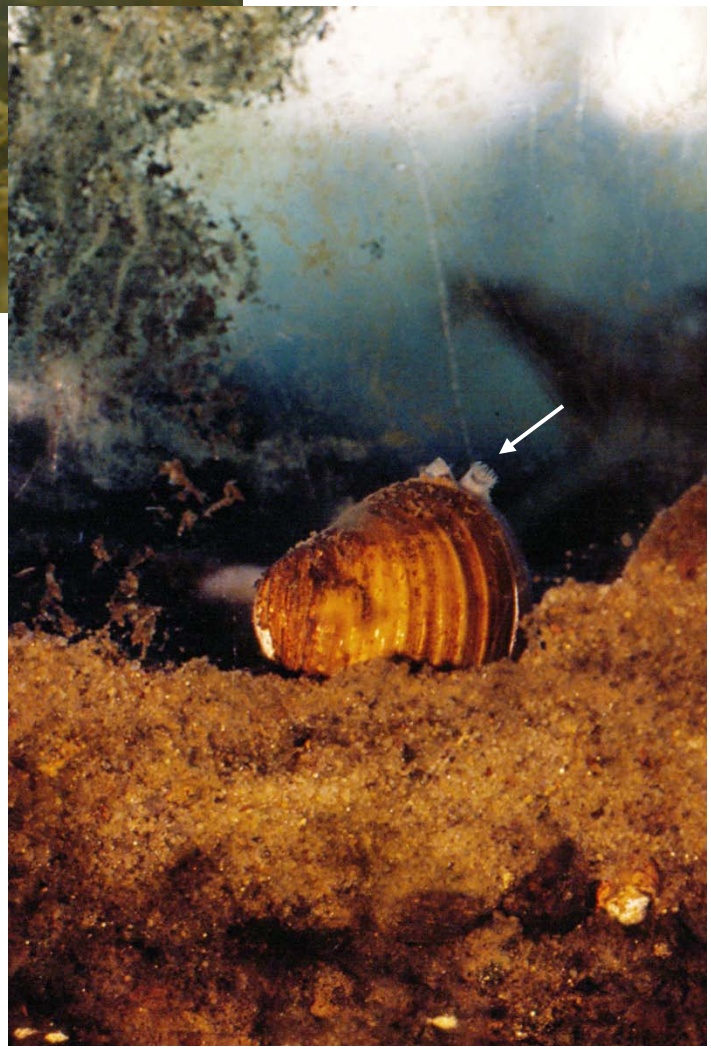
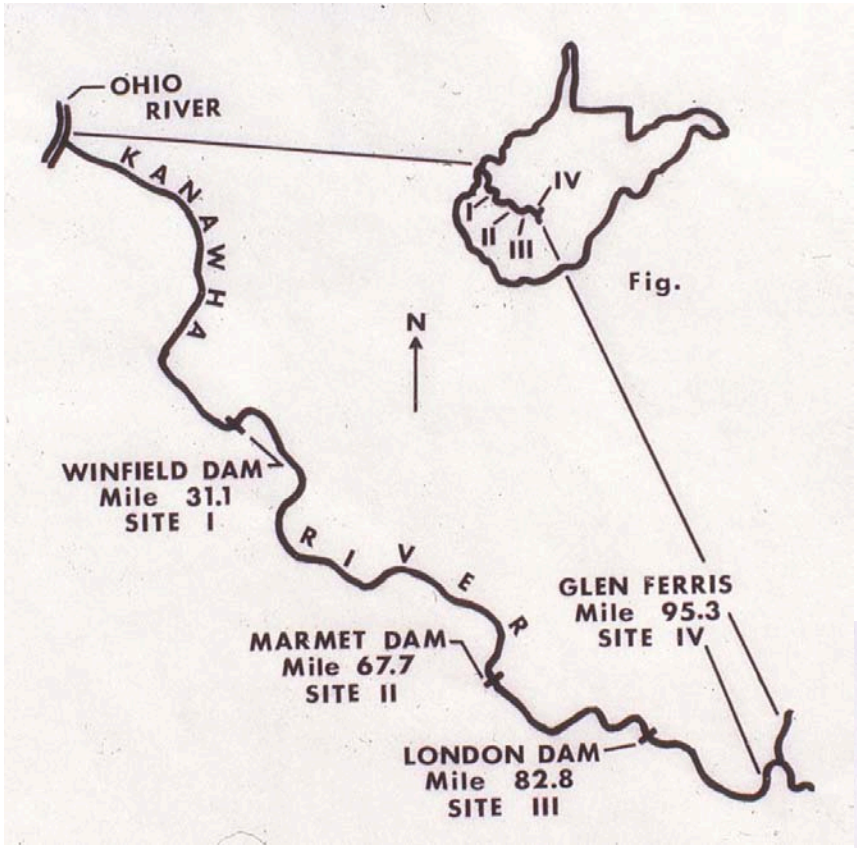
Corbicula fluminea, burrowing.

