## RIVER/STREAM

### Field testing a spatially-explicit model for smallmouth bass reproduction for flow management

Donald J. Orth, William L. Knotek, Henriette I. Jager, Webster Van Winkle
Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University

We compare the results of an individual-based, spatially explicit model with field data on spawning times, nesting success to the swim-up stage, and early survival of smallmouth bass Micropterus dolomieu in a stream environment. The model environment consists of cells, in which depth and velocity are predicted from daily discharge records. Mortality sources that were modelled include: male abandonment due to extreme flow or temperature, predation, and excessive velocities. We monitored numbers of nests, nesting success (percent of nests producing swim-up fry), and number of swim-up fry in 1992, 1993 and 1994 on the North Anna River. Independent monitoring of recruitment success of smallmouth bass in late summer indicated that, compared to previous years, 1992 was a poor year class, 1993 was exceptional, and 1994 was intermediate. The model accurately predicted spawning times each year and observed differences among years. Model predictions of low nesting success, few swimups, more re-nesting, and low recruitment in 1992 matched the field observations. The low production of young smallmouth bass in 1992 was directly related to higher whole nest losses and higher brood mortality due to excessive velocities. Timing of whole nest failures due to high flows in the field closely matched model results. In the other two years the predation mortality was the dominant source of early mortality. Life cycle processes must be linked directly with hydraulics of riverine habitats in order to develop more environmentally benign operating regimes.

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### Streambed stability and hydraulics in spawning habitats of non-game fishes in the upper Roanoke River, VA

Ryan Kennerly Smith
Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University

Alterations of sediment dynamics in spawning habitats have been implicated in declines of several stream fishes. For example, excessive bed movement during egg incubation periods may result in reduced reproductive success of simple lithophilic spawners. Bed stability of spawning habitats of stream fishes is being investigated in the upper Roanoke River, Virginia, a watershed heavily impacted by agriculture and urbanization. Spawning areas of several darters and minnows were identified through snorkeling observations. Microhabitat variables (sediment diameter, embeddedness, depth, velocity, and shear stress) were then characterized at these

spawning areas. Stability of these spawning microhabitats is now being evaluated with repeat measurements of monumented cross-sections and tracer particles. Preliminary results indicate that little bed movement has occurred in the spawning habitats from the initiation of the study in early spring until present. Cross-sectional shape in most habitat types has remained fairly constant. However, two spates have resulted in small gravel deposition in midstream bars and moved tracer particles less than 30 mm in diameter. No changes have been observed in spawning microhabitats.

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**Ecomorphology guilds: A preliminary assessment of Roanoke River fishes**

Matthew Chan
Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University

Diverse communities of fishes pose a formidable obstacle for local governments or agencies which desire to know the effect of discharge changes on fish habitat. Within PHABSIM studies, limited resources for field measurements often determine the number of fishes studied. The selection of target species is often highly political and selected species tend to have commercial or recreational importance. These species typically have generalized habitat requirements which fail to represent the diverse requirements of the fish community. Habitat guilds are useful for analysis of diverse communities because they incorporate many species but still require large amounts of field data for classifying species into guilds. The use of ecomorphology guilds which classify fishes into habitat guilds based on morphology may overcome obstacles with both of the previous methods. I review work to date on ecomorphology guilds, develop the rational of the thirty-two morphology measurements used to describe species, and present the relationships of morphology to habitat-use guilds for eight species of Roanoke River fishes.

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**Use of a two-dimensional hydraulic model for evaluating habitat conditions of stream fishes.**

David Crowder*, Panos Diplas, Edmund J. Pert, and Donald J. Orth
Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University

Despite acknowledged drawbacks, 1-dimensional (1D) hydraulic models have been the standard for modeling stream habitat for almost two decades. Recently, however, researchers have begun to examine the potential of 2D models in evaluating stream habitat. We used a 2D hydraulic model, RMA2, to model a reach of a Sierra Nevada river in order to evaluate the model's potential for predicting fish habitat. Our objectives were 1) to determine if the model was operable in a geometrically complex river containing a variety of flow conditions and numerous obstructions in the flow field and 2) to develop a meaningful method for linking the hydraulic

model output with fish habitat data. Initial results indicate that the 2D model has good potential for modeling complex fish habitat, especially compared to 1-D hydraulic models. For the area modeled thus far, the 2D model output offered very reasonable spatially-explicit results. We are currently evaluating different techniques for linking the hydraulic model with fish habitat data. Because the 2D hydraulic models represents a potentially significant improvement over 1D models, 2D hydraulic models may well become a more-commonly used fisheries tool. Our results indicate that further testing of 2D hydraulic models should continue in order to improve modeling of riverine conditions for fish.

