reveal the presence of *Morum (Cancellomorum) veleroae* living at moderate depths on appropriate substrates.

Six living species of *Morum (sensu lato)* are know to occur in warm to tropical waters of the New World, four in the Western Atlantic and two in the eastern Pacific (Emerson, 1968a). The only other West American Recent representative of this genus is *Morum (Morum) tuberculosum* (Reeve, 1842), a shallow-water species of the nominate subgenus. Reeve's taxon also is represented in the western Atlantic by an analogue, *Morum (Morum) oniscus* (Linné, 1767), the type species of *Morum* Röding, 1798.

LITERATURE CITED

Dance, S. P., and W. K. Emerson. 1967. Notes on *Morum dennisoni* (Reeve) and related species. Veliger, *10* (2): 91-98, pl. 12.

Emerson, W. K.

1968a. The American species of the genus *Morum*. Ann. Repts. Amer. Malacol. Union for 1967, pp. 74-75.

1968b. A new species of the gastropod genus *Morum* from the eastern Pacific Ocean. Journ. Conchyl., Paris, *107* (1): 53-57, pl. 1.

NORTHERN RANGE EXTENSION AND WINTER MORTALITY OF RANGIA CUNEATA

BY JOHN L. GALLAGHER AND HARRY W. WELLS
Department of Biological Sciences
University of Delaware, Newark, Delaware

The brackish water mactrid clam, *Rangia cuneata* (Gray), until recently was believed to occur no farther north than Virginia (Abbott, 1968). This species occurs at Roanoke Island, North Carolina, and Wass (1963) found it was abundant in the James River, Virginia. Pfitzenmeyer and Drobeck (1964) have more recently reported it from the Potomac River. Because this species is harvested for food from various estuaries along the Atlantic and Gulf coasts, the extent of its northward migration is of special interest.

In October, 1967, four living specimens of *Rangia cuneata* were dredged from the tidal waters of North East River, Maryland, at the head of Chesapeake Bay (39° 32′ N, 75° 59′ W). This collection was made in approximately six feet of water. A year later (December 30, 1968), thousands of shells of this species were found washed onto the shore of the Elk River near Thackery Point (39° 28.5′ N 7,5° 58.3′ W), about five miles south of the first collection

site. The latter location is along the waterway leading to the Chesapeake and Delaware Canal which connects Chesapeake Bay with Delaware Bay.

The probable cause of the mass mortality observed in Elk River was low temperature. A similar mass mortality had been observed here in the winter of 1966-67. Heavy ice conditions occur most winters in the Elk River, occasionally requiring ice breaker assistance for ships *en route* to and from the Chesapeake and Delaware Canal. At the time the dead *Rangia* were observed in 1968, ice lined the shore although the deep water channel was free of ice. The victims of this mortality probably came from the shallows where the stress of low temperature would be greatest. Under these physical conditions, clams in deep water could survive and maintain the population in this area.

Salinity conditions within the Elk River (0.3% in January, 1969) are an unlikely alternative cause of death, because *Rangia cuneata* has been reported living in the Potomac River in a similar salinity regime. However, low salinity may have increased stresses upon clams at low temperatures. Pollution is considered unlikely as a cause of the mortality because no other species was

