

APPENDIX E

Biological metric values for benthic macroinvertebrates sampled from the Carmel River

Biological metric values for Carmel River monitoring sites, years 2000 to 2009.

	Fall 2000					Spring 2001						Fall 2001			
	CRCA	CRSH	SHRC	CRSP	CRRR	CRCA	CRSH	CRSP	CRDD US	CRDD DS	CRRR	CRCA	CRSH	CRSP	CRRR
Richness:															
Taxonomic	17	20	24	22	21	17	28	32	28	26	26	20	16	20	20
EPT*	5	8	9	13	9	7	11	16	12	12	11	6	6	10	9
Ephemeroptera	1	1	2	3	3	1	4	3	4	3	3	1	1	2	2
Plecoptera	0	0	1	2	0	1	0	1	0	0	0	0	0	0	0
Trichoptera	4	7	6	8	6	5	7	12	8	9	8	5	5	8	7
Coleoptera*	0	1	1	1	2	0	1	2	1	2	2	1	2	2	2
Predator*	7	6	6	4	7	5	8	9	6	5	8	4	4	2	4
Composition:															
EPT Index (%)	61	72	37	74	68	21	22	79	65	66	66	64	42	86	53
Sensitive EPT Index (%)	7.0	0.3	0.6	11	2.8	3.6	2.2	21	25	19	28	1.2	0.6	8.4	15
Shannon Diversity	2.0	1.9	2.4	2.0	2.2	1.9	2.2	2.1	2.5	2.5	2.4	2.1	1.8	2.1	2.5
Dominant Taxon (%)	27	37	31	35	32	31	26	30	19	18	23	25	44	34	23
Non-insect Taxa (%)*	29	25	33	18	19	24	29	19	32	27	27	30	13	20	20
Tolerance:															
Tolerance Value	5.1	5.5	5.7	4.4	4.5	5.6	5.6	4.2	4.1	4.4	4.0	5.4	5.5	4.5	4.6
Intolerant Organisms (%)*	7.0	0.3	1.4	11	2.6	3.6	1.6	17	25	19	28	1.2	0.6	7.4	14
Intolerant Taxa (%)	5.9	10	13	23	9.5	18	11	22	18	19	15	5.0	6.3	10	10
Tolerant Taxa (%)*	12	15	17	9.1	19	18	18	13	32	19	23	20	6	15	15
Functional Feeding Groups:															
Collector-Gatherers (%)	52	48	44	32	48	58	59	45	48	31	41	39	31	30	23
Collector-Filterers (%)	13	6.8	20	51	23	35	27	33	22	37	23	25	52	51	38
Collectors (%)*	65	55	64	83	71	93	86	78	70	68	63	65	82	81	61
Scrapers (%)	16	29	26	3.0	10	0.6	4.0	1.0	1.8	2.0	1.8	16	8.6	7.4	16
Predators (%)	9.4	12	9.4	3.4	17	2.8	7.4	6.8	8.2	11	10	18	5.8	1.8	5.8
Shredders (%)	0.0	0.0	0.8	0.8	0.2	0.6	0.0	0.8	0.4	0.0	0.2	0.0	0.0	0.0	0.0
Other (%)	9.2	3.0	0.0	10	1.8	3.4	2.8	13	20	20	25	1.6	3.2	10	18
Abundance/Biovolume:															
Organisms per m ²	2800	2100	3200	10000	13000	4400	5800	7800	5900	9100	9600	3800	4300	5900	4000
Organisms (ml per m ²)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* metrics used for index of biotic integrity

Biological metric values for Carmel River monitoring sites, years 2000 to 2009.

