

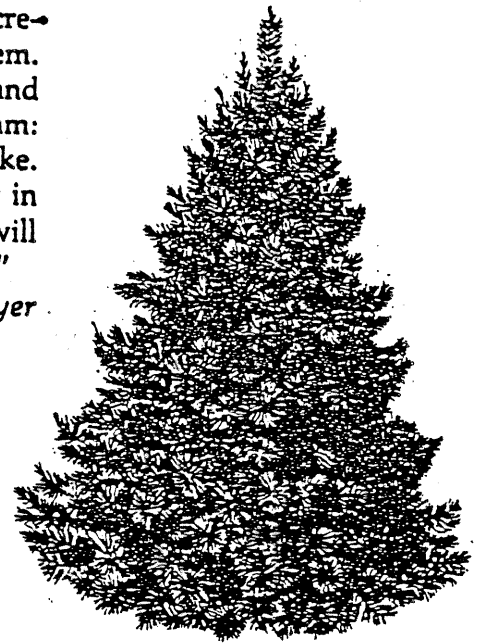
Southeastern Water Pollution
Biologists Association
Newsletter



And God saw everything that was made, and found it very good. And God said: This is a beautiful world that I have given you. Take good care of it, do not ruin it.

It is said that before the world was created, the Holy One kept creating worlds and destroying them. Finally God created this one, and was satisfied. God said to Adam: "This is the last world I shall make. I place it in your hands; hold it in trust. For if you defile it, there will be no one to set it right for you."

—*Gates of Prayer*



December 1990

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HIGHLIGHTS

By the time most of you receive this issue of the SWPBA newsletter, the holiday season will have come and gone. However, let me extend to each of you greetings and wishes for a Merry Christmas and Happy New Year!

Highlights of this newsletter include: (1) minutes and agenda from the 1990 SWPBA business meeting at Jekyll Island; (2) an article from the journal Wildlife in North Carolina titled "Top of the Class" by Lawrence S. Earley describing North Carolina's Outstanding Resource Waters program (please note discussion of ORWs in North Carolina state report); (3) an article by Skip Call (Kentucky Division of Water) discussing the zebra mussel Dreissena polymorph; and (4) a new newsletter section on endangered species taken from Endangered Species, a technical bulletin by the U.S. Fish and Wildlife Service.

A copy of a key to the larval ceratopogonids of the USSR is also included in this newsletter. I was made aware of this key by V.M. Glukhova in the October 25, 1990 Florida Benthological Newsletter (Vol. 4 (3): 18-22).

During this season when we celebrate Christ's birth, I thought it might be interesting to include the following article which appeared in The Amicus Journal (Winter 1990 p:54-56). The article presents the Jewish tradition that we are obligated not only to conserve, but to enhance and enrich the earth as its trustees and caretakers. I hope this article will enlighten and enrich our Christmas observance.

The Southeastern Water Pollution Biologists Association Newsletter is a publication for those interested in aquatic biological monitoring in Environmental Protection Agency Region IV.

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SWPBA 1990-1991 Secretary: Vickie Bauer, Alabama Department of Environmental Management, Field Operations Division, 1751 Congressman W.L. Dickinson Drive, Montgomery, Alabama 36130

SWPBA Newsletter Editor: Giles Miller, Kentucky Division of Water. Same address as President.

Message from the President

Another great meeting has come and gone. I'd like to take this opportunity to thank our outgoing president, Dave Chestnut, for his year of energetic service, and Bruce Pruitt for working so hard to make this year's meeting happen. I also want to congratulate Vickie Bauer on her election to the office of secretary.

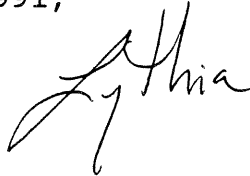
Since next year's meeting is to be held in South Carolina, I volunteered Dave Chestnut, ex prez, to be local arrangements chairman. I think this means he has to bring chairs and arrange with the locals where we can drink beer and play volleyball.

We've tentatively chosen the week of November 18th for the 1991 meeting, to take advantage of cheaper off-season rates and to be sure we're out of sampling season. We like Hilton Head for a location, and it looks like room rates will be about the same as this year's were (\$59 for single or double). Plan on a "small fee" of about \$15 for the cookout, since registration fees probably won't cover it (the pig roast was free this year thanks to Del Hicks). Of course, the availability of volleyball courts, cookout area, hot tubs, beachfront state parks, and meeting room quality will all be considered before a contract is signed with any hotel. If you have any complaints or suggestions, call Dave at (803) 734-5393. You can call me if you have nice things to say.

An "official" call for papers will be made sometime in the future. Please contact me if you have any suggestions for session topics, panel discussions, or invited speakers.

Finally. I'd like to apologize for my team's gloating over the volleyball championship. It wasn't polite, especially since we were very nearly beaten. And it wasn't like the other team didn't have some pretty good excuses. Although I did think it was unusual that the "sun was in their eyes" no matter which side of the court they were on. Come to think of it, it was overcast. Well, they did also say the "wind was blowing too hard" on their side. I suppose they could claim a "moral victory"-I mean, nobody caught them cheating. Looking forward to another good, clean game next year.

Happy 1991,



Minutes of the 1990 SWPBA Business Meeting
Jekyll Island, Georgia
Dave Chestnut Presiding

The business meeting of the Southeastern Water Pollution Biologists Association (SWPBA) was called to order at 10:30am October 4, 1990. President Dave Chestnut extended thanks to Del Hicks for providing us with the Pig Roast and to Bruce Pruitt for the excellent meeting arrangements. A motion was made by Mike Beiser and seconded by Skip Call to approve the minutes of the the 1989 meeting. After being reminded by the membership that motions needed to be voted on, the president called for a vote and the minutes were approved unanimously with no corrections. No old business was brought up for discussion.

New business items brought up were as follows:

We discussed the time of year in which to hold the annual meeting. It seems that holding the meeting in early October, as was done this year, conflicted with many sampling programs still in progress. The idea of holding the meeting in February was discussed, but because of the biennial 305(b) report that many of us have to deal with, this idea was not popular. Another suggestion was Spring. Three choices were voted on: November (majority), February (3 votes), and Spring (0 votes). Next year's meeting will be held sometime in November. The executive committee will decide on a date.

Next new business was a discussion of EPA-sponsored workshops. A Freshwater Invertebrate Taxonomy workshop is "on-line" for 1991, but a date had not been set as of this report. There is a considerable amount of interest in a phytoplankton/periphyton workshop. According to Del Hicks, interested states should write a letter to the Water Quality Coordinator in Athens or to Mike McGee, Branch Chief, stating their interest and the number of people interested in attending. A biocriteria workshop was also discussed. Dave Penrose has offered to help write a letter/agenda on the biocriteria topics we feel need to be addressed in such a workshop. A subcommittee was formed (Vicki Tauxe and Skip Call volunteered and Hoke Howard was volunteered in absentia) to coordinate with Dave P. Dave C. noted that Jim Harrison would also like to assist in a biocriteria workshop.

Skip was asked to write a summary of what individual states are doing with laboratory certification for an upcoming newsletter.

Membership in SWPBA was discussed. Dave C. read the portion of the by-laws concerning membership, and there was no motion to amend. It was decided that we maintain the status quo and ask Giles to keep track of requests for newsletters by other organizations or individuals. It was suggested that we may need to charge a subscription fee for newsletters for non-members if we have too many requests.

Dave C. suggested inviting speakers from EPA headquarters and other agencies to speak at the SWPBA

meeting, since they might provide us with informative talks as well as help improve inter-agency communications.

The "Colorado approach" to biomonitoring requirements was explained by Bill Peltier and discussed. Kentucky and North Carolina have sent letters to EPA in Washington to voice objection to any modification of EPA policy regarding whole effluent toxicity testing requirements and limitations. Susan Cohn and Steve Tedder will distribute copies of these letters to interested parties.

Dave C. announced that South Carolina would host next year's meeting. Location and date will be set by the local arrangements chairman and the executive committee. No other new business was brought up, so elections for new officers were held. Lythia Metzmeier (Kentucky) was elected president and Vickie Bauer (Alabama), secretary. During the ballot-casting, the game ball was awarded to the winning team of the volleyball tournament, K.Y.N.A.C.

Susan Cohn made a motion to adjourn, and Vicki Tauxe seconded. The 1990 SWPBA meeting was adjourned at 11:20am.

ANNUAL MEETING OF THE SOUTHEASTERN WATER
POLLUTION BIOLOGISTS ASSOCIATION (SWPBA)

THE BUCCANEER CLARION RESORT JEKYLL ISLAND, GEORGIA
OCTOBER 2-4, 1990

AGENDA

Tuesday, October 2, 1990

8:00 - Noon	Registration (\$15 to cover breaks and materials)	
8:30 - 8:45	Introduction	Mr. David Chestnut
8:45 - 9:45	Overview of State Program Highlights	One representative from each state
9:45 - 10:00	EPA Region IV Overview	Mr. Bruce Pruitt
10:00 - 10:15	Trend or Assessment? Edible Fish Tissue Data from a Textile Impacted Pond	Mr. Doug Darr
10:15 - 10:30	Break	

Biocriteria Development and Ecoregion Definition

10:30 - 10:45	Introduction - Goals of Ambient Monitoring; Why do we measure what we do, and is it really what we want?	Mr. David Chestnut
10:45 - 11:00	A New "Hilsenhoff-Type" Biotic Index for the Southeastern United States	Mr. Dave Lenat
11:05 - 11:30	Assessing Lotic Integrity using Geographic Information Systems and Biological Monitoring	Mr. Chris O'Bara
11:30 - 1:00	Lunch	
1:00 - 1:15	Potamoplankton, the River Continuum, Ecoregions, and other concepts: recycling old data into new information	Ms. Lythia Metzmeier
1:20 - 1:35	The Development of Criteria for Bioclassification Using Seven Years of Benthos Data, With Emphasis on Seasonal and Headwater Stream Complications	Ms. Trish MacPherson
1:40 - 4:00	Panel Discussion	
Panel Members	Mr. David Penrose - North Carolina, moderator Ms. Vickie Bauer - Alabama Mr. Mike Beiser - Mississippi Ms. Trish MacPherson - North Carolina Ms. Lythia Metzmeier - Kentucky Ms. Vicki Tauxe - Florida	Each panel member should be prepared to discuss the experience and efforts of their state regarding these topics

Wednesday, October 3, 1990

8:30 - 8:55	Wetlands Advanced Identification of Western Kentucky	Mr. Bruce Pruitt
9:00 - 9:15	Update of Interagency Cooperative Investigation of a PCB contaminated lake - Lake Hartwell, SC / GA	Mr. Don Dycus
9:20 - 9:35	Organic Chemical Assessment of Sediment, Two Finfish and Three Shellfish Species in Charleston Harbor, SC	Mr. Doug Darr
9:40 - 9:55	Reservoir Continuum Concept with Respect to Spatial and Temporal Patterns of Dissolved Oxygen and Heat in Warm-Water, Deep-Storage Reservoirs	Mr. Ron Chandler
10:00 - 10:20	Break	
10:20 - 10:35	The Arising Need for Standardizing Qualitative Macroinvertebrate Samples by Sampling Time	Mr. Billy Gene Justus
10:40 - 10:55	Is Biomonitoring Working in the Kentucky Pollution - Discharge Elimination System (KPDES)?	Ms. Susan Cohn
11:00 - 11:15	The B.A.T. Team Approach to Toxicity Testing	Mr. Todd Harris
11:15 - 1:00	Lunch	
1:00 - 1:15	An Overview of Whole Effluent Toxicity in North Carolina Compliance History	Ms. Dianne Williams Wilburn

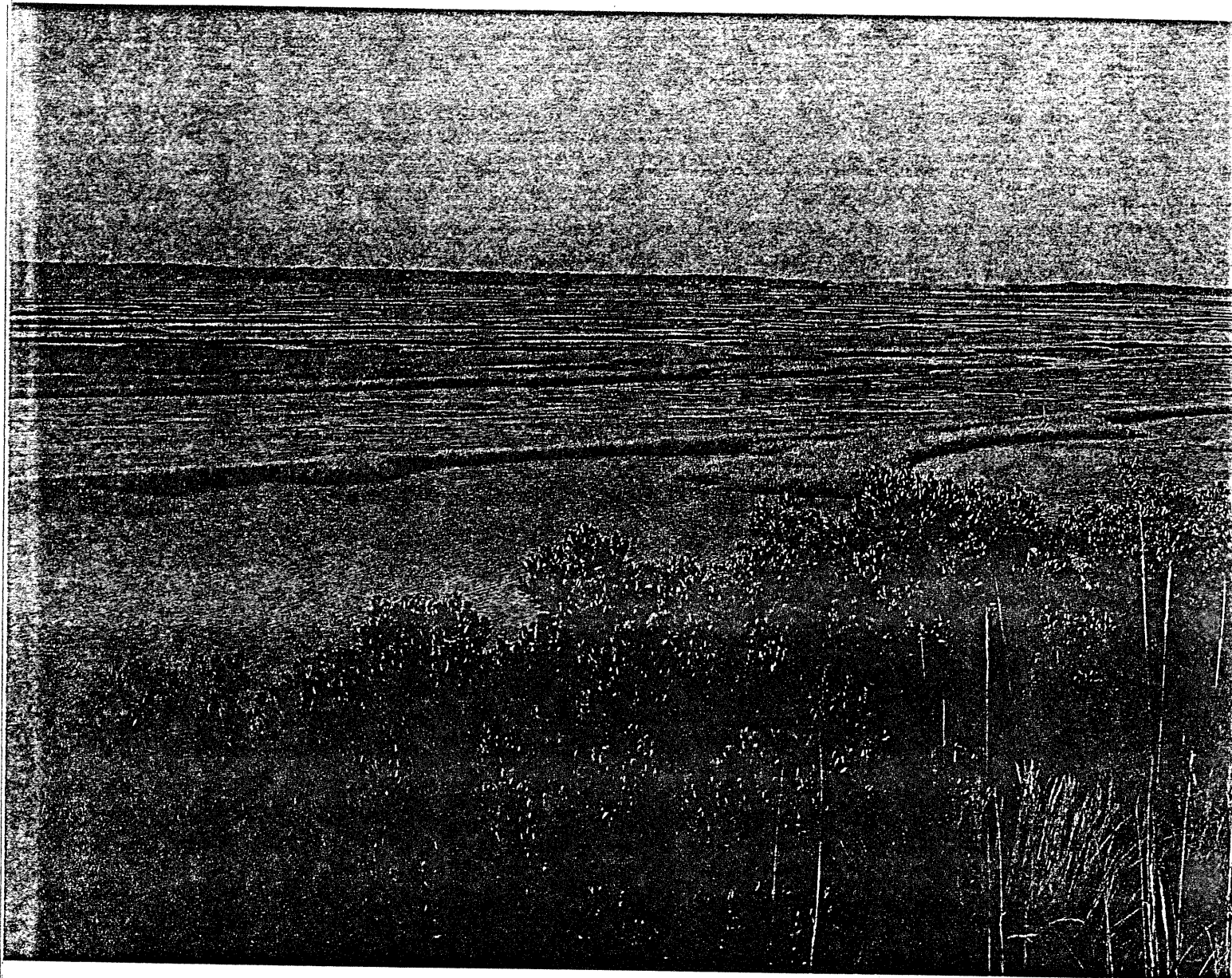
Biological Laboratory Certification

1:20 - 1:35	Two Years Retrospective of the Biological Laboratory Certification Program in North Carolina	Mr. Matt Mathews
1:40 - 3:30	Panel Discussion	
Panel Members:	Mr. Skip Call - Kentucky, moderator Dr. Debra Sauer - South Carolina Mr. Matt Mathews - North Carolina Mr. Norman Blakey - Alabama	Each panel member should be prepared to discuss their efforts regarding this topic

Thursday, October 4, 1990

8:30 - 8:45	Toxic Algal Bloom of <u>Microcystis aerogenes</u> on Lake Washington, a Mississippi Delta Oxbow	Mr. Stanley Rogers
8:50 - 9:20	Benthic Macroinvertebrate Community of the Perdido Bay Estuary	Mr. Gary Halcomb
9:20 - 9:35	Toxicity Testing in Alabama	Ms. Cathy Matthews
9:40 - 9:55	Short-Term Toxicity Testing of Juvenile Freshwater Mussels as a Supplemental Measure to Insure Adequacy of National Toxics Control Policy	Mr. Aubrey McKinney
10:15 - 11:00	Business Meeting	

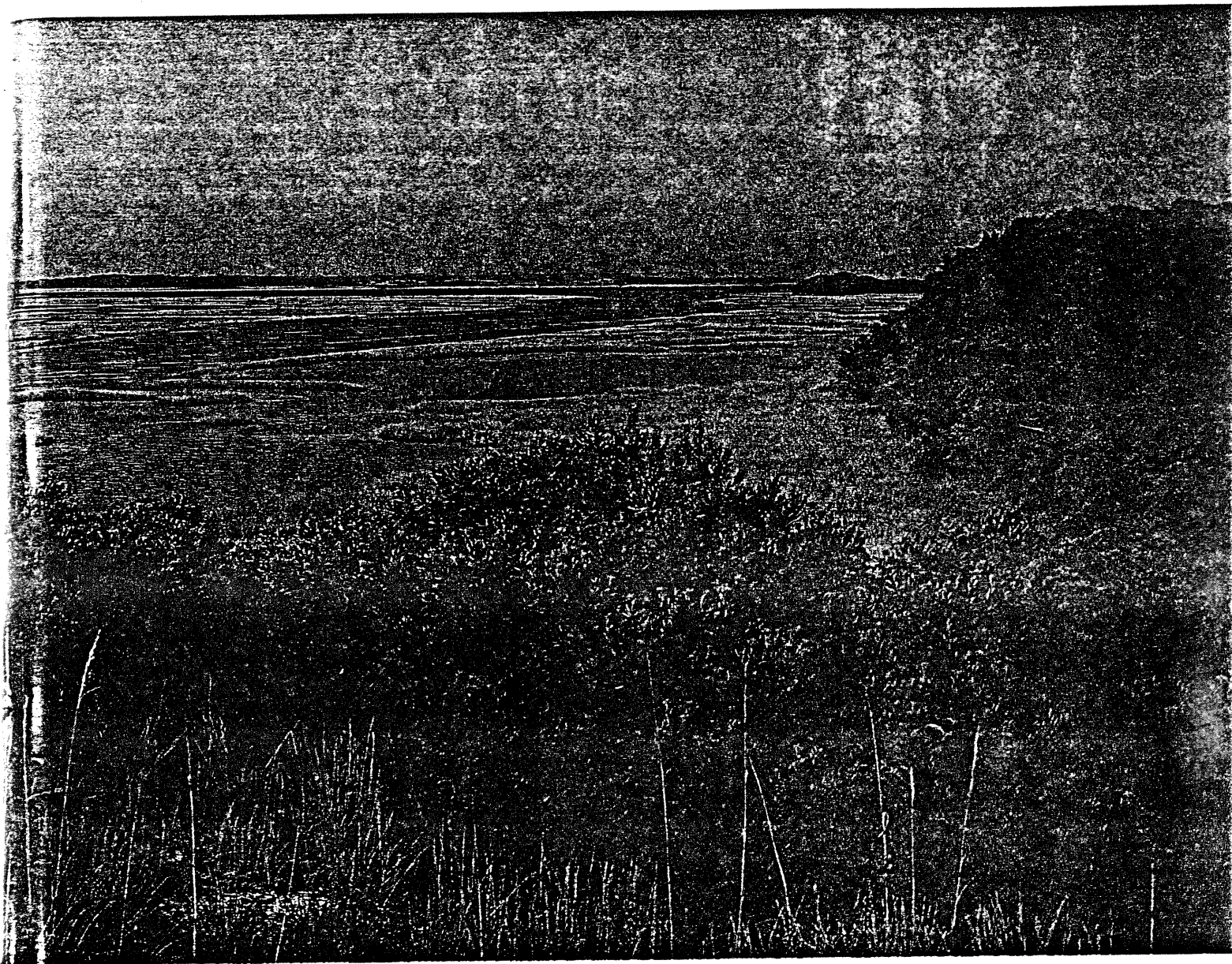
ADJOURN



TOP OF THE CLASS

They're the best rivers, creeks and sounds we've got left, and the Outstanding Resource Waters program gives them some muscular protection. Yet, more waters may deserve this protection, and even tougher standards could be needed to keep them free of pollution.

by Lawrence S. Earley
photographed by Ken Taylor



From the banks of a mountain stream these days, the odds are pretty good that you'll hear a kind of music that is neither uplifting nor harmonic. On the one hand are nature's quiet melodies — of water kissing rock, of breeze stirring spruce. Yet more and more these natural sounds are blending with sounds of another kind — of chain saws rasping, of backhoes roaring as second-home developments, roads and golf courses replace natural habitats.

