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Aquatic Macroinvertebrates of Wapanocca National Wildlife Refuge

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HETEROCHROMATIC PATTERNS IN *DROSOPHILA VIRILIS* INTERPHASE NUCLEI

In interphase nuclei of *Drosophila* there is a distinct chromocenter. This is clearly seen in salivary gland preparations where one large chromocenter is present with all of the chromosomes attached to it. In the large nuclei of the larval brain a distinct chromocenter can be demonstrated when these cells are treated to show chromosomal heterochromatin.

HSU (1971) and Beck (1977) demonstrated that the regions near the centromere in *Drosophila melanogaster* and *D. virilis* were heterochromatic and comparable to the constitutive heterochromatin composed of satellite DNA of mammalian chromosomes. Gall et al. (1973) found three satellite DNAs in *D. virilis* that were rich in adenine and thymine. Ellison and Barr (1972) and Mayfield and Ellison (1975) showed that there were two to three A-T rich satellites localized in interphase nuclei as heterochromatic masses when studied with fluorescence staining. This study was made to see if the chromocenters observed in interphase nuclei correspond to the heterochromatic masses demonstrated with fluorescence stains.

Slides of larval ganglia of *D. virilis* were prepared according to Guest (1975) and the giant interphase nuclei were treated to demonstrate heterochromatin following Hsu (1971). These giant cells were counted in a mixture of cells from male and female larvae. Of 100 nuclei counted, 86 showed a single heterochromatic mass, 11 had two chromocenters, and three showed three chromocenters. Since the Y chromosome is completely heterochromatic, 25 cells from male larvae were studied to determine if the appearance of two or more chromocenters was related to the sex chromosomes. Of the 25 nuclei counted, 23 had one chromocenter (92%), and two had two heterochromatin masses (8%). This is comparable to the 86% of the mixed population that showed a single chromocenter. Thus, it appears that the presence of two chromocenters is not related to the sex chromosomes.

In examining cells with a single chromocenter, 12 showed an irregular mass with one or two extensions from the mass. This also was apparent in four of the 11 nuclei studied that had two chromocenters.

Mayfield and Ellison (1975) suggested a one to one correspondence between the number of heterochromatic masses and satellite DNA and showed with fluorescence techniques that the single heterochromatic mass could be distinguished as three A-T rich satellites. The Giemsa technique will not discriminate between DNA satellites. However, the fact that 14% of the nuclei showed two or more chromocenters indicates that in some cases the constitutive heterochromatin composed of satellite DNA does separate and can be distinguished by Giemsa staining. The irregular shape of many of the chromocenters may also be an expression of the partial separation of the satellite DNAs. Ellison and Barr (1972) suggested that the number of chromocenters present could result from chromosome orientation in anaphase. Heterochromatin in close proximity would form the chromocenter, and this association would persist throughout the following interphase. Each of the six pairs of chromosomes in *D. virilis* contains the same satellite DNAs and if, in anaphase, these fuse, the resulting chromocenter would be observed in interphase until the S phase when the satellite DNA begins replication.

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AQUATIC MACROINVERTEBRATES OF WAPANOCCA NATIONAL WILDLIFE REFUGE

Wapanocca Lake and its contiguous swamps may have been formed by the New Madrid earthquakes of 1811-12, but probably predate this event. The area had flourishing willow and cypress stands prior to 1827 (Madden, M. R. 1978. Wapanocca: A History - Hunting Club to Wildlife Refuge. Appendix II. *In:* Jackson, H. E. 1979. A Cultural Resources Reconnaisance of Wapanocca National Wildlife Refuge. Vol. II. Report prepared by the Research Institute, NE Louisiana Univ. 120 p.). However, infrequent and moderate habitat alteration has occurred since that time. Wapanocca Lake was drained in 1968, and a levee system was constructed to inhibit inflow of silty and potentially contaminated waters from surrounding intensively cultivated farmland and from the Mississippi River. General repair work and undergrowth removal were also undertaken at this time. The lake was again drained in 1979 and repairs were made. On both occasions the lake was refilled with relatively silt-free deep-well water.

