ABSTRACTS
CONTRIBUTED PAPERS

1986 A.M.U. MEETING
MONTEREY, CALIFORNIA, U.S.A.

MALACOLOGY IN THE SOVIET UNION. Clement L. Counts, III, College of Marine Studies, University of Delaware Lewes, Delaware.

As a result of a one month exchange visit to the Academy of Sciences of the USSR, arranged through the United States National Academy of Sciences, it was possible to meet with Soviet malacologists at three Soviet institutions. The Zoological Institute, Leningrad, continues to serve as the principal repository of molluscan systematic resources within the USSR. The major zoogeographic strength of the collections is the fauna of the Palearctic. The Zoological Institute, Baku, is involved in environmental toxicology studies of the Mollusca, principally in the areas of hydrocarbon pollution of fresh and brackish waters, as well as completing faunistic work for the *Red Book*, the Soviet list of rare and endangered species. The Institute of Zoology and Parasitology, Dushanbe, is engaged in faunistic, taxonomic, and ecological research on introduced species of molluscs.

A review of the 1977 survey of malacologists of the USSR (Amitrov, 1983) revealed 844 biologists, geologists, chemists, geographers, and veterinary physicians were engaged in malacological research. 566 of these were geologists, 271 biologists, and the remainder spread over the other disciplines. The majority of those malacologists responding to the survey had received their candidates degree. Of the subspecialties of malacology, the most frequently reported, in descending order of response, were systematics, general ecology, stratigraphy, morphology, general biology, and phylogenetics. Of the major bodies of water within and around the USSR, Soviet malacologists most frequently reported studying the Mollusca of the Caspian Sea, the Black Sea, the Pacific Ocean, and the Don River Basin. However, these researches were mostly paleontological. Most malacologists within the USSR conducted their studies (listed in descending order of frequency) within the Crimea, Ukrainian SSR, the Caucasus, Central Asia, and Siberia. A review of birth statistics for Soviet malacologists revealed that, as of 1977, most active scientists were aged 52 to 41 years (range = 86 - 19 years) and that normal replacement of retiring malacologists appears to be in progress.

PRAIRIE DU CHIEN, WISCONSIN REVISITED - 10 YEARS AFTER DREDGING, Marian E. Havlik, Malacological Consultants, La Crosse, Wisconsin.

In July 1976 about 100,000 cu m were dredged from the East Channel of the Mississippi River, Prairie du Chien, WI. Since then over 175 endangered *Lampsilis higginsi* have been recovered from the dredge disposal site. Over 1/2 of these specimens were likely alive at the time of the dredging. In the past 10 years this area of the Mississippi has seen increased pressures from many sources stressing 35 living naiad species. In 1978 about 50 barges a year were unloaded. In 1984 over 500 barges were handled at one facility; the number at the city harbor has remained around 25 each year. Scraped and broken living naiades have been observed in navigable areas 3 to 4 m deep and at the edge of the 60 to 120 m wide navigation channel suggesting that prop wash may deposit naiades some distance from their original position. Fleeting has occurred in several shallow areas causing demonstrable damage to the substrate, shoreline and living naiades; several dying gravid *L. higginsi* have been stranded at the water's edge apparently unable to reestablish themselves in the substratum after being impacted by barge fleeting.

After repeated trips to the area 1567 empty shells (821 whole and 746 discrete valves) have added to the understanding of this highly variable species but taxonomic problems cannot be solved without adequate numbers of preserved soft parts (to date 35 preserved). Of 72 additional living specimens seen briefly, 55 were permanently marked, and all were returned to the river. The species is consistently about 0.5% of any population.

Commercial clamming pressures have greatly increased over the past several years. This fact combined with a naiad die-off of unknown causes since 1982 further stresses the largest known population of *L. higginsi* as indicated in 1985 by larger numbers than usual of fresh-dead shells in several areas. Since 1981 consistently high summer water levels have caused considerable erosion of numerous islands.

