We performed a Spearman-rank correlation between the unpooled 21 fossil sampling units and 58 fossil subsampling units. The overwhelming majority of correlations were significantly positive: 80% (167) of comparisons between sampling units, and 78% (1261) of subsampling units (see datasheet). Hence, in the fidelity analysis with LAs and DAs, the subsampling units from the fossil bed were treated as a single fossil bed, or at least, representing a homogeneous bed, and were analyzed as a single FA.

SUPPLEMENTARY DATA 1—Absolute abundance of mollusks from TPR and TPF.

	Living		Death		Fossil	Additional information
	MS	RS	MS	RS		
Pomacea canaliculata (Lamarck, 1822)	0	5	1	11	1	
Potamolithus aff. *orbignyi* (Pilsbry, 1896)	431	615	57	86	17	
Potamolithus sp.	467	467	89	89	0*	
Potamolithus aff. *lapidum* (Orbigny, 1835)	0	0	0	0	19	
Potamolithus aff. *callosus* (Pilsbry, 1925)	0	0	0	0	16	
Potamolithus petitianus (Orbigny, 1840)						Cited as fossil by E.V. Oliveira (personal communication, 2005).
Biomphalaria sp.	1	3	17	30	0	
Gundlachia sp.						Cited as fossil by E.V. Oliveira (personal communication, 2005).
Heleobia aff. *bertoniana* (Pilsbry, 1911)	0	0	5	5	81	
Heleobia aff. *piscium* (Orbigny, 1835)	0	0	0	0	21	
Heleobia aff. *parchappei* (Orbigny, 1835)	0	0	0	0	12	
Heleobia australis (Orbigny, 1835)						Cited as fossil by E.V. Oliveira (personal communication, 2005).
Diplodon delodontus wymanii (Lea, 1860)	4	4	2.5	3.5	14	Cited as fossil by Bombin (1976).
Diplodon parallelopipedon (Lea, 1834)	0	0	0	4	9	
Diplodon rhuacoicus (Orbigny, 1835)	0	0	0	0	25	
Diplodon variabilis (Maton, 1809)						Cited as fossil by Bombin (1976).
Diplodon sp.	4	4	0	0	0*	
Anodontites trapesialis forbesianus	1	1	0	0	15	Cited also as fossil by Bombin (1976).
Mycetopoda siliquosa (Spix, 1827)	0	0	2	2	0	
Monocondylaea minuana (Orbigny, 1835)	0	0	0	0	6	

Leila blainvilleana (Lea, 1834)						Cited as fossil by Bombin (1976).
Cyanocyclas limosa (Maton, 1811)	0	0	0	4	180	Cited also as fossil by Bombin (1976).
Corbicula fluminea (Müller, 1774)	12	12	5	11	0	
Corbicula largillierti (Philippi, 1844)	103	103	27.5	61.5	0	
Eupera klappenbachii (Mansur and Veitenheimer, 1975)	1	2	1	1	1	
Pisidium punctiferum (Guppy, 1867)	1	1	0	0	0	
Pisidium sterkianum (Pilsbry, 1897)	1	9	3	3	0	

SUPPLEMENT—Rank order of genera relative abundance (%) of the fossil assemblage from the Touro Passo Formation and living and death assemblages of the Touro Passo River, at small scale (MS) and large scale (RS; see text). "I" denotes invasive genera. (Data for living and death assemblages were compiled from Martello et al., 2006).

		MS		RS	
	Fossil	Death	Living	Death	Living
Cyanocyclas	34.09			0.01	
Heleobia	32.38	2.38		1.60	
Potamolithus	20.07	69.52	86.84	56.27	88.25
Diplodon	9.09	1.19	0.77	2.41	0.65
Anodontites	2.84		0.09		0.08
Monocondylaea	1.13				
Pomacea	0.18	0.47		3.53	0.40
Eupera	0.18	0.47	0.09	0.32	0.16
Corbicula (I)		15.47	11.12	24.58	9.38
Biomphalaria		8.09	0.09	9.64	0.24
Pisidium		1.42	0.96	0.96	0.81
Mycetopoda		0.95		0.64	

SUPPLEMENT—Correlation indices and p-values for comparisons between living, death and fossil assemblages, considering species. P-value (after Bonferroni correction) = 0.002.

Spatial Scale	Pair of assemblages	Pearson	P-value	Spearman	P-value
MS	LA x DA	0.965	0.00000000	0.650	0.00105284
	LA x FA	-0.108	0.63126360	-0.531	0.01103592
	DA x FA	-0.138	0.54022509	-0.395	0.06877860
RS	LA x DA	0.904	0.00000001	0.644	0.00122540
	LA x FA	-0.094	0.67649781	-0.565	0.00612218
	DA x FA	-0.139	0.53858705	-0.262	0.23868954

SUPPLEMENT—Correlation indices and p-values for comparisons between living, death and fossil assemblages, considering genera. P-value (after Bonferroni correction) = 0.002.

Spatial Scale	Pair of assemblages	Pearson	P-value	Spearman	P-value
MS	LA x DA	0.991	0.00000000	0.641	0.02461270
	LA x FA	0.069	0.83206889	-0.205	0.52293185
	DA x FA	0.038	0.90765364	-0.245	0.44352470
RS	LA x DA	0.942	0.00000463	0.760	0.00413075
	LA x FA	0.072	0.82434485	-0.274	0.38871528
	DA x FA	-0.038	0.94242712	-0.233	0.46532118

SUPPLEMENT—T-test statistics for comparison between living, death and fossil assemblages, considering species. P-value (after Bonferroni correction) = 0.002.

Spatial Scale	Pair of assemblages	Mean difference	Std. Dev.	Std. Error	t	P
MS	LA x DA	37.0909	110.9597	23.6567	1.568	0.13185448
	LA x FA	27.6818	142.1938	30.3158	0.913	0.37154710
	DA x FA	-9.4091	48.3705	10.3126	-0.912	0.37192171
RS	LA x DA	41.5909	135.7999	28.9526	1.437	0.16558726
	LA x FA	36.7727	168.7520	35.9780	1.022	0.31837011
	DA x FA	-4.8182	51.6687	11.0158	-0.437	0.66629513

SUPPLEMENT—T-test statistics for comparison between living, death and fossil assemblages, considering genera. P-value (after Bonferroni correction) = 0.002.

Spatial Scale	Pair of assemblages	Mean difference	Std. Dev.	Std. Error	t	P
MS	LA x DA	68.66667	216.60504	62.52849	1.098	0.29558794
	LA x FA	51.41667	260.16549	75.10331	0.685	0.50775658
	DA x FA	-17.25000	69.56733	20.08236	-0.859	0.40868940
RS	LA x DA	76.25000	262.02147	75.63908	1.008	0.33507822
	LA x FA	67.41667	311.43932	89.90479	0.750	0.46906945
	DA x FA	-8.83333	78.18403	22.56979	-0.391	0.70299227