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**Use of hydraulic habitat data collected at multiple spatial scales for evaluating the use of micro scale habitat data.**

Edmund J. Pert*, Donald J. Orth, Craig Roghair, David Crowder, and Panos Diplas
Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University

We collected habitat data (depth and velocity) in a Sierra Nevada river for young-of-the-year (YOY) rainbow trout at three spatial scales surrounding the exact point where fish were located (microhabitat) in order to assess whether the depth and velocity of micohabitat differed from the area surrounding the point where microhabitat is collected. Our objectives were: 1) To determine if microhabitat data collected for YOY rainbow trout is representative of the surrounding habitat, up to 1 square m in size. 2) To compare fish habitat data for YOY rainbow trout collected at three different spatial scales, up to 1 square m in size. 3) To determine patterns in spatial habitat arrangements surrounding YOY rainbow trout that are likely to influence habitat selection. We found that micro-scale habitat was not representative of much of the surrounding habitat, and habitat measured at different spatial scales differed in important ways. In addition we noted characteristic patterns of hydraulic conditions that offered insight into YOY trout habitat selection. Based on our results, we feel that the standard techniques of using microhabitat data may be unsuitable for describing the hydraulic conditions that YOY trout use to select stream position. If flawed, frequently-used techniques to collect microhabitat data could result in inappropriate prescription of instream flows.

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**Habitat of the riverweed darter, Etheostoma podostemone, Jordan**

William J. Connelly
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The riverweed darter, Etheostoma podostemone Jordan, is endemic tothe Roanoke River

drainage and was first described by David Starr Jordan in 1889. Only a few studies since then have examined the ecology of the riverweed darter. This study had four objectives: 1) to compare current conditions of riverweed, Podostemum ceratophyllum, beds to historical accounts, 2) to observe the association between the riverweed darter and Podostemum ceratophyllum, 3) to determine any substrate preferences exhibited by the riverweed darter, and 4) to compare microhabitat conditions of the upper North Fork and upper South Fork of the Roanoke River. Podostemum beds were rare in the South Fork of the Roanoke River and nonexistent in the upper North Fork. Where Podostemum beds were present, it acted as a sediment trap. Few riverweed darters were found around these beds. Causes for the decline of Podostemum since Jordan's time are unknown. Comparisons between microhabitat locations where riverweed darterswere encountered and randomly chosen microhabitat locations revealed no significant differences; as a result, there is insufficient evidence to conclude that microhabitat selection by riverweed darters is non-random. Comparisons between the upper North Fork and upper South Fork of the Roanoke River are still in progress.I am a senior in Virginia Tech's Fisheries Science program with aninterest in nongame species, and this project is the result of a summer fellowship sponsored by the Virginia Water Resources Research Center.

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**American eel (*Anguilla rostrata*) density, length, and age characteristics in the Shenandoah River drainage, Virginia.**

Kevin R. Goodwin*and Paul L. Angermeier
Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University

Increasing elver harvests and decreasing adult catch rates in portions of its range have raised concern over the status of the American eel (*Anguilla rostrata*) population. We studied eels in the Shenandoah River to document density, size, and age structure of local subpopulations. This information can help track regional changes in population dynamics. Eels were captured by electrofishing from October, 1996 to December, 1997. Total length ranged from about 30 to 100 cm (mean= 72.6 cm), which indicates that these eels were larger than those in most coastal and inland studies. Fifty eels were aged using whole or cracked and sanded sagittal otoliths. Individuals ranged in age from 6 to 19 years. Another 205 were released after being measured and tagged. Each was marked internally with a Passive Integrated Transponder (P.I.T.) tag and externally with an injectable elastomer. Catch rates were low compared with other studies of American eels, varying from zero to nine fish per hour (mean= 1.8 $hr^{-1}$). The recaptured eels have not shown any movement beyond the pool of original capture. Distances between captures ranged from 0 to 800m. Published observations of American eel movement in estuarine and freshwater habitats have shown similar ranges of movement.