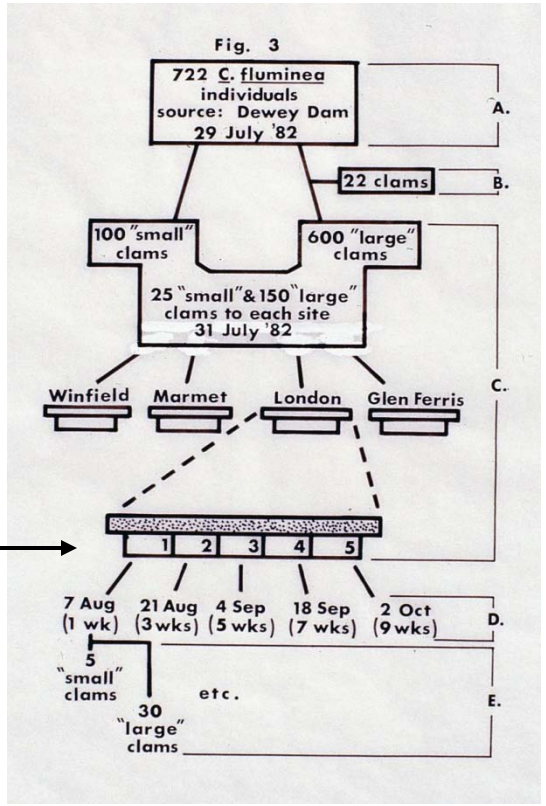


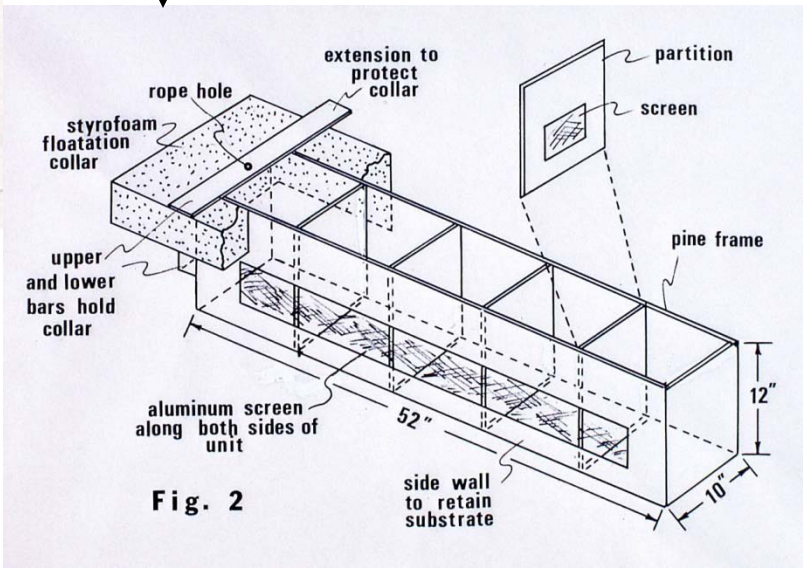
Corbicula fluminea (note siphons; arrow indicates incurrent siphon).

Corbicula fluminea; study sites & protocol.



Cage design →





Marmet Locks, Kanawha River, WV.

Corbicula fluminea; growth rates and heavy metals uptake study.

