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THE FRESHWATER MUSSELS OF THE TONAWANDA CREEK BASIN IN WESTERN NEW YORK

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ABSTRACT

We surveyed the unionid fauna of Tonawanda Creek basin in the Niagara River drainage in western New York in 1998, and found specimens of 19 species, of which sixteen were live. Our records of live or presumed live (found as recently spent shells) populations include two species that are rare in western New York and the eastern Lake Erie basin: *Lampsilis fasciola* and *Truncilla truncata*. We also found two old spent shells of *Epioblasma triquetra*. The basin's mussel diversity was primarily found in the lower mainstem, with tributaries being relatively species-poor. Despite some evidence of unionid decline and habitat degradation from the impacts of urbanization and agriculture (which is the predominant land-use in the basin), the mussel community of Tonawanda Creek is remarkably diverse. Moreover, it is regionally significant, given the decline of mussel communities elsewhere in the eastern Great Lakes basin.

Key words: Unionidae, Tonawanda Creek Basin, New York.

INTRODUCTION

We conducted a survey for freshwater mussels in Tonawanda Creek and its tributaries in western New York in August, 1998. Early historical records of the creek's mussel community (Robertson & Blakeslee, 1948; also see Strayer *et al.*, 1991 and Strayer & Jirka, 1997 for a treatment of earlier records) are sketchy. More recent records (Strayer *et al.*, 1991; Strayer, 1995) are limited in scope, but indicate that the creek contains one of the most diverse mussel communities in New York State, consisting of species typical of the Lake Erie basin. Our objective was to obtain more comprehensive data on the current status, species composition, distribution, and relative abundance of unionids in the Tonawanda Creek basin.

Tonawanda Creek (Fig. 1) originates on the northern edge of the Allegheny Plateau, running north and then west, emptying into the Niagara River in the vicinity of Grand Isle. The mainstem and tributaries from the headwaters to the Portage Escarpment (Fig. 1) are generally clear streams of moderate gradient with coarse, unconsolidated substrate,

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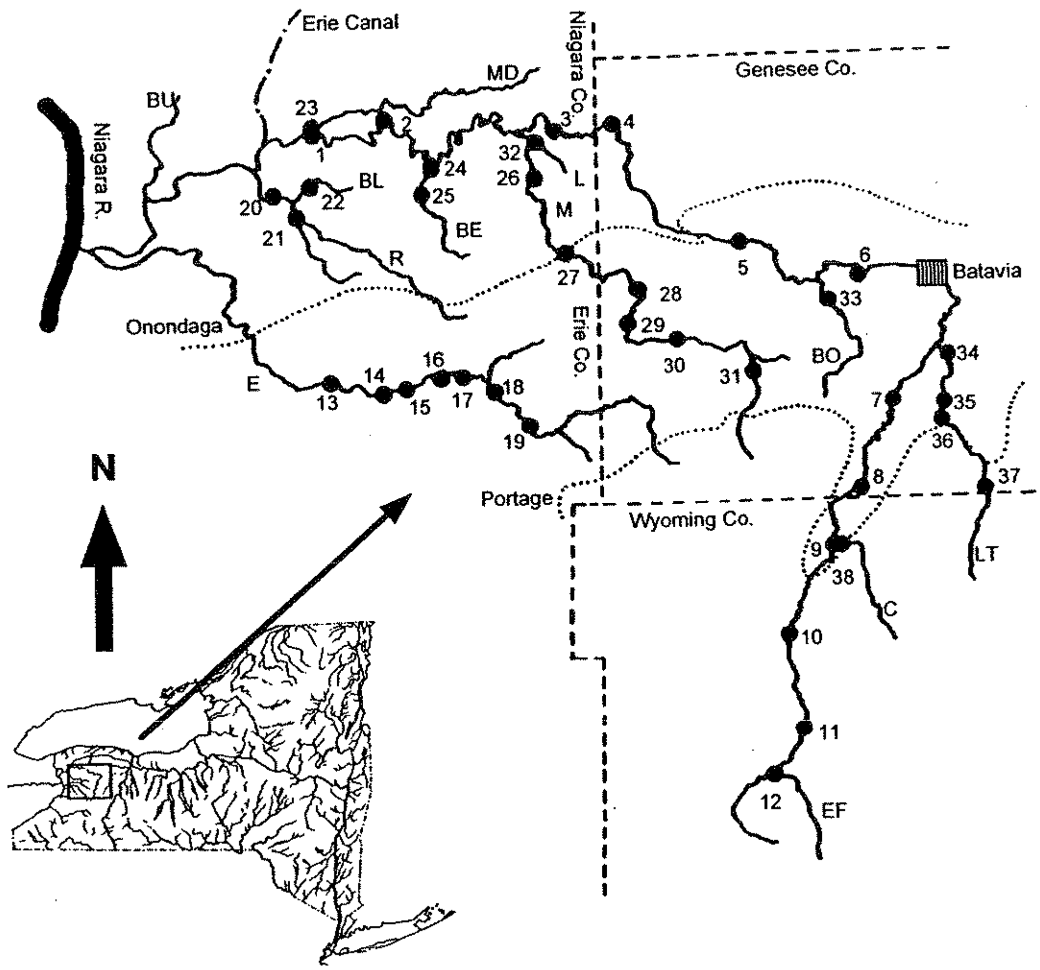