It's the noise of money, as some people tiresomely point out. But to no one's surprise, it's also a discord that threatens some of the best — and some of the last — of the state's pristine waters. For when the engines stop, often what's left is only the memory of a clean waterway. In its place is a degraded stream fouled by discharges from water-treatment plants, by higher temperatures caused by canopy removal, by loads of fertilizers and

Pristine view of the marshes behind Bear Island (above) indicates why the area has been designated an Outstanding Resource Water. This water classification offers protection from pollution to the state's best waters. In some coastal ORWs, new marinas (below) are barred to protect the shellfish resource.



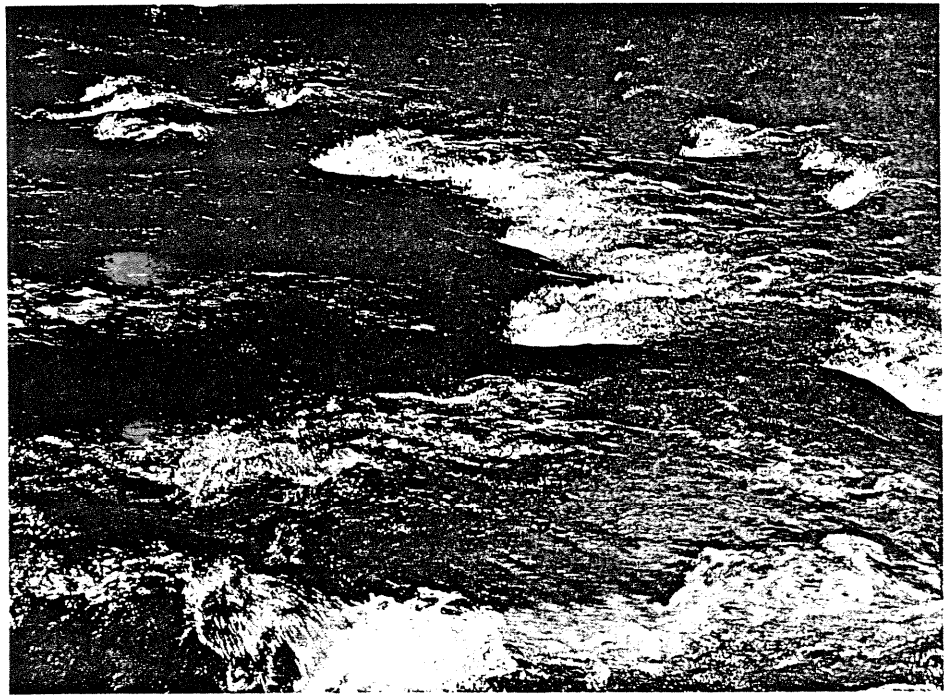
TOP OF THE CLASS

pesticides from lawns, golf courses and other developed areas.

That's one reason why pristine and pure waterways are rare and it's one reason why the state, beginning in 1986, introduced a new water classification of "Outstanding Resource Waters" to protect what's left. Twenty-five rivers, sounds and creeks in the mountains and along the coast have been named as ORWs so far (see "The Cream of the Crop"). They range in size from the 8.5-mile Gipp creek in Cherokee County to the 74,400-acre Core Swamp in Carteret County. They're the cream of the crop, North Carolina's finest waterways, and now they'll get some of the best protection the state can offer.

Though many conservationists see flaws in the ORW program, most are enthusiastic over its potential. "I think it's an extremely important step forward for North Carolina," says Charles Peterson, a marine biologist with the UNC Institute of Marine Sciences in Morehead City and a member of the Environmental Management Commission, which designates ORWs. "It's high time we got past that stage of almost unregulated watersheds, especially in the mountains, and went on to examining what goes in our water to maintain the values they represent."

"Outstanding Resource Waters" is only one of a number of classifications assigned to state waters according to their best uses. Every river, creek, sound or reservoir has a classification of some kind that specifies what



those uses are and assigns standards for their protection. If the water is being used as a municipal water supply, for example, it needs higher standards than if it's being used for swimming and fishing. Commercial shell-fishing waters also have higher water-quality standards than other saltwater areas.

In addition, supplemental classifications are attached to waters to do other things, according to Greg Thorpe, supervisor of the Water Quality Standards and Assessment Unit with the Division of Environmental Management. "They may designate a water body as sensitive to nutrients, in which case it gets a 'nutrient sensitive water' (NSW) classification entitling it to additional management strategies. Or, the classification can recognize a certain resource-related use, such as trout waters (Tr), which would protect the propagation and maintenance of trout."

Two other supplemental classifications, "high quality waters" (HQW) and "outstanding resource waters" (ORW), recognize rivers, creeks and sounds with the best water quality or with special uses that need to be protected. But an ORW differs from a HQW because it possesses at least one of a number of special ecological or recreational values that need protection: (1) an outstanding fishery or fish habitat; (2) significant recreational value; (3) a special designation already attached to the river, such as a state or national wild and scenic river classification, national wildlife refuge, or some other designation. Or it may be (4) a component of a state or national park, or may have (5) some special ecological or scientific significance, such as an area used for research and education.

In Burke County, for example, Henry Fork

To protect its high-quality rivers, streams and sounds, North Carolina has developed two supplemental water classifications in recent years: Outstanding Resource Waters and High-Quality Waters. Waterways so designated have excellent water quality, but an Outstanding Resource Water also has high recreational or ecological values that need to be protected.

was named an ORW because of its excellent water quality, its diverse fish community and an unusually high level of water-based recreation. It also provides habitat for several rare and endangered plant and animal species. Core Sound, including the Southeastern Pamlico Sound and Back Sound area, supports critical fish and shellfish populations, including North Carolina's entire population of bay scallops. It's also an important research area and is partially bounded by Cape Lookout National Seashore and the Cedar Island Wildlife Refuge.

Communities have rallied behind ORW nominations and for good reason. An ORW gets some of the best protections the state offers. First, no new discharges of any kind are allowed. This restriction protects the water from "point-source pollution," or pollution that enters the river from a single point, such as a water-treatment plant. "ORW classification really tightens up on discharges into rivers," says N.C. Wildlife Resources Commission biologist Joe Mickey. "There are other ways to treat that sewage and developers have to find ways of doing that."

There's protection against non-point-

Parking lots and other paved and cleared areas often channel pollution-laden rainwater to sensitive waters. To protect ORWs against this kind of non-point-source pollution, wet-detention ponds like the one below are required for some large developments. These enable pollutants to settle before the water is released.



source pollution as well. This is the most common form of pollution, often the result of runoff from farmland, feedlots, parking lots, roads and other cleared and paved surfaces. Rainwater falling on these surfaces is less likely to be absorbed by the ground and more likely to flow directly into rivers. When it does, it may carry different kinds of pollutants, depending on where it's coming from: leads associated with cars; fertilizers and pesticides from lawns and farms; or sediments from construction activities. To reduce this kind of pollution, developments in ORW watersheds must limit the amount of hard-surface areas or incorporate engineered stormwater controls, such as wet detention ponds, into the project.

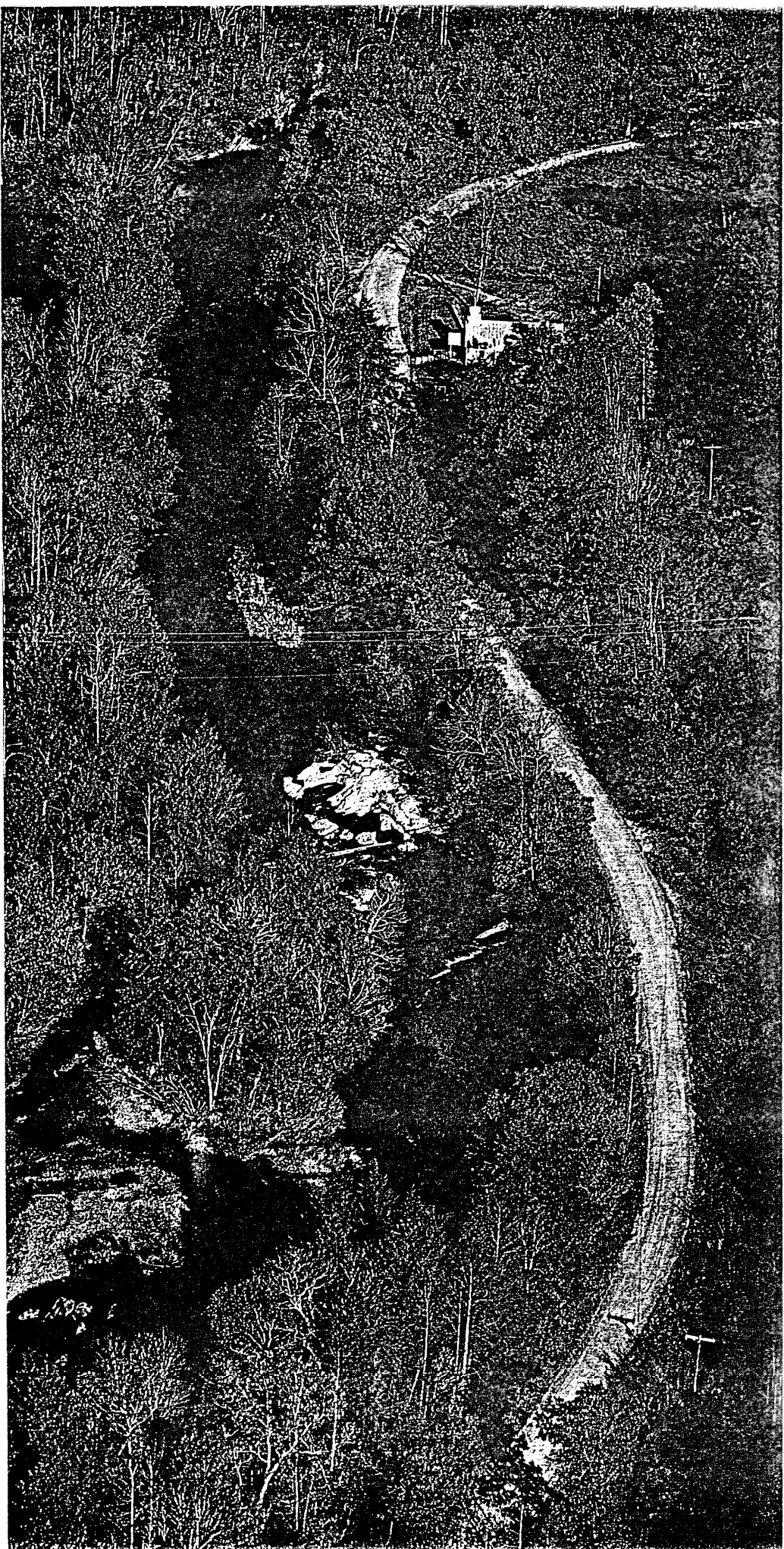
In coastal ORWs, in addition, there may be restrictions on the construction of new marinas, a growing source of pollution in coastal waters. Plus, the protection offered each ORW is, to a certain extent, individually tailored to protect its chief values. And the protections can be tightened up. "It's a federal requirement that our standards and rules are reviewed every three years," says Thorpe. "So if we see that something isn't working, the EMC has ample opportunity to fix that."

So if ORWs reduce pollution in pristine waters, create public awareness of the values of local rivers or sounds, and provide a dynamic framework for fine-tuning the protection, why doesn't everybody love them?

Perhaps the one criticism that DEM officials hear the most is that ORW classification reduces the value of property adjacent to ORW waters and can stifle development. A good case in point, these critics maintain, is the Alarka Creek incident. This past April, Alarka Creek in Swain County was nominated as an ORW. The nomination occurred at the same time that an investment group was negotiating to buy and develop a large tract of land adjoining the creek. Because an ORW carried more restrictive environmental requirements than the creek then had, the group backed off.

The departure outraged Swain County officials and citizens. At public hearings required as part of the ORW nomination process, these officials complained that the ORW nomination had scared away a development that would have provided jobs to the economically depressed county. As a result of the hearings, Alarka Creek was designated as

The South Toe River in Yancey County was the first river to be named an ORW. This mountain stream offers an excellent trout fishery, one of the important natural resources that the designation protects.



TOP OF THE CLASS

an HQW rather than an ORW.

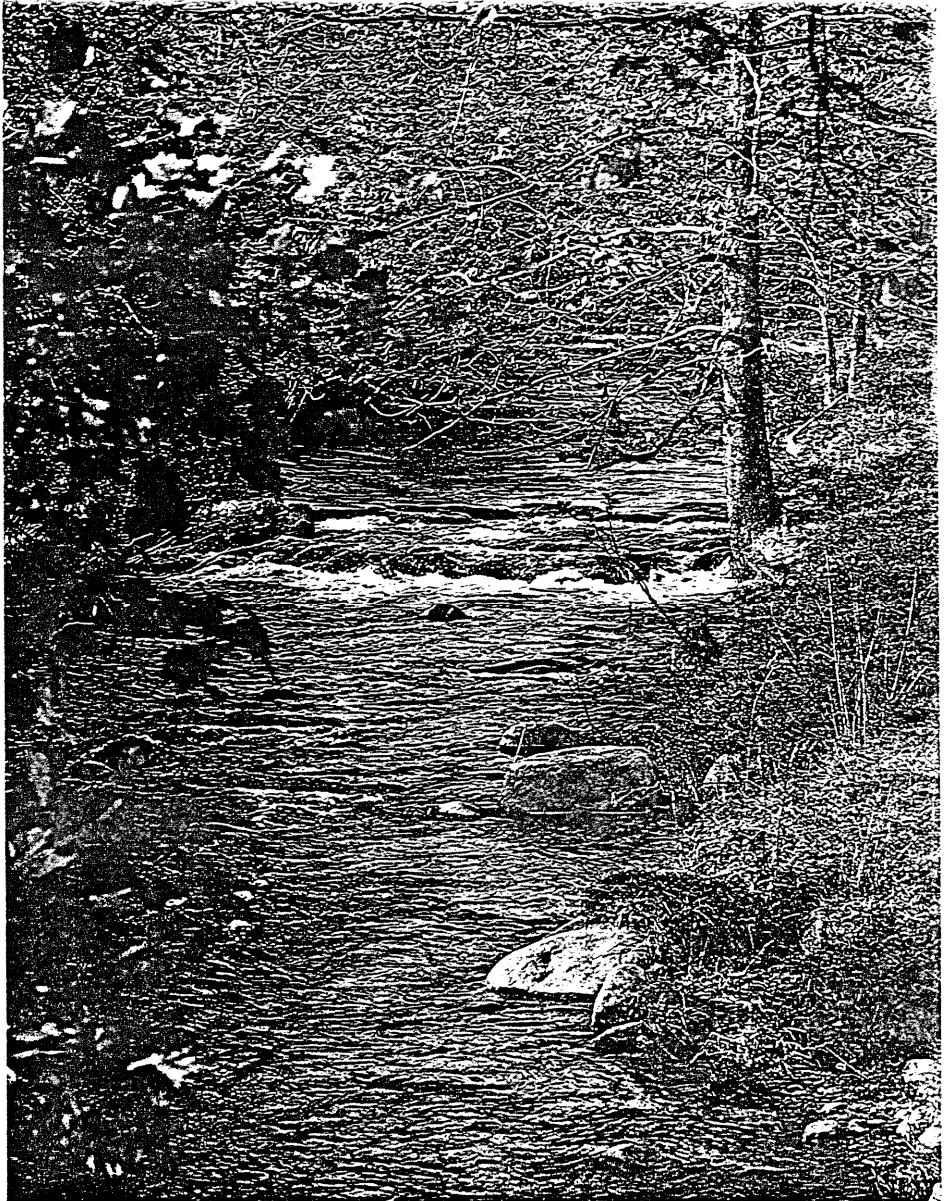
Is ORW classification bad for business? No, says Forrest Westall, regional water-quality supervisor for DEM in Asheville. "I don't think that any project that is proposed would be blocked by ORW or HQW classifications," he says. "What we're asking is, if you're planning on building on an ORW or HQW water, do it so that it has a minimal impact on the water. In the short term there may be delays, but if developers look into it in enough detail, and with enough technical support from their engineers and architects, and if they talk with us, then I do not believe that any project that is proposed would be blocked by an ORW or HQW."

"We're trying to protect the water quality of the stream, not trying to tell people what they can do with their property," he adds.

On the other side of the coin, some say that ORW protections are painfully limited. One reason is that though ORW protections reduce pollution from some sources, they have no effect on others.

Some of these limitations were made frustratingly clear in 1988 by a notorious case in Alleghany County, in western North Carolina, involving a golf club development called Olde Beau. Siltation from construction activities at the development destroyed the trout fishery in one creek, Laurel Branch, and severely damaged the headwaters of Mitchell River, which had been recently designated an ORW. "Here was the Mitchell River declared an ORW and a month later it was pretty severely damaged by the development," says Joe Mickey. "They really didn't have a whole lot of control over that."

"The Olde Beau project typified a situation where a developer could follow the technical requirements of the law and still create a great deal of problems for a river," says Charles Brady of Lenoir, a member of the Environmental Management Commission. The developer could clear land without storm-



water controls on the headwaters of an ORW because the Sedimentation Pollution Control Act (1973) exempted farming, logging or mining operations from the provisions of the act, which requires an erosion-control plan before land can be cleared. The developer claimed a logging exemption, a loophole that has been consistently exploited by developers, especially in the mountains, permitting them to bypass environmental safeguards.

At least partially as a result of public outrage over the degradation of the two waterways, and subsequent litigation, Rep. Marie Colton (D-Buncombe) introduced new legislation during the 1989 session of the General Assembly that has tightened up some of these loopholes. To claim an exemption now, developers and loggers must institute best management forest practices and a modest fine has been established for violations.

