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Steven E. Cummings
Macalester College

James A. Jones
Macalester College

Occurence of Corbicula Manilensis Phillipi in the Lower Minnesota River

STEVEN E. CUMMINGS* and JAMES A. JONES**

ABSTRACT - On March 2, 1978, several empty shells of the fresh water clam, *Corbicula manilensis* Phillipi, were collected in the Minnesota River near the Blackdog electric generating plant in Burnsville, Minnesota. Since this Asiatic species was first observed in America in 1935, it has spread into all major river systems of North America. Its northernly extension in the Mississippi River system was, however, thought to end in northeast Iowa and to exclude Minnesota. Occurence of this species is a potential liability because it often exerts a disruptive influence in the community that it invades.

First observed in the state of Washington in 1938, *Corbicula manilensis*, introduced from Asia, has relentlessly invaded every major river basin in North America. Such rapid and widespread dispersal of a fresh water mollusk in North America is unparalleled (Clench). In the Mississippi River basin, this species first appeared in Lousiana and Mississippi. Having permeated the waters of southern United States, its range began to extend northward and soon included the upper Ohio River (Stein, Burch, as cited by Eckblad). In 1974 the clam was discovered in the effluent channel of a power plant at Lansing, in northeast Iowa (Eckblad). This northerly progression by *C. manilensis* was not surprising in light of its high reproductive capacity and tolerance of extreme environmental conditions. The clams' existence in Minnesota was not documented, however, until the summer of 1977, when several small shells were collected in the St. Croix River near Hudson, Wisconsin. They were found by researchers from the Philadelphia Academy of Science (Krosch).

Most recently, *C. manilensis* was discovered in the Minnesota River on March 2, 1978, at the Northern States Power Company's Blackdog electric generating plant near Burnsville, Minnesota. The discovery was made by the Field Zoology class of Macalester College. Eight empty half shells were collected by hand from silt substrate, within three meters of shore. One week later 42 additional empty half shells and one live specimen were retrieved at that site. Most of the shells were located along the margin of a small lake which receives the thermal effluent from the Blackdog generating plant and which discharges directly into the river by means of a small channel. Some specimens were also found in the channel, and a few were located slightly downstream in the main body of the river. The shells varied in height from six to 44 millimeters; in age from one to five years. From the estimated ages of the collected shells, this clam apparently has lived undetected in Minnesota waters for at least four years. A plausible explanation for the lack of detection is that small specimens of *C. manilensis* are similar in appearance to native *Sphariidae*, and sometimes mistaken for them. Also, a significant mortality of *C. manilensis* may have occured recently, resulting in a greater abundance of empty shells deposited near shorelines.

Other reports (Eckblad, Rodgers *et al.*, Gardner *et al.*, Krosch) indicate that *C. manilensis* has been found near electric generating plants elsewhere. Explanations include the possibility that the clam "hitch-hikes" on coal barges as a means of dispersal. Thus, it is transported directly to these sites. Also, research indicates that water temperature, flow rate, turbidity, and plankton density contribute significantly to the population dynamics of this species (Rinne). These factors may be more favorable in the vicinity of generating plants. Bottom composition does not appear to be a limiting factor since *C. manilensis* has been found on highly varying substrate types.

C. manilensis has often created a substantial economic and ecologic problem where it occurs. In fact, it is described as "currently the most costly liability of all exotic mollusks in North America" (Sinclair). Vast beds of this prolific organism are reported to have clogged steam condensers and conduits carrying untreated water (McMahon), and to have ruined sand or gravel substrate used in the production of cement (Sinclair). Furthermore, they are responsible for the decimation of endemic populations of other bivalves, thus threatening the ecological balance of the aquatic community they invade (Gardner *et al.*).

The alarmingly rapid and widespread distribution of *C. manilensis* in North America is attributed to several factors. The larvae are incubated and released as free living pelagic veligers, whose dispersal is not restricted by dependence on a parasitic host (Sinclair). Also, the larvae may survive digestion by aquatic birds which carry them to new areas (Clench, Britton and Murphy).

Man plays the most significant role in their distribution, however, by providing the clams with nationwide transportation for use as food, fish bait, and aquarium novelties. Irrigation canals have been a source of overland transportation in the southwest. Once established, this species has proven to be highly resistant to many environmental stresses. Furthermore, growth is rapid and sexual maturity is reached within a year. Factors such as these have aided *C. manilensis* in achieving a very expansive range. However, the limits of its expansion have yet to be realized.

The extent to which *Corbicula manilensis* will become a liability in Minnesota waters remains to be seen. Therefore, further study of this clam in our fresh water communities is important, for it exists as an example of the potential consequences that may result from introducing a foreign species to a new environment.

*STEVEN E. CUMMINGS was a student at Macalester College in St. Paul at the time of the research project reported here.
**JAMES A. JONES is a professor in the Biology department at Macalester College.

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Space-Time in the Creative Process

KATHLEEN COOPER*

ABSTRACT - An inquiry about the nature of the universe and man's ability to perceive it: Do the concepts of time and space veil the realization of man's full potential and responsibility as a creative entity in a creative universe?

A given star is said to be "a thousand light-years away." Is time equal to space or the opposite side of the same coin? Space is the distance between physical beings. Is time the distance between energy manifestations or spiritual occurrences? Speed shortens the time distance between physical objects, i.e., it shortens space. Speed also shortens the time between energy manifestations. Space travel causes the retardation of aging, and, if light traveled faster, the star would be less than "a thousand light years away." A star traveling fast enough would be immediately known. It would be no time and no space away.

A physical object will fill up a given space if it is large enough. Can an energy occurrence fill up time if it is large enough? Are the acts of man, time being the distance between these acts, minute manifestations of the all-encompassing creative energy of the universe which in its "all" and unified intensity knows no time, just as physical objects are part of the total physical world?

In the equation $E = M C^2$ the physical is an observable juncture between energy and energy. Physical objects are manifestations of temporally arrested energy. If matter travels fast enough (C^2), the time between energy and energy is nothing, and the physical becomes nonexistent. Speed shortens time. Speed shortens space. And speed shortens the difference between energy and matter.

*KATHLEEN COOPER, a teacher of German and English at Burnsville (Minnesota) Senior high school, received B.A. and B.S. degrees from the University of Minnesota and the M.A. degree from the University of Arizona. She has been employed at a Gymnasium in Essen, Germany, and has taught at the University of Arizona.

What is the creative process of the universe? -- A constant exchange of energy and matter, a giving of energy to form matter, a giving of matter to form energy. The exchange can take place through speed or through the creative life process. The point where the exchange occurs knows no space or time. The physical and the energetic or spiritual are one. There are no physical characteristics or energy characteristics per se. There is only the "all," which undivided is the essence of both the spiritual and the physical.

E(Matter spatially arrested in energy.) = M(Energy temporally arrested in matter.)

The moment of creation knows no time and no space. It is the essence of "all."

Is the task of man to help direct the creative process? To help determine the balance between the material and the spiritual? Are space and time misleading and knowledge-limiting illusions? Is the "all" now?