US Army Corps
of Engineers
Waterways Experiment
Station

Zebra Mussel Research Technical Notes

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Distinguishing the Zebra Mussel, Quagga Mussel, and Conrad's False Mussel Based on Shell Morphology

Background and purpose

Since their introduction into the Great Lakes in the late 1980s, zebra mussels (*Dreissena polymorpha*) have spread as far south as New Orleans. Another biofouler, the quagga mussel (*Dreissena bugensis*), was detected in the Great Lakes in the early 1990s (Lei and Miller 1994). Conrad's false mussel (*Mytilopsis leucophaeta*), a bivalve that resembles *Dreissena* spp., inhabits brackish waters of the Atlantic and the Gulf of Mexico. This latter species is occasionally collected in the inland waterway system; however, it is not a biofouler and will not cause problems in freshwater systems. The purpose of this technical note is to describe shell shape differences among the zebra mussel, quagga mussel, and Conrad's false mussel. Additional information can be found in Pathy and Mackie (1993).

Additional information

This technical note was prepared by Mr. David Felder, U.S. Army Engineer Waterways Experiment Station (WES). For more information, contact Dr. Andrew C. Miller, WES, (601) 634-2141. Dr. Ed Theriot, WES, (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Description

The common name of *D. polymorpha* is derived from the pattern of zebra-like stripes on the shell. The scientific name *polymorpha* refers to the many forms that are found in pattern and shape. The best way to distinguish zebra mussels (Figure 1) from quagga mussels (Figure 2) is to look at the ventral margin. The ventral margin of the zebra mussel is straight; the quagga mussel has a more rounded ventral margin. This distinction is easiest to see in specimens with a total shell length greater than 7 mm. In addition, quagga mussels have a greater total width than zebra mussels (Lei and Miller 1994).

Conrad's false mussel, which is only rarely found in the inland waterway system, looks something like both species of *Dreissena* from the exterior (Figure 3a). However, this species has a tooth-like structure, called the apophysis, which can be seen when the shell is opened and viewed with a hand lens or dissecting microscope (Figure 3b).

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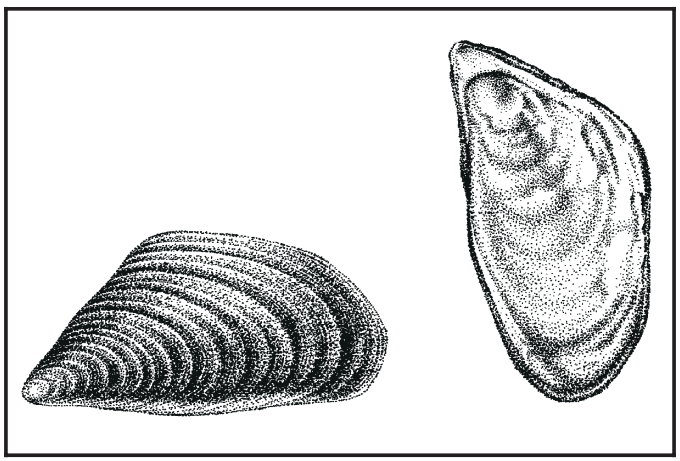