But beyond the loophole, Olde Beau pointed out a serious dilemma for the Environmental Management Commission as it sought to provide protections for ORWs.

Named an ORW in 1988, the Mitchell River (seen above before it was heavily silted) was almost immediately affected by sedimentation from construction activity on its headwaters (below). Lack of erosion controls wrecked the trout fishery from one stream, Laurel Branch, and severely damaged the Mitchell River. The notoriety of the case caused state agencies to tighten up laws controlling sedimentation pollution.



"Because the EMC manages water quality and sedimentation is under the Division of Land Quality, the EMC has very little oversight over sedimentation," says Brady. Adds Charles Peterson: "It's a source of frustration when you're on a body like the EMC and you can only manipulate some of the factors leading to pollution."

This flaw in ORW protection was seized upon last summer by coastal developers who

claimed that ORW restrictions unfairly targeted development while ignoring other sources of pollution such as agriculture, forestry and certain kinds of fishing practices. In some coastal waters, agriculture by itself contributes more pollution (sedimentation, pesticides) than any other source but is exempt from many environmental laws. It's a situation that many observers think must be addressed.

"The ORW classification was one way to control one source of degradation, one source of pollution," says Mike Corcoran, executive vice president of the N.C. Wildlife Federation. "But it's very clear now that agriculture and other non-point-source pollution must be dealt with. It's very clear that forestry, both in the timber-growing and the timber-harvesting phases, as well as in the pulp-mill phase, also has a major impact on our water."

Other coastal critics of ORW protection say that restrictions on development are not enough to protect the quality of the water. The seven coastal waters named as ORWs comprise some of the most pristine shellfish habitats left in North Carolina, but the coast is exploding with development, threatening some of them with bacterial contamination from urban and residential runoff, discharges from leaking septic tanks and marinas. "A few years ago, heavy rains didn't affect our shellfish waters that much," says Bob Benton, head of the Shellfish Sanitation Branch, with the Division of Environmental Health. "Today with all the land that's being cleared, ditched, paved and built upon, we're getting more runoff into coastal waters, more pollution and more temporary closures of shellfish waters." Not surprisingly, most closures occur in areas with the greatest population growth.

ORW classification attempts to protect these coastal waters chiefly by limiting the built-upon area to 25 percent of the 575-foot buffer zone adjoining the water. That's too much construction, says Todd Miller, director of the North Carolina Coastal Federation. "The basic flaw in ORW protections here is that they are inadequate to achieve the level of protection that the standards call for," he says. He cites the Pine Knoll Shores community at the eastern end of Bogue Sound, just outside of the ORW portion (Western Bogue Sound), where the state closed the shoreline to shell-fishing because of stormwater runoff. Those were waters that were not far off from being ORW quality, Miller notes, and Pine Knoll Shores is built upon only to a 17-percent density. Miller says that limiting development to 12-15 percent of the buffer zone would do a better job of protecting the waters.

"People and clean water don't really go together," says Miller. "If you put a Wrightsville Beach next to one of these ORWs, you're not going to have clean water any longer. So if

we're serious about protecting these areas, we have to control the density of land use so that the land can soak up the contaminants that people put on them before they reach the water."

These criticisms of the ORW program are hardly quibbles, yet no one doubts that it will go a long way toward meeting the state's goal of identifying and preserving its pristine waters. It's a goal that means a lot to many North Carolinians, for whom a river or creek isn't just a dumping ground but a source of life,

pleasure and quickening memory. Said one man at an ORW public hearing:

"I don't have to have a report or anything else to tell me how clean and beautiful my little river is. I know how much my children and my family have enjoyed it and I hope that in the years to come that I can tell my grandchildren and great-grandchildren that we worked hard to preserve that river for them."

He speaks for many in North Carolina who believe that clean water ought to be a right, not a privilege. ☐

Cream of the Crop

While 25 waters have been listed as ORWs so far, more are being nominated. Anyone can nominate a water body as an Outstanding Resource Water, as long as it meets the criteria for the classification: excellent water quality and at least one special ecological or recreational value. Public hearings are held to debate the designation and the Environmental Management Commission makes the final decision.

The first ORW named, in 1987, was the South Toe River in Yancey County. The last to be named, in April 1990, was Naked Creek, in Richmond and Montgomery counties.

Here is the list of ORWs as of June 1990:

Water Body	River Basin
Stump Sound	Cape Fear
Middle and Topsail sounds	
Masonboro Sound	
Wilson Creek	Carawba
Henry Fork	
Jacob Fork	
Upper Creek	
Steels Creek	
South Toe River	French Broad
Cataloochee Creek	
South Fork Mills River	
Fires Creek	Hiwassee
Gipp Creek	
Chatooga River	Little Tennessee
Nantahala River	
Naked Creek	Lumber River
Neuse — SE Pamlico Sound area	Neuse
Alligator River	Pasquotank
Swanquarter and Juniper Bay area	Hyde
Roosevelt Natural Area	White Oak
Core and Back sounds	
Western Bogue Sound and Bear Island area	
Mitchell River	Yadkin
Elk Creek	
Barnes Creek	

The Zebra Mussel, Dreissena polymorpha, the Unwelcome
Invader From the Ponto-Caspian Region of Western Russia

S.M. Call, Aquatic Biologist, Kentucky Division of Water,
18 Reilly Road, Frankfort, Kentucky 40601

The zebra mussel, Dreissena polymorpha (Pallas, 1771) is potentially the most dangerous exotic to invade North American waters. It appears to be altering food webs; disrupting ecosystem balances; reducing or eliminating desirable native species; degrading both commercial and sport fishing; interfering with navigation, recreational boating, and beach use; and biofouling municipal and industrial water intakes.

Under ideal conditions, one zebra mussel is capable of filtering one liter of water per day. Aquatic biologists believe that portions of Lake Erie may have population densities up to 900,000 mussels per square meter. They estimate that the entire volume of the western basin of Lake Erie is now filtered by Dreissena every four days.

Dreissena is native to the Black, Caspian and Azov seas. In Europe it was introduced into several freshwater ports in the late 1700s, and by the 1830s, Dreissena had spread throughout most of the continent and invaded Great Britain. Introduction into North American waters apparently occurred in late 1985 or early 1986. Cargo ships taking on ballast waters from European freshwater ports were believed to have inadvertently captured and transported Dreissena larvae or juveniles. The first North American records

came from Lake St. Clair and Erie in 1988. Records now exist for all the Great Lakes, the Finger Lakes and Erie Canal in New York, the headwaters of the Ohio River, and one unconfirmed report from Norris Lake in Tennessee. Dreissena has probably entered the Mississippi River from Lake Michigan via the Chicago Diversion Project.

The zebra mussel can grow to a size of 5 cm (2 in.), though the typical size found in the colonies is generally less than half the maximum. It establishes colonies on any solid, non-toxic surface and may reach densities of 100,000 per square meter and up to 15 cm thick. The shell is triangular in shape (varies from slightly obtuse to a right triangle), with an acute umbone and slightly arched valves. The periostracum is typically yellowish to brownish with alternating zig-zag or wavy bands of brown or yellow, especially at the umbonal end. No hinge teeth exist, however, a calcareous shelf, called an apophysis, is found on the inside of each valve at the umbone. The nacre is white to purple or white with purple markings. The mussel generates a tuft of dense, elastic fibers called byssal fibers (threads) from a gland in the foot. These threads protrude through the two valves at the umbonal end and allow Dreissena to establish barnacle-like encrusting colonies. The juveniles are capable of severing these fibers and generating new Buoyant threads which allow them to drift with the current.

Probably the reason that Dreissena is such a successful invader is its high reproductive rate. Though inhabiting freshwater, the zebra mussel has retained the high fecundity

(30,000 to 40,000 eggs per female) of its marine ancestors. Dreissena becomes sexually mature when it reaches about one centimeter in length, which usually occurs in the second year or the end of the first year of life. It lives from three to six years and is capable of producing viable offspring throughout its life. Egg production commences when the water temperature reaches about 12°C (54°F) and continues asynchronously as long as the water temperature remains above 12°C. In the Great Lakes region, reproduction lasts from 6 to 8 months, but as the mussel migrates southward, the reproductive period may increase, possibly becoming continuous in southern latitudes of the United States. Eggs are fertilized outside the shell and remain suspended in the water column. In two to three days, at a temperature of 14°C (57°F) or above, the eggs develop into free swimming larvae called "veligers." Veligers are planktonic, allowing them to be readily dispersed by currents. The veligers remain in the water column from 5 to 18 days (usually 8 to 12). As the veligers increase in size, they become too heavy to remain suspended and settle to the bottom. During the "settling stage", the zebra mussel may experience high mortality (up to 99%) resulting from hypoxia, temperature shock, or failure to locate suitable habitat. After settling, the veligers attach themselves to firm substrates and within three weeks develop into "juveniles" or "post-veligers". Juveniles undergo several anatomical and morphological changes to become adults. Post-veligers may permanently attach to a suitable substrate or may move about by crawling with the aid of their foot, or by floating as previously described.

The zebra mussel feeds primarily on phytoplankton. It is capable of efficiently filtering phytoplankton down to 0.7 microns, but prefers the 15 to 40 micron size range for consumption. While feeding, Dreissena filters out nearly all particulate matter including phyto- and zooplankton, as well as fine allochthonous material. Unconsumed particulate matter is bound up into a mucus mass called pseudofeces and ejected from the mussel's siphons. This process effectively removes all planktonic and allochthonous material from the water column, thus, removing these food sources from the food web.

Dreissena appears to be an indicator of moderate to good water quality, preferring waters that have good dissolved oxygen regimes, are not overly enriched, and have high calcium content. Zebra mussels prefer water temperatures between 20° and 25°C (68-77°F) and current velocities of 0.15 to 0.5 m/sec (1/2 to 1 1/2 ft/sec). Adults can tolerate temperatures ranging from 7° to 32°C (45-90°F) and current velocities up to 2m/sec (6 ft/sec). Adults are typically found at depths of 2 to 7 m (6 to 23 ft) but have been observed as deep as 50 m (164 ft). Juveniles and young adults tend to occupy shallower reaches, while mature individuals are typically found in deeper waters.

The economic impact of zebra mussels to society may be substantial. Cost estimates range as high as four billion dollars to redesign municipal and industrial water intake structures for the Great Lakes region. Currently, Detroit Edison is spending an additional \$500,000 a year in increased maintenance costs to keep their power plants operational. As Dreissena migrates southward,

these costs will escalate.

The potential for the spread zebra mussels into inland waters of the United States is certain. Only areas having extremely soft water or have summer water temperatures that exceed 32°C (90°F) will be immune to the invasion. Within the water column, currents disperse veligers and juveniles, while adults are transported on boat hulls and motors, fish traps, or any number of other items. Veligers and juveniles will also be easily transported in live wells and bait buckets. Waterfowl and other wildlife may disperse Dreissena in wet feathers or fur. Since zebra mussel adults can survive out of the water for several days, possibly up to two weeks in damp environments, the overland transport of Dreissena from the Great Lakes region southward on boat hulls and in boat-motor cooling systems has the potential to occur at an exceedingly rapid rate. We may speculate that the zebra mussel has already spread to most major impoundments in the southeastern United States.

ENDANGERED SPECIES

Numerous endangered species inhabit the streams, rivers, and lakes in the southeastern corner of the United States. This section will periodically provide updates on aquatic endangered species as they appear in the U.S. Fish and Wildlife Service's technical bulletin Endangered Species.

Information for this newsletter was taken from the Endangered Species Vol. XV No. 8, August 1990.

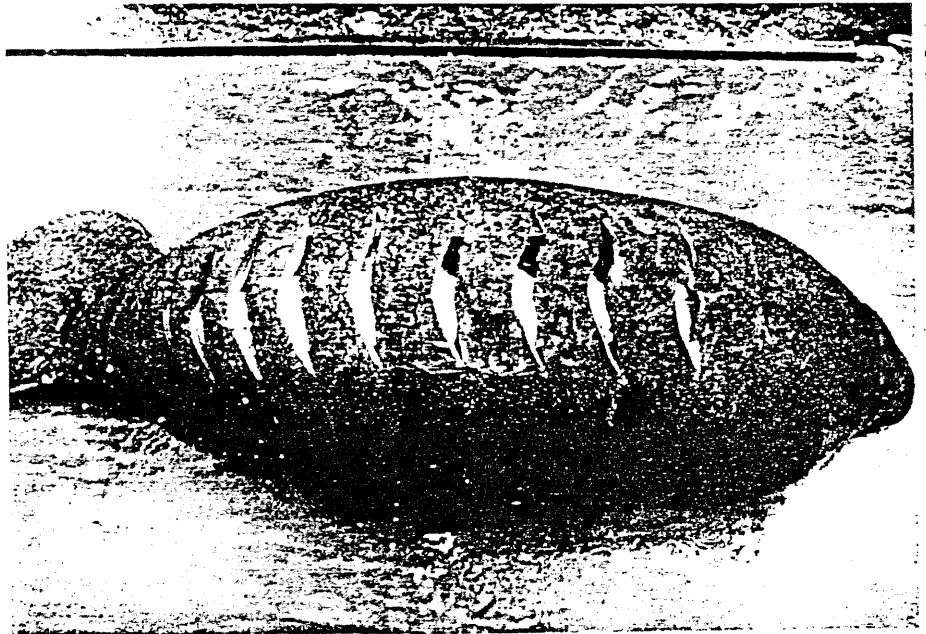
If you have any information regarding endangered species and would like to share it, please feel free to send it to the newsletter editor. Thanks.

Florida Adopts New Manatee Protection Law

Robert O. Turner
Manatee Coordinator
Jacksonville, Florida, Field Office

Boat collisions are the primary human-related cause of manatee (*Trichechus manatus*) injuries and deaths in Florida. Last year, collisions accounted for 51 of the 166 manatee deaths in the State (see BULLETIN Vol. XV, No. 5). Most of the approximately 1,200 remaining manatees in the State's waters have scars from boat collisions. To address the growing problem, the Florida legislature has strengthened the Florida Manatee Sanctuary Act. Many organizations and agencies, including the Save the Manatee Club, the Florida Department of Natural Resources' Division of Marine Resources, and the Fish and Wildlife Service's Jacksonville and Vero Beach, Florida, Field Offices, worked together to help enact the bill. Such legislation was recognized as an important priority in the revised Florida Manatee Recovery Plan.

The new State law expands Florida's authority to protect manatee habitat, adopt rules to protect manatees from harassment, and designate areas as manatee sanctuaries. Navigational signs to prevent collisions with boats can now be placed on State bottomlands without State land leases. Another highlight of the statute is an increase in revenues dedicated to the Save the Manatee Trust Fund. Over \$730,000 will now be earmarked for the fund each year from boat registration revenues—a large increase over the \$250,000 formerly allocated for this purpose. In addition, all of Florida's counties now have the option to increase their own boat registration fees by 50 percent and to use the funds for manatee protection. Previously, only counties with a population of at least 100,000 people were authorized to increase these fees.



...what Florida's new manatee protection law is intended to prevent. Motorboat propeller wounds caused this manatee's death. Most surviving adult manatees in Florida waters carry scars from similar encounters with speeding boaters.

Under the new legislation, local governments are authorized (once they receive State approval) to regulate motor boat speed and operation for manatee protection in waters within their jurisdiction. Also, the Florida Department of Natural Resources is now authorized to establish speed zones around power plant warm-water discharge ponds during any time of the year. Previously, the time limit set for these restrictions was from November 15 to March 31.

The manatee population in Florida has been declining for many years, due in large part to boat collisions. As Florida's human population continues to grow, the number of powerboats will increase along with the potential for manatee injury, mortality, and harassment. It is hoped that Florida's new law will help reverse the decline of the manatee population.

Final Listing Rules Approved for Six Species

During July of 1990, listing rules for six species — five plants and one mussel — were made final. Endangered Species Act protection is now available to the following:

Purple Cat's Paw Pearly Mussel (*Epioblasma (Dysnomia) obliquata obliquata* (= *E. sulcata sulcata*))

This 3- to 4-inch (7.5- to 10.0-centimeter) freshwater mussel has fine, wavy, green rays on its shell. Historically, this subspecies occurred throughout the Ohio River and its large tributaries in Ohio, Indiana, Illinois, Kentucky, Tennessee, and Alabama. The construction of large impoundments on the rivers, however, reduced the mussel's preferred riverine gravel/sand habitat and likely affected the distribution and availability of the mussel's fish host. Today, only two relic, apparently nonreproducing populations exist, one in a reach of the Cumberland River in Tennessee and one in a reach of the Green River in Kentucky. Unless undiscovered reproducing populations exist or methods

can be developed to maintain the known populations, the species will probably soon become extinct. The Green River population is threatened by water pollution from oil and gas activities, by altered stream flows from upstream reservoirs, and by commercial fishing for other mussels. The Cumberland River population is potentially threatened by river channel maintenance, navigation projects, gravel dredging, and incidental commercial take. The Fish and Wildlife Service proposed listing the purple cat's paw pearly mussel as Endangered in the July 27, 1989, *Federal Register* (see BULLETIN Vol. XIV, No. 8), and the final rule was published July 10, 1990.

Tulotoma Snail (*Tulotoma magnifica*)

The only species in its genus, *T. magnifica* can be distinguished from other freshwater snails by its ornamentation and large adult size. Its shell is round, somewhat larger than a golf ball, and typically decorated by spiral lines of knob-like structures. As a gill-breathing, filter-feeding mollusk, it needs free-flowing river habitat that is clean and well-oxygenated.

Historically, the tulotoma snail was known from the main channels of the Alabama and Coosa Rivers and the lower reaches of some large tributaries. These rivers, however, have been extensively altered by dredging and impoundments

for navigation and hydropower. Further, water quality has been degraded by siltation and by the discharge of municipal and industrial wastes. As a result, the tulotoma snail has been extirpated from the Alabama River, and its range in the Coosa River system has declined at least 98 percent in the main channel (and about 50 percent in the tributaries). Believing the species to be in danger of extinction, the Service has proposed to list *T. magnifica* as Endangered (F.R. 7/11/90).

The only tulotoma snail population known to remain in the Coosa River is on a 3-mile (5-kilometer) reach below Jordan Dam. Water quality problems associated with discharges from the dam, including low levels of dissolved oxygen and altered water temperatures, could affect this population. The Federal Energy Regulatory Commission, which is responsible for the periodic relicensing of dams, will be required to evaluate the impacts of Jordan Dam on the tulotoma snail if the species is listed under the Endangered Species Act. Other Federal agencies whose activities could affect the snail include the Environmental Protection Agency and the Army Corps of Engineers.

Yellow-blotched Map Turtle (*Graptemys flavimaculata*)

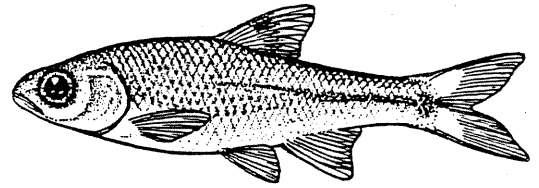
Also known as the yellow-blotched sawback, this medium-sized aquatic turtle is characterized by a shell or carapace with a solid yellow or orange spot in each scute and a ridge of conspicuous dorsal spines. It is endemic to the Pascagoula River system in southeastern Mississippi, including the Leaf and Chickasawhay Rivers and other tributaries. This species faces a number of threats, the most

serious of which are habitat modification and deteriorating water quality. On July 11, 1990, the Service proposed to list *G. flavimaculata* as a Threatened species.

