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N D. [redacted] [1,2]*, R
G [redacted] [2], J [redacted] H. H [redacted] [3],
. B [redacted] K [redacted] [3], J M. G [redacted] [4]
P J. D [redacted] [5]

log-transformed, species abundance matrix. Here we employ these two metrics to assess recovery in Middle Lake, constructing recovery targets from the 22 non-acidic lakes. We use the mean ± 2 SD as our target for richness (Yan *et al.* 1996b; Kilgour *et al.*

and by the early 1990s, yellow perch contributed >99% of fish caught in multiple trap net sets (J.M. Gunn, unpublished data). In summary, the physical, chemical and food web regimes of the lake have dramatically improved, in the sense that they are now more typical of non-acidified lakes. There are however two key exceptions. First, Cu and Ni levels, while greatly reduced are still elevated in comparison with remote lakes (LaZerte 1986). Secondly, most northern Ontario lakes have fish, but a community formed essentially solely of planktivorous (i.e. stunted) yellow perch is highly unusual.

In comparison with the 22 non-acidic lakes, the zooplankton community of Middle Lake has improved steadily over the last 30 years, but the entire community has not yet recovered. Ice-free season average crustacean species richness has increased from 2.6 species per standard count in 1973 to an average of six to eight species after 2000 (Fig. 2). While the pattern of improvement is clear, the target of 8–12 species per count per year (Yan *et al.*

1 Ice-free season average abundances (animals per m^3) of all zooplankton taxa recorded in two or more years in Middle Lake*

	Cladocera†						Copepoda‡								
	S. sp	C. s.	B. l.	D. b.	D. m.	H. g.	A. v.	O. m.	Cy. c.	Ca. c.	L. m.	C.b.t.	S. o.	T. e.	M. e.
CA1	2.32	1.13	0.58	0.25	0.08	−0.72	2.32	1.75	0.25	0.07	0.01	−0.29	−0.38	−0.38	−0.39
CA2	3.63	0.54	−0.15	−0.64	−0.46	0.18	1.39	−0.89	0.06	−0.34	−0.4	0.02	0.22	0.29	0.46
1973		329	48647				17		112						
1974		37	1071				157		48	248		0.7			
1975	0.2	394	122				10		47	1	0.1	0.1		0.2	
1976		17192	113				26		86	8					
1977	19.9	3707	18				118		4574	4	5.3		0.7		
1978	8.9	1265	5				64	51	7767						
1979§	7.8	555	1066				75	293	1242	40	6.7				
1981		26	6994				3		98	18883	2843				
1982	5.1	194	219						18	85137	4249				
1983		174	6412					45	108	110614	4124				
1984		164	9517					3.8	75	25898	1513				
1985	0.5	21	176					1.1	23	14826	1992				
1986		27	257	9	10		2		188	11216	1393				
1987		379	12668		18		0.5	110	430	16674	1131				
1988		406	25936	23	77			19	129	24798	2171				
1989	0.7	39	62892	105	25	1		11	265	39223	4415	28			
1990		22	33678	70	521				11881	32066	1504	1469			
1991		65	67997	3352	272				12914	13776	3018	1248			
1992		18	32094	646	3822				2701	24605	2025	1227			
1993		22	17859	366	1699				6273	22391	1971	895	6		
1994		93	45584	5565	1920				14077	12716	1078	2460	32		
1995		21	68681	4247	499				6340	6615	410	745	9	93	
1996		41	106931	6233	2071				14678	20442	959	924	1094	442	
1997			31551	12730	2817				4988	27941	1082	941	1025	109	
1998		15	47695	10770	2721				12827	31363	1018	593	832	838	
1999		83	25764	7033	1573				7686	22427	1150	1001	903	946	
2000		155	49714	3155	3255				8748	18868	311	1513	785	737	
2001		44	4256	933	1196	12			6234	6199	644	486	770	150	13
2002		8	4684	829	3343				6231	8396	570	332	598	328	216

Cladoceran and copepod species are separately sorted based on the ranks of taxa scores on the first CA axis of their respective ordinations (see Figs 3 and 4). CA axis I and II scores of the taxa are provided.

*Additional species recorded in just a single year in Middle Lake were *Daphnia dubia* in 1985, *Eubosmina tubicen* in 1986, *Daphnia longiremus*, *Daphnia pulex* and *Daphnia retrocurva* in 1990, *Epischura lacustris* in 1992, and *Cyclops scutifer* in 1996. Additional species found only in the reference lakes that were included in the analyses were the Cladocera: *Daphnia ambigua*, *Polyphemus pediculus* and *Eubosmina longispina*.

†These Cladocera are *Simocephalus* sp. (S. sp), *Chydorus sphaericus* (C.s.), *Bosmina longirostris* (B.l.), *Diaphanosoma birgei* (D.b.), *Daphnia mendotae* (D.m.) and *Holopedium gibberum* (H.g.).

‡These Copepoda are *Acanthocylops vernalis* (A.v.), *Orthocyclops modestus* (O.m.), cyclopoid copepodid (cy.c.), calanoid copepodid (ca.c.), *Leptodiaptomus minutus* (L.m.), *Cyclops bicuspidatus thomasi* (C.b.t.), *Skistodiaptomus oregonensis* (S.o.), *Tropocyclops extensus* (T.e.), and *Mesocyclops edax* (M.e.)

§The lake was not sampled in 1980.

O. modestus, the appearance of *L. minutus* and *S. oregonensis*, the two most common calanoid copepods in Ontario (Rigler & Langford 1967), and the appearance of stable populations of three other common cyclopoid copepods, *C. bicuspidatus thomasi*, *T. extensus* and *M. edax* (Table 1). On average the number of copepod species in the Middle Lake assemblage increased from one in 1973 to five in 2002, accounting for the majority of the increase in zooplankton species richness (Fig. 2).

In contrast to the copepods, the cladoceran trajectory was promising, but recovery has stalled (Fig. 4a). The acid- and metal-tolerant *Bosmina longirostris* and *Chydorus sphaericus* remain dominant members of the assemblage (Table 1). The 1986 appearances of *Diaphanosoma birgei* and *Daphnia*

mendotae

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