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**Summertime mvements of fish in two virginia mountain streams**

Dr. Charles Gowan
Department of Biology, Randolph-Macon College

Summertime movements of salmonids, cottids, percids, and cyprinids were monitored in two Virginia mountain streams in 1997 using two-way weirs. Lick Run (Bath County) is a spring-fed stream in which flows remainedconstant during the June-August monitoring period, and Guys Run (Rockbridge County) is a non-spring stream with a more variable hydrologic regime. In each stream, two weirs were constructed about 150 m apart, each capable of catching fish moving upstream and downstream past the weir location. Weirs were checked daily and captured fish were measured (total length; nearest mm), batch-marked using fin clips to indicate weir and direction of movement, and released in the direction of capture. Distances moved by marked fish were determined based on recaptures at weirs and during monthly electrofishing samples taken in the reach between weirs. Goals of the study were to quantify movement rates (fish per day) of each species, estimate minimum distances moved during summer, and to determine if differences in movement patterns existed among species and between streams.

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**Morphological differences of fish from different stream mesohabitats**

Anne Kugler
Department of Biology, Randolph-Macon College

Fish were collected from the South Anna River, Hanover County, Virginia, by backpack electrofishing during Summer 1997 to test if morphological differences existed between fish in fast- versus slow-velocity mesohabitats. Body form was characterized with the truss method, a system of 11 morphological landmarks defined by fin insertion points and externally-evident bony structures. Coordinates of the landmarks were digitized from preserved specimens, and a spreadsheet used to calculate distance between landmarks, yielding 22 morphometric measurements. Multivariate statistical analysis of the truss distances will be used to test for morphological differences among fish assemblages inhabiting different mesohabitats.

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**Long-term changes (1948-1996) in the taxonomic and trophic structure of stream fish assemblages in the Anacostia River Basin, Maryland**

Clarke, Christopher*, Greg Garman, and Steve Mcininch
Virginia Commonwealth University

Human activities, including agriculture and urbanization, alter watersheds and streams across broad temporal and spatial scales but relatively few studies have related the effects of disturbance to long-term changes in the structure of lotic communities. The stream fish assemblages of six

tributaries of the Anacostia River Basin (Maryland, USA) were sampled quantitatively at 19 sites during 1996. These data were compared to fish collections from the period 1948-1988 at the same locations to evaluate changes in assemblage structure during a 48-y period. A geographical information system (GIS) was used to quantify current and historical land use patterns within a 1-km radius around each stream sites. Study findings suggest strong community resilience in species richness 0ver the 48-y period, but the taxonomic structure was substantially different relative to 1948 at 17 sites. Pollution tolerant species dominated the assemblage in each time period. Our observations showed little change in the trophic structure between 1948 and 1996. A steady increase in urbanization occurred within the watershed between 1948 and 1996, and our results show that urbanization was the landscape attribute that explained the most variation in the fish assemblage structure in 1996.

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**A two-structure age comparison for introduced and native catfishes from a Chesapeake Bay tidal tributary**

Mark A. King*[1], Greg Garman[1], and Dean Fowler[2]
[1]Virginia CommonwealthUniversity
[2]Virginia Department of Game and Inland Fisheries