A BIOTIC INDEX FOR NAIAD MOLLUSKS IN THE UPPER MISSISSIPPI RIVER SYSTEM. Marian E. Havlik, Malacological Consultants, La Crosse, Wisconsin.

I propose a biotic index for naiad mollusks to assess their ecological value in the Upper Mississippi River System (UMRS), particularly in sensitive areas recently identified by researchers and agencies. Weights (values) would be in groups from 1 to 10: the most common species would receive a value of 1 to 3, moderately common a value of 4 to 6, uncommon a value of 7 or 8, and most of the rare species would receive a value of 9 or 10. Not all rare species have a high value because sometimes their presence indicates a degraded habitat; other species are rare apparently because of the lack of host fish. Some species that appear to be rare in recent UMRS studies, such as *Anodonta suborbiculata* and *Lampsilis radiata luteola*, are given medium values because

often these species occupy shallow water habitat not usually thoroughly searched (< than 20 m offshore). If a species is represented by pristine fresh-dead shell only, then the assigned value would be subtracted by one. Species represented only by weathered shell material are listed but not given numerical values. If extralimital or historic species, such as *Potamilus capax* or *Quadrula fragosa*, are ever discovered alive they would be given a value of 10. If juveniles 3 years of age or younger are found of a species with a value of 9 or 10, three extra points are given for each species thus represented. Juveniles of species in group 8 would be given one extra point. Based on recent records, *Magnonaias nervosa*, *Obovaria olivaria*, and *Quadrula metanevra* appear to be critical indicator species. If one or more of these species is not present at a site (defined as 0.5 mile length of river) then it is unlikely that any of the species with a value of 9 to 10 will be present. Examples of these indices have been applied to individual sites and various pools in the UMRS. Five numerical categories with values ranging from poor to excellent have been developed. The index could be easily revised to reflect future data on UMRS naiad species.

TWENTIETH CENTURY CHANGES IN THE FRESHWATER MUSSEL FAUNA OF THE CLINCH RIVER (TENNESSEE AND VIRGINIA). S. A. Ahlstedt, Tennessee Valley Authority, Norris.

This study investigated the current status of freshwater mussel populations in the Clinch River since first being reported by Ortmann (1918). Freshwater mussel species have declined from a reported 60 species to the 47 species identified in this study. Impoundments have drastically reduced the mussel fauna in the lower Clinch and mussels have failed to recolonize a portion of the upper Clinch below Carbo, Virginia, following two major toxic spills in 1967 and 1970.

SPERMATOGENESIS IN THREE SPECIES OF UNIONIDS (BIVALVIA: UNIONIDAE). M. Bowie Kotrla, Department of Biological Science, Florida State University, Tallahassee.

Light and electron microscopic studies of spermatogenesis in *Anodonta imbecilis*, *Elliptio icterina*, and *Villosa villosa* were performed to determine (1) whether differences in sperm morphology exist at the subfamilial level and (2) the relationship of phylogeny and fertilization biology to gamete morphology in internally fertilizing bivalves.

No interspecific differences were found in morphology or histochemical staining reactions of cells at any stage of spermatogenesis. Spermatogonia are grouped immediately adjacent to the acinar basal laminae, are attached to each other by septate desmosomes, and have nuclei in which the chromatin is organized into many small irregular clumps. Groups of spermatocytes are medial to the spermatogonia and are identified by the chromatin reorganization occurring prior to and during meiosis. During spermiogenesis, cytoplasmic volume is considerably reduced, nuclear elongation is accompanied by chromatin condensation, and mitochondria migrate toward the posterior end of the nucleus.

In addition to the typical spermatogenetic pathway outlined above, there is a second, atypical pathway involving spermatogenetic cysts. Early cysts consist of 2-32 densely packed masses of DNA each of which is surrounded by a small amount of cytoplasm. More mature cysts are loose aggregations of randomly oriented sperm. These results support the hypothesis of Coe and Turner (1938, *Journal of Morphology* 62:91-111) that the cysts differentiate into sperm morphologically identical to those produced in the usual fashion.