FIG. 1. Sampling stations in the Tonawanda Creek Basin. Numbers show sampling stations (See Table 1 for precise locations), and letters show tributaries, as follows: BE = Beeman Creek, BL = Black Creek, BO = Bowen Creek, BU = Bull Creek, C = Crow Creek, E = Ellicott Creek, EF = East Fork, L = Ledge Creek, LT = Little Tonawanda Creek, MD = Mud Creek, R = Ransom Creek. The interrupted line is the Erie Canal. Dashed lines show county boundaries, and dotted lines show the Onondaga and Portage Escarpments.

largely composed of loose glacial till material, and the catchment is a mix of forested and agricultural lands. Between the Portage and Onondaga Escarpments (Fig. 1), agriculture is the predominant land use. In this area, the water is fairly turbid and the gradient is moderate, with frequent riffles. Substrate is varied, ranging from coarse particles (cobble, boulder, and bedrock) to sand. Below the Onondaga Escarpment (at Indian Falls), the creek is a medium-sized river (15 - 40 m wide) and grades into a lowland/lake plain system: between the Onondaga Escarpment and site 3 (Fig. 1), riffles are still relatively frequent and the gradient is low to moderate, while below site 3, low-gradient pool habitats are abundant, bordered by infrequent riffle/runs of sand/gravel/cobble substrate. Here the water is typically extremely turbid.

Human activity has affected Tonawanda Creek substantially: the lower reach of the creek merges with the Erie Canal, for which the creek has been channelized. Between May and November, the entire flow of the creek is diverted northward into the canal towards Lockport rather than westward into the Niagara River. Also, point and non-point pollution from residential and commercial development in the metropolitan Buffalo area in the south-western most portions of the basin and from small cities and towns such as Batavia, Williamsville, and Akron have also impacted the river. In addition, much of the basin upstream of the Erie Canal supports agricultural activities, and the creek suffers from an array of associated habitat alterations.

METHODS

Thirty-eight sites (Table 1, Fig. 1) were visited in August 1998 during periods of low flow. Where water clarity allowed, timed visual searches were conducted with glass-bottomed buckets. Mussels were hand-picked, identified, recorded, and replaced in the substrate. Select spent shells were collected as voucher specimens, which will be deposited in the New York State Museum. We examined a variety of habitats, with an emphasis on riffles and runs. At sites with high water turbidity, substrate was manually probed for live animals and shore areas were searched for spent valves (sites 1, 2, 20, and 30). At sites with high turbidity and soft substrate, we pulled an upside down bow rake across the substrate to find mussels (sites 7, 34). A large number of additional sites (> 25) not listed in Tables 1 and 2 were quickly inspected and not sampled in accordance with judgments pertaining to poor accessibility, poor unionid habitat, and/or difficult sampling conditions. Two tributaries (Bull Creek, Mud Creek) are under-represented in this survey because of these factors. Mussel nomenclature follows Turgeon *et al.* (1988), except in the case of the taxonomic uncertainty surrounding *Lampsilis ovata* (= *cardium*), which is here referred to as *L. ovata* (Say), and *Pyganodon* (= "*Anodonta*") *grandis* (Say) (Hoeh 1990).