Introduced catfishes in tidal fresh waters of the mid-Atlantic and southeastern regions reach large individual sizes and may exhibit high rates of individual growth, presumably as the result of predation on resident or anadromous fishes. To insure reliability of calculated growth rates for the introduced blue catfish and flathead catfish, and for native white catfish, sectioned pectoral spines were tested by comparing annuli counts with counts from paired samples of sectioned lapilli otoliths. Loss of spine annuli due to central lumen erosion or exterior abrasion may result in age underestimates from spines, whereas otoliths should represent accurate growth histories throughout the life of the individual. Precision estimates and graphs to detect ageing >bias between structures for otolith ages 0-15 (n=70; 65-1190 mm TL) support >the use of spines for blue catfish (mean overall CV=5%). However, flathead >catfish spines were less reliable (mean overall CV=10%) for ages 1-7 (n=63; >225-951 mm TL); spines underestimated ages >age-2 as determined from otoliths.. >Although the data were limited for white catfish (n=11; 127-310 mm TL), >two-structure comparisons suggest that spine-derived ages will typically underestimate older (age 3-5) individuals. Longevity was greatest for blue catfish (to age-15) and growth was rapid for both blue and flathead catfish, though variability in length-at-age was, for some ages, high. White catfish growth was comparatively slow, but was equivalent to white catfish growth
rates published elsewhere.

## RESERVOIR

### The assessment of water quality in Virginia's reservoirs: A pilot study using an index of biotic integrity

McInnich, Steve*[1], Greg Garman[1], Lou Seivard[2], Richard Browder[2]
[1]Virginia Commonwealth University Center for Environmental Studies
[2]Virginia Department of Environmental Quality.

Biological monitoring and its many variations (e.g. IBI) have become established procedures in the assessment and evaluation of aquatic environments of varied types. This may be attributed to benefits to long-term monitoring capabilities and the ability to aid in determination and isolation of sources of degradation. The unique nature of reservoirs, however, makes them a difficult subject for assessment using biomonitoring approaches. We tested the efficacy of using the index of biotic integrity in feeding tributaries as a surrogate for direct monitoring of reservoir health.

Two separate statistical treatments of the collected data reveal some separation of the three reservoirs. Differences in community composition and relative abundance are reflected in the indirect gradient analysis and the mean IBI scores reflect separation based on the structure and function of the community as well as the members' resilience to degradation. Further comparison was made with qualitative labels applied to the reservoirs based on VA DEQ standards. Preliminary findings suggest that utilizing this methodology in tributaries feeding reservoirs may effectively monitor the biotic integrity of reservoir watersheds.

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### Temporal distribution and diet overlap of larval gizzard shad and sunfish in Claytor Lake, Virginia

R. J. Small, Jr.* and John Ney
Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State

Gizzard shad *Dorosoma cepedianum* may negatively affect zooplantivorous forage-fish and young-of-year sport-fish through trophic competition. By influencing zooplankton density and composition, larval shad may alter prey availability to larval sunfishes *Lepomis* spp. The intensity of this impact will depend on interspecific overlap in timing of zooplanktivory, diet composition, and zooplankton availability. We are currently examining the temporal distribution, abundance, and diet of larval shad and sunfish in addition to the abundance and composition of zooplankton in mesotrophic Claytor Lake, Virginia. Extensive ichthyoplankton sampling in 1997 indicated that larval shad are present in the limnetic zone from early June to early August; abundance of larval shad peaked in early July (0.04 fish/$m^3$). Larval sunfish are present in the limnetic zone from late June to late August; abundance of larval sunfish also

peaked in early July (0.50 fish/m3). Density and composition of limnetic zooplankton showed no relationship to density of larval shad. Ongoing work will determine if trophic competition exists between these species based on temporal overlap, resource availability, and diet composition.

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**Comparison of pelagic sportfish and black bass diets following a gizzard shad introduction**

C. Craig Bonds*and John Ney
Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State

Gizzard shad, illegally introduced into Claytor Lake, Virginia in the late 1980s, have expanded to comprise more than one-third of fish biomass,but their benefit as a prey source has not been determined. We collected pelagic piscivores (stocked striped and hybrid striped bass and walleye) and three black bass species by electrofishing and gillnetting over a 1-yr period todescribe their seasonal diets.Alewife constituded > 80% of stomach contents by weight ofpelagic piscivore diets in Spring and Summer months while gizzard shadcomprised > 70% of moronid diets and approximately 50% of walleye diets in Fallmonths. Black bassdiets varied both seasonally and among species. Largemouthbass diet included 40% gizzard shad in Spring and Fall and 47% bluegill duringSummer months.Crawfish accounted for > 50% of spotted bass and smallmouth bass diets throughout the year. Utilization of gizzard shad by even the largest sportfish isalmost exclusively limited to age-0 shad. The seasonal pattern of shad consumption reflects the morphological and distributional availability of young-of-year gizzard shad. Shad seasonally supplanted alewife in the diets of pelagic piscivores and largemouth bass. The effect of this dietary shift on sportfish growthremains to be determined.