The refuge, located approximately 6.5 km W of the Mississippi River and 0.4 km S of Turrell, Crittenden County, Arkansas, consists of 2,220 ha, fairly equally proportioned among three major habitat types. These are the freshwater impoundment, which includes the 240 ha Wapanocca Lake and cypress-willow swamp; bottomland timber, which is seasonally flooded; and agricultural land, which is cooperatively farmed, with the refuge receiving suplemental waterfowl foods (Fig. 1). Primary functions of this refuge are to provide a wintering area for migratory waterfowl, to provide a nesting and brooding area for resident wood ducks, and to serve as a link in the chain of refuges along the Mississippi River to encourage the southward migration of Canada Geese. Secondary functions are to maintain representative populations of indigenous species associated with bottomland hardwood forests, and to provide for the public enjoyment of all migratory bird resources (Wapanocca National Wildlife Refuge records).

The purpose of this study was to ascertain the success of this refuge in attaining one of its goals, specifically the maintenance of indigenous species populations. Further, this study contributes to our knowledge of the native fauna of Arkansas.

Eight trips and 14 discrete collections were made between 8 March 1977 and 8 March 1980 (Table 1, Fig. 1). On most occasions, aquatic dip nets were used, and specimens were preserved in 70% EtOH. Adult odonates were collected with sweep nets, papered, placed in acetone overnight, then placed in clear plastic envelopes with data cards. A light trap was used on 1 October 1979, and all adult caddisfly and true fly data are from this collection. All specimens are catalogued and housed in the ASU aquatic macroinvertebrate collection.

One hundred sixty-three taxa were collected, of which 130 were identified to species or subspecies (Table 2). Greatest diversity was provided by Coleoptera (39 taxa), Diptera (31 taxa) and Hemiptera (21 taxa). The composition of the aquatic macroinvertebrate community reflects the refuge's shallow, thickly vegetated nature. Coleoptera and Hemiptera are, in general, poorly adapted to an aquatic existence, and do best in such habitats. The Diptera collected are characteristic of aquatic ecosystems having a rich organic substrate.

Six species known to be new state records are designated by an asterisk (Table 2). Five of these *(Ranatra australis, R. buenoi, Potamyia flava, Oxyethyra pallida* and *Oecetis distissa)* are common, widespread, and their occurrence has been published for most contiguous states. The publication of such common species as new state records for Arkansas emphasizes our lack of knowledge regarding many Arkansas floral and faunal groups.

The sixth species, *Caecidotea laticaudata*, shows some differences from the original description (Williams, W. D. 1970. A revision of North American epigean species of *Asellus* (Crustacea: Isopoda). Smithsonian Contr. to Zool. 49:1-80), and approaches *C. foxi* (Flemming, L. E. 1972. The evolution of the eastern North American isopods of the genus *Asellus* (Crustacea: Asellidae). Part I. Int. J. Speleol. 4:221-256) in some respects, especially in the long cannula on the second pleopod endopod of the male. Either *C. laticaudata* is a variable species that includes *C. foxi* and the Wapanocca specimens, or the Wapanocca specimens represent an undescribed species (Thomas E. Bowman, Crustacea Curator, Natl. Museum of Natural History, *pers. comm.*).

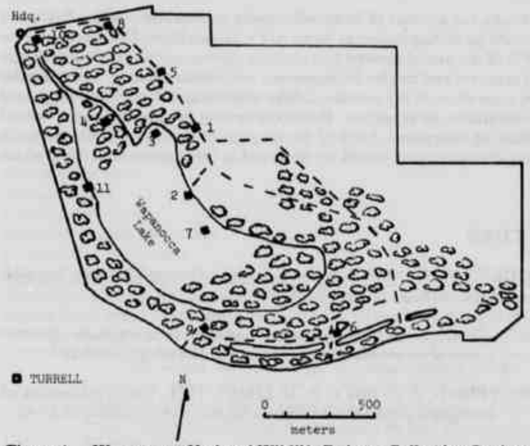

Figure 1. Wapanocca National Wildlife Refuge. Collecting Stations are designated by numbers 1-11.