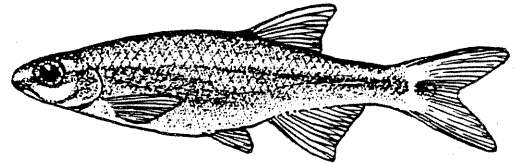
The yellow-blotched map turtle requires riverine habitat with a moderate current, sand or clay substrate, sand bars or beaches for nesting, and snags or other debris for basking and shelter from predators. Navigation and flood control projects have removed basking structures and nesting beaches in order to deepen the channel and promote faster water flows. Dredging river bottoms for gravel also has destroyed nesting sites and increased turbidity, which has led to declines in populations of the snails and insects upon which the turtle feeds. Erosion from certain logging and agricultural practices is contributing to stream sedimentation. Water quality is being degraded even further by municipal effluents, dioxin contamination, releases of brine wastes from oil fields, and the permitted discharges of a variety of chemicals.

The turtle's practice of basking on logs and snags gives it refuge from most predators but makes it vulnerable to humans. Some basking turtles are shot by people who use them for target practice. A more serious threat is posed by the pet trade. This very attractive species of turtle has been advertised for retail sale at \$65.00 each, and knowledgeable commercial collectors can seriously deplete a local population in a short time. Mississippi lists the yellow-blotched map turtle under State law as endangered and prohibits collecting without a permit, but this restriction is difficult to enforce. The impacts from shooting and collecting grow more serious as the species declines.

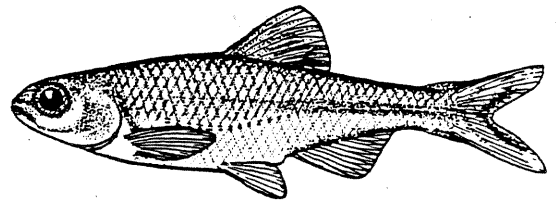
If the yellow-blotched map turtle is listed by the Service as Threatened, Federal agencies will be required to ensure that none of their activities are likely to jeopardize the species' survival. Involved Federal agencies could include the U.S. Army Corps of Engineers through its flood control and navigation projects and the Environmental Protection Agency through the Clean Water Act provisions for pesticide registration, wastewater treatment, and effluent discharge permits.



Notropis zonistius



Notropis signipinnis



Notropis pyrrhomelas

KEY FOR DETERMINING SUBFAMILY, TRIBE, AND GENUS FOR LARVAL STAGES OF THE FAMILY CERATOPOGONIDAE

Translation of Glukhova, V.M. 1979. Larval midges of the subfamilies Palpomyiinae and Ceratopogoninae of the Fauna of the USSR. Nauka Publishers, Leningrad. 230 pp.

Translators: Lawrence J. Hribar, Auburn University, & George C. Steyskal, United States National Museum.

1. Body segments bearing numerous variously shaped processes or long setae. Having fore and hind prolegs. Antennae projecting, displaced to rear third of head. Head hypognathous.
.....SUBFAMILY FORCIPOMYIINAE Lenz 1934.
- 1'. Body segments without processes, only with inconspicuous short hairs. No or only hind proleg. Head hypognathous or prognathous. Antennae short or weakly lengthened, always on front end of body.....2.
2. Body C-shaped. Final segment bearing proleg with hooks. Head hypognathous. Mandibles look like broad plates with 3 coarse teeth. Larva only creeps.
.....SUBFAMILY DASYHELINAE Lenz 1934.....Genus *Dasyhelea* Kieffer 1911.
- 2'. Body straight, no prolegs. On anal segment only setae of varying lengths, rarely with spinose setae. Head prognathous. Mandibles narrow, sabre-like, sometimes with small teeth or two rudimentary teeth at base.....3.
3. Mandibles very long, their length making up about 1/3 length of head.....
.....TRIBE HETEROMYIINI Wirth 1962.....Genus *Clinohalea* Kieffer 1917.
- 3'. Mandibles short, their length at most 1/6 - 1/7 length of head.....4.
4. Larva more often with strongly drawn out head, head ratio more than 2.2. If head less drawn out, then hind edge of ventral side of collar extended as small triangles or hemispheres. On ventral and dorsal sides of anal segment either 4 short setae arranged in rows of 2 - one transverse and perpendicular to forward longitudinal row (Fig. 20b), or only a transverse row of two groups of two approximated setae (Fig. 32, 33), or one longitudinal row of six tufts of numerous fine setae (Fig. 17). Frontal suture often short, rarely moderate. Mandibles always with "blood-gutters." Labrum narrow, projecting, its length to width ratio not exceeding 1:2. Larva usually large or medium.SUBFAMILY PALPOMYIINAE Enderlein 1936.....5.
- 4'. Head short or moderately drawn out, head ratio less than 2.1. Arrangement of setae on anal segment different. Collar on ventral side always without triangular expansions, as a rule, broken on dorsal side, in the manner of two semicircles. Frontal suture more often long (reaching beyond pit k), rarely medium. Mandibles without "blood-gutters," rarely (Genus *Monohelea*) with them, but weakly developed. Labrum short and broad; ratio of its length to width more than 1:2.5. Larva small, rarely medium, swimmer or crawler.....
.....SUBFAMILY CERATOPOGONINAE Newman 1834.....7.
5. Head considerably or strongly drawn out, head ratio as a rule more than 2.2. Small collar on ventral side evenly wide on whole extent. If somewhat protruded in middle, then head very short. Subgenal ratio 1.5 - 1.6. Arrangement of setae on anal segment different (Fig. 28b, 31b, 33b, 39b). Stout setae on anal segment equal to 3/4 or 1/2 length of segment and always

- paired. Frontal suture always medium (not farther than seta q) or short (ending at seta p). Body segments containing accumulations of pigment of different shades of brown, orange, or lilac colors. Larvae swim or creep.....TRIBE PALPOMYIINI Enderlein 1936.....6.
- 5'. Head, as a rule, moderately lengthened, head ratio at most 2.1. Front end noticeably narrowed, subgenal ratio not less than 1.6. Collar on ventral side with distinct triangular or semicircular processes. Setae on anal segment rather short and thin, arranged with a pair of setae behind preceded by two solitary setae (Fig. 18) or elongated row of a few tufts of setae (Fig. 17). Frontal suture medium (as far as seta s). Larva only swims.....TRIBE SPHAEROMIINI Newman 1834.....14.
6. Frontal suture without fail reaches beyond pit r, head long, conical. Even if head shorter, then collar has small triangular projections on ventral side.....Genus *Palpomyia* Meigen 1818.
- 6'. Frontal suture extending only as far as seta p or a little past, but not reaching pit r, head cylindrical or long, conical.....Genus *Bezzia* Kieffer 1899, *Palpomyia lineata* (Meigen 1834).
7. Head very small compared to the thick body. Powerfully developed neck, made up about half the length of the prothorax. Frontal suture drawn out as far as pit k. Setae of anal segment short, slender, inconspicuous, arrangement in one row of equal distance each from the other. Larva crawls, sluggish.....Genus *Serromyia* Meigen 1818.
- 7'. Head large in comparison with body. Neck shorter, not exceeding 1/4, more often 1/6 - 1/8 length of first thoracic segment. Frontal suture long (as far as z) or more brief (as far as q). Setae of anal segment short, medium, or long. Larva a swimmer, sometimes quickly crawling.....8.
8. Antennae relatively long, markedly projecting. Frontal suture drawn out as far as seta s. Anal setae medium or long (0.5 to 0.8 length of anal segment). Labium weakly developed, rounded. Body weakly pigmented in thoracic segments.....9.
- 8'. Antenna projecting, short. Frontal suture either long (reaching as far as pit z), or short (as far as seta q). Ventral suture present or absent.....10.
9. Larva extremely small. Length of head about 150 micrometers; head brief, head ratio 1.6. Ventral suture not long, not reaching seta y.....Genus *Brachypogon* Kieffer 1899.
- 9'. Larva larger. Length of head about 190 micrometers. Head more drawn out, HR not less than 1.8. Ventral suture long, extending almost as far as seta y.....Genus *Isohelea* Kieffer 1917.
10. Body without pigment or with small amount of pigment in the form of accumulations of light greyish-green color on the thoracic segments. Frontal suture drawn out as far as z or as far as t. Anal setae slender, light, short, arrangement on dorsal and ventral sides in one transverse row, equally spaced or slightly drawn together, forming two groups. Larva nonswimming or poorly swimming.....Genus *Stilobezzia* Kieffer 1911.
- 10'. Anal setae long, but if short, then differently arranged. Larva a swift swimmer.....11.
11. Larva without pigment, body milky white or slightly greyish. Anal setae medium or long.....12.

- 11'. Body of larva, at least thoracic segments, pigmented. Anal setae short or very long.....13.
12. Frontal suture long, as far as pit z. Small collar broken on abdominal side, formed of two semicircles. Ventral suture broken when molting. Mandibles without "blood-gutters." Epipharynx with two combs.....Genus *Ceratopogon* Meigen 1803.
- 12'. Frontal suture medium, as far as seta q. Small collar not broken on ventral side. Ventral suture not broken when molting. Mandibles with noticable or weakly developed "blood-gutters". Epipharynx with one comb.....Genus *Monohalea* Kieffer 1913.
13. Larva with very long setae on anal segment (equal to its length). Inner fat body also tinged with greyish color. Setae s and u, in back of o, forming a tuft. Seta u lying above and behind seta v. External layer of fat body greysih-brown.....Genus *Alluaudomyia* Kieffer 1913.
- 13'. Setae on anal segment very short. Inner fat body always unpigmented. All setae single. Seta u above and forward of v.....Genus *Culicoides* Latrielle 1809.
14. Anal segment tapered. On dorsal and ventral sides are arranged a line of six tufts of numerous slender long setae, sitting on large oval bases.....Genus *Jenkinshelea* Macfie 1934.
- 14'. Anal segment rounded or somewhat narrowing on rear end. Altogether up to 4 short single setae on ventral and dorsal sides arranged as 2 setae and 2 pits – transverse behind and longitudinal in front.....15.
15. Thoracic segments of larva with spots of black color. Head bright yellow.....Genus *Nilobezzia* Kieffer 1921.
- 15'. Larval body containing brown masses of pigment.....16.
16. Larva large, body length 16-17 mm, head length over 450 micrometers. Head moderately extended, head ratio at the most 1.8. Triangular expansion of collar on ventral side of head.....Genus *Sphaeromias* Curtis 1829.
- 16'. Larva smaller, head length less than 450 micrometers. Expansion of ventral side of collar rounded.17.
17. Head markedly extended, head ratio more than 2. Front end of head strongly narrowed, subgenal ratio more than 1.8. Labrum long, its length equal to its width, head amber yellow. Thoracic segments with a bright brown design in the form of irregular spots.....Genus *Probezia* Kieffer 1906.
- 17'. Head less drawn out, head ratio less than 2. Anterior of head wider, subgenal ratio not more than 1.7. Labrum shorter, length less than width.....Genus *Mallochohelea* Wirth 1962.

ILLUSTRATIONS ARE TRACINGS OF GLUKHOVA'S ORIGINAL
 FIGURES. TRACINGS ARE UNMODIFIED EXCEPT THAT IN
 SOME INSTANCES ORIENTATION OF SETAE HAS BEEN ALTERED
 TO IMPROVE CLARITY. ONLY THOSE NECESSARY TO
 ACHIEVE GENERIC IDENTIFICATIONS ARE INCLUDED. SEE THE
 ORIGINAL PUBLICATION FOR A MORE COMPLETE SET OF FIGURES.

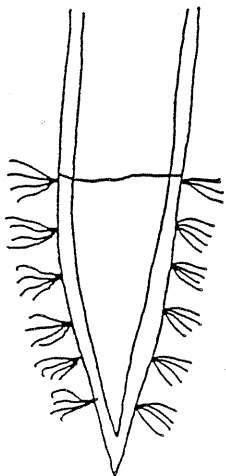


FIG. 17

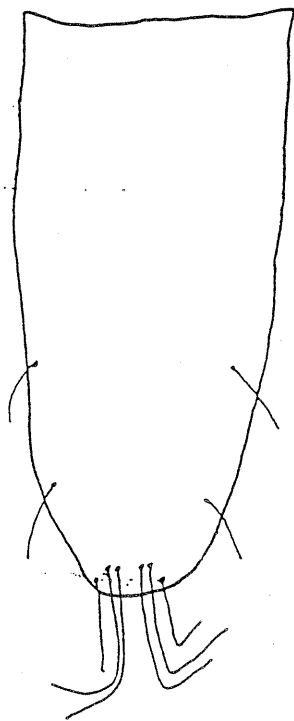


FIG. 32

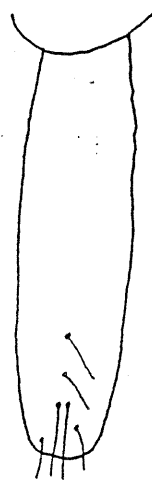


FIG. 18

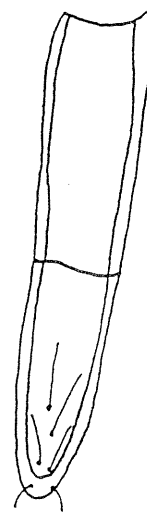


FIG. 20b

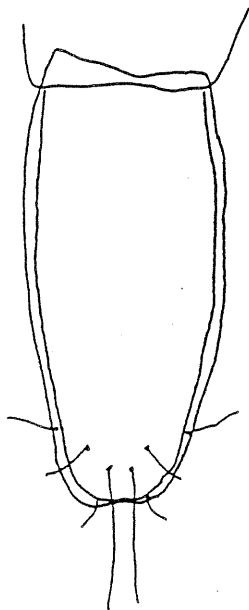


FIG. 28b

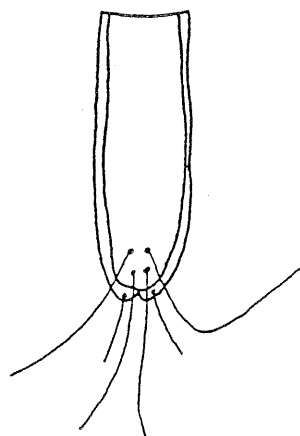


FIG. 31b

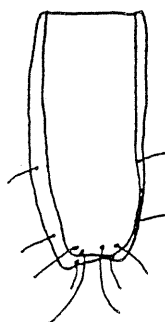


FIG. 33b

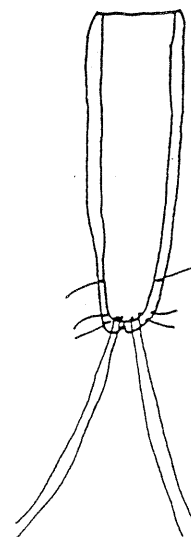
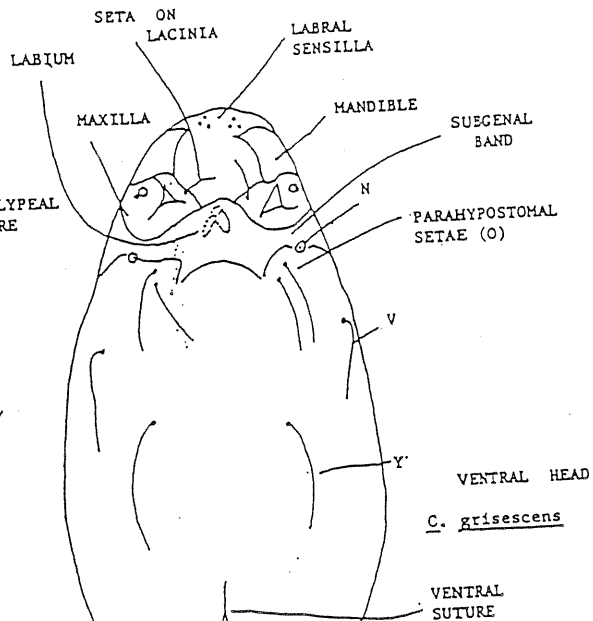
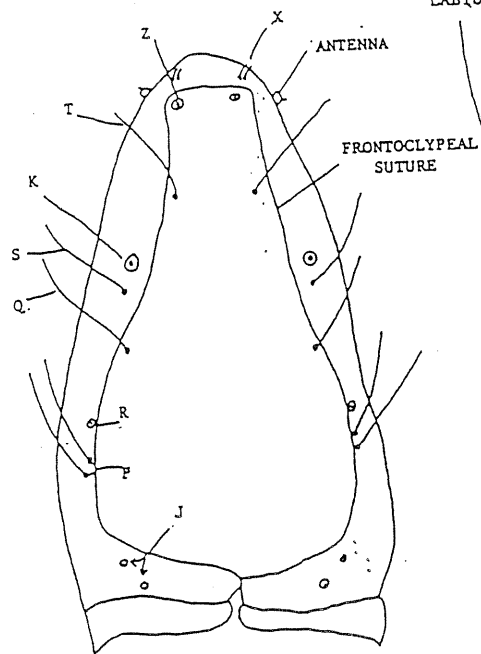


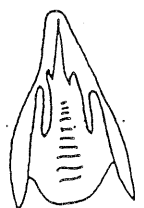
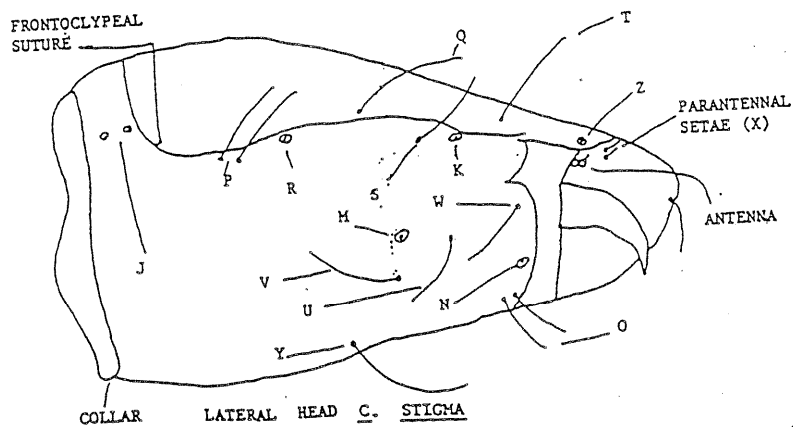
FIG. 39b

DORSAL HEAD

C. stigma



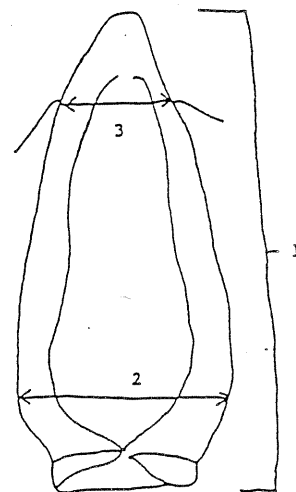
C. grisescens



EPIPHARYNX



HYPOPHARYNX



1/2 = Head Ratio

1/3 = Subgenal Ratio



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Rabbi James Prosnit

And God saw everything that was made, and found it very good. And God said: This is a beautiful world that I have given you. Take good care of it, do not ruin it.