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**Walleye in Virginia's small impoundments**
**Where do they go? What do they do?**

Darrell W. Bowman
Virginia Department of Game and Inland Fisheries

Walleye have been managed for years in Virginia's small impoundments primarily through stocking. However, relatively little knowledge exists as to the behavior and habitat use of walleye in Virginia, and many populations seem to be un-exploited. As part of a statewide effort to learn more about walleye in small impoundments, a telemetry study was initiated in 110 acre Lake Frederick, Frederick County, Virginia. The objective was to document seasonal and diel movement and habitat use to aid in management and to provide information to anglers. Five walleye were surgically implanted with ultrasonic, temperature sensitive, transmitters in April 1997. Since then walleye have been located during mid-day once per week, and tracked for twenty-four hours once per month. Different patterns of habitat use have been demonstrated

seasonally thus far, and significant movement has been almost entirely nocturnal. Habitat use does not seem to conform to what has been traditionally documented for walleye in the midwest and northern regions of this species native range, with tagged fish primarily spending summer days laying in standing timber, in relatively shallow water, near the bank. This distribution pattern seems to be controlled by temperature and dissolved oxygen preferences / requirements during summer-time stratification and resulting anoxic hypolimnion. Work is ongoing with project completion expected May 1998.

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## ENVIRONEMNTAL

### Environmental orientation of watershed-based organizations

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USDA Forest Service

An increasing number of community-based watershed organizations have developed in recent years. Many of these watershed groups have as their aim the management of nonpoint sources of water pollution. It would be instructive to determine the effectiveness of community-based watershed organizations in actually improving water quality. However, there is generally a lag time between group action and changes in water quality parameters. Therefore, an interim predictor of organizational performance could be useful in gauging the future direction and effectiveness of the group. Two components that explain a significant portion of the variation in individual environmental behavior are: knowledge and values. It was postulated that the environmental behavior of a watershed group should be a function of the environmental knowledge and values of the group. Further, since community-based organizations may be reflective of local norms, the environmental orientation of the group should be similar to individual orientation. Results of a survey of individuals in two Alabama watersheds showed significant differences in environmental knowledge and values between watersheds. Similar surveys of the two watershed organizations suggested analogous differences in environmental orientation in the respective groups. The difference found between community-held values is discussed as a possible contributing factor to observed organizational differences. The utility of these data in providing useful insights into effective community-based water quality management is also discussed.

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### Public values of riparian areas on the Jefferson National Forest

Pert, Heather*[1], McMullin, Steve L[1]., and Dolloff, C. Andrew[2]

[1]Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State
[2]USDA Forest Service Coldwater Fisheries Research Unit

In the Spring of 1997, a series of public meetings were held to identify public values of riparian areas on the Jefferson National Forest. Three phases were used to identify values associated with riparian areas. In the first phase, a brainstorming session was used to identify and list all values. Participants generated over 190 values during this phase. During the second phase, participants reviewed all values and organized them into categories. The third phase entailed prioritizing each of the categories of values. We used the Analytic Hierarchy Process (AHP) to prioritize values. The AHP is a participatory decision-making tool used for prioritizing alternatives in complex situations.

From our meetings, we identified public values and prioritized the relative importance of these values. We determined that the DFC for riparian areas on the Jefferson National Forest should have a strong emphasis on water quality and quantity, protection of riparian-dependent species and their habitat, and the maintenance of the integrity of the relationship between riparian areas and the surrounding environment. Activities such as recreational uses and commodity uses could be allowed only if they do not negatively affect the above characteristics of riparian areas. Pre- and post-surveys were used to evaluated the effectiveness of the meetings.