Table 1. Collecting Stations and Dates, Wapanocca National Wildlife Refuge.

Station*	Description of Station with date
1	Borrow pit 600 m N of observation tower. 3 March 1977.
2	Observation tower. 3 March 1977, 28 July 1978, 1 October 1979.
3	North corner of Wapanocca Lake. 5 May 1977.
4	Boat trail. 5 May 1977.
5	Borrow pit 1500 m NNW of observation tower. 11 August 1977.
6	NW corner of Woody Pond 2. 11 August 1977.
7	Water lotus bed, Wapanocca Lake. 29 October 1977.
8	Borrow pit 1200 m E of headquarters building. 29 October 1977.
9	NW corner of Woody Pond 1. 28 July 1978.
10	Boat landing 100 m SE of headquarters building. 21 April 1979, 8 March 1980.
11	Public boat launching area. 8 March 1980.

*Station numbers correspond with those of Figure 1.

The diversity of aquatic macroinvertebrates in this refuge suggests three things. First, a variety of microhabitats is available. The borrow pits immediately adjacent and parallel to the levees consistently yielded the greatest diversity of macroinvertebrates. Swamp habitat also supported a diverse fauna. Diversity of aquatic plants was greatest in these areas, and water depth varied to a maximum of 2 m. Cypress stands supported fewer species, because fewer microhabitats are present in these nearly homogeneous stands. A second point regards food. The abundant decomposing vegetation in fairly shallow, fairly clear water allows rapid recycling of nutrients. This contributes greatly to the food base and supports a numerically dense macroinvertebrate community as well as a diverse one. Finally, the diversity and abundance of aquatic macroinvertebrates suggest that this refuge possesses water of good quality. Neither turbidity nor potential contaminants become limiting, it would appear. The diversity and density of molluscs also suggest that the water is at least moderately hard and therefore has some buffering capacity. Little information has been published concerning the water quality requirements of aquatic Hemiptera. Nevertheless, personal observations indicate that certain taxa (e.g. *Merragata, Pelocoris, Neoplea*) require undisturbed, clean habitat for population development. *Neoplea striola* requires static, shallow, clear water where there is an organic bottom and a high nutrient source with thin-stemmed or narrow-leaved vegetation (Gittleman, S. H. 1974. The habitat preference and immature stages of *Neoplea striola* (Hemiptera: Pleidae). J. Kansas Entomol. Soc. 47(4):491-503). In the present study *Peloccoris* was taken regularly, and one series of 73 specimens was collected in a short period of time. *Neoplea* was collected on every occasion, and once was captured at an estimated rate of 100 individuals per dip net sample.

We conclude that Wapanocca National Wildlife Refuge is successfully maintaining populations of species indigenous to Arkansas' bottomland hardwood forests. Such sanctuaries are an important counterbalance to man's continued alteration of his environment.

We thank Bill A. Grabill, former Refuge Manager, Joseph A. Oliveros, current Acting Refuge Manager, and their personnel for their considerable assistance in conducting this study. The following persons identified and/or confirmed identifications of the indicated taxa: Donald Newton (Turbellaria, *Aelosoma, Stylaria*), Jarl K. Hiltunen (Oligochaeta), Donald J. Klemm (Hirudinea), Mark Gordon (Mollusca), Thomas E. Bowman (Isopoda), H. H. Hobbs, Jr. *(Procambarus)*, Paul Kittle (Gerridae), John T. Polhemus (selected Hemiptera), Guenter A. Schuster (Trichoptera), H. H. Neunzig *(Ostrinia)*, Paul J. Spangler (selected Dytiscidae, Helodidae, Noteridae), Frank N. Young (selected Hydrophilidae), Warren U. Brigham *(Peltodytes)*, W. W. Wirth (*Atrichopogon*, Chironomidae, Stratiomyidae), W. M. Beck, Jr. (Chironomidae), F. C. Thompson *(Chrysops)*, and W. N. Mathis (Tipulidae).