It is said that before the world was created, the Holy One kept creating worlds and destroying them. Finally God created this one, and was satisfied. God said to Adam: "This is the last world I shall make. I place it in your hands; hold it in trust. For if you defile it, there will be no one to set it right for you."

—*Gates of Prayer*

According to the traditional Jewish view, it has been 5,749 years since God created the heavens and earth, the plant life and swarming things, and the animals and human beings. Genesis 1:28 says God blessed the first guardians: "Be fertile and increase, fill the earth and subdue it and have dominion over the fish of the sea and over the fowl of the air and over every living thing that creepeth upon the earth."

As guardians of God's world, we have become careless of our sacred duty. Recall the grotesque images of recent summers: beaches fouled by tides of illegally dumped medical wastes; poisoned fish, gills clogged with slimy oil; hundreds of dolphins dead. Despoiled beaches and putrid water are not the only evidence of our uncontrolled dominion. We have wit-

nessed toxic-waste dumps leaking into groundwater, PCB fires forcing the evacuation of entire cities, and landfills stuffed to capacity. And of course, the litany of environmental woes must include heat, droughts, floods, and fires as the earth heats up.

We have dominated the earth and subdued the fish of the sea, and the results are terrifying. The Genesis text was never meant to be licensed to exploit and abuse nature; rather, it made humanity the custodian of God's earth. "The earth is the Lord's and the fullness thereof" (Psalms 24:1). Our obligation is not only to conserve, but to enhance and enrich the earth as its trustees and caretakers. It is not a commodity belonging to us. This is the basic Jewish ethic of nature. And it is one of the precepts most ignored and hardest to grasp.

An ancient tradition demonstrating that ethic was known as Jubilee. Every seventh year was a sabbatical year, or a year of rest for the land. And every seventh sabbatical year, the *shofar* was blown to announce the commencement of the fiftieth year as *Yovel*, or Jubilee.

That jubilee had three principles: two consecutive years without agricultural activity; the manumission of all slaves; and the return of any landed property sold in the previous forty-nine years to its original owners. The intent of those provisions was made clear in a commentary to Leviticus 25:23. The land was God's property, made available for the use of all people. It was not to be exploited for the enrichment of some to the

detriment of others. If need compelled a person to dispose of a holding, that person could not deed it away in perpetuity for it was not his to sell. Although most biblical scholars feel that the law was never practiced, as it was impractical, it nonetheless stood as a theology of ownership and the earth.

Our obligation is not only to conserve, but to enhance and enrich the earth as its trustees and caretakers. It is not a commodity belonging to us. This is the basic Jewish ethic of nature.

This sacred relationship must be reaffirmed through attitudinal changes. By altering larger paradigms, we can better affect individual behavior. We know we should waste less and conserve more, but unless we as a society begin to see our relationship to the earth in different ways, even doomsday scenarios will not move us to change. A renewed commitment to some basic Jewish values can provide a suitable framework to build on.

First, we are responsible for each other. There is a famous Talmudic story about two men in a rowboat heading toward land. One man

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The Bettmann Archive

Noah leaving the ark. The biblical covenant between God and Noah extended to all living things and to the earth itself. In the context of the creation story, it marked the end of chaos and the beginning of order in nature. Within the Jewish tradition especially, the Noahic covenant is interpreted as requiring human responsibility toward all creation.

suddenly starts to bore a hole in the bottom of the craft. When challenged, he retorts angrily, "This is none of your business. I am boring the hole under my seat!"

The modern equivalent, of course, is more complex. The September 12, 1988 issue of the *New Republic* argued:

One nation's poison is another nation's meat. How do you get a rapidly developing hand-to-mouth na-

tion to give up their first taste of economic security in the name of some distant ecological benefit? Environmentalism is a luxury they feel they can't afford.

But neither is a head-in-the-sand approach. The Jewish view is that the earth is a boat, a vehicle on which we are privileged to ride.

Second, the haves have responsibility for the have-nots. We are required to share what is entrusted to us with those in need. For thou-

sands of years Jews have been required, not just encouraged, to leave the product of the corners of the field and the gleanings of the harvest for the poor and for strangers. Today, *Tzedakah* (charitable actions) directed to Ethiopian victims of famine, survivors of floods in Bangladesh, or New York's hungry and homeless, are our means of redistributing some of God's resources.

The Principle of Bal Taschit

When in your war against a city you have to besiege it a long time in order to capture it, you must not destroy the trees, wielding the ax against them. You may eat of them, but you must not cut them down. Are trees of the field human to withdraw before you into this besieged city? —Deuteronomy 20:19

In this biblical passage, even those fighting for their very existence were prevented from destroying the source of human sustenance, namely fruit-bearing trees. To destroy trees would mean eventual defeat for all, whether the actual battle was won or lost.

Evolving Jewish tradition extended this legislation to include additional environmental regulations such as laws against misuse of water supplies, overgrazing of pastures, and unjustified treatment or killing of animals.

The nineteenth century Rabbi Samson Raphael Hirsch summarized the principle of Bal Taschit (*don't waste*) as follows:

"Do not destroy anything!" is the first and most general call of God, which comes to you, man, when you realize yourself as master of the earth. . . . God's call proclaims to you . . . If you destroy, if you ruin—at that moment you are not a man, you are an animal, and have no right to the things around you. I lent them to you for wise use only; never forget that I lent them to you. As soon as you use them unwisely, be it the greatest or the smallest, you commit treachery against My world, you commit murder and robbery against My property, you sin against Me!" This is what God calls unto you, and with this call does He represent the greatest and smallest against you and grants the smallest, as also the greatest a right against your presumptuousness.



Isaiah in the wilderness.

Third, a little is not insignificant if it is a little good. Good small works can create a consciousness and a community that collectively do a great amount of good. In the words of Rabbi Michael Chernick, "The Jewish way to social justice bids us to let our people and our society know that in a world created by God and inhabited by humanity made in God's image, refraining from littering, the streets is an act of the sanctification of God's name." No act in our world is insignificant when we recognize the presence of God the Creator.

Our tradition teaches that no act of goodness is too small in attempting to repair our society. Although individually we may never complete the great tasks of bettering the world, we are not permitted to desist from participating in those tasks. In other words, *Aseh Tov*. Do some good. Don't just talk and theorize. To quote Mark Twain, "To do good is noble. To tell others to do good is also noble—and a hell of a lot easier." Jewish values are built on deed and action.

Fourth, never despair. Our spirit has enabled us over and over again to find the will and to develop the means to move forward. At the same time, Jewish tradition insists that even as we strive to ensure our own survival, we remember that all life has rights that must be respected. We Jews know better than anyone what can happen when a society chooses to deny warnings because the impending evil is too massive or distant to be understood. We know that the unthinkable can happen. Therefore, we must ally ourselves with those groups and forces in our society that expose problems and try to correct them. We must join in the task of repairing the world.

Repairing the world, or *tikkun olam*, is a Jewish value. We are not only trustees but partners in the ongoing works of creation. Can we resolve to do our small part? To conserve, safeguard, and ensure the sacred continuation of all life, and make certain the miracle continues? □

ALABAMA

SEASON'S GREETINGS from our office to yours.

The time of the year has arrived when field work has nearly come to a halt and the bugs have begun their yearly call to be identified. Of course the dedicated biologists here have answered the call and have begun the arduous task of seeking the names for one and all. This process will probably be completed in mid-January. Vickie and Brien completed approximately 65 macroinvertebrate Bioassessments during 1990. This was our first season using a form of the Rapid Bioassessment technique completed on 30 stations around the state. The remaining assessments utilized modified Hester-Dendy plate samplers. We have been quite pleased with the speed at which these samples have been processed for identification. This is due in a large part to the efforts of our Laboratory Technician, Gerrie Sanders and our Cooperative Education Student, Janet Glenn. We are especially anxious to analyze the data we have collected from the Rapid Bioassessments and to evaluate the large array of metrics available. We also will be examining the methods to determine if there are any improvements or modifications that can be made to increase our efficiency without sacrificing accuracy. In the near future we hope to begin testing of our new main frame macroinvertebrate program that we anticipate will greatly increase the speed and accuracy of biometric calculations and report generation.

Fish collections have nearly been completed for this year. Tissue will be analyzed for lead, mercury, dioxin, PCBs and pesticides. Largemouth bass and a bottom feeder were obtained from stations on the Conecuh River in Southcentral Alabama, the Mobile, Tensaw and Tombigbee Rivers in Southwestern Alabama, and from Weiss, Neely Henry and Logan Martin reservoirs on the Coosa River in Eastern Alabama.

With the impending move in the new year, the Toxics Unit has been busy with their commitment list for fiscal year 91. The toxics staff has performed tests on 12 facilities for acute toxicity and 2 facilities for chronic toxicity using fathead minnows and Ceriodaphnia dubia as test species. The results of the tests are relayed to the proper engineer in the Water division for review. The Toxics staff anticipate reviewing toxicity tests performed for coalbed methane permits within the next year. Toxicity testing requirements were incorporated into new permits starting in June 1990, and old permits up for renewal will have toxicity testing requirements added within the next year.

ADEM is participating in a multi-agency cooperative effort between the states of Georgia and Alabama to study the water quality of West Point Lake and its tributaries. West Point Lake is located on the Chattahoochee River on the border between Georgia and Alabama. The Task force that has been created will fill the need to coordinate study plans and make effective use of the study results to assist in resolving the lake water quality problems. More data are specifically needed to determine the impacts of increasingly stringent water quality control measures currently being implemented upstream. If these controls are inadequate, new data will help determine what additional pollution control measures are needed. Both Alabama and Georgia have been awarded Phase I Clean Lakes Grants to assist in this effort.

Bob Cooner (Field Operations) and James "Mac" McIndoe (Water Division) will be attending the EPA sponsored "Water Quality Standards for the 21st Century" meeting followed by the "Biological Criteria: Research and Regulation" held in Arlington, Virginia, December 10-13, 1990. "Mac" is Chief of the Water Quality Branch of the Water Division, which is responsible for review and recommendations related to water quality standards. Since our next triennial review is about two years away, we are glad that "Mac" will be able to attend the symposium. This will further familiarize him with the recent advances of "Biocriteria" and the experiences of other states that have adopted them as part of their water quality standards.

Field Operations IS moving. (We just aren't sure when.) Preparations are underway to ready the buildings for occupation. It will be a truly unique experience to have an office and laboratory with windows. The Department of Corrections has been contracted to do the repair, cleaning and painting of the new facilities. Whenever they are complete (probably early 1991) we will begin the task of dismantling our laboratories and reassembling them in the new location. We have hopes that this process will be completed before our 1991 sampling frenzy begins.

MERRY CHRISTMAS AND A VERY HAPPY NEW YEAR!!!!

FLORIDA

Big news will be announced at the end of this boring diseration on the status of biology in Florida (Don't peek!).

Biology is not quite dead in Florida. Many of us are still feeling pretty blue, but there are a few rays of hope for biology that we'd like to share.

First, the "Point Source Program", which basically involves a fairly thorough upstream-downstream type of biological assessment prior to permit renewal, is a reality. The "assessment" involves a habitat assessment and several measures of macroinvertebrate and periphyton condition and several water quality parameters including algal assay. The short and sweet reports include an assessment of these results as well as information on the facility's operation. The reports also have a "bottom-line" impact assessment - sort of a small, medium, large thing - which adds a potency factor.

Personnel-wise, most of the operation is run out of the Tallahassee Biology Lab, (which, by-the-way, is gearing up with a beautiful new lab and new staff!). The district biologists that were transferred from the ex-Technical Assistance section to the Division of Facilities are making the field collections and assessments and sre identifying what they can and shipping the rest.

Anyway, it's an established program now that involves biological assessment, and that's a good start. For more information or copies of the report, contact Russ Frydenborg (909/487-2245). Russ will also be attending the Biocriteria conference in the DC area. Hope he sees some of you there.

Second, Florida has finalized major contracts with Mike "Rapid Bioassessment" Barbour's group and EPA, Corvalis "Ecoregion" czars Bob Hughes and Jim Omernik. Hopefully, these contracts to develop Florida-specific bioassessment protocols and ecoregion/ecotype/reference sites will be strongly interactive with a wide range of DER staff, particularly the district biologists in the Division of Water Management. Through the contracts we hope to maintain focus on biological assessment and biocriteria for the next few years.

As for other general news, we have a new Govenor and all indications are that DER will have new management. No one knows what that will bring or what priorities will be stressed. There seems, now, to be a vague wave of understanding at the upper management level that ambient monitoring needs more attention (especially since district reorganization). Hopefully, the new managers will come in

with this recognition and act with zeal. Finally, the really big news: Tom Savage got married! We wish him the best of luck and happiness.

KENTUCKY

This could be a pretty wet Christmas for many Kentuckians. Early this week the state experienced a major precipitation event (up to 5in of rain fell in some areas). Needless to say, flooding occurred in most river basins. This weekend it is expected to rain again (hopefully not as heavily).

In this news release, I'll try to hit the high points of the year 1990. Here goes.

Ambient biological monitoring - fourteen stations were sampled; ID work is currently being conducted; we assisted ORSANCO with Ohio River lock chamber fish sampling

Intensive surveys - intensive surveys were conducted in the Little Sandy River, Eagle Creek, and South Elkhorn Creek basins; reports were finalized for the South Fork Red River and Millers Creek surveys

Wetlands - Advanced Wetland Identification was conducted this year in four counties in the Western Kentucky Coalfield; 90% of the field work has been completed; wetland criteria is in draft (criteria were developed by Bruce Pruitt, Bill Anslie (EPA) and Jeff Grubbs (KDOW)); discussion has continued regarding the mining of a large wetland area in Hopkins County; work to determine future of wetlands in Jefferson County (Louisville) in regard to county development has continued

Bioassay - see following attachment

Recreational use assessment - microbiological investigations were conducted in the North Fork Kentucky River and South Fork Licking River basins; as a result of findings from the North Fork study, 160 stream miles were posted for a primary use advisory (swim at your own risk!); municipal dischargers were the prime contributor to pollution in the North Fork, with straight pipe discharges second in importance

Kentucky Rivers Assessment - a draft has been completed and sent to reviewers; beginning to see the light at the end of the tunnel!

Personnel - several items on this front

Al Westerman is no longer with the Ecological Support Section, he now is a section supervisor with the Technical Services Branch

John Brumley will be joining the Ecological Support Section to assist Lythia with scum and reference reach work

Scott Hankla has joined the Standards and Specifications Section; he is continuing work on the rivers assessment

Charlie Roth was established as the supervisor of the Bioassay Section

As this year closes, we wish all members of SWPBA a Merry Christmas and Happy New Year!!!!

The Bioassay Section tested 35 facilities this past year. Following is a list of these facilities, water tested (final -FE- or prechlorinated final -PC- effluent), county, and LC50 estimates for each species. All testing was done in our new mobile laboratory which works much better than the living room of state park cabins. We are moving up in the world.

FACILITY	EFFLUENT	COUNTY	<u>C. dubia</u>	<u>P. promelas</u>
Lexington Town Br	PC	Fayette	58.9	>100
Hickman STP	PC	Jessamine	>100	>100
Midway	PC	Woodford	>100	>100
Blue Sky	FE	Fayette	59.5	47.1
Nicholasville	FE	Jessamine	>100	>100
Wilmore	FE	Jessamine	>100	>100
Berea	FE	Madison		>100
Tates Creek Richmond	FE	Madison	0*	>100
Dreaming Creek	PC	Madison	0*	>100
Elkhorn City	PC	Pike	>100	>100
Jenkins	PC	Letcher	>100	>100
Prestonsburg	PC	Floyd	69.2	>100
Pikeville	PC	Pike	>100	71.1
Paintsville	PC	Johnson	64	>100
Fleming-Neon	FE	Letcher	35.28	26.23
Hazard	FE	Perry	27.5	8.9
Whitesburg	PC	Letcher	>100	75.8
Hindman	PC	Knott	>100	9.0
Barbourville	FE	Knox	>100	>100
Middlesboro	FE	Bell	>100	>100
Corbin	PC	Laurel	>100	>100
Williamsburg	FE	Whitley	>100	>100
Pineville	PC	Bell	>100	>100
Harrodsburg	FE	Mercer		>100
Danville	PC	Boyle		>100
Ky Utilities Brown	Fly Ash	Mercer		>100
Stanford	FE	Lincoln		>100
Lancaster	FE	Garrard		>100
Auburn	FE	Logan	>100	>100
Scottsville	PC	Allen	>100	>100
Glasgow #2	PC	Barren	>100	59
Bowling Green	PC	Warren	38.7	91.7
Franklin	PC	Simpson	>100	>100
Caveland-Horse Cave	FE	Hart	>100	>100

Most facilities tested at the end of the pipe were dechlorinated by the facility prior to release. One disinfected with UV. The "*" denotes 0% survival in 100% effluent (we had a shortage of C. dubia that round).

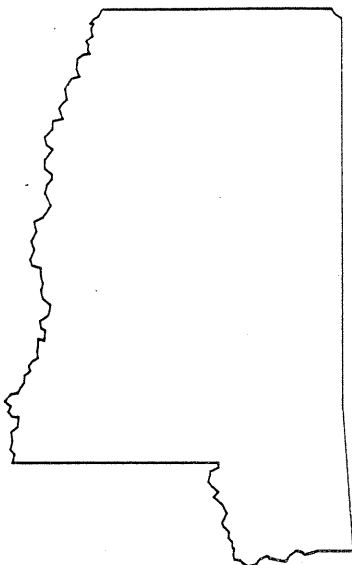
Most of the facilities tested would qualify for chronic permit limits, however our personpower has been limited so we have not done chronic testing in the past. We are planning to run some chronic tests next summer, once things settle some and we begin producing on ample supply of organisms in our new culture facility.

Since our testing season ended we have officially become the

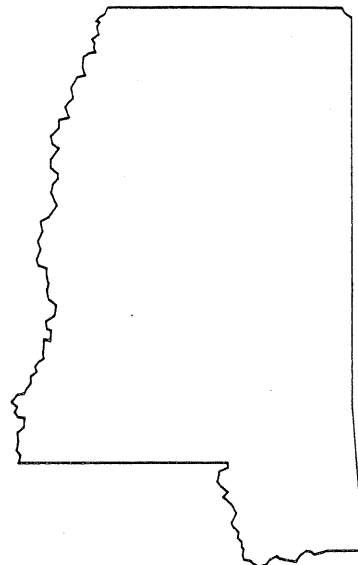
Bioassay Section (BS) with Charles Roth as our new supervisor. Al Westerman is no longer in our branch; he was named supervisor of a newly created Risk Assessment section in the Div. of Environmental Services. Currently, Lee Colten and Susan Cohn round out the BS section and we have a position yet to be filled.

We have finally started culturing our own fathead minnows and daphnids. Our productivity still leaves a lot to be desired, but we are at least able to separate the males from the females now that they have matured enough to exhibit characteristic markings. Susan may be calling on some of you for advice with the culturing.

Lee is computer tracking the monthly/quarterly self-monitoring reports that we are constantly reviewing. This is making it much easier to find all the holes in reporting. If anyone is interested in discussing the tracking system, Lee will be happy to talk with you about it.