Corbicula fluminea (Mollusca: Pelecypoda) as a Biological Indicator of Heavy Metals in the Kanawha River, WV

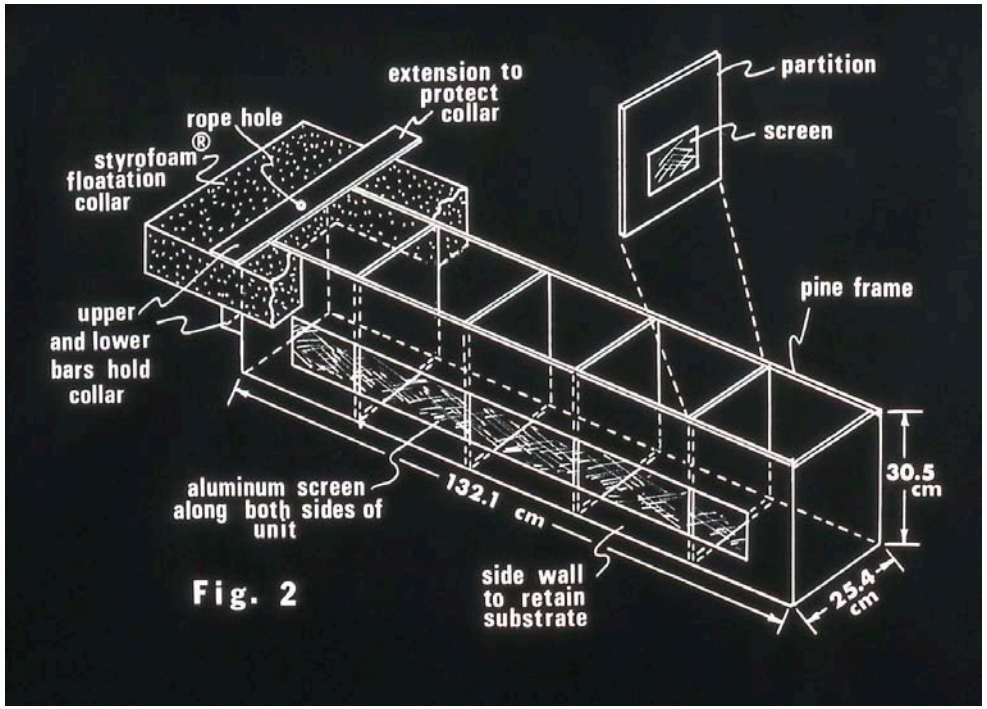
James E. Joy, Anita J. Pritchard,
and Donald Danford
Department of Biological Sciences
Marshall University
Huntington, West Virginia 25701

Abstract

Two hundred large (16 to 24 mm) *Corbicula fluminea* individuals were monitored for 10 heavy metals at four different sites (50 clams at each site) on the Kanawha River over a nine week period. Analysis of the viscera revealed silver in the smallest concentrations (between 0.1 and 0.2 μg/g) of the metals at all four sites. Cadmium was also found in low concentrations (between 0.2 and 0.4 μg/g). Iron was found in the highest concentrations, in some cases surpassing 500 μg/g. Magnesium levels were also high, generally ranging between 100 and 200 μg/g at all sites. Concentrations of zinc were interesting because of their virtually unchanging levels (≡ 30 μg/g) at all four sites over the nine weeks. Copper concentrations were also very constant (between 7.0 and 9.0 μg/g) at all sites with the exception of weeks 7 and 9 at Marmet when copper levels reached 17.0 and 12.0 μg/g, respectively. While generally low, chromium levels were quite variable, ranging from 0.5 μg/g at London, to a high of 12.0 μg/g at Glen Ferris. Manganese levels were also quite variable, ranging from a low of 9.2 μg/g at Winfield to a high of 100 μg/g at London.

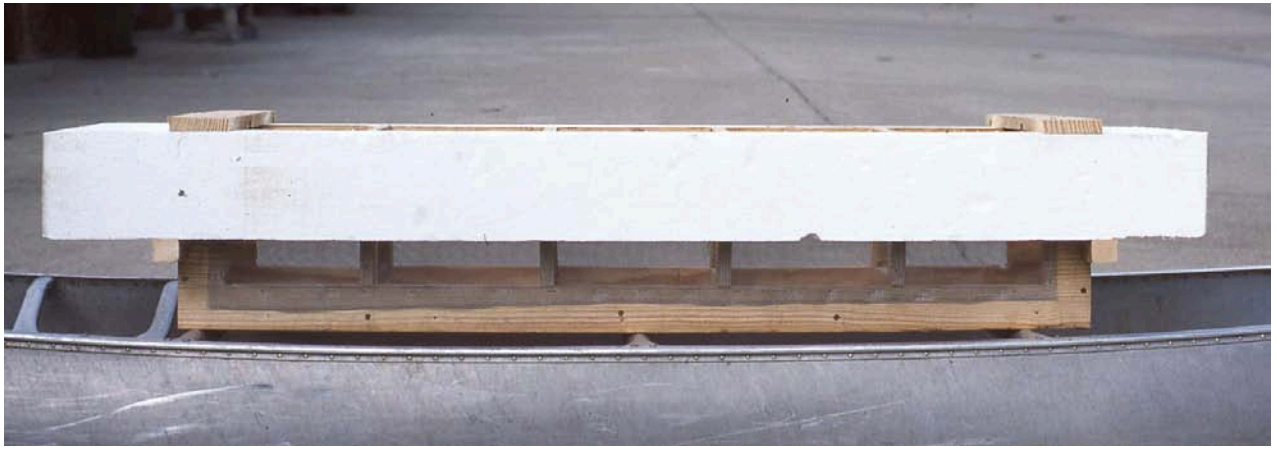
Proc. WV Acad. Sci. 55: 113-117 (1983)