	Spring 2002				Fall 2002					Spring 2003					Fall 2003				
	CRCA	CRSH	CRSP	CRRR	CRCA	CRSH	CRRW	CRSP	CRRR	CRCA	CRSH	CRRW	CRSP	CRRR	CRCA	CRSH	CRRW	CRSP	CRRR
Richness:																			
Taxonomic	13	15	21	21	14	15	21	17	22	16	22	16	14	27	21	16	19	20	21
EPT*	5	7	11	10	5	5	8	7	5	5	9	8	6	10	7	6	6	5	8
Ephemeroptera	1	1	3	4	1	1	1	1	1	2	3	3	1	3	1	1	1	1	3
Plecoptera	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Trichoptera	4	5	7	6	4	4	7	6	4	3	6	5	5	7	5	5	5	4	5
Coleoptera*	0	0	1	2	0	0	0	0	3	0	1	0	1	1	0	0	1	1	2
Predator*	2	3	3	4	5	5	7	4	6	5	6	4	4	7	6	7	6	8	6
Composition:																			
EPT Index (%)	39	50	71	45	42	32	37	49	18	30	40	49	58	71	30	45	46	64	38
Sensitive EPT Index (%)	2.2	3.4	13	18	3.8	0.2	1.6	1.8	11	1.6	4.0	6.6	8.6	38	1.8	0.6	1.0	3.4	25
Shannon Diversity	1.7	1.4	1.8	2.3	2.1	1.7	2.1	2.4	1.9	1.7	1.7	1.7	1.5	2.2	1.9	1.6	2.0	2.2	2.3
Dominant Taxon (%)	33	44	42	24	24	41	23	24	33	33	35	36	47	33	45	40	33	27	24
Non-insect Taxa (%)*	23	13	19	24	29	33	29	35	36	38	23	25	14	33	29	25	42	40	38
Tolerance:																			
Tolerance Value	5.9	5.2	4.7	4.9	5.8	5.8	5.8	5.5	5.7	5.7	5.4	5.2	5.1	3.9	5.9	5.7	6.2	5.5	4.4
Intolerant Organisms (%)*	2.0	1.6	3.2	18	3.8	0.2	1.4	1.8	11	1.4	1.6	2.6	5.8	38	2.0	0.6	1.0	3.4	25
Intolerant Taxa (%)	15	27	33	19	7.1	6.7	9.5	12	4.5	6.3	14	19	14	19	14	6.3	5.3	5.0	9.5
Tolerant Taxa (%)*	15	13	10	19	29	20	19	24	32	38	18	13	7	26	24	31	32	30	29
Functional Feeding Groups:																			
Collector-Gatherers (%)	67	58	48	58	46	41	59	45	33	56	56	52	53	42	27	37	68	42	19
Collector-Filterers (%)	28	39	46	26	17	41	28	31	33	37	38	39	36	7.8	48	41	16	25	7.2
Collectors (%)*	95	96	94	84	63	83	86	76	66	93	95	92	90	50	74	78	84	67	26
Scrapers (%)	0.0	0.0	1.4	2.8	19	8.8	4.8	8.2	15	0.2	0.2	0.8	0.2	4.8	13	16	6.8	18	13
Predators (%)	2.8	1.2	1.2	4.0	14	7.6	4.2	10	2.2	5.8	3.0	3.0	3.2	11	10	5.6	5.4	8.2	36
Shredders (%)	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.6	0.0	0.0	0.0	0.4
Other (%)	2.4	2.2	2.6	9.6	4.6	0.8	4.8	5.8	16	1.4	2.2	4.6	7.0	33	2.0	0.4	3.6	7.2	24
Abundance/Biovolume:																			
Organisms per m ²	5600	5900	7800	5400	4400	4700	2900	2500	15200	4700	4000	3100	3600	2600	9600	3800	7000	4100	5300
Organisms (ml per m ²)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* metrics used for index of biotic integrity

Biological metric values for Carmel River monitoring sites, years 2000 to 2009.

	Fall 2004						Fall 2005					Fall 2006				
	CRLP	CRCA	CRSH	SHRC	CRSP	CRRR	CRLP	CRCA	CRSH	CRSP	CRRR	CRLP	CRCA	CRSH	CRSP	CRRR
Richness:																
Taxonomic	39	21	22	16	24	27	41	20	20	15	22	37	22	22	20	23
EPT*	15	5	5	8	6	5	18	6	6	5	7	19	6	7	11	8
Ephemeroptera	6	1	1	1	1	2	7	1	1	1	2	7	2	2	2	2
Plecoptera	5	0	1	1	0	0	6	0	1	1	0	6	0	1	2	1
Trichoptera	4	4	3	6	5	3	5	5	4	3	5	6	4	4	7	5
Coleoptera*	3	0	1	0	1	3	5	0	1	0	1	4	0	1	0	1
Predator*	17	6	6	5	8	9	16	9	8	4	8	12	9	7	5	7
Composition:																
EPT Index (%)	25	29	22	38	59	30	60	60	20	59	55	41	45	30	75	77
Sensitive EPT Index (%)	21	7.1	0.4	3.4	23	26	44	0.4	0.6	0.4	12	19	3.9	1.0	7.3	20
Shannon Diversity	2.6	1.7	1.8	1.5	2.3	1.7	2.9	2.2	1.8	1.8	2.4	2.4	2.3	2.1	1.8	2.3
Dominant Taxon (%)	33	50	35	52	24	51	16	32	52	40	24	31	27	35	46	25
Non-insect Taxa (%)*	13	33	41	31	33	37	15	30	35	40	41	11	41	32	25	39
Tolerance:																
Tolerance Value	4.8	5.5	5.8	5.2	4.7	4.7	3.3	5.5	5.8	5.3	5.0	4.6	5.7	5.8	5.0	3.9
Intolerant Organisms (%)*	22	7.1	0.4	3.4	23	26	44	0.6	0.6	0.4	11	18	3.9	1.0	6.7	20
Intolerant Taxa (%)	36	4.8	9.1	13	13	3.7	29	10	5.0	6.7	9.1	35	4.5	9.1	20	13
Tolerant Taxa (%)*	13	33	27	25	25	37	12	25	30	27	36	14	32	23	20	30
Functional Feeding Groups:																
Collector-Gatherers (%)	48	31	51	60	42	60	34	48	28	50	31	59	45	39	49	24
Collector-Filterers (%)	18	51	35	29	16	2	12	18	53	39	25	13	25	39	33	28
Collectors (%)*	66	81	86	88	59	62	46	66	81	88	56	72	71	78	82	52
Scrapers (%)	8.4	5.5	6.1	2.8	12	6.0	30	16	3.0	5.5	3.6	13	10	7.7	6.3	3.9
Predators (%)	18	5.7	7.6	5.3	5.2	5.0	14	15	14	3.7	25	9.4	14	13	4.3	13
Shredders (%)	6.2	0.0	0.2	3.4	0.0	0.2	5.5	0.0	0.6	0.4	0.2	3.3	0.0	1.2	2.9	0.4
Other (%)	0.8	7.5	0.2	0.2	24	27	4.3	2.8	0.8	2.0	15	1.2	5.1	0.6	4.5	31
Abundance/Biovolume:																
Organisms per m ²	1400	2900	1100	6500	3000	600	2200	4400	4400	5100	4700	1376	2452	957	2153	5323
Organisms (ml per m ²)	ND	ND	ND	ND	ND	ND	2.5	5.0	4.1	5.3	9.6	2.5	6.2	1.7	3.7	11.1