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Table 2. Aquatic Macroinvertebrates of Wapanocca National Wildlife Refuge.

TURBELLARIA
- *Macrostomum appendiculatum?* (Fabricius)
- *Macrostomum tubum* (Graff)
- *Catenula*
- *Microdalyellia*
- *Gyratrix hermaphroditus* Ehrenberg
- *Mesostoma ehrenbergii* (Focke)
- *Mesostoma lingua?* Schmidt
- *Mesostoma vernale?* Hyman
- *Phaenocora highlandense* Gilbert
- *Phaenocora lutheri?* Gilbert
- *Rhynchomesostoma rostrata* (Muller)
- *Typhloplana viridata* (Abildgaard)

OLIGOCHAETA
- *Aelosoma*
- *Dero digitata* (Muller)
- *Haemonais waldvogeli* Bretscher
- *Stylaria fossularis* Leidy
- *Aulodrilus pigueti* Kowalewski
- *Limnodrilus hoffmeisteri* Claparede
- *Peloscolex multisetosus* (Smith)

HIRUDINEA
- *Erpobdella punctata* (Leidy)
- *Mooreobdella microstoma* (Moore)
- *Helobdella stagnalis* (Linnaeus)
- *Helobdella triserialis* (Blanchard)
- *Placobdella montifera* Moore
- *Placobdella ornata* (Verrill)

GASTROPODA
- *Goniobasis potosiensis plebeius* (Anthony)
- *Viviparus intertextus* (Say)
- *Lymnaea (Pseudosuccinea) columella* (Say)
- *Gyraulus parvus* (Say)
- *Helisoma trivolvis* (Say)
- *Menetus dilatatus* (Gould)
- *Physa gyrina?* Say

PELECYPODA
- *Musculium lacustre* (Muller)
- *Musculium transversum* (Say)
- *Carunculina parva* (Barnes)

ISOPODA
- **Caecidotea laticaudata?* (Williams)
- *Caecidotea obtusa* (Williams)
- *Lirceus*

AMPHIPODA
- *Hyalella azteca* (Sassure)
- *Crangonyx* sp. nr. *gracilis* Smith

DECAPODA
- *Palaemonetes kadiakensis* Rathbun
- *Procambarus (Ortmannicus) acutus acutus* (Girard)

COLLEMBOLA
- *Isotomurus palustris* (Muller)
- *Podura aquatica* Linnaeus
- *Sminthurides*

HEMIPTERA
- *Belostoma lutarium* (Stal)
- *Hesperocorixa lucida* (Abbott)
- *Hesperoxorixa nitida* (Fieber)
- *Trichocorixa calva* (Say)
- *Trichocorixa kanza* Sailer
- *Gelastocoris oculatus* (Fabricius)
- *Gerris marginatus* Say
- *Limnoporus canaliculatus* (Say)
- *Merragata brunnea* Drake
- *Hydrometra*
- *Mesovelia mulsanti* White
- *Pelocoris femoratus* (Palisot de Beauvois)
- **Ranatra australis* Hungerford
- **Ranatra buenoi* Hungerford
- *Ranatra nigra* Herrick-Shaffer
- *Notonecta irrorata* Uhler
- *Notonecta raleighi* Bueno
- *Notonecta undulata* Kirkaldy
- *Neoplea striola* (Fieber)
- *Microvelia hinei* Drake
- *Microvelia pulchella* Westwood