MISSISSIPPI



THE END OF AMBIENT BIOMONITORING 1990

The 1990 Ambient Biomonitoring season was a good one for us here in Mississippi. Where we had rain and swollen waters in '89, we had none this year. Where the water was turbid last year it was clear at some sites this year. We were able to see many of our stations at really low flow and get a better idea as to what habitats and substrates were really there. The lack of precipitation also did much to help us stay on schedule, and only one site had to be missed this year due to the intrusion of emergency situations. Although we're not yet dancing in the streets or any such thing, one of our historically bad sites showed indications of improvement this year. It was a surprisingly slow year for fish kills, and although many hot, overcast days provided us with prime fish kill conditions, only about 6 occurred all season long. Many of these have been discussed in previous issues of the newsletter.

Lab biologists recently completed the 1990 ambient biomonitoring program. Over 40 sites were sampled for fish tissue analysis, and 90 sites were assessed using macroinvertebrates. Additionally, six estuarine sites along the Mississippi Gulf coast were monitored using fish and periphytometers. We are encouraged that our program is expanding and that we have been able to include many new sites into our macroinvertebrate biomonitoring network. This year alone 20 sites in north Mississippi were assessed for the first time in hopes of finding some reference sites. Also near the end of the ambient monitoring window, several other estuarine sites were visited and next year some of these will be monitored using fish tissue analysis and periphytometers.

Our attempt to locate reference sites was in its second year of screening, and we are grateful to our chemistry section for

the nutrient analyses that they did on our behalf at those sites which had passed last year's screening criteria as potential reference sites.

Now, of course, it is time to pay our dues for all those nice summer days in and along Mississippi's streams and work up all of the information we collected. Hopefully, some of our candidate reference sites will meet more stringent criteria, and a few macroinvertebrate state records will be verified.

THE LAST FISH KILL OF 1990?

Well, we're not sure yet, but we definitely hope so. This kill occurred in west-central Mississippi and was investigated by Skeeter Peeter:

Bayou Pierre Fish Kill Is Under Investigation

From Staff Reports

A large fish kill in Bayou Pierre about one-half mile upstream from where the bayou flows into the Mississippi River was being investigated today by state and federal officials.

The kill was reported to Terry Miles, game warden in Claiborne County.

At least 2,000 dead fish were reported at the site on Bayou Pierre, which flows east to west through Claiborne County. The site can be reached only by boat.

Water samples will be taken to determine the cause.

The phenomenon is not unusual in

periods of extreme heat when oxygen levels are depleted in streams. However, last week's rains and cooler temperatures make a heat-related kill seem unlikely.

"Pollution is more likely to be a possibility whenever the water is moving," said Fred Nazary, of the State Bureau of Fisheries and Wildlife. "Oxygen depletion caused by hot weather is more of a problem in stagnant water such as a pond."

Other possible causes include runoff of agricultural chemicals.

One report from the scene indicated the dead fish were bass, perch, bream and buffalo.

Cause Of Fish Kill Undetermined

From Staff Reports

Authorities with the state Bureau of Pollution Control have been unable to determine the cause of a fishkill that occurred in Claiborne County's Bayou Pierre sometime Sunday.

"Most of the fish had decomposed and sunk to the bottom and we have to have fresh dead fish to determine a cause of death," said Billy Justus, an environmental scientist with the bureau. "We were able to gather only a small amount of information because it wasn't reported to us until Monday."

Justus said this lack of data also prevented his department from saying if other fish in the bayou were safe to eat.

The fishkill occurred about one-half mile upstream from where Bayou Pierre flows into the Mississippi

River. The kill was reported to Terry Miles, game warden in Claiborne County.

At least 2,000 dead fish, including bass, perch, bream and buffalo, were reported on the site. State officials at that time said since the bayou contained moving water they suspected some type of pollution rather than hot weather which often depletes water oxygen levels and can cause a fish kill.

"We were unable to determine if a toxin caused this kill," Justus said. "But I will say 2,000 fish don't die quickly in one place for no apparent reason."

Bureau of Pollution Control scientists were at Bayou Pierre most of Monday collecting samples and questioning local residents.

Justus said anyone spotting a fish kill on public waters should call his department at 961-5183 or 961-5184 as soon as possible.

THE LEAF RIVER DIOXIN ISSUE

OR

HOW MANY MORE MILES OF RIVER WILL BE CLOSED TO FISHING?

We have been inundated since the last newsletter by much public concern about the dioxin levels in the Leaf, Escatawpa, and Pascagoula Rivers. Additional studies have been undertaken by our lab, court cases have been heard, and additional river miles have been closed to commercial and recreational fishing. The following series of clippings is a smattering of what has been going on lately:

Trouble Expected In Finding A Jury For Pollution Case

LEAKESVILLE, Miss. (AP) — A Gautier resident was scheduled to go to court today in a \$102 million pollution lawsuit against a paper company, but some officials predict it might be difficult to find a jury.

Wesley N. Simmons has accused Leaf River Forest Products, a pulp mill operating in New Augusta since 1984, of failing to warn the public of possible dioxin contamination from plant discharges into the river.

Attorneys may run into some snags seating a 12-person jury from the pool of 73 Greene County voters called for duty. Since Simmons filed his suit in January, 10 similar suits, with more than 400 plaintiffs, have been filed in nearby George and Jackson counties.

Circuit Judge Darwin Maples called prospective jurors together late last week to distribute a list of plaintiffs in the other cases. He told them to review the list during the weekend to determine if they were related or otherwise familiar with the people suing the company.

Simmons' suit claims either Leaf River Forest Products or its former parent company, Great Northern Nekoosa Corp., operated the plant negligently, resulting in contamination of the fish and discharge of a dark and foul-smelling effluent which changes the river's color.

Great Northern Nekoosa Corp., which has headquarters in Mil-

linocket, Maine, was taken over by Georgia-Pacific Corp. this past spring.

A particular dioxin, one of a group of 75 chemical compounds that have been found to cause cancer in animals, is produced in the chlorine bleaching process that makes paper white. Its health threat to humans has not been proven, and some studies have suggested the dioxin's cancer-potency factors were significantly overstated.

On Oct. 5, the state Department of Environmental Quality closed the Leaf River below the pulp mill to commercial fishing because of dioxin levels that continue to be found in bottom-feeding catfish. The Pascagoula River, which stems from the Leaf, and the Escatawpa River, where International Paper Co. has a mill, also were closed to commercial fishing.

Georgia-Pacific has spent \$10 million since 1988 to reduce its dioxin levels by 98.1 percent, company spokesmen have said.

Maples issued a verbal gag order on those involved in the case. Jury selection is scheduled to begin at 9 a.m. in the Greene County Courthouse in Leakesville.

Simmons is asking \$2 million in compensatory damages and \$100 million in punitive damages.

Testimony Continues In Leaf River Trial

By The Associated Press

LEAKESVILLE — Jurors on Tuesday were shown photographs and aerial videotape footage of a jet black Leaf River as attorneys for plaintiff Wesley Simmons began to argue their pollution case against Georgia-Pacific paper company.

The nine-woman, three-man jury is hearing testimony to try to decide whether Georgia-Pacific should pay damages to Simmons, who owns property on the dioxin-polluted Leaf River.

Attorneys said the pictures, taken a month ago, illustrate the damage done to the river by the discharge of dioxins from the company's Leaf River Forest Products pulp mill near New Augusta.

However, attorneys for Georgia-Pacific said color was not a clear indication of pollution and that the mill has met all state requirements concerning color of its effluent.

Simmons, a retired commercial fisherman, is suing Georgia-Pacific for releasing dioxins into the river, which borders property that he owns. He wants the firm to pay \$100 million in punitive damages and \$2 million in compensatory damages.

Also Tuesday, John Deakle, attorney for the plaintiff, showed jurors a 1985 company memorandum that suggested officials knew about dioxin being discharged at a pulp mill in Maine.

The presence of dioxin in the Leaf River was not known by the general public until the federal Environmental Protection Agency released the information last year.

None of the testimony given Tuesday was directly related to Simmons.

Testimony continues today and is expected to last 2½ weeks.

Biologists: Wildlife Unharmmed By Dioxins

LEAKESVILLE, Miss. (AP) — Wildlife along the Leaf River has not suffered because of Georgia-Pacific's Leaf River Pulp Operations mill, a biologist who works part-time for the company said Wednesday.

University of Southern Mississippi biology professor Fred Howell said the river habitat is healthy and thriving. He also testified the river wasn't unusually dark, as attorneys for plaintiff Wesley Simmons claim.

"The river certainly is not dead or dying. The tests we've done show the biology's in good health," said Howell, who has worked for the mill as a consultant since 1983.

An earlier witness, wastewater treatment engineer William H. Malloy, rejected plaintiff attorney John Deakle's description of the river as "black as tar." Regardless of the exact shade, Malloy said, the color of the river poses no health risks.

"There is no health problem," said Malloy. "It's a matter of aesthetics."

Simmons, who built his Greene County home on the river three years ago, is suing the corporation for \$102 million. Simmons claims he is afraid of getting cancer from eating catfish

caught in the dioxin-contaminated river and that the pollution has diminished the value of his property.

During Howell's testimony, attorneys for Georgia-Pacific presented a group of photographs — taken some 40 miles upriver from the mill — that showed sandbars that appeared reddish-brown.

Lawyers for the plaintiff have argued that such discoloration is caused by the mill's wastewater effluent. Howell said the change in color is the result of iron oxide being drawn from the ground by receding waters.

Simmons' lawsuit says he is worried about the effects of dioxins, chemical compounds which were an unintentional byproduct of the mill's bleaching process.

Though studies have shown that exposure to dioxins has caused cancer in some animals, its effect on people is being debated.

Throughout the trial, Deakle has accused the company of "polluting for profit" without concern for possible health hazards.

Two defense witnesses besides Howell denied the claim Wednesday.

Leaf River Suit Should Have Major Ramifications

LEAKESVILLE, Miss. (AP) — Wesley Simmons' case against Georgia-Pacific was closely watched by attorneys, environmentalists and business people because it was the first in the area where an individual sued over the threat of pollution, observers say.

Simmons, a native of Gautier, filed suit against Georgia-Pacific, charging that the Leaf River had been spoiled by wastewater from the company's Leaf River Pulp Operations mill, near New Augusta in Perry County.

In his plight, Simmons was compared by some observers as the biblical David going up

against Goliath.

A victory by Simmons was expected by officials to open the door to many other suits against other mills in the area.

"The case was very significant, but not as significant as some hoped it would be, because there's never been a case where a landowner successfully sued because of exposure to dioxin," said Shelly Stewart, director of pulp and paper industry concerns for the environmental organization Greenpeace.

Simmons claimed he was afraid of developing cancer because he ate catfish from the

river. Jurors decided against him on that point but awarded him \$40,700 for loss of property value. Georgia-Pacific also was ordered to pay \$1 million in punitive damages.

"It's still making waves in the legal community," Stewart said. Suits claiming devaluation of property because of pollution will likely surface all over the country, which has 104 bleach-kraft pulp mills.

Attorneys for Simmons said they've talked to 3,200 potential plaintiffs in Perry, George, Greene and Jackson counties in southeast Mississippi.

The audience at the 12-day Leaksville trial was a diverse mix. There were attorneys from other pulp mills, a few officials from the Georgia-Pacific headquarters in Atlanta and handful of retired and unemployed area residents, including some former commercial fishermen. All were keenly interested in the outcome.

"This gives us great hope," Jerry Wicks said about a half-hour after the verdict was announced. Wicks, 64, and his wife, Nancy, watched the entire trial. They live on the Pascagoula River and have a similar suit pending

Jury awards Benndale man \$1M in Leaf River dioxin suit

■ Georgia-Pacific plans to appeal the case to the state Supreme Court.

By Susie Spence
Clarion-Ledger Gulf Coast Bureau

LEAKESVILLE — Jurors on Tuesday awarded \$1.047 million to a man who claimed Georgia-Pacific contaminated Leaf River with potentially cancer-causing chemicals.

"God created that river for all of us and

that's the way it should be," a tearful Wesley Simmons of Benndale said after the verdict. "I think the jury has spoken for the truth. I'm going to go home and get a good night's sleep."

The verdict may have far-reaching effects, said Circuit Court Judge Darwin M. Maples of Lucedale, who presided over the 12-day trial.

"It'll set a precedent as to what the average person is thinking about the cases," Maples said. "I hope the river is not damaged to the extent people think it is because it plays

a vital role in the lives of the people of south Mississippi."

Simmons, 57, was among about 3,000 south Mississippians suing or planning to sue Georgia-Pacific Pulp Operations, charging it contaminated the Leaf and Pascagoula rivers with dioxin.

Georgia-Pacific will appeal to the Mississippi Supreme Court, said company attorney Lee Davis Thames of Jackson. "We think there are a lot of things the Mississippi Supreme Court could review," Thames said.

John Deakle, Simmons' Hattiesburg attorney, said he believes the Greene County case is the first in the nation against a bleached-kraft pulp mill to come before a jury.

"It's a benchmark case," Deakle said. "It will have ramifications throughout the United States ... There's no telling how many tens of millions of tons of bleached kraft pulp is produced in the U.S. and it all creates dioxin."

The bleaching is what makes paper white. The New Augusta mill is one of 104

such pulp mills in the country.

Simmons, who built his Greene County home on the Leaf River about three years ago, claimed chemicals dumped into the river devalued his property. Simmons also claimed he suffered by worrying he would develop cancer from exposure to the river and eating fish from it.

The nine-woman, three-man jury began deliberations about 12:30 p.m. and returned with a verdict shortly before 5 p.m. The suit sought \$102 million.

See LEAF, 5A

Jury foreman Morrison Pierce of George County said jurors voted unanimously against awarding damages to Simmons for emotional stress.

The jury voted 10 to 2 in favor of awarding Simmons \$1 million in punitive damages, the foreman said. "It was very tough and we're really tired," Pierce said.

The jury also gave Simmons \$20,700 for loss of property value and \$20,000 for trespassing. Simmons maintained floodwaters from the river, polluted by the company, had encroached on his land.

Several multimillion-dollar suits have been filed in the 19th Circuit Court District against the mill. All make similar claims that the mill polluted the water and fish, endangering human health and lowering riverfront property value.

Deakle said he has filed civil claims for about 700 people and plans to file another 1,800 to 2,000 in coming months.

He said two other people, Jack

and Hilda Long of Benndale, will have their case heard in George County Circuit Court in January.

"We're glad the first step is over," said Hilda Long, 47. "We're worried about what the river could do to our grandchildren, and we're just holding on to what we've got right now."

Nancy Wicks and her husband, Jerry, also plan to sue. The couple lives in Jackson County along the Pascagoula River, almost 60 miles down river from the plant.

"We feel real good after this," Nancy Wicks said. "This is a giant step."

The Environmental Protection Agency has warned against eating fish from the Leaf and Pascagoula rivers south of the mill. Warning signs have been posted along the river banks and last week a sign was posted on the sand bar in front of Simmons' camp.

■
The Associated Press contributed to this report.

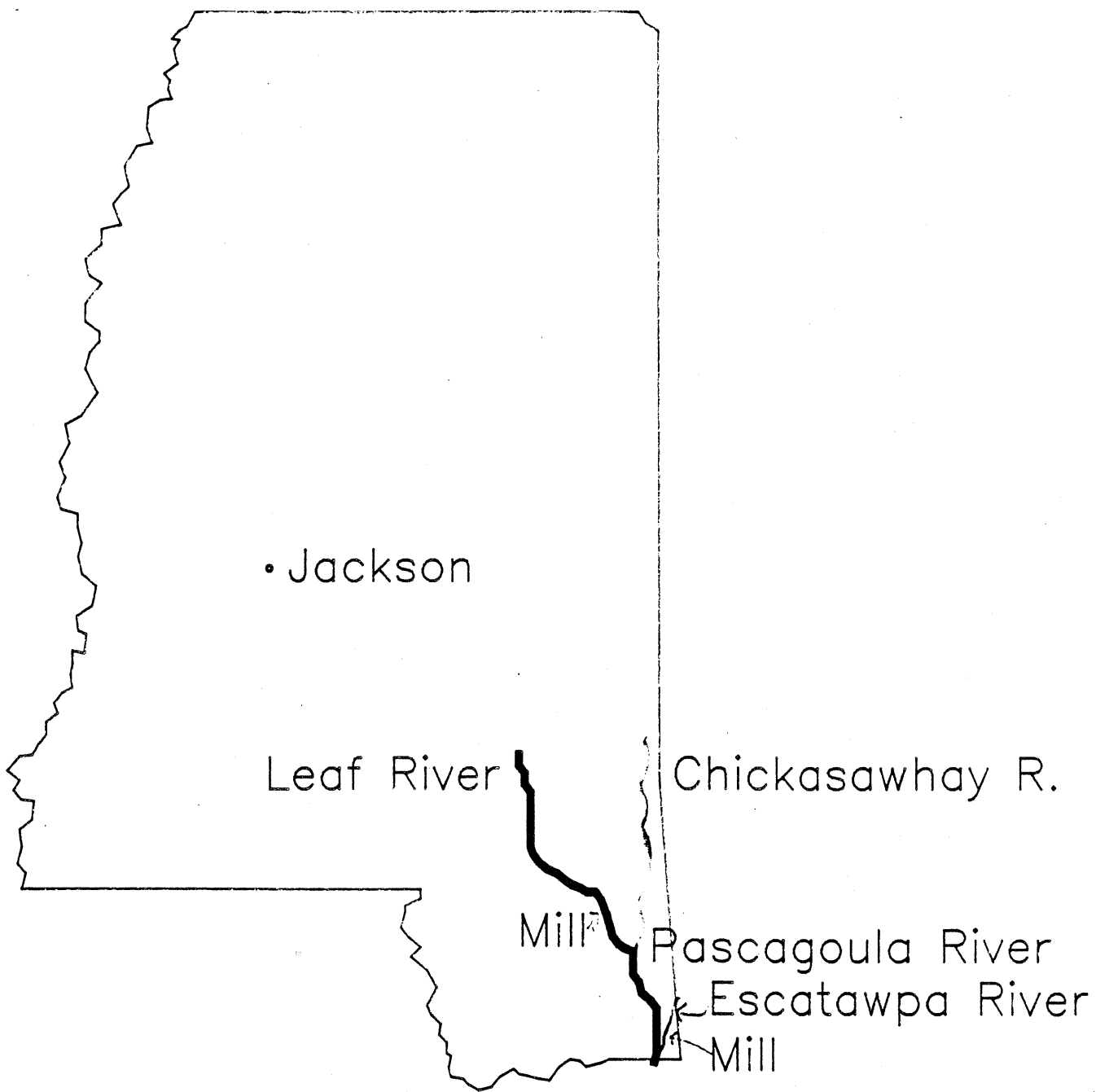
AN UPDATE ON DIOXIN STUDIES ON THE LEAF RIVER

As you can see dioxin has become a very important issue in Mississippi and the MS Office of Pollution Control (MS OPC) has had it's hands full attempting to monitor the existing problem at the Leaf, Pascagoula and the Escatawpa Rivers (See figure). We are currently half way through the collection phase of a two year seasonal study on the Leaf River and, in response to the tissue advisory on the Pascagoula River have just extended the study area downstream into this river. This study has made tremendous demands on laboratory personnel who have persistently continued to collect and analyze ambient data in addition to monitoring dioxin levels in the designated study area.