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## MUSSELS

### Recovery status of freshwater mussels in the North Fork Holston River downstream of Saltville

William F. Henley* and Richard J. Neves
Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University

The freshwater mussel fauna of the North Fork Holston River (NFHR)downstream of Saltville, Virginia declined from at least 24 species, as observed in 1918, to one species in 1974 due to mercury pollution. To determine the degree of recovery of mussels in the NFHR downstream of Saltville, and to provide recommendations for future mussel translocation sites, 19 sites were surveyed using a snorkeling catch-per-unit-effort (CPUE) method. At sites where investigator CPUE values (no./h) equaled or exceeded 5 mussels/h, a CPUE survey was conducted along transect lines. If investigator CPUE values equaled 10 mussels/h, a quadrat survey was conducted along the transects. Nine species of mussels were observed in the NFHR, and reproduction, as indicated by the presence of juveniles, was noted at 5 sites. Recovery of mussels was judged to be occurring downstream of NFHRM 56.4 based on species aggregations and recruitment. The number of mussels collected at sites, random CPUE (no./h), transect CPUE (no./h), and density (no./0.25m2) were generally inversely correlated to total Hg content, but not methylmercury content, as measured in Corbicula fluminea (Muller, 1774) from proximate sites. Translocation recommendations for the NFHR downstream of Saltville, Virginia were made

based on species aggregations, recruitment, and the distribution of total mercury.

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## FISH GENETICS

### Evaluation of DNA amplification fingerprinting for genetic characterization of brook trout, Salvelinus fontinalis, populations in the Shenandoah National Park Area

Supawadee Poompuang[1], Eric M. Hallerman[1], and C. Andrew Dolloff1[2]

[1]Department of Fisheries and Wildlife Sciences,Virginia Polytechnic Institute and State University
[2]U.S. Forest Service Southern Research Station

Development of non-lethal methods of sampling would prove useful for population genetic surveys of small populations. We evaluated DNA amplification fingerprinting (DAF), a method based on use of the polymerase chain reaction (PCR), and compared our results to those of classical isozyme methods in a screening of brook trout (Salvelinus fontinalis) populations from Paine Run, Piney River, and Staunton River of north-central Virginia. DAF was carried out using ten different decamer primers. Results showed only low levels of genetic variability within and between populations. Since the allelic nature of observed variantion could not be inferred, certain statistical genetic analyses were not available. Of 23 isozyme loci screened, consistently scorable variation was observed at nine polymorphic loci. Differences in allele frequencies among the three Shenandoah-area populations were found to be statistically significant. Hence, the DAF methodology proved less powerful than traditional genetic marker methods, and other PCR-based approaches will have to be evaluated.

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### Determination of the native range of the orangefin madtom (Noturus gilberti) in Virginia.

Aiken, Mary L. and Mark T. Kopeny
University of Virginia, Biology Department

The orangefin madtom (Noturus gilberti) is restricted to the James River drainage in Virginia and the Roanoke River Drainage in Virginia and North Carolina. It is a habitat specialist with a disjunct distribution in intermontane and upper Piedmont streams. Currently, the species is listed as Protected by VDGIF and Species of Concern by USFWS. Determination of the appropriate protective status for the orangefin at both the state and federal levels is based in part on the extent of the species' native range. It is suspected to be native only to the Roanoke Drainage. Conclusive information is lacking, but collection records from the 1950's and the pattern of range expansion documented in the 1970's suggests a relatively recent introduction into the James drainage. We are attempting to determine if orangefins are recently introduced in

the James, through analysis of molecular genetic variation among samples collected in both drainages. We collected specimens from each of three populations in the James drainage and two in the Roanoke drainage, and developed protocols for amplifying an 1100 base-pair region of the mitochondrial ND2 gene. Thus far we have sequenced a 600-700 nucleotide region from three specimens, one from each of three populations sampled, and are presently developing sequences from one specimen from each of the two remaining populations. We will describe our lab protocols, present preliminary results, and explain our approach for further methodologies and analyses.

