TroAd, adult trophic mode [Flo, floral feeder; Other, non-floral feeder]; BS, body size ($\log_e$ -transformed).

(a) C:N, coarse trophic mode

Model	Lik. ratio	Δ DF	p	Δ AIC
BS $\times$ Tro	8.27	2	0.015	4.27
BS $\times$ TroAd	7.78	1	<0.01	5.78
Table of coefficients				
	Estimate	SE		
Intercept (Det, Flo)	4.20	0.22		
BS	0.12	0.12		
Tro (Herb)	0.62	0.31		
Tro (Pred)	0.07	0.21		
TroAd (Other)	0.19	0.21		
BS $\times$ Tro (Herb)	-0.75	0.34		
BS $\times$ Tro (Pred)	0.18	0.12		
BS $\times$ TroAd (Other)	-0.36	0.13		

(b) C:N, fine trophic mode

Model	Lik. ratio	Δ DF	p	Δ AIC
BS $\times$ TroAd	5.66	1	0.017	3.663
BS $\times$ Tro	5.83	3	0.120	1.16
Table of coefficients				
	Estimate	SE		
Intercept (Pred:High, Flo)	3.99	0.23		
BS	0.29	0.13		
Tro (Det:Plant)	0.22	0.23		
Tro (Det:Microbial)	0.77	0.25		
Tro (Pred:Low)	0.64	0.33		
TroAd (Other)	0.25	0.22		
BS $\times$ Tro (Det:Plant)	-0.19	0.13		
BS $\times$ Tro (Det:Microbial)	0.24	0.27		
BS $\times$ Tro (Pred:Low)	0.14	0.21		
BS $\times$ TroAd (Other)	-0.31	0.13		

Table S3. Statistical model describing body P content for all specimens with a coarse trophic mode description, with phylogenetic information (GLS, $\alpha = 10.0$). Key: TroAd, adult trophic mode [Blood, blood feeder; Det, detritivore; Flo, floral feeder; None, do not feed as adults; Pred, predator]; BS, body size ($\log_e$ -transformed).

Model	Lik. ratio	Δ DF	p	Δ AIC
BS	7.57	1	0.006	5.57
TroAd	12.59	4	0.013	4.59
Table of coefficients				
	Estimate	SE		
Intercept (Blood)	30.99	11.64		
BS	4.58	1.71		
TroAd (Det)	17.18	13.33		
TroAd (Flo)	33.42	12.29		
TroAd (None)	18.64	13.27		
TroAd (Pred)	24.52	13.09		