At the initiation of the Leaf River dioxin study, in the spring of 1990, our intentions were to collect bottom dwelling fish, specifically channel catfish, from six sites along the Leaf River. Five of these sites were located in an approximate 50 km reach of stream below the mill while one was approximately 16 km above the mill. After analysis of the data generated by the second sample effort (summer 1990) it became evident that levels of dioxin in specific size classes of fish were declining as the study progressed. However, it also became obvious that levels were consistently higher in large flathead catfish than in channel catfish of the same age group. Since that time we have modified our collection techniques to insure collection of both of these two indicator species.

Consumption advisories were first issued for a ten mile reach of stream starting just above Leaf River Forest Product's discharge and extending downstream to the Beaumont bridge (see last issue of the newsletter). This was a result of elevated tissue levels in fillets of channel catfish collected at the two monitoring sites immediately downstream of the mill's discharge.

On 5 October, 1990 this office issued a ban on commercial fishing on the Leaf River below the mill discharge as well as on the receiving Pascagoula River to the Gulf of Mexico. This means that currently a 40 mile reach of the Leaf River and the entire 90 miles of the Pascagoula are closed to commercial fishing, and various levels of consumption advisories are in effect for the recreational fisherman. The issuance of this ban came at an unfortunate time for Georgia Pacific Corporation, owners of Leaf River Forest Products, as it went into effect less than a week before a scheduled hearing of a \$102,000,000 law suit against the corporation. As you read in the above clippings, this was the first of an estimated 3000 suits against Georgia Pacific by residents living on this waterway. To put it mildly, Georgia Pacific was more than just a little upset at our decision to close this much waterway, and took out full page ads in newspapers to prove it. The ban was MS OPC's response to a TCDD level of 41.3 parts per trillion in the fillets of a 5.8 kg



flathead catfish collected at the site the greatest distance from the mill effluent (at Merrill, MS). This discovery also motivated this office to extend our study area some distance downstream into the Pascagoula River. Fish were collected from two sites along the Pascagoula River in addition to the six sites in the area of the mill in the fall sampling effort but analyses are still pending.

WELCOME BACK

Just when we at the lab were wondering how much more DIOXIN WE COULD POSSIBLY STAND!!!! we received relief in the form of Henry Folmar. Henry had worked for the Bureau Lab unit as fisheries biologist for 8 years before leaving to become director of the Turcotte Fisheries Lab in Mississippi. After 2 years there, he rejoined us on 15 October and is now in charge of the Leaf River dioxin study, and will design and head up additional studies on problems with contaminated fish tissue as they are needed. Sounds like he'll be kept busy. I am sure those of you who know Henry realize how much of an asset he is to our program.

A REQUEST FOR INFORMATION

For those of you who were unable to attend the '90 SWPBA meeting in Georgia, please send us your dioxin data.

Sincerely,

Skeeter Justus
MS Office of Pollution Control Lab
121 Fairmont Plaza
Pearl, MS 39208

THE LATEST ON THE TOXIC ALGAL BLOOM ON LAKE WASHINGTON

In September, Stanley Rodgers and Mike Beiser were again at Lake Washington to check up on the toxic Microcystis bloom which had occurred three weeks previously. We were accompanied by one of our engineers, Robert Seyfarth, and met there by a county supervisor and the ever-present and pesky reporter. It was a windy and cold day, and it felt good to stick our hands down into the lake water to collect samples. The Microcystis bloom had ended, and very few cells were noted in the samples we took. In spite of the cold north wind, it was quite a pleasant diversion from a day in the office, and the sight of a shaking reporter and a shivering politician with windblown faces and watering eyes

made me glad to be a field biologist.

IT SEEMS SOME GOOD CAME FROM THE ALGAL BLOOM

Residents Consider Lake Cleanup

GLEN ALLAN, Miss. (AP) — Area residents have been briefed by federal and state officials on pollution problems facing Lake Washington and possible methods to clean up the beleaguered oxbow lake.

The lake has been the focus of a \$100,000 U.S. Environmental Protection Agency-funded feasibility study since February 1989 in which experts sought to evaluate existing water quality and to identify and evaluate restoration measures to improve the lake's water quality.

About 120 residents attending Thursday night's public hearing at Glen Allan High School were told by scientists a fact that many of them already knew — the lake is suffering from decades of agricultural runoff and raw sewage.

Compared to oxbow lakes inside the Mississippi River levee, Lake Washington has dramatically higher phos-

phorus, nitrogen and algae concentrations, said Forrest Payne of the Little Rock, Ark.-based FTN Associates, the contractor in charge of the lake study.

Officials say more than 90 percent of the phosphorus and nitrogen in the lake comes from agricultural runoff.

And a state Department of Health study found that 74 percent of the septic tanks attached to houses surrounding the lake are adding to the pollution.

Scientists want to reduce the amount of phosphorous in the lake by 60 percent, which would go towards restoring it to the popular fishery it was until the 1970s.

"Basically we're talking about a combination of techniques," Payne said. "There's no one magic formula."

Funding a cleanup will be the main challenge to cleaning up the lake,

TOXICOLOGY UPDATE

Lab toxicologist Doug Upton has been busy this past several months performing the acutes scheduled for this year. Additional chronic bioassays have been scheduled for December and the next few months.

Doug and Stan took our mobile toxicology lab to New Augusta in October to do Ceriodaphnia and fathead tests on the effluent of Leaf River Forest Products as part of the labs Leaf River dioxin studies. The mill passed both the water flea and the fathead bioassay.

THE PERRY CREEK STUDY

The benthic samples from the 1990 phase of the Perry Creek study have been identified, and as reported in the last newsletter did not differ greatly from last years samples. Because of the lack of rain this year, however, one of the streams had dried up and could not be sampled. The benthic fauna at the most impacted of the three sites was dominated by an ephydrid, at the least impacted site Nectopsyche, and at the middle site Chironomus was the dominant taxon. Some of the chemical parameters measured this year at the worst impacted site

are given below:

Salinity	7.5 ppt
Conductivity	16,400 <u>um</u> ho
Hardness	1400 mg/L
Alkalinity	125 mg/L
pH	7.8
Dissolved Oxygen . .	9.5 mg/L

Compare this with the least impacted site we could find on Perry Creek:

Salinity	4.5 ppt
Conductivity	5220 <u>um</u> ho
Hardness	800 mg/L
Alkalinity	150 mg/L
pH	8.1
Dissolved Oxygen . .	12.1 mg/l

It seems to us that all of the sites we studied show at least some impact due to the brine influx from the oil drilling activity. Analysis of the macroinvertebrates indicates that the site furthest from the major activity is the least impacted.

THE MISSISSIPPI-ALABAMA REFERENCE SITE WORKSHOP

We would like to thank everyone for their comments on our studies thus far in this endeavor. Several people spoke to me about our joint-sampling talk and the comparison of the Mississippi and Alabama sites during the 1990 SWPBA meeting. Vickie and Mike are working on a poster presentation for the 1991 NABS meeting on the joint sampling done at the workshop, and have exchanged collections for the purpose checking each other's identifications.

Here in Mississippi our agency has hired M.A.R.I.S. to produce a land-use map, and this should greatly help Jim and Bob complete their task of locating high probability reference site areas within our state. We are currently trying to organize a meeting in January to get together and discuss progress and problems encountered thus far and modify the project time table if necessary.

NORTH CAROLINA

BENTHOS

Recent Surveys

Most of our efforts during the fall season have been concentrated on a few large studies. We have also had to do without ace taxonomist Dave Penrose, who is still educating Washington (DC) about biomonitoring.

Discharges

Aquatic Toxicity Studies. We (Dave Lenat) have completed a study of 16 dischargers, comparing eight dischargers which are passing their *Ceriodaphnia* chronic tests with eight dischargers which are failing these tests. Preliminary data indicated that a positive chronic test successfully identified many problems, but a negative test was not a reliable predictor of instream conditions. DEM will be conducting further tests with these facilities to determine the reasons why the toxicity tests did not detect some problems.

Low Flow Studies. We (Larry Eaton) looked at a variety of facilities which discharged to small positive "30Q2" streams. These studies demonstrated that properly operated tertiary wastewater treatment plants can discharge to low flow streams with no impact. However, most of the facilities we have inspected (especially those with secondary treatment) have shown moderate to severe effects on the stream biota.

Oxford WWTP. We evaluated the status of the existing discharge to Fishing Creek (3 sites, 9/90) and compared this information to a survey from June 1989. While conditions have improved (largely through the elimination of one discharge), there is still a toxic impact. Analysis of morphological deformities in Chironomus larvae was useful in making this assessment.

Other

Seasonality Studies. Another round of surveys has been completed to evaluate the magnitude of seasonal changes. This should give us 1-2 years of quarterly data for most sites, and we will try to evaluate this information before planning further seasonality tests.

"Surely we should realize, like the amateur, that the organic world is also an inexhaustible source of spiritual and esthetic delight. And especially in the college we are unfaithful to our trust if we allow biology to become a colorless, aridly scientific discipline, devoid of living contact with the humanities. Our intellects will never be equal to exhausting biological reality.... We should all be happier if we were less completely obsessed by problems and more accessible to the esthetic and emotional appeal of our materials, and it is doubtful whether, in the end, the growth of biological science would be appreciably retarded." (William Morton Wheeler, 1923)

"Today these words sound strange indeed, for most of our biological laboratories have lost all contact with the amateur-one is almost tempted to say, with nature-and to mention science and the humanities in one sentence is heresy. One wonders, however, whether any science can survive in isolation from society."

M.A.Evans and H.E.Evans, 1970, William Morton Wheeler, Biologist

Taxonomy

"What you may think of , in scientific work, as useless, like the search for the North Pole, or the naming of a new species of fish, is really a contribution to our knowledge, and knowledge is power - and a power that, sooner or later, will be needed and can be turned into the dynamo to give added possibilities to life."

"Each grain of knowledge I acquired, going to school with nature, was added to each other grain I possessed, that these grains grew into a foundation stone, that the stones accumulated until I had a substructure, and on that substructure I could build me a house."

Luther Burbank and W. Hall, Harvest of the Years, 1927

New or Unusual NC records

Estuarine records - Larry Eaton continues to add to our list of estuarine species:

Pelecypoda: Amgydaliu papyrum, Linga pennsylvanica, Divaricella quadrisulcata.

Polychaeta: Antinoella sarsi, Onuphus jenneri, Piromis eruca, Spirochaetopterus costarum.

Decapoda: Synalpheus sp., Euceramus praelongatus, Pinnotheres ostreum, Ovalipes stephensoni, Micropanopeus urinator, Sipunculidae, Phascolion strombi.

Freshwater records:

1. Heterotrissocladius species C (Saether). UT Bones Fork, Richmond County, 10/89. This is only our second collection of this weird midge. See Saether's (1975) revision of Heterotrissocladius, pg. 24.

2. Habrophlebiodes sp. South Toe River, Yancey County, 5/90. Separation of this species from Paraleptophlebia requires minute inspection of the labrum. We probably miss many of these individuals, but sharp-eyed Neil Medlin found this one.

3. Stenelmis. We have been sending large batches of Stenelmis to Kurt Schmude (Dept. Entomology, 237 Russell Labs, 1630 Linden Drive, Madison WI 53707), and I'm sure he also would be interested in receiving specimens from other monitoring groups in the southeast. His initial work indicates that there are many new species, as well as new distribution records for the southeast. Clean coastal plain streams seem to be the most productive collecting areas.

New Publications

Eagleson, K.W., D.R. Lenat, L.A. Ausley, and F.B. Winborne. 1990. Comparison of measured instream biological responses with responses predicted using the Ceriodaphnia dubia chronic toxicity test. Environmental Toxicology and Chemistry. 9: 1019-1028.

Lenat, D.R. 1990. Reducing variability in freshwater macroinvertebrate data. pp. 19-32. In: W.S. Davis (editor). Proceeding of the 1990 Midwest Pollution Control Biologists Meeting. USEPA, Region V, Environmental Sciences Division, Chicago. IL. EPA-905-9-90/005.

At long last available! Some copies still available from DRL, but most reliable source is Pat Hudson, US Fish & Wildlife Service, National Fisheries Research Center-Great Lakes, 1451 Green Rd, Ann Arbor MI 48105:

Hudson, P.L., D.R. Lenat, B.A. Caldwell, and D.S. Smith. 1990. Chironomidae of the Southeastern United States: a checklist of species and notes on biology, distribution and habitat. US Fish & Wildlife Service. Fish & Wildlife Research 7: 1-46.

Method Testing - Joint collections

At the recent Carolinas Area Benthologists meeting, many of us discussed the possibility of a joint sampling venture to compare methods. North Carolina, South Carolina, and Duke Power company will probably be involved in this sampling, but we would also like to see Kentucky and Georgia participate in this project. Collections will take place in the fall (after the usual summer rush), and North Carolina biologists will choose a central location, probably in or near the Chattooga River basin. Interested groups should plan on sampling 3 sites with their standard methods, possibly combined with a test of 100-count samples. Because of the large crowd we hope to have participating, each group would be assigned a specific stream reach (100+ meters). Call Dave Lenat (919-733-6946) to let me know if you wish to participate, and your preferences for sampling sites and times.

We also discussed the eventual exchange of samples and/or specimens for QA purposes. North Carolina will be glad to give a second opinion on identifications, as long as you are willing to return the favor. You may send:

1. Entire (picked) samples for ID checks (no checks on enumerations). Midges and worms should already be slide-mounted. These may be sent with or without your identifications.
2. Individual specimens (or sets of specimens), i.e., one taxon per bottle. Slide mounted specimens may also be sent.

We may not give back a "correct" identification, but we'll give a second opinion. This will help to ascertain if southeastern biologists are identifying macroinvertebrates in a consistent manner.

MACROPHYTES (From Steve Mitchell)

Those of you that are interested in macrophytes will remember that a bunch of Agencies in North Carolina "redid" an old aquatic plant survey last year to assess the current status of hydrilla in our State.

The old survey was conducted in 1981 and found 13 of 180 water bodies with "known" infestations of hydrilla. Last years survey (summer 1989) examined 120 water bodies based on several criteria: known hydrilla infestation, proximity to known infestations, 1981 sites, important water resources, etc. Seventeen new locations of hydrilla were discovered, bringing the total number of known infestations in North Carolina to 48.

At the end of the first survey, hydrilla infested approximately 200 acres in North Carolina water bodies in the Raleigh area. After our last survey, it inhabits approximately 1260 acres and is found from the mountains to the coast. The majority of the sites are still located in the Neuse River Basin and in the Raleigh area of Wake County.

So far this year, there are an additional 6 locations to be added to the list, and while 54 locations of this weed is nothing to you Florida boys, I wonder if we haven't passed over the lag stage of this problem and will now begin to find this weed everywhere?

AQUATIC TOXICOLOGY UNIT

Toxicity Evaluation Group:

Fiscal year 89-90 toxicity test tally is as follows: 95 acute, 66 chronic, 39 ambient site, 67 contract laboratory-related, 10 special studies, and 108 quality assurance. This fall has seen a lot of activity around the lab compound as we make preparations for the move into our new complex. We have evacuated two EPA-vintage lab trailers already; the rest of the move should occur in early 1991.

TEG staff members have kept the Group well-represented at recent professional meetings. Susan Snead attended the SWPBA meeting at Jekyll Island. In November, Phil

Bethea, Lance Ferrell, and Chris Prescott went to the 1990 SETAC meeting in Arlington, VA.

The remainder of 1990 will see all of us at the Cary site quite busy as we pack the labs and prepare our cultures for their new home "in the city." Somewhere in there, we'll also try to get in the holiday spirit. We'd like to wish a joyful holiday season to all of you. See you in '91!!

Data Assessment and Certification Group

As part of its attempt to take a proactive role in the quality assurance of submitted toxicity data, the group is now evaluating reference toxicant testing data submitted by the certified laboratories. Issues being addressed include adherence to test protocols and proper response to out-of-range test results.

A series of performance evaluation samples have been distributed to the certified laboratories with considerable support and expertise provided by the Toxicity Evaluation Group. Expertise of the laboratories in the performance of acute and chronic *Ceriodaphnia* toxicity testing as well as acute fathead minnow toxicity testing will be evaluated.

Additionally, the group is processing applications for renewal of certification for the coming year. There will be 16 laboratories certified, of which 13 are commercial contract laboratories. Of the remainder, one is operated by a municipality and two are operated by utilities.

Outstanding Resources Waters (ORW) and High Quality Waters (HQW) in North Carolina

North Carolina's present administrative codes (1990) presently allow for two supplemental classifications for areas with excellent water quality. The following definitions (complete with tortured English) are from the 15A NCAC 2B .0100:

1. Outstanding Resource Waters (ORW): unique and special waters of exceptional state or national recreational or ecological significance which require special protection to maintain existing uses.
2. High Quality Waters (HQW): waters which are rated as excellent based on biological and physical/chemical characteristics through division monitoring or special studies, native and special native trout waters (and their tributaries) designated by the Wildlife Resources Commission, primary nursery areas (PNA) designated by the Marine Fisheries Commission and functional nursery areas designated by the Wildlife Resources Commission or other appropriate agencies, critical habitat areas designated by the Wildlife Resources Commission or the Department of Agriculture, all water supply watersheds which are classified as WS-I or WS-II or those for which a formal petition for reclassification as WS-I or WS-II has been received from the appropriate local government and accepted by the Division of Environmental Management, and all Class SA waters.

No new dischargers are allowed in ORW areas, and existing dischargers may not expand their loading rates, although they may increase discharge volume. HQW areas may receive new dischargers, but they receive more stringent limits than dischargers to normal streams. Both types of classification usually receive management plans which include restrictions on nonpoint source runoff from new developments.

Several kinds of biological information may be used to establish HQW status: an biological rating of Excellent, or the documentation of critical habitat for threatened/endangered species. These species may be listed by either federal or state agencies, although the official NC list is still in preparation. Listing, in itself, is not sufficient; the Wildlife Resources Commission must take the additional step of declaring "critical habitat".

An excellent biological rating (based on benthic macroinvertebrate surveys) is necessary for an ORW rating. An ORW stream also must have one of five "resource values":

- (1) Outstanding fish habitat or fisheries.
- (2) Unusually high level of water-based recreation or the potential for such recreation.
- (3) Special designation (Such as Wild and Scenic).
- (4) Important component of state or national park or forest.
- (5) Special ecological significance or scientific value.

Evaluation of these resource values is an uncertain science. It is often necessary to consult with a variety of "experts" to reach a defensible consensus of opinion.

Nomination for ORW streams may be made by private citizens, or may come from the ORW subcommittee of the Natural Areas Protection Planning Group. The NAPPG is an interagency committee concerned with natural areas throughout the state. All nominations must be accompanied by specific information, and the Division discourages nominations which are intended solely to block a discharger or new development.

The initial round of ORW designations concerned noncontroversial streams, often streams in national or state parks. Some of the second round included catchments with some disturbed areas, or upstream segments which did not meet the ORW requirements. The Chattooga River ORW classification is a good example of this problem; it included headwater areas impacted by urban and agricultural runoff. In these situations, the Environmental Management Commission had to make basin-specific recommendations for

a management plan. To date, they have simply extended the highly restrictive ORW regulations to include the entire catchment. Future ORW designations, however, may have to include some boundary zone between impacted headwater areas and clean downstream segments. HQW nominations automatically include a one-mile boundary, but there are no clear guidelines for ORW streams.