RESULTS AND DISCUSSION

We observed 19 species, 16 of them as live specimens (Table 2). Two species were observed only as recently dead spent shells (*Lampsilis fasciola* (Rafinesque) and *Alasmidonta viridis* (Rafinesque)), and an additional species was observed only as old spent shells (*Epioblasma triquetra* (Rafinesque)). In addition, a live specimen of *Potamilus alatus* (Say) was observed at site 1 in 1987 (Strayer *et al.*, 1991). *Potamilus alatus* is often found in still-water, low gradient habitats (Strayer & Jirka, 1997), areas that we were unable to search due to deep water and extreme turbidity. Thus it is almost certain that *P. alatus* still exists in lower mainstem of Tonawanda Creek.

TABLE 1. List of sites. Numbers correspond to Table 2.

1. Tonawanda Creek, Transit Rd., Pendelton Twp., Niagara Co.; Amherst Twp., Erie Co.
2. Tonawanda Creek, Rapids, Lockport Twp., Niagara Co.; Clarence Twp., Erie Co.
3. Tonawanda Creek, Cedar Rd., Royalton Twp., Niagara Co.; Newstead Twp., Erie Co.
4. Tonawanda Creek, Meadville Rd., Alabama Twp., Genesee Co.
5. Tonawanda Creek, old bridge crossing near Christie Rd., Pembroke Twp., Genesee Co.
6. Tonawanda Creek, Route 5, Batavia Twp., Genesee Co.
7. Tonawanda Creek, Hunn Rd., Alexander Twp., Genesee Co.
8. Tonawanda Creek, Genesee St., Alexander Twp., Genesee Co.
9. Tonawanda Creek, Dunbar Rd., Attica Twp., Wyoming Co.
10. Tonawanda Creek, Eck Rd., Bennington Twp., Wyoming Co.
11. Tonawnada Creek, Centerline Rd., Orangeville Twp., Wyoming Co.
12. East Fork, Route 98, Sheldon Twp., Wyoming Co.
13. Ellicott Creek, Main St., Lancaster Twp., Erie Co.
14. Ellicott Creek, Stony Rd., Lancaster Twp., Erie Co.
15. Ellicott Creek, Pavement Rd., Lancaster Twp., Erie Co.
16. Ellicott Creek, Ransom Rd., Lancaster Twp., Erie Co.
17. Ellicott Creek, Town Line Rd., Lancaster Twp., Erie Co.
18. Ellicott Creek, Walden Ave., Alden Twp., Erie Co.
19. Ellicott Creek, North Rd., Alden Twp., Erie Co.
20. Ransom Creek, Millersport Hwy., Amherst Twp., Erie Co.
21. Ransom Creek, Dodge Rd., Amherst Twp., Erie Co.
22. Black Creek, Dann Rd., Amherst Twp., Erie Co.
23. Mud Creek, Transit Rd., Pendleton Twp., Niagara Co.
24. Beeman Creek, Rapids Rd., Clarence Twp., Erie Co.
25. Beeman Creek, Parker Rd., Clarence Twp., Erie Co.
26. Murder Creek, Swift Mills, Newstead Twp., Erie Co.
27. Murder Creek, Akron Falls Park, Newstead Twp., Erie Co.
28. Murder Creek, Lake Rd., Pembroke Twp., Genesee Co.
29. Murder Creek, Cohochton Rd., Pembroke Twp., Genesee Co.
30. Murder Creek, Route 77, Pembroke Twp., Genesee Co.
31. Murder Creek, Richley Rd., Darien Twp., Genesee Co.
32. Ledge Creek, Route 93, Newstead Twp., Erie Co.
33. Bowen Creek, Hopkins Rd., Batavia Twp., Genesee Co.
34. Little Tonawanda Creek, Old Creek Rd., Alexander Twp., Genesee Co.
35. Little Tonawanda Creek, West Bethany Rd., Alexander Twp., Genesee Co.
36. Little Tonawanda Creek, Gilhooly Rd., Alexander Twp., Genesee Co.,
37. Little Tonawanda Creek, Linden Mills, Bethany Twp., Genesee Co.
38. Crow Creek, Exchange St., Attica Twp., Wyoming Co.