Figure 1. Zebra mussel *(Dreissna polymorpha)*

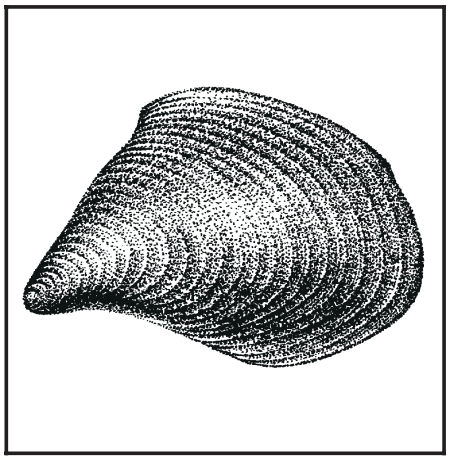

Figure 2. Quagga mussel *(Dreissena bugensis)*

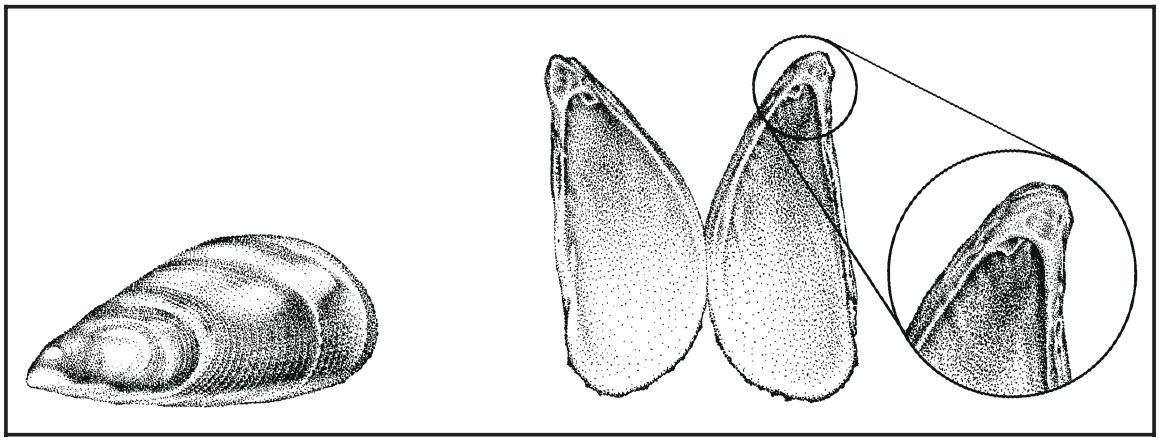

Figure 3. Conrad's false mussel *(Mytilopis leucophaeta)*

References

Lei, J., and Miller, A. C. 1994. "Shell Shape Differences in *Dreissena* spp.," Technical Note ZMR-1-21, Zebra Mussel Research Program, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Pathy, D. A., and Mackie, G. L. 1993. "Comparative Shell Morphology of *Dreissena polymorpha, Mytilopsis leucophaeta*, and the "Quagga" Mussel (Bivalvia: Dreissenidae) in North America," *Canadian Journal of Zoology*, Vol 71, pp 1012-1023.

Table 1. Inorganic and Organic Contaminants in Suspended Sediment and Zebra Mussel Pseudofeces from the Netherlands

Contaminant	Suspended Sediment	Pseudo Feces	Background *Dreissena*	*Dreissena* at 271 days
Metals	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
Cadmium	9.2	9.6	2.3	2.6
Mercury	1.7	1.6	0.2	0.3
Lead	183	207	2.1	5.2
Copper	111	107	21.4	29.3
Chromium	128	144	3.5	7.7
PCBs and pesticides	µg/kg OC[1]	µg/kg OC	µg/kg fat	µg/kg fat
PCB-153	778	952	591	1,214
Other PCBs	3,187	3,786	1,596	3,186
HCB	423	520	59.1	214.3
Dieldrin	220	267	77	56
DDT	437	338	45	44
DDE	194	228	127	164
Petroleum PAHs	mg/kg OC	mg/kg OC	µg/kg fat	µg/kg fat
BaP	28	31	318	3,214
Other PAHs	95	107	3,727	18,214

Source: Reeders and Bij de Vaate (1992).
Note: Background tissue concentrations (zebra mussels from Lake Ijsselmeer) were compared to zebra mussels exposed for 271 days at a contaminated location.
[1]Organic carbon.

Table 2. Organic and Metal Contaminants in Zebra Mussel Tissues from Western Lake Erie (N = 4)

Contaminant	Concentration	
Organics	µg/kg wet	ppm dry
PCBs	520	4.0
HCB	0.83	0.0065
DDTs	22	0.180
Chlordanes	14	0.111
Metals	ppm dry	
Cadmium	3.4 to 5.3	
Chromium	<0.8 to 3.2	
Copper	13 to 15	
Lead	2.2	
Mercury	0.02	
Nickel	19	
Zinc	160	

Source: Kreis et al. (1991).