"Our crude civilization engenders a multitude of wants, and lawgivers are ever at their wit's end devising. The hall and the theater and the church have been invented, and compulsory education. Why not add compulsory recreation? Our forefathers forged chains of duty and habit, which bind us notwithstanding our boasted freedom, and we ourselves in desperation add link to link, groaning and making medicinal laws for relief. Yet few think of pure rest or of the healing power of Nature. How hard to pull or shake the people out of town! Earthquakes cannot do it, nor even plagues. These only cause the civilized to pray and ring bells and cower in corners of bedrooms and churches."

John Muir

"If a thousand individuals derive in the aggregate, a certain amount of enjoyment from some feature of the environment, than ten thousand individuals should derive ten times that amount of enjoyment. Therefore, everything worth while should be made accessible to the greatest possible number of persons. This all sounds very democratic and altruistic, and it has always served as convincing sales-talk for those who scheme to exploit some precious bit of nature in their own interest.

The fallacy in the foregoing argument is almost too obvious to point out. The arrival of ten times as many persons in the Great Open Spaces does not mean that ten times as many persons will enjoy the Great Open Spaces; it merely means that the Great Open Spaces will cease to exist."

Francis Sumner, 1945, *The Life History of an American Naturalist*

South Carolina

DOUG DARR LEAVES SCDHEC

Doug Darr is leaving the South Carolina Dept. of Health and Environmental Control to go to the Fish and Game Division of Alabama's Dept. of Conservation and Natural Resources. Doug will be the District Fisheries Biologist for the North Central District headquartered in Decatur.

Doug will be responsible for the pond management program. He has already unofficially checked some ponds for Randy Owens of the group Alabama. He will also assist in the reservoir management of Lakes Gunterville, Wheeler, Pickwick, Lewis Smith and the Bear Creek Lakes.

Doug's address as of New Year's Eve will be P. O. Box 366, Decatur, AL 35902. The office is just a couple miles off I-65 in Wheeler National Wildlife Refuge, so go see him on your way through. His office phone number will be (205) 353-2634. As always, he says he would be happy to talk about water quality sampling or water quality problems.

Doug is finishing the State-wide fish tissue report before he leaves. The Langley Pond edible fish tissue assessment is ready for press. If you would like a copy of any of these, contact him at (803) 734-5399.

Public Well-Informed About Environmental Issues

Hazardous waste disposal is the No. 1 environmental issue in South Carolina followed by air pollution and water pollution, according to a University of South Carolina public opinion survey of the state's residents.

"The survey on environmental issues," a telephone survey of 600 state residents, was conducted by USC's Division of Research of the College of Business Administration in April 1990. An outside group was selected by DHEC to eliminate the possibility of perceived bias in the results.

Major issues covered by the survey are: (1) The public's awareness of environmental concerns such as air and water quality and the impact of an individual's behavior on his/her health as well as the environment. (2) The public's knowledge of DHEC's legislated responsibilities. (3) The public's willingness to modify behaviors to improve environmental problems.

DHEC's strategic planning process identified public education on the environment and awareness of relative risks due to environmental factors as a priority area. Other environmental issues among the priority areas include regulation of hazardous waste, solid waste management and environmental toxins.

To develop information and education materials of interest to the public, DHEC needed to know what the public knew, what actions they said they were taking, and what actions they might be willing to take to protect the environment. The survey data will aid this educational process.

Overall, the public is relatively well-informed about environmental issues. Their assessments concerning products which contain hazardous waste, their understanding of the responsibilities of government agencies, and their assessment of South Carolina relative to other states on air and water quality and household waste are generally accurate.

The public is explicit about a desire for continued emphasis on environmental protection. They strongly agree that decisions about the environment should be based on protecting public health. There is strong evidence that the public is not willing to protect the environment "at all costs", but that environmental protection should be a consideration in economic development.

According to the survey, DHEC is viewed as a credible source of information

see PUBLIC OPINION page 4

Public Opinion . . . from page 1

tion about the environment and its impact on an individual's health. When asked to choose the most credible source of information about the environment, some 28 percent of respondents believe that doctors and nurses are the most credible. Action or citizen groups were selected by 22.2 percent. State agencies like DHEC, and federal agencies such as EPA were selected by 16.4 percent and 16.1 percent of the respondents, respectively.

A major concern of the public is waste disposal, whether it be hazardous, nuclear, or household waste. More than half the respondents believe South Carolina disposes of more hazardous waste than other states. Respondents seem willing to engage in activities minimizing problems associated with waste disposal as long as they do not cost the individual much money.

Respondents are very likely to sort trash and vote for legislators who support greater controls on hazardous waste disposal. Regarding household waste minimization, respondents are most likely to recycle aluminum cans followed in order of likelihood of activities, recycle paper products, vote for legislators who support recycling, and pay \$20 a year in special fees for special trash collection. The implication is the public is willing to take actions which are low cost in time and money.

The public expresses a greater likelihood to engage in other activities which may minimize problems associated with waste disposal than they are to take actions to minimize the negative impact of water and air quality. The public would like to know more about actions which individuals can take to minimize problems associated with each of the major environmental issues covered by the survey.

Virtually identical responses were given concerning the quality of South Carolina's surface water and ground water. Half of respondents viewed both the surface water and the ground water as about the same quality as other states. Nearly one-third believe the ground water and the surface water to be of better quality than other states, with less than 20 percent believing it to be worse. Some 58 percent of respondents would vote for legislators who support stricter water quality standards.

The public supports the need for more legislation to minimize the negative impact of behaviors on the environment. Respondents strongly support

laws which require people to recycle and believe recycling centers should be more convenient. Also needed are more laws to protect state air quality and an overall state land development plan.

**The implication
(of survey responses)
is that the public
is willing
to take actions
which are low cost
in time and money.**

When asked about areas of responsibility for state agencies, the agency most often misidentified as responsible for DHEC's mandated activities is the Water Resources Commission. About two-thirds correctly identified DHEC as the agency responsible for septic tank permits and pollution control. About half know that DHEC inspects public water systems. About 85 percent recognize DHEC inspects eating establishments.

The greatest misconception occurs for developing and implementing land use planning. Only seven percent of respondents knew that no state agency is primarily responsible for this activity. One-fourth believe that DHEC is responsible and one-fourth do not know who is responsible. Nearly 20 percent of respondents believe the Coastal Council or the Wildlife and Marine Resources Department is the responsible agency.

For more information or a copy of the survey, contact DHEC's Office of External Affairs at 734-5038.

DHEC Board Approves Dioxin Standard

The S.C. Board of Health and Environmental Control approved the establishment of limitations on 109 compounds, including dioxin, allowed in South Carolina's rivers and streams.

The board, at its monthly meeting in Columbia Oct. 11, voted 4-1 in favor of the water quality standards package. The package included a limit of 1.2 parts per quadrillion for dioxin.

"The levels adopted by the board are expected to be protective of both the public health and the environment," said James Joy, chief of DHEC's Bureau of Water Pollution Control.

The recommended standards will be given to the S.C. General Assembly for approval. If approved, they will be reviewed by the U.S. Environmental Protection Agency.

While the standards for South Carolina waters won't become effective until after approval by the legislature, DHEC immediately will begin using the board-approved standards in its permitting process, Joy said.

DHEC staff worked on the standards approximately 18 months before making the recommendation. The most controversial standard was the proposed level for dioxin because of disagreement over the degree of dioxin's toxicity. Alabama, Maryland and Virginia have adopted a 1.2 limit, although environmental groups frequently criticize it as too lenient.

"Dioxin is considered an animal carcinogen, yet it has not been shown to cause cancer in humans," said Dr. Robert F. Marino, director of DHEC's Division of Health Hazard Evaluation. "However, exposure to this substance should be limited."

A health advisory, issued in June 1989, warned the public not to eat fish or shellfish from the Sampit River after elevated dioxin levels were found in fish tissue samples. The advisory remains in effect.

"We firmly believe this standard will provide an appropriate level of protection to the environment and public health," Joy said. "Once International Paper Co. implements corrective actions to meet these standards, the level of dioxin is expected to be lowered to a point where DHEC can reopen the Sampit River in Georgetown County for

... in the News

fishing and shellfishing.

"If the 1.2 parts per quadrillion standard does not accomplish these goals then the staff will ask that a tighter limit be implemented."

"The levels adopted by the board are expected to be protective of the public health and the environment."

Jim Joy
Chief
Bureau of Water Pollution Control

Dioxin is the generic name given to a group of compounds known as polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans. The term usually refers to the most toxic compound, 2,3,7,8 tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD.

TENNESSEE DEPARTMENT OF
HEALTH AND ENVIRONMENT
Environmental Laboratory, Aquatic Biology

Fellow SWEBA members:

Yes I know! We are all jerks. All those great papers we and the Division of Water Pollution submitted and then we didn't show. We sincerely apologize. We tried our hardest to get travel approval, but higher budget decision makers would not allow it. So much for the winein' and gripein'.

Suddam Hussain, So damn insane. plagiarized by Dale Rector
(I probably misspelled his
name but I don't care.
Get out them bicycles.)

Personnel are going in and mostly out of our department like roaches in and out of a garbage can. Three WPC managers have taken employment elsewhere. The Environmental Laboratory Aquatic Biology Section has lost three Biologist II's and one Biologist III in the last three months. The Laboratory has been allowed, however, to refill most of these positions. If we shut down, the whole department gets in a bind because we do alot of the environmental grunt work.

Even the bureaucrats have realized that.

Our employees who have justifiably sought and gotten employment elsewhere are:

Martha Hunter	EPA Atlanta
Joy Broach	Fleming Training Center
	Murfreesboro TN
Leira Scott	Eckenfelder Inc.
Paul DeFoor	Whereabouts unknown

New employees we have recently hired are:

Todd St. John	Tenn. Tech.
	M.S. Fisheries
Debbie Gillis	Austin Peay
	M.S. Biology

Both Todd and Debbie have strong backgrounds in fisheries and macroinvertebrate analysis respectively. Also Debbie Arnwine has finally gotten salary compensation for being a Biologist III. She hasn't seen her first check yet, though. We are still short one Biologist II and one Biologist III. That's not too bad I guess, considering the circumstances. By the way, the Governor presented Jeff Duke

with a certificate because he (Jeff not the Governor) has done extra special good work in the field of biology as recognized by his peers.

Work-wise we are extremely occupied with four 319H non-point source field studies involving quarterly biological sampling. The studies include fish and macroinvertebrate sampling aimed at determining differences before and after Best Management Practice installations. Two NPS studies are dealing with dairy runoff in Middle and East Tennessee. The third and fourth studies deal with soil erosion in West Tennessee and strip mining in the Big South Fork River area.

106 work continues, as always, with NPDES toxicity testing, and water quality surveys. We recently collected fish at six stations in the Memphis area and the Mississippi River in order to determine the extent of chlordane and possible dioxin contamination in fillets. Chlordane is an old problem while dioxin may be a newfound one. We hope the dioxin worm can does not open further.

Here's an idea for SWEBA officers and members. We've been putting on toxicity workshops for a couple a years. Other states have been doing the same thing. If SWEBA sponsors the workshops, extra fees can be stuck in a SWEBA account. We can arrange to have extra fee money. When state travel funds are lacking this account could be used to get at least one person from each state to the annual meetings. If one person can get funded, the rest can pile in the same car and motel room. Folks are likely to be willing to pay their own food expenses if they have help with the other greater expenses. I don't know if it's legal within the bylaws or easily workable. You think on it.

Sincerely

A handwritten signature in cursive script, appearing to read "Dale Rector".

Dale Rector
TDHE

615- 262-6327

U.S. EPA Region IV - Athens

Region IV, EPA is sponsoring a benthic macroinvertebrate course for Region IV state biologists entitled "Biology and Identification of Southeastern Mayfly, Stonefly and Caddisfly Larvae" which will be held at Clemson University, Clemson, S.C. during the weeks of May 6th and May 13th. Dr. John C. Morse, Professor of Entomology and Director of The Clemson University Arthropod Collection, will be the instructor for this ten day course. Dr. Morse has presented an expanded version of this course last year which was attended by several of the Region IV state biologists. The course is highly recommended by those that attended last year.

This course is deemed important since much of our focus today in biomonitoring deals with biocriteria and bioassessment. The three orders (Ephemeroptera or Mayflies, Plecoptera or Stoneflies and Trichoptera or Caddisflies) that are the subject matter for the course are important constituents of the benthic community and represent a major facet of many of the biometrics or indices utilized today in bioassessments.

EPA, Region IV, under contractual arrangement, will be providing the tuition for the course. The only costs to attendees would be per diem.

Attached you will find a course syllabus and a list of accommodation and rates for Clemson. For registration in the course, which will be limited to a class size of fifteen, please call me at (404) 546-2405.

Sincerely,

Hoke S. Howard
Aquatic Biologist

Enclosure

Hotel Rates in Clemson, S.C.

Holiday Inn
P.O. Box 512
Clemson, S.C. 29633

State employees, single occupancy \$36
Phone: 1-800-HOLIDAY

Comfort inn
P.O. Box 1496
Clemson, S.C. 29633

State employees, single occupancy \$36
Phone: 1-803-653-3600

Ramada Inn
P.O. Box 1706
Clemson, S.C. 29633

State employees, single occupancy \$38
Phone: 1-803-654-7501

Biology and Identification of Southeastern Mayfly, Stonefly, and Caddisfly Larvae

Clemson University
6 - 17 May 1991

Instructor: John C. Morse

SYLLABUS

- | | |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 May | Arrival, check-in for students. |
| 6 May | <p>Lecture I: Introductions, course objectives, schedule, evaluation procedures. Freshwater biotopes, habitat type, river continuum concept.</p> <p>Lecture II: How to collect and preserve larval mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera = EPT) and other aquatic insects.</p> <p>Field Trip: Collecting EPT in a fifth-order stream.</p> |
| 7 May | <p>Lecture III: Insect morphology and special adaptations for aquatic life.</p> <p>Lecture IV: Orders of aquatic insects.</p> <p>Laboratory: Insect morphology and diagnosis of EPT larvae.</p> |
| 8 May | <p>Lecture V: Evolution and natural history of mayflies (Ephemeroptera).</p> <p>Lecture VI: Identification of larvae of mayfly families.</p> <p>Laboratory: Identification of larvae of mayfly families.</p> |
| 9 May | <p>Lecture VII: Identification of larvae of southeastern Ephemeroptera (Schistonota) genera.</p> <p>Lecture VIII: Identification of larvae of southeastern Ephemeroptera (Pannota) genera.</p> <p>Laboratory: Identification of larvae of southeastern mayfly genera.</p> |

10 May	Lecture IX:	Evolution and natural history of stoneflies (Plecoptera).
	Lecture X:	Identification of larvae of stonefly families.
	Field Trip:	Collecting EPT in third-order streams.
11-12 May	Personal time:	Individual collecting and working on identification of personal collections.
13 May	Lecture XI:	Identification of larvae of southeastern Plecoptera (Euholognatha) genera.
	Lecture XII:	Identification of larvae of southeastern Plecoptera (Systellognatha) genera.
	Laboratory:	Identification of larvae of stonefly families and genera.
14 May	Lecture XIII:	Evolution and natural history of caddisflies (Trichoptera).
	Lecture XIV:	Identification of larvae of caddisfly families.
	Field Trip:	Collecting EPT in springs, seeps, and first-order streams.
15 May	Lecture XV:	Identification of larvae of southeastern Trichoptera (Annulipalpia) genera.
	Lecture XVI:	Identification of larvae of southeastern Trichoptera (Integripalpia) genera.
	Laboratory:	Identification of larvae of southeastern Trichoptera families and genera.
16 May	Laboratory:	Identification of larvae of southeastern Trichoptera families and genera (continued).
	Lecture XVII:	Using Rapid Bioassessment Protocols and an EPT Index to Monitor for pollution of southeastern streams.
	Field Trip:	Using Rapid Bioassessment Protocols and an EPT Index to Monitor for pollution of southeastern streams.
17 May	Examination:	Practical, open-book identification of EPT larvae to genus; closed-book examination on EPT natural history.

17 May (continued)

Collection submission (for evaluation and return to student).

- NOTES: All lectures will be 50 minutes in duration, all laboratories and field trips 120 to 180 minutes.
- Collection: Each student will be responsible for submitting an identified collection of EPT larvae. A collection of at least 60 correctly identified and curated genera will be evaluated as "Excellent." Specimens will be collected during scheduled field trips and on students' personal time; identification and curation of specimens will be accomplished on students' own time.
- Evaluation: Student evaluation will be based 50% on final examination, 50% on collection.
- Texts: Texts for the course will be,
- (1) Aquatic Insects and Oligochaetes of North and South Carolina, edited by A.R. Brigham, W.U. Brigham, and A. Gniska, 1982, Midwest Aquatic Enterprises, Mahomet, Illinois, and
 - (2) An Introduction to the Aquatic Insects of North America, edited by R.W. Merritt and K.W. Cummins, 1984, Kendall/Hunt Publishing Company, Dubuque, Iowa.
- Equipment and supplies: Students are encouraged to bring their own waders and other personal field and laboratory supplies and equipment. Microscopes and some field and laboratory supplies and equipment will be provided.

MEETINGS

- January 17-19, 1991 - South Atlantic Regional Aquaculture Conference. Mariner's Inn Resort, Hilton Head Island, South Carolina. Contact: Gerry Bonnette, South Carolina Department of Agriculture, P.O. Box 11280, Columbia, SC 29211, (803) 734-2210.
- March 19-22, 1991 - 1991 Midwest Pollution Control Biologists Meeting. Lincolnwood Hyatt Hotel, Chicago, Illinois. Contact: Wayne Davis, USEPA Region V, 536 South Clark Street, 10th Floor, Chicago, IL 60605, (312) 886-6233.
- March 27-28, 1991 - 1991 Region III Water Pollution Biology Workshop. Cacapon State Park, Berkeley Springs, West Virginia. Contact: Ron Preston, U.S. EPA Region III, 303 Methodist Bldg., 11th & Chapline Streets, Wheeling, West Virginia 26003. Room reservations should be made by February 28 directly with Cacapon State Park (304) 258-1022.
- May 20-23, 1991 - Third Annual Conference of the Society for Ecological Restoration. Sheraton Plaza Hotel, Orlando, Florida. Contact : SER (608) 262-9547 or Dr. Steven G. Richardson (813) 534-7160.
- May 21-24, 1991 - 39th Annual Meeting of the North American Benthological Society. College of Santa Fe, Santa Fe, New Mexico. Abstracts should be sent by 11 January 1991 to: Cliff Dahm, Department of Biology, University of New Mexico, Albuquerque, NM 87131.
- August 12-14, 1991 - 11th International Symposium on Chironomidae. University of Amsterdam. Contact: Congress Management, Conference Office, University of Amsterdam, Spui 21, 1012 WX Amsterdam.
- September 8-12, 1991 - 121th Annual Meeting of the American Fisheries Society. San Antonio Marroitt Riverwalk, San Antonio, Texas. Contact: Executive Director, AFS, 5410 Grosvenor Lane, Suite 110, Bethesda, MD 20814-2199, (301) 897-8616.
- November 11-16, 1991 - 11th Annual International Symposium of the North American Lake Management Society. Sheraton Denver Tech Center, Denver, Colorado. Contact: NALMS Office (202) 466-8550.