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# Posters

**Proposed multi-year fisheries survey of the tidal freshwater James River, Virginia**

Robert L. Simmonds, Jr., Dean L. Fowler, and Mitchell D. Norman

Virginia Department of Game and Inland Fisheries

The tidal freshwater James River and its tributaries support important fisheries in Virginia, including largemouth bass (*Micropterus salmoides*) and catfish (*Ictalurus spp.*). This system also supports anadromous fish runs including striped bass (*Morone saxatilis* ) and American shad (*Alosa sapidissima*). However, this system has not been comprehensively evaluated, due to its large size and because of jurisdiction overlap (i.e., freshwater managed by VDGIF and marine managed by VMRC). We propose conducting spring, summer, and autumn electrofishing at multiple sites within each of three mainstem sections between Hog Island and the Fall Zone and at 2 sites on each of 9 major tributaries in 1998 and 1999. Sampling at each site will be stratified among habitats as appropriate (e.g., marsh, tidal flat, and steep banks on the mainstem). Addition sites on smaller tributaries will be electrofished one time in either spring 1998 or 1999. Other sampling gears will be used as time permits. Headwaters will be sampled using backpack electrofishing in 2000, concurrent to a creel survey in the tidal area. This broad evaluation will give us a good overview of the tidal James River and its tributaries, allowing us to identify and address specific fisheries management issues in the watershed.

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**Effects of habitat quality on brook trout distribution in two Virginia streams.**

John Jordan
Environmental Studies Program, Randolph-Macon College

Habitat quality for foraging trout was monitored in two Virginia streams,one spring-fed and one

non-spring-fed, from June-August, 1997. In each stream, a 150-m long study reach, approximately 3-5-m wide, was selected for study, and habitat quantified at high, medium, and low flow along transects set perpendicular to flow at 3-m intervals. On each transect, depth, velocity, cover, and substrate were quantified at each of 9 locations equally-spaced between the stream margins. Temperature was monitored using continuous recording thermographs, and insect drift density was quantified based on drift-net samples. Based on these data, spatial variation in foraging quality was characterized within each reach using a bioenergetics model, and compared to trout distributions as measured with backpack electrofishing in 30-m subsections of the reach.

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**NOTIFIED ON 2/18/98**

~~**Can Abundance of Macroinvertebrate Drift be Predicted from Habitat Variables?**~~

~~Ryan Boggs~~
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~~The purpose of this study was to determine if the abundance and composition of macroinvertebrate drift at a location is related to measurable physical attributes of the habitat immediately upstream. Twenty-four macroinvertebrate drift samples were collected in summer 1997 using a 363-micron-mesh, 0.46-m-wide drift net set at the downstream end of riffles in two streams, Lick and Guys Runs, located in Bath and Rockbridge Counties, Virginia. Physical attributes of the riffle immediately upstream of the collection point were measured, including water depth, water velocity, substrate size, and total riffle surface area. Multiple regression will be used to test for a significant relationship between drift density and the physical habitat variables.~~

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**UNCONFIRMED**

**Trophic Ecology of Native and Introduced Catfishes in the Tidal James River, Virginia**

Louis F. Chandler and Greg C. Garman
Virginia Commonwealth University

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Dean L. Fowler
Virginia Department of Game and Inland Fisheries

Species introductions are frequently associated with negative ecological impacts and may result in the extirpation of native taxa in aquatic systems. In coastal Virginia rivers, nonidigenous piscivorous fishes, including large ictalurids such as the blue catfish, Ictalurus furcatus, and flathead catfish, Pylodictus olivaris, may affect both native and anadromous fishes as the result of predation. The objective of this study was to determine the trophic ecology of nonidigenous and native catfishes in the tidal James River, Virginia, in order to assess the potential predatory effects of large, recently introduced piscivorous ictalurids on the native fish assemblage, and especially anadromous clupeid fishes. A sample of 4,156 catfish were taken from 13 locations throughout the tidal freshwater reach of the James River during three seasons between 1996 and 1997. Stomach content analysis revealed that channel catfish and white catfish were omnivorous, feeding on a wide variety invertebrates and plant material; in contrast, blue catfish and flathead catfish were largely piscivorous. Piscivory was more evident among flathead catfish, 91% of which had consumed other fish. Blue catfish were piscivorous in 29 % of the stomachs>observed. Consumption of Alosa spp. ranged between 5 % and 27% of all fish >consumed by flathead catfish and blue catfish and was greatest among blue catfish of the fall season where large numbers of out-migrating juvenile Alosa spp. were consumed by medium-sized predators. This study suggests potentially negative consequences associated with blue catfish and flathead catfish introductions into the tidal James River, including effects of predation on migratory fishes, including American shad, for which ambitious restoration programs have been undertaken.