Considering the unionid decline in the western Lake Erie basin in New York (Strayer *et al.*, 1991) and Canada (Metcalfe-Smith *et al.*, 1998) three of our records are notable for their regional or global rarity:

Epioblasma triquetra

We found two spent shells at two downstream mainstem sites (sites 1 and 3), the first records of this species from Tonawanda Creek, and the first specimens collected in New York since 1950. Both shells were old, though one (juvenile size) was considerably more recent than the other. While these specimens do not provide evidence that this species still exists in Tonawanda Creek, it may still be extant in the lower mainstem. With a few exceptions, *E. triquetra* is typically rare and can be difficult to detect. Historical records of this species in western New York are limited to the Niagara River, Lake Erie, and the Buffalo River (Strayer & Jirka, 1997), from all of which *E. triquetra* has probably been extirpated due to zebra mussel impacts (former two) and habitat degradation (latter, Strayer *et al.*, 1991). Moreover, *E. triquetra* has suffered serious declines in the lower Great Lakes basin in Canada, and may be extirpated from this area (Metcalfe-Smith *et al.*, 1998).

Lampsilis fasciola

Two recently dead spent shells were found at site 4 in the lower mainstem, in addition to a small number of old spent shells. There appears to be a small population of this species at this site. Also, an old spent shell was collected in 1996 at site 3 by Mike Wilkinson of the New York Department of Environmental Conservation, though we found no specimens of *L. fasciola* here. These are the first published records of this species from Tonawanda Creek, and the first collections of *L. fasciola* in the Erie/Ontario basin of New York since 1906. The habitat preference of this species (riffles in clear and hydrologically stable creeks and rivers (Strayer & Jirka, 1997)) may explain the limitation of its distribution to sites (sites 3 and 4) in the mainstem where turbidity was comparatively less than downstream areas (sites 1 and 2) and riffle/run habitats were most extensive.

Truncilla truncata (Rafinesque)

This species was observed at site 2 as three live specimens. This is the first live record of *T. truncata* in New York since Robertson & Blakeslee's (1948) record in Tonawanda Creek near Pendleton near our site 1. Also, an old shell was found at site 1 in 1994 (Strayer, 1995). This species appears to be sparsely distributed in the lower mainstem. Strayer & Jirka (1997) considered it likely that small populations of *T. truncata* lived in the Niagara River and Lake Erie, but these populations have probably been severely impacted by zebra mussels. Thus Tonawanda Creek may support the only population of *T. truncata* still extant in New York.

Species richness in the Tonawanda Creek basin was greatest in the lower portions of the mainstem (sites 1-4), which is a common pattern of

TABLE 2. Collection records of unionids from Tonawanda Creek. Site numbers correspond to Table 1. Numbers indicate the number of live specimens found at each site. D = recent spent shell; d = old spent shell. Search method key: V = visual searches; P = substrate manually probed, riverbanks searched for spent valves. PR = soft substrate probed with a rake.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Alasmidonta marginata			1	D			d								5			d	
Alasmidonta viridis			d																
Amblema plicata	13	26	>133	5															
Anodontoides ferussacianus							10							2	8	3		1	
Elliptio dilatata	1	2	d	D															
Epioblasma triquetra	d		d																
Fusconaia flava	d	4	6	D															
Lampsilis fasciola				D															
Lampsilis ovata	2	4	>57	6															
Lampsilis siliquoidea	2	41	6	4	1		20							2	17	4	8	39	5
Lasmigona compressa	D	3	1				1											1	
Lasmigona costata	11	18	7	11															
Leptodea fragilis	2	6	2																
Ligumia recta	d	4	22	1															
Ptychobranchus fasciolaris	1	d	2	d															
Pyganodon grandis	2	2	1		D	D									D			20	
Strophitus undulatus	D	1	1	D															
Truncilla truncata		3																	
Villosa iris	D	2	D	D															
Number of species	14	14	16	12	2	1	4	0	0	0	0	0	0	2	4	2	1	5	1
Search method	P	P	V/P	V	V	V	PR	V	V	V	V	V	V	V	V	V	V	V	V
Person-hours search time	2.7	3.2	5.2	3.9	0.5	0.6	1.4	0.5	1	0.5	0.5	0.5	1.2	0.6	2	0.7	0.5	1.3	0.5