Table 3. Concentrations of Elements, DDE, and PCBs (ppm dry weight) in Zebra Mussel Tissues and Shells from New York State Waters

	Location[1]				
Contaminant	**Gen/U**	**Hud/A**	**Nia/A**	**Oneida**	**Ont/A**
Cadmium					
Tissue	3.0	1.7	5.0	0.7	0.6
Shell	0.6	0.4	0.9	0.3	0.6
Chromium					
Tissue	5.0	2.7	5.0	1.6	1.9
Shell	9.8	9.0	10.1	9.0	8.0
Mercury					
Tissue	0.38	0.06	0.08	0.05	0.7
Shell	ND[2]	ND	ND	ND	ND
Nickel					
Tissue	13.5	5.7	18.9	4.2	7.3
Shell	9.0	4.7	8.5	3.2	3.2
Lead					
Tissue	4.4	2.2	3.4	1.0	1.8
Shell	1.8	ND	9.6	9.4	ND
Selenium					
Tissue	3.8	3.0	2.7	2.6	2.9
Shell	—	—	—	—	—
Zinc					
Tissue	191	138	160	99	124
Shell	9.6	7.8	13.5	4.5	4.5
DDE - tissue	ND	ND	ND	0.02	0.04
PCBs - tissue	0.6	5.7	0.9	0.5	1.04

Source: Secor and others (1993).

[1]Location descriptions are as follows:

Gen/U = Genesee River between Erie Canal and Lake Ontario
Hud/A = Hudson River between Hudson and Catskill, NY
Nia/A = Niagara River hydroelectric power reservoir
Oneida = Oneida Lake-Sylvan Beach (relatively pristine site)
Ont/A = Lake Ontario-Oswego Harbor

[2]Not detectable.

Table 4. Metal Concentrations in Zebra Mussel and Quagga Mussel Soft Tissues

Contaminant	Concentration Range, ppm dry weight
Cadmium	4.5-11.9
	4.8-8.7
	3.1-6.6
Chromium	2.6-18
	3.0-5.2
	2.3-7.4
Mercury	0.09-0.28
	0.09-0.27
	0.08-0.55
Nickel	4.6-12.1
	3.6-12.6
	3.9-17.3
Lead	1.8-7.9
	2.1-4.0
	1.9-6.3
Selenium	3.4-4.4
	3.1-4.5
	3.3-5.3
Zinc	71.8-300
	75.2-390
	64.5-192

Source: Mills and others (1993).
Note: Concentration ranges at depths of 25 to 85 meters at Oldcott, 30 Mile Point, and other locations in Lake Ontario.

Table 5. Regulatory Action Levels for Leachable Contaminants in United States and Canada

		Canada	
Contaminant, mg/L	United States	Leachate Toxicity	Registration Limit
Cadmium	1.0	0.5	0.05
Chromium	5.0	5.0	0.5
Lead	5.0	5.0	0.5
Mercury	0.2	0.1	0.01
Selenium	1.0	1.0	0.1
PCB	—	0.3	0.03
Aldrin/dieldrin	—	0.07	0.007
Chlordane	0.03	—	—
DDT	—	3.0	0.3
Endrin	0.02	0.02	0.002
HCB	0.13	—	—
Lindane	0.4	0.4	0.04
Toxaphene	0.5	0.5	0.05

Source: Doherty and others (1993).

Table 6. Summary of Organic and Metal Contaminant Concentrations and Percent Lipids for Zebra Mussel Shell, Whole Animals, and Tissue

Contaminant	Shell (N = 1)	Whole (N = 3)	Tissue (N = 3)
Organics		µg/kg (ppb) dry weight	
Total PCBs	7.9	48	1,070
DDT analogs	0.2	1.2	27
HCB	0.02	0.05	0.8
G-chlordane	<0.01	0.08	1.9
(Lipids, percent)	(0.05)	(0.26)	(6.9)
	Shell (N = 3)	**Whole (N = 3)**	**Tissue (N = 2)**
Metals		mg/kg (ppm) dry weight	
Cadmium	0.1	0.5	4.1
Chromium	0.5	0.9	2.7
Copper	2.1	4.9	24
Nickel	0.5	1.5	14
Lead	0.3	0.6	1.8

Source: Kreis and others (1994).
Note: Zebra mussels of size class 16-19 mm, from western Lake Erie.