The head of a mature sperm has a bullet-shaped nucleus and very little cytoplasm. The midpiece consists of 5 spherical mitochondria surrounding a pair of centrioles. The cone-shaped flagellar anchoring apparatus occupies the posterior end of the midpiece. The flagellar axoneme is of the typical 9 + 2 arrangement and originates from the distal centriole.

The unusual morphology of these sperm indicates that unionid fertilization may not occur in the manner previously supposed and reconfirms the diversity of sperm types among bivalves.

A PRELIMINARY EXAMINATION OF GEOGRAPHIC VARIATION IN A SIMULTANEOUS HERMAPHRODITE, *ANODONTA IMBECILIS* (BIVALVIA: UNIONIDAE): ELECTROPHORETIC AND HISTOLOGICAL EVIDENCE. Walter R. Hoeh, Museum of Zoology, The University of Michigan, Ann Arbor and **Eileen Cordoba** and **Richard J. Trdan,** Department of Biology, Saginaw Valley State College, University Center, Michigan.

Individuals of *Anodonta imbecilis* were collected at the following seven localities during 1985: Cedar River (CR) and Lake Contos (LC), Gladwin Co., Michigan; Appalachicola River (AR) and Mosquito Creek impoundment (MC), Gadsden Co., Florida; Ocmulgee River (OR), Ben Hill-Coffee Co. line, Georgia; Loch Raven Reservoir (LR), Baltimore Co., Maryland; Pickering Creek (PC), Chester Co., Pennsylvania.

Electrophoretic examination of gill tissue homogenates was performed on starch gels. Nineteen loci were scored. Fourteen (73.7%) were monomorphic across all populations. PEP-1, AAT, PGM, AO, and EST-1 displayed polymorphism within and among some populations. Bivalves from CR, LC, OR, and LR were monomorphic for all loci. AR and MC individuals displayed an extreme heterozygote deficiency. PC individuals were monomorphic for a unique allele at the PEP-1 and AO loci.

Histological examination of the visceral mass was performed using paraffin cross sections (7μm, H&E) from animals fixed in 10% buffered formalin. A ratio of testicular to ovarian tissue area was determined for each individual. The ratios across populations and geographic regions were analyzed using non-parametric statistics. Michigan (CR + LC) vs. East Coast (LR + PC) and "Florida" (AR + MC + OR) vs. East Coast populations had significantly different ratio distributions. The three geographic regions, in order of decreasing testicular/ovarian ratios, are East Coast > "Florida" > Michigan. In addition, the gonad organization in PC individuals was unique. Eggs and spermatozoa were seen together in the gonoducts of some individuals from CR, AR,

MC, and OR. One gamete type was never observed without the outer type being present.

In summary: 1) there is a geographic component to the variation seen in the testicular/ovarian ratios, 2) electrophoretic and histological evidence suggest an additional species (PC) may exist on the Northern Atlantic Slope, 3) electrophoretic and histological evidence are consistent with a hypothesis of self-fertilization in some populations.

TAXONOMIC AND BIOCHEMICAL CHARACTERIZATION OF FLORIDA ELYSIIDAE USING STARCH GEL ELECTROPHORESIS. T. R. Nutall, *Florida Institute of Technology*, Melbourne.

Electrophoretic methods were used in the taxonomic resolution of Ascoglossan species. The consistancy of enzyme banding patterns within a species was determined using four species (three congeneric and one confamiliar) of Elysiidae. These patterns were then compared between species and used to construct a dichotomous key. Banding frequencies were used to calculate genetic identities and distances from which a phylogenetic tree was constructed. Specimens of the four species (*Elysia tuca* Marcus, 1967; *E. subornata* Verrill, 1901; *E. papillosa* Verrill, 1901; *Tridachia crispata* Mörch, 1863) were collected from Florida's eastern and southern coasts, starved for 24-48 hours, and frozen at -70°C. Each specimen was gently ground up and the homogenate electrophoresed on a horizontal starch gel. The gels were stained to detect the presence of one of five enzymes: glucose phosphate isomerase, phosphoglucomutase, aminopeptidase I, esterase, and malate dehydrogenase. All four species possessed some allozymes that were extremely (>95%) consistant, regardless of geographic and morphological differences among individuals. *Elysia tuca* and *E. papillosa* were electrophoretically indistinguishable except at rapidly evolving loci (coding for esterase and aminopeptidase I). Enzyme banding patterns are an inexpensive and objective taxonomic tool for distinguishing closely related species of the Elysiidae. Banding patterns can be used to construct a dichotomous key, and band frequencies can be used to generate evolutionary distances and phylogenetic relationships.