* metrics used for index of biotic integrity

Biological metric values for Carmel River monitoring sites, years 2000 to 2009.

	Fall 2007					Fall 2008						Fall 2009				
	CRLP	CRCA	CRSH	CRSP	CRSW	CRLP	CRCA	CRSH	SHRC	CRSP	CRSW	CRLP	CRCA	CRSH	CRSP	CRRR
Richness:																
Taxonomic	30	20	18	22	23	39	23	14	19	25	23	40	20	15	16	18
EPT*	8	5	5	8	7	16	7	4	7	11	9	22	6	5	7	9
Ephemeroptera	1	1	1	2	2	6	1	1	1	1	3	9	2	3	1	3
Plecoptera	3	0	1	1	1	5	0	1	1	2	1	6	0	0	2	0
Trichoptera	4	4	3	5	4	5	6	2	5	8	5	7	4	2	4	6
Coleoptera*	4	0	1	1	1	5	1	1	1	1	1	5	0	0	0	1
Predator*	11	8	6	8	6	15	7	4	6	9	7	13	7	4	5	1
Composition:																
EPT Index (%)	18	18	28	31	34	42	22	7	32	31	56	82	9	17	23	84
Sensitive EPT Index (%)	3.3	0.8	0.6	2.6	9.6	22	0.6	0.2	5.7	5.9	26	70	1.2	0.0	1.2	51
Shannon Diversity	1.7	1.7	1.8	1.5	2.3	2.5	1.7	1.3	1.7	1.5	2.2	2.6	1.1	1.3	1.3	1.6
Dominant Taxon (%)	58	50	33	53	25	25	56	62	52	57	25	28	73	56	64	50
Non-insect Taxa (%)*	17	25	22	23	35	15	35	36	26	28	39	18	25	40	31	28
Tolerance:																
Tolerance Value	5.6	5.9	6.0	5.7	5.4	4.5	5.9	6.3	5.3	5.5	4.5	2.0	5.9	6.2	5.9	2.9
Intolerant Organisms (%)*	3.5	1.0	0.6	2.6	9.6	22	1.0	0.2	5.7	5.7	26	69	1.4	0.0	1.2	50
Intolerant Taxa (%)	23	10	5.6	14	13	36	13	7.1	16	20	13	40	20	0.0	25	11
Tolerant Taxa (%)*	23	30	17	23	22	15	26	29	21	28	30	15	15	33	31	22
Functional Feeding Groups:																
Collector-Gatherers (%)	27	32	54	34	37	40	25	33	60	25	24	24	18	39	29	19
Collector-Filterers (%)	58	51	35	56	35	26	58	62	27	61	32	9	74	56	66	26
Collectors (%)*	85	83	88	89	72	66	83	95	87	86	56	33	93	95	96	44
Scrapers (%)	4.7	1.2	2.4	0.8	9.2	17	5.5	0.2	1.8	0.2	1.1	27	0.6	0.2	0.6	4.9
Predators (%)	6.7	15	8.0	7.2	8.2	16	11.3	5.0	5.5	8.1	17	9.2	5.5	5.2	2.6	0.4
Shredders (%)	1.6	0.0	1.0	0.8	0.2	0.6	0.0	0.2	5.5	2.2	1.1	2.8	0.0	0.0	0.4	0.0
Other (%)	2.4	1.0	0.2	1.8	11	0.4	0.4	0.0	0.0	3.1	25	28	1.2	0.0	0.6	50
Abundance/Biovolume:																
Organisms per m ²	2452	4163	4809	4205	8494	2452	4187	4426	4187	4785	6580	1615	6418	1579	4223	4965
Organisms (ml per m ²)	4.3	5.1	4.1	4.0	15.7	3.7	5.4	4.1	7.0	5.6	11.5	2.4	53.6	2.1	5.7	7.2

* metrics used for index of biotic integrity