EPHEMEROPTERA
- *Caenis*
- *Callibaetis*

ODONATA
- *Argia*
- *Anomalagrion hastatum* (Say)
- *Enallagma civile* (Hagen)
- *Enallagma signatum* (Hagen)
- *Ischnura posita* (Hagen)
- *Gomphus maxwelli* Ferguson
- *Anax junius* Drury
- *Epitheca cynosura* (Say)
- *Erythemis simplicicollis* Say
- *Libellula vibrans* Fabricius
- *Pachydiplax longipennis* Burmeister
- *Pantala flavescens* Fabricius
- *Perithemis tenera* Say
- *Plathemis lydia* Drury
- *Tramea lacerata* Hagen

MEGALOPTERA
- *Chauliodes rastricornis* Rambur

TRICHOPTERA
- *Hydropsyche*
- **Potamyia flava* (Hagen)
- *Orthotrichia aegerfasciella* (Chambers)
- **Oxyethira pallida* (Banks)
- *Agrypnia vestita* (Walker)
- *Oecetis cinerascens* (Hagen)
- **Oecetis distissa* Ross
- *Oecetis inconspicua* (Walker)

LEPIDOPTERA
- *Ostrinia penitalis* Grote

COLEOPTERA
- *Phytobius velatus* Beck
- *Agabus aeruginosus* Aube
- *Bidessonotus inconspicuous* (LeConte)
- *Celina angustata* Aube
- *Coptotomus venustus* Say
- *Hydroporus hybridus* (Aube)
- *Hydroporus rufilabris* Sharp
- *Hydroporus undulatus undulatus* Say
- *Hydrovatus pustulatus compressus* Sharp
- *Hydrovatus pustulatus pustulatus* Melsh.
- *Laccophilus fasciatus rufus* Melsh.
- *Laccophilus maculosus maculosus* Say
- *Laccophilus proximus proximus* Say
- *Matus bicarinatus* (Say)
- *Neobidessus pullus pullus* (LeConte)
- *Thermonectes basillaris* (Harris)
- *Uvarus granarius* (Aube)
- *Uvarus lacustris* (Say)
- *Hydrocanthus iricolor atripennis* Say
- *Suphisellus parsoni* Young
- *Gyrinus analis* Say
- *Peltodytes dunavani* Young
- *Peltodytes sexmaculatus* Roberts
- *Cyphon*
- *Berosus pantherinus* LeConte
- *Cercyon mendax* Smetana
- *Enochrus consortus* Green
- *Enochrus ochraceus* (Melsh.)
- *Helochares maculicollis* Mulsant
- *Helocombus bifidus* LeConte
- *Helophorus*
- *Hydrochus rufipes* Melsh.
- *Hydrochus subcupreus* LeConte
- *Hydrophilus triangularis* Say
- *Paracymus subcupreus* (Say)
- *Tropisternus blatchleyi blatchleyi* d'Orch.
- *Tropisternus lateralis nimbatus* (Say)
- *Tropisternus mexicanus mexicanus* LaPorte
- *Tropisternus mexicanus striolatus* (LeConte)

DIPTERA
- *Atrichopogon*
- *Chaoborus punctipennis* (Say)
- *Ablabesmyia peleensis* (Walley)
- *Ablabesmyia*
- *Clinotanypus pinguis* (Loew)
- *Chironomus crassicaudatus* Malloch
- *Coelotanypus*
- *Cricotopus remus* Sublette
- *Cricotopus*
- *Dicrotendipes nervosus* (Staeger)
- *Einfeldia*
- *Endochironomus nigricans* (Johannsen)
- *Glyptotendipes lobiferus* (Say)
- *Glyptotendipes*
- *Goeldichironomus holoprasinus* (Goeldi)
- *Hydrobaenus*
- *Kiefferulus dux* (Johannsen)
- *Larsia*
- *Lauterborniella*
- *Parachironomus*
- *Polypedilum illinoense* (Malloch)
- *Polypedilum*
- *Procladius*
- *Tanypus*
- *Culex territans* Walker
- *Empididae*
- *Sepedon*
- *Odontomyia*
- *Stratiomys*
- *Chrysops*
- *Tipula*

*Denotes new state records

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