“Corbicula cages” used in experimental study of growth rates, heavy metals & PCB uptake.



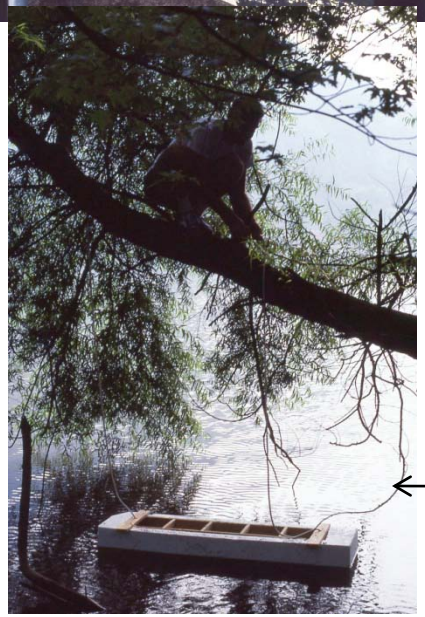
Cage design

“New” cage showing 5 compartments.



After 9 weeks in the field.

Cage preparation and placement in the field (along wall of lock chamber).



Securing cage at Glen Ferris, upriver from lock chambers.

Corbicula fluminea; Kanawha River, WV studies.

A 40-WEEK STUDY ON GROWTH OF THE ASIAN CLAM, *CORBICULA FLUMINEA* (MÜLLER), IN THE KANAWHA RIVER, WEST VIRGINIA

James E. Joy
Department of Biological Sciences
Marshall University
Huntington, WV 25701

ABSTRACT

A sample population of Corbicula fluminea *individuals maintained in cages was monitored over a 40-week period (12 March to 16 December 1983) to assess growth (in shell length, and overall body weight), percentage of total body weight made up of soft tissues (i.e. "condition index"), and mortality rate. There were virtually no increases in length or weight when water temperatures were below 10°C. Noticeable growth began when water temperature reached ~ 14°C. Highest rates of growth (shell length, 0.66 mm/wk; weight, 0.26 gm/wk) occurred when water temperatures were between 24° and 30°C. "Condition indices" (ranging from a low of 12.6% in June to a high of 21.2% in October) for experimentally caged clams were similar to those found in natural stream clams. Twenty-five of the 300 (8.3%) clams under experimental conditions died.*

In September 1980, operation of Unit 2 at Arkansas Power and Light's Nuclear One power plant near Russellville had to be shut down because of an extensive invasion of the reactor's emergency cooling system by Asian Clams, *Corbicula fluminea* (Müller, 1776). The cleanup took 29 days at a cost to AP&L of 15.3 million dollars (Griffin, 1983). After the AP&L case, the Nuclear Regulatory Commission found that 10 other nuclear power plants had experienced biofouling problems because of *C. fluminea*, although not to the extent found in the Arkansas facility (Buel, 1983).

The biofouling potential of this clam species prompted the NRC, and the Electric Power Research Institute of Palo Alto, California, to sponsor the Second International *Corbicula* Symposium at Little Rock, Arkansas (hosted by AP&L and the University of Arkansas) in June of 1983. During those meetings McMahon (1983, *pers. comm.*) stressed the need for more information regarding northeastern populations of *C. fluminea*. Although the present work had begun prior to the symposium, McMahon's comments provided an added incentive for the continuation of this project assessing the growth of *C. fluminea* in West Virginia over an extended time period.