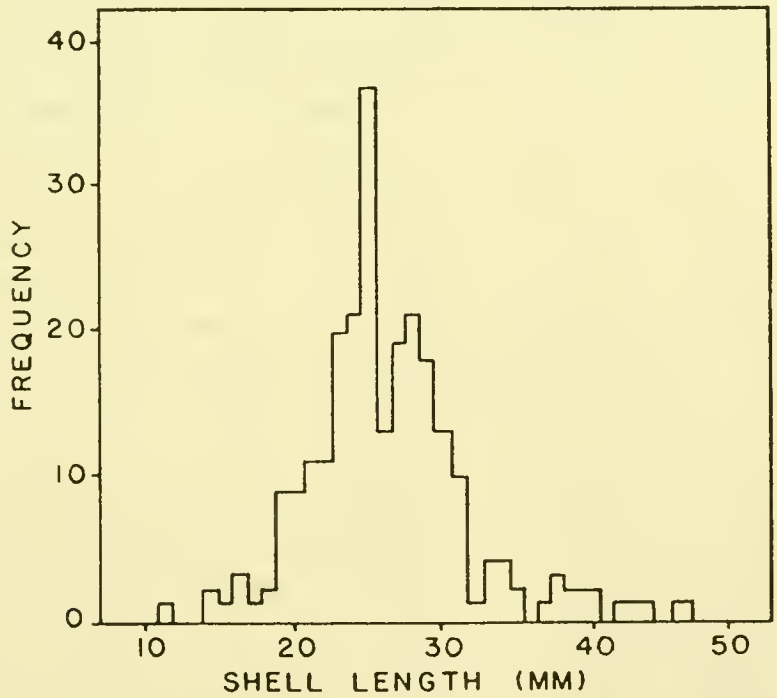

Fig. 1. Length distribution of *Rangia cuneata* from Elk River, Maryland, December 30, 1968.

found to have succumbed. As a crude assay, water samples taken at the time of collection were found to support developing frog embryos and tadpoles.

From a representative sample of 244 specimens collected from a 200-yard section of the beach, the length-frequency distribution shown in Fig. 1 was constructed. Shell lengths ranged from 11 to 46 mm., with a mean of 26 mm. and a standard deviation of 5.2 mm. In comparison with data presented by Pfitzenmeyer and Drobeck (1964) for clams from the Potomac River, the shells from Elk River have a greater average length. At present, however, it is not known if this mortality were selective, or if the dead clams were indeed representative of the total living population in that river. Lengths reported by Wolf and Petteway (1968) for *Rangia cuneata* at different ages, and observations of growth rings on these shells indicate that the Elk River mortality involved individuals ranging from one to four years old. In most cases, the flesh of the clams was badly decomposed at the time of collection.

Pfitzenmeyer and Drobeck (1964) suggested that *Rangia cuneata* may have been introduced to the Potomac River with seed oysters. Because the oyster bars closest to the Elk River are approximately 30 miles away in Chesapeake Bay, it is conceivable that this clam has spread northward from the oyster growing area. Pfitzenmeyer and Drobeck considered the possibility that, after many years' presence elsewhere in the Potomac River drainage system, this species had expanded its distribution to areas where it attracted biologists' attention. However, they discounted this possibility since no sudden environmental changes had been noted which could be correlated with the clams' discovery. In the absence of marked recent changes in the local environment, their conclusion seems applicable to the Elk River situation. If future surveys show this population to be relatively isolated, it would increase the probability of man's introduction of *Rangia cuneata* into the immediate area, possibly in waste from dredge gear or spoil barges.

On the other hand, winter kills in the Elk River suggest that this species is approaching its natural northern geographic limit under present climatic conditions. Richards (1938) has reported fossil *Rangia cuneata* in New Jersey, indicating former Pleistocene extension into that state, but he could find no living specimens. The sea-level canal connecting Chesapeake Bay to Delaware Bay

presents an opportunity for the transport of larvae and reproductive stages of aquatic organisms tolerant to brackish waters. The larvae of *Rangia cuneata,* described by Chanley (1965), can readily be transported in this fashion. The proximity of the canal to the Elk River collection site makes it probable that *Rangia cuneata* will be found living in brackish waters of the Delaware Bay system, paralleling the record of its Pleistocene distribution in that area.

Specimens have been deposited in the United States National Museum, Division of Mollusks.

Literature cited

Abbott, R. T. 1958. Seashells of North America. Golden Press, New York. 280 pp.

Chanley, P. E. 1965. Larval development of the brackish water mactrid clam, *Rangia cuneata.* Chesapeake Sci. *6* (4) : 209-213.

Pfitzenmeyer, H. T., and K. G. Drobeck. 1964. The occurrence of the brackish water clam, *Rangia cuneata,* in the Potomac River, Maryland. Chesapeake Sci. *5* (4) : 209-212.

Richards, H. G. 1938. Animals of the seashore. Bruce Humphries, Inc., Boston. 273 pp.

Wass, M. L. 1963. Check list of the marine invertebrates of Virginia. Va. Inst. of Marine Science, Spec. Sci. Rept. 24. 56 pp.

Wolfe, D. A., and E. N. Petteway 1968. Growth of *Rangia cuneata* Gray. Chesapeake Sci. *9* (2) : 99-102.