TABLE 2: continued

Species	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Alasmidonta marginata							d												
Alasmidonta viridis		d				D	d								d				
Amblema plicata																			
Anodontoides ferussacianus				D		D	d			5		d			1	1			
Elliptio dilatata							d												
Epioblasma triquetra																			
Fusconaia flava							d												
Lampsilis fasciola																			
Lampsilis ovata																			
Lampsilis siliquoidea	18												1		4				
Lasmigona compressa						d													
Lasmigona costata																			
Leptodea fragilis																			
Ligumia recta																			
Ptychobranchus fasciolaris																			
Pyganodon grandis	89		45	D			1								9				
Strophitus undulatus																			
Truncilla truncata																			
Villosa iris						D	d												
Number of species	2	1	1	2	0	4	7	0	0	1	0	1	1	0	4	1	0	0	0
Search method	P	V	V	V	V	V	V	V	V	V	P	V	V	V	PR	V	V	V	V
Person-hours search time	0.5	0.5	0.3	0.5	0.3	0.6	1.2	0.4	0.5	0.6	0.5	0.5	0.3	0.4	0.7	0.4	0.5	0.5	0.3

unionid distribution in rivers (van der Schalie, 1938). Species richness patterns also corresponded to the physiographic divisions created by the Onondaga and Portage Escarpments (Fig. 1). Nineteen of the 20 species recently recorded from the creek were observed in the lower mainstem below the Onondaga escarpment (sites 1-4). The riffle/run habitats that we sampled in this reach were dominated by *Amblema plicata* (Say) (approximately 41% of the live specimens in sites 1-4), *Lampsilis ovata* (16%), *Lampsilis siliquoidea* (Barnes) (12%), and *Lasmigona costata* (Rafinesque) (11%). The water in this area was extremely turbid, and severely hindered the efficiency of our searches. This was especially so at sites 1 and 2, where visual searches could not be conducted. Also, Murder Creek yielded some evidence of a formerly diverse mussel community below the Onondaga escarpment at Akron Falls (site 26; Fig. 1; Table 2), with a species-poor community farther upstream (sites 27-31).

Between the Portage and Onondaga Escarpments (sites 5 - 8), mussels were locally dense in the mainstem, and habitats appeared suitable for many of the species found at sites 1-4. However, we observed only seven species in this area, suggesting that the Onondaga escarpment blocks upstream dispersal for many of the species below the escarpment. Species above this escarpment may have dispersed there early in the history of the basin, using either high-level postglacial lakes or postglacial drainage outlets.

Mussels were entirely absent from the mainstem and principal tributaries upstream of the Portage escarpment (sites 8-12), where the habitat is dominated by coarse unconsolidated substrate. It is unlikely that this area ever supported any unionids on account of poor habitat.

With the exception of the aforementioned Murder Creek, the principal tributaries were relatively species poor.

Unionids in Tonawanda creek have undoubtedly declined this century, given the anthropogenic habitat alterations noted earlier. Hints of unionid decline in the mainstem above the Onondaga escarpment can be gleaned from Robertson & Blakeslee (1948), who describe the presence of large specimens of *Lasmigona costata* and *Lampsilis siliquoidea* in the vicinity of our sites 5 and 6, as well as *Alasmidonta marginata* (Say) at site 6, while alluding that "rarer forms" could be found upstream to Batavia (below site 7) and downstream to North Pembroke (near site 5). We found a depauperate fauna in this area, consisting of only a few live specimens of *L. siliquoidea* and spent valves of *Pyganodon grandis*. Water pollution from the small city of Batavia has been undoubtedly responsible for much of this decline. We found a greater diversity of mussels upstream of Batavia at site 7 than at sites 5 and 6 (Table 2).

For the lower mainstem below the Onondaga Escarpment, we cannot determine whether the creek has retained its original mussel fauna despite the habitat alterations noted earlier, given the dearth of historical records available. The only reliable record of a species that we did not find is an old record of *Toxolasma parvum* (Barnes) from the Erie Canal at Buffalo (Strayer & Jirka, 1997). In the tributaries below the Onondaga Escarpment, mussel communities in both lower Murder Creek and lower Ellicott Creek (in the Buffalo metropolitan area between its confluence with Tonawanda Creek and site 14) have almost certainly been impacted by point source water pollution from industrial areas in upstream population centers.