It should be added that *C. fluminea*, as an introduced species, has become widely dispersed throughout the major drainages of the United States, and that many types of industrial facilities are threatened by large accumulations of this nuisance species. For an account of the spread of this clam the reader is referred to McMahon (1982).

Materials and Methods

On 5 March 1983, 470 *Corbicula fluminea* individuals, measuring 9.0 to 15.2 mm in shell length, were collected from Mud River, West Virginia (MG92885315, USGS Topographic Map, Milton Quadrangle, W. Va. 1972) and carried to the laboratory at Marshall University in two 20 liter containers. Twenty clams were selected at random, cleaned with absorbent nylon reinforced towels (Fisher Teri® Wipers), measured individually for shell length to the nearest 0.1 mm with vernier calipers, then weighed collectively for total weight. Soft tissues were removed from these clams, blotted dry on another absorbent towel, then weighed. A baseline "condition index" (C. I.) was determined by:

$$\text{C. I.} = \frac{\text{wet soft tissue weight}}{\text{total weight}} \times 100 = \_\_\_\_\_\%$$

Growth Rates of the Asiatic Clam, *Corbicula fluminea* (Müller), in the Kanawha River, West Virginia[1]

KENNETH J. WELCH AND JAMES E. JOY

Department of Biological Sciences, Marshall University, Huntington, West Virginia 25701

Abstract. This study was designed to assess growth rates of *Corbicula fluminea* under summer and winter conditions. A total of 80 small *C. fluminea* individuals were segregated into three shell length classes based on initial shell length. Thirty clams were assigned to Class I (<10 mm); 25 to Class II (10 to 11.9 mm); and 25 to Class III (12 to 14 mm), and placed in separate cages in the Kanawha River at Marmet, West Virginia, for a 12 week period (16 July thru 7 October 1983) when mean water temperature was 26.6°C. 'Warm water' growth rates (length/weight) were: Class I, 0.95 mm/week and 0.27 gm/week; Class II, 0.86 mm/week and 0.29 gm/week; Class III, 0.80 mm/week and 0.30 gm/week. An additional 78 clams were assigned to the same shell length classes and maintained in the Kanawha River for a 12 week period (11 October 1983 through 3 January 1984) when mean water temperature was 10.3°C. Thirty-three clams were assigned to Class I; 30 to Class II; and 15 to Class III. 'Cold water' growth rates were: Class I, 0.09 mm/week and 0.009 gm/week; Class II, 0.08 mm/week and 0.013 gm/week. Class III clams were destroyed by a predator. Summer growth rates were approximately 10.7 times higher than winter growth rates based on length and 22-32 times higher based on weight. In addition, smaller clams had higher growth rates than larger clams.

Corbicula fluminea (Müller), the Asiatic clam, was first reported from the United States (West Coast) in the late 1920's. Since that time this clam has become widely distributed throughout the major drainages of the United States, although it is absent from the midwest and Great Lakes (with a few exceptions where it survives in the flumes of power plants) because of low winter temperatures. For an account of the spread of this introduced species, refer to McMahon (1982). *Corbicula fluminea* is a major industrial biofouling organism, where it is a potential safety problem for coal-fired and nuclear power generating stations, and a threat to efficient operation of other industrial facilities.

McMahon (1983, pers. comm.) emphasized the need for more information regarding northeastern populations of *C. fluminea*. As a consequence, the major objective of this study was to define the relationship between temperature and growth in a northeastern population of *C. fluminea* and compare growth rates with those known for *C. fluminea* in western and southwestern United States.

MATERIALS AND METHODS

On 16 July 1983, eighty *Corbicula fluminea* individuals were collected from the Kanawha River, West Virginia at the Marmet Locks and Dam (milepoint 67.6, U.S. Army Corps of Engineers, Kanawha River Navigation Charts, January 1975), and divided into three classes based on shell length: Class I, <10 mm (30 clams); Class II, 10-12 mm (25 clams); and Class III, 12-14 mm (25 clams). Clams were measured individually to the nearest 0.1 mm with vernier calipers and a mean length recorded for each class. Larger clams (e.g., 20-30 mm) were not studied because their rates of growth are relatively low. *Corbicula fluminea* specimens >30 mm are not routinely found in the Kanawha River.

[1]This work was supported, in part, by the Marshall University Foundation. We also extend our appreciation to the U.S. Army Corps of Engineers' personnel for permitting access to the Marmet Locks.

Corbicula fluminea;
ova, sperm.