MORPHOLOGY OF THE GILL GLANDS IN EUDORIDOID NUDIBRANCHS. M. Jonas, Friday Harbor Laboratories, Washington.

The gill glands of *Archidoris pseudoargus* and *Peltodoris atromaculata* are located at the base of the gills. Size and number of the glands increase with the size of the gills. The glands lie in the collagenous connective tissue that separates the afferent and efferent gill vessels. Narrow arborescent ducts lead from the gill surface to the glands. Each gland consists of glandular cells and supporting cells that form a more or less spherical organ with a small eccentric lumen. The fine structure of the glandular cells shows a large nucleus at the cell base and numerous membrane-bound secretion granules containing an electron dense material scattered throughout the cytoplasm. A thin basal lamina separates the gland from the surrounding hemolymph space. The cell surface of the supporting cells bears many cilia that fill the lumen of the gland. No secretion granules are to be observed in the lumen. The function of the gill glands is not known. Histochemical tests for the presence of proteins and mucopolysaccharides in the gland cells were negative.

A COMPARISON OF THE MINUTE MARINE SHELLS OF MIDWAY ISLANDS WITH THOSE OF THE ISLAND OF HAWAII. Bertram C. Draper, Los Angeles Museum of Natural History, California.

After two years of research on the minute marine shells of Hawaii, I had the opportunity to study and identify similar shells collected by Donald R. Shasky in twelve locations at Midway Islands, representing over 160 species also found at Hawaii. Midway was formed about seven million years ago while Hawaii is about one million years old on its west side and only a few thousand years on the east side. The ocean currents flow from east to west on both sides of the 1500 mile chain of islands between Hawaii and Midway, thus migration by ocean currents is from the newest island to the oldest. All specimens from Midway are from depths of two to eight meters, while many of the 300 plus species from Hawaii are from greater depths.

Noticeable differences were mainly in color and/or sculpture, but were limited to only about 30 species of the 160 studied. The variations were found mostly in species that live by filter feeding or grazing. These species are less likely to be replenished by migration in the currents, so are more likely to be affected by evolutionary changes at the older Midway atoll. Differences in numbers of any species collected at the two areas were disregarded due to the limited period of collecting at Midway.

Species cited for differences in sculpture and color:
- *Euchelus gemmatus* (Gould, 1895)
- *Joculator ridicula* Watson, 1866
- *Leptothyra verruca* (Gould, 1845)

Species cited for differences in sculpture only:
- *Scissurella pseudoequatoria* Kay, 1979
- *Vanikoro cancellata* (Lamarck, 1822)

Species cited for differences in color only:
- *Gibbula marmorea* (Pease, 1867)
- *Tricolia variabilis* (Pease, 1861)
- *Schwartziella gracilis* (Pease, 1861)
- *Caecum septimentum* de Folin, 1867
- *Trivia exigua* Gray, 1930
- *Kermia aniani* Kay, 1979
- *Julia exquisita* Gould, 1862
- *Leptothrya rubricincta* (Mighels, 1845)
- *Rissoina ambigua* (Gould, 1849)
- *Lophocochlias minutissimus* (Pilsbry, 1921)
- *Cerithium placidum* Gould, 1861
- *Lienardia baltreata* (Pease, 1860)
- *Koloonella hawaiiensis* Kay, 1979
- *Kellia rosea* Dall, Bartsch & Rehder, 1938