There are a number of species that conceivably could have once lived (or may yet be found) in the lower mainstem of Tonawanda Creek for which no records exist, based on the historical unionid distribution in the Lake Erie basin in New York State and habitat preferences (gathered from Strayer & Jirka, 1997). It should be noted that these species (listed on Table 3) are all rare and of limited distribution in western New York, and are mostly represented by records that are over 50 years old. Thus the probability that any given species from Table 3 occurred in Tonawanda Creek is at best low, although small cryptic species (*Simpsonais ambigua* (Say)) or species that prefer habitats that we were unable to search (*Lasmigona complanata* (Barnes), *Ligumia nasuta* (Say), and *Toxolasma parvum*) are probably a bit more likely to be former (or present) residents of the creek than the others.

Despite the evidence of some decline, the lower mainstem of Tonawanda Creek is remarkable for its abundance and diversity of mus-

TABLE 3. Conjectural list of species that may have once occurred (or may yet persist) in Tonawanda Creek, based on reliable historical records and habitat preferences (see Strayer & Jirka, 1997). Locations in bold represent live specimens found since 1970.

Species	Range in the Lake Erie/Ontario basin in New York
Actinonaiais ligamentina	Niagara River, Oak Orchard Creek
Lasmigona complanata	Erie Canal (Monroe County)
Ligumia nasuta	Niagara River, Erie Canal, Lake Erie
Pleurobema cordatum	**Niagara River**
Potamilus capax	**Niagara River**, Twelvemile Creek
Quadrula pustulosa	Niagara River
Quadrula quadrula	Niagara River
Simpsonaiais ambigua	Lake Erie, Buffalo River, Cayuga Creek
Truncilla donaciformis	Lake Erie

L. nasuta, not P. capax should be in bold-face type.

sels. Moreover, Tonawanda Creek's unionid community in is regionally significant when viewed in the context of the decline of mussel communities in the eastern Lake Erie basin noted by Strayer *et al.* (1991), in the Lower Great Lakes basin in Canada (Metcalfe-Smith *et al.*, 1998), and the probable decline in the communities in the Niagara River and Lake Erie due to zebra mussel invasion. In this sense, Tonawanda Creek is clearly an outstanding remnant of the Great Lakes basin mussel fauna in New York and the eastern Lake Erie/Lake Ontario basin.

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LITERATURE CITED

HOEH, W.R. 1990. Phylogenetic relationships among North American *Anodonta* (Bivalvia: Unionidae). *Malacological Review*, 23: 63-82.

METCALFE-SMITH, J.L., STATON, S.K., MACKIE, G.L. & WEST, E.L. 1998. Assessment of the current conservation status of rare species of freshwater mussels in southern Ontario. *National Water Research Institute Contribution*, No. 98-019. 83 pp.

ROBERTSON, I.C.S. & BLAKESLEE, C.L. 1948. The Mollusca of the Niagara Frontier region. *Bulletin of the Buffalo Society of Natural History*, 19: 1-191.

STRAYER, D.L. 1995. Some collections of freshwater mussels from Scoharie Creek, Tonawanda Creek, and the Allegheny basin in New York in 1994. Report to the New York Natural Heritage Program, Latham, NY. 3 pp.

STRAYER, D.L. & JIRKA, K.J. 1997. The pearly mussels of New York State. *New York State Museum Memoir 26*. New York State Education Department. 113 pp.

STRAYER, D.L., JIRKA, K.J. & SCHNEIDER, K.J. 1991. Recent collections of freshwater mussels (Bivalvia: Unionidae) from western New York. *Walkerana*, 5(13): 63-72.

TURGEON, D.D., BOGAN, A.E., COAN, E.V., EMERSON, W.K., LYONS, W.G., PRATT, W.L., ROPER, C.F.E., SCHELTEMA, A., THOMPSON, F.G. & WILLIAMS, J.D. 1988. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. *American Fisheries Society Special Publication*, 16: 1-277.

VAN DER SCHALIE, H. 1938. The naiad fauna of the Huron River, in Southeastern Michigan. *Miscellaneous Publication*, Museum of Zoology, University of Michigan, (40): 1-80.