Bio:

Louis Fairfax Chandler was raised in Westmoreland County, Va. near the >Potomac and Rappahannock rivers where he developed an early appreciation >aquatic ecology. He dreamed of catfish stomach contents as a young boy: >sorting, counting, and solving the mysteries favorite fishing baits for >large, non-native ictalurids. Louis received a B.A. in Environmental Studies from Randolph-Macon College in 1995, attended a semester at University of Md. Baltimore Co. as a part time Biology Graduate Student in the fall of 1995, and began full time at V.C.U. under Dr. Garman in the Spring of 1996. He claims that the apex of his life has been electrofishing for large catfish with Dean Fowler and Muktar Farouqi. Those are times that he will never forget.

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**A genetic technique for identifying host fishes for freshwater mussels (Bivalvia: Unionidae) of the Clinch River, Virginia and Tennessee.**

Watson, Brian T.* and Richard J. Neves.

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North America's freshwater mussels (Bivalvia: Unionidae) have been declining in numbers and

diversity over the past three decades. Efforts to stem this decline through re-introductions and artificial propagation have been hampered by the lack of information on host fish-mussel relationships. Typically, induced infestations of glochidia on suspected host fishes have served as the primary method for identifying suitable hosts. Because there are drawbacks to this approach, a method to genetically identify unionid glochidia attached to host fishes has been developed. This technique is now being used to complete a genetic key to the unionids of the Clinch River, Virginia and Tennessee. Working with tissue from adult mussels, we are using the polymerase chain reaction (PCR) followed by restriction enzyme digests to identify unique genetic "fingerprints" for 42 mussel species in the river. To date, 23 species have been genetically identified, and 12 species have been isolated into 3 separate groups. Tissue samples from the remaining 7 species are being sought or processed. Once constructed, the key will be used to identify host fish-mussel relationships by removing glochidia collected from wild fish and comparing their genetic blueprints to the genetic key.

**"Fish Host Identification for Endangered Freshwater Mussels (Bivalvia: Unionidae) in the Upper Tennessee River Drainage".**

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Fish host identifications were completed in 1996 and 1997 for two Virginia state listed freshwater mussel species, the black sandshell (Ligumia recta) and Tennessee heelsplitter (Lasmigona holstonia), and four federally endangered freshwater mussel species, the tan riffleshell (Epioblasma florentina walkeri), purple bean (Villosa perpurpurea), dromedary pearlymussel (Dromus dromas), and birdwing pearlymussel (Lemiox rimosus). Both state-listed species exhibited low degrees of host specificity in laboratory tests. Host fish for L. recta include largemouth bass, green sunfish, redbreast sunfish, rockbass, white perch, yellow perch, platy, and convict cichlids. The banded sculpin was the only host fish identified for L. holstonia but rockbass, stoneroller, striped and warpaint shiners were identified as potential hosts. Conversely, the federally endangered species exhibited high degrees of host specificity. Host fish for E. f. walkeri were limited to the banded and/or mottled sculpin and several percids; greenside, redline, fantail, and snubnose darters. Fish hosts identified for V. perpurpurea were also the banded and/or mottled sculpin and two percids; greenside and redline darters. The fantail darter was the only fish host identified for D. dromas, with the gilt darter, tangerine darter, and Ohio logperch identified as potential hosts. Additionally, a second darter (snubnose) was identified as a host for L. rimosus.