THE UNIVERSITY OF TENNESSEE KNOXVILLE

Southeastern Fishes Council Proceedings

Volume 1
Number 25 *Number 25 (March 1992)*

Article 1

3-1-1992

Number 25 (March 1992)

Southern Fishes Council

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Recommended Citation

Southern Fishes Council (1992) "Number 25 (March 1992)," *Southeastern Fishes Council Proceedings*: No. 25.

Available at: https://trace.tennessee.edu/sfcproceedings/vol1/iss25/1

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Number 25 (March 1992)

Abstract

(March 1992) - Water Currents in Spawning Areas of Pebble Nests of Nocomis leptocephalus (Pisces: Cyprinidae). By E.G. Maurakis, et al., 3 pp.

Minutes, Regional Reports and News Notes.

Keywords

water currents, spawning, pebble nests, nocomis leptocephalus

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Southeastern Fishes Council
PROCEEDINGS
DEDICATED TO THE PRESERVATION OF SOUTHEASTERN FISHES

Number 25 March 1992

WATER CURRENTS IN SPAWNING AREAS OF PEBBLE NESTS OF *NOCOMIS LEPTOCEPHALUS* (PISCES: CYPRINIDAE)

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Breeding males of *Nocomis leptocephalus* construct pebble mound nests for spawning in slow to moderate water currents during spring. Eggs and sperm are deposited in spawning pits on the upstream slope of nests where males clasp females (Maurakis et al., 1991a). Reduced current velocities in the spawning pits result from interrelated physical characteristics of nests and streams. It is hypothesized that this reduction in current is related to mound construction and is ultimately important to survival of fertilized eggs.

Methods

Pebble nests of *N. leptocephalus* were studied in streams in Virginia, North Carolina, and Georgia from 1986-1990. Locality data are available upon request.

Measurements of physical characteristics of 17 nests in 12 streams were made with a meter stick. Water current velocities (1 cm above mound nests and 1 cm above substrates) were measured with a Marsh-McBirney current meter. Velocities were recorded 0.5 m upstream of the mound, 0.5 m downstream of the mound, above the crest of the mound, and in spawning pits (Table 1; Fig. 1). In addition, the same parameters were measured at three artificial nests that were constructed by us.

Means were calculated for each parameter (Table 1). Ratios were calculated to determine the significance of synergistic effects among pertinent characteristics. Backward stepwise regression (SAS, 1985) was used to evaluate the relative contributions of physical characteristics of nests and streams on water current in spawning pits.

Results

Current velocity ($\bar{x}$0.006 m/sec) in spawning pits that are concentrated a midpoints of upstream slopes of active nests of *N. leptocephalus* was significantly less (F=8.51, df=17) than values recorded downstream of nests($\bar{x}$0.087 m/sec), above the mound crest ($\bar{x}$0.11 m/sec), and upstream of the mound ($\bar{x}$0.11 m/sec) (Table 1). Empirical data for current velocity in spawning pits on upstream slopes of nests that were constructed in a stream (avg. flow 0.14 m/sec) by us were lowest (0 m/sec) at the mound base, intermediate (0.01 m/sec) at the midpoint of the upstream slope of the mound, and highest (0.03 m/sec) at the crest.

Five factors are associated with reduced water current velocities in spawning pits: length and angle of the upstream slope of a mound, water depth at a nest, stream flow upstream of a nest, and water depth at the midpoint of the upstream slope of a mound (Table 2).

Discussion

The intermediate location of the spawning pit on the upstream slope of a nest and its reduced current velocity probably serve to enhance reproductive success in *N. leptocephalus*. The reduced current velocity may optimize retention of gametes, and consequently fertilization in the pit. As eggs of *N. leptocephalus* are neither adhesive nor cohesive, decreased current velocity in pits reduces the chance that the demersal, fertilized eggs will be swept out of pits by breeding activities of fishes over nests (i.e. ♀ + ♂ *N. leptocephalus* and nest associates). Similarity of nest construction among other *Nocomis* species suggests that water currents in the pits (e.g. *Nocomis biguttatus*) and spawning trough (e.g.. *Nocomis micropogon*) of their nests are comparable to those in the pits in nests of *N. leptocephalus*.

A spawning pit is covered with pebbles collected by a breeding male *N. leptocephalus* after a spawning episode (Maurakis et al., 1991a). The pebble covered pits are usually located near

midpoint of the upstream slope of mounds where the water current is less than that at the crest of the mound but greater than that at the base of the mound. Faster currents at the crest may damage eggs; slower currents at the base limit gas exchange. The mid-slope location is apparently a compromise between these two locations, optimizing conditions in interstices during development of buried eggs and post-hatch larvae.

Nest construction and spawning behaviors in *Nocomis* spp. differ from those of species in other pebble nest-building cyprinid genera (i.e. *Exoglossum* and *Semotilus*). However, the reduced current velocity conditions in spawning pits of *N. leptocephalus* are similar to those (0.04 m/sec) in spawning pits of pit/ridge nests of all recognized species of *Semotilus* (Maurakis et al., 1990). Reduced water current velocities (0.04 m/sec) similarly occur in spawning areas on upstream slopes of nests of the two species of *Exoglossum* (Maurakis et al., 1991b). Males of the three pebble nest-building genera cause reduced current velocity for egg deposition by physically modifying an area of streambed. The reduced flow, a result of their nest building activity, may provide a selective advantage to individuals of each group.

Acknowledgments

Funding was in part by University of Richmond Faculty Research Grants, Robert F. Smart Undergraduate Research Award, and research awards from Highlands Biological Station, North Carolina. We thank Virginia Power Water Quality Laboratory for use of a water current meter.

Literature Cited

Maurakis, E.G., W.S. Woolcott, and J.T. Magee. 1990. Pebble nests of *Semotilus* species. Southeastern Council Fishes PROCEEDINGS 22:7-13.

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____, ____, and ____. 1991b. Nest construction and reproductive behavior of *Exoglossum* species. Bulletin Alabama Museum Natural History 10:11-16.

SAS Institute, Inc. 1985 *SAS User's Guide: Statistics*. Version 5. SAS Institute, Inc., Cary, North Carolina. 956 p.

Table 1. Stream (n=12) and nest (n=17) characteristics of active *Nocomis leptocephalus* nests. Capital letters in parentheses following characteristics are used in ratios.

Characteristic	Mean	S.D.	Range
Stream (cm)			
Depth (D)	24.59	6.96	13-37
Width	410.00	225.97	100-650
Mound (cm)			
Length	74.35	25.56	40-120
Height	12.01	4.73	4.50-20.70
Width	62.85	15.24	29.0-86.0
Length of upstream slope (L)	49.18	16.56	24.50-80.70
Water depth at midpoint of upstream slope (Y)	18.59	6.99	7.50-32.85
Angle of upstream slope (degrees)	17.6	5.0	11.0-25.1
Pit (cm)			
Depth (K)	2.77	1.55	0.50-7.00
Length (J)	7.07	3.85	2.00-15.00
Width	6.53	3.99	1.00-15.00
Water Current (m/sec)			
Upstream of mound	0.111	0.555	0.04-0.21
Over ridge	0.109	0.094	0.04-0.33
Pit	0.006	0.021	–0.03-0.05
Downstream of mound	0.087	0.085	0.02-0.30
Ratios			
K/L	0.058	0.035	0.013-0.160
D/K	12.726	10.516	3.250-46.000
Y/L	0.424	0.211	0.133-0.836
D/J	4.314	2.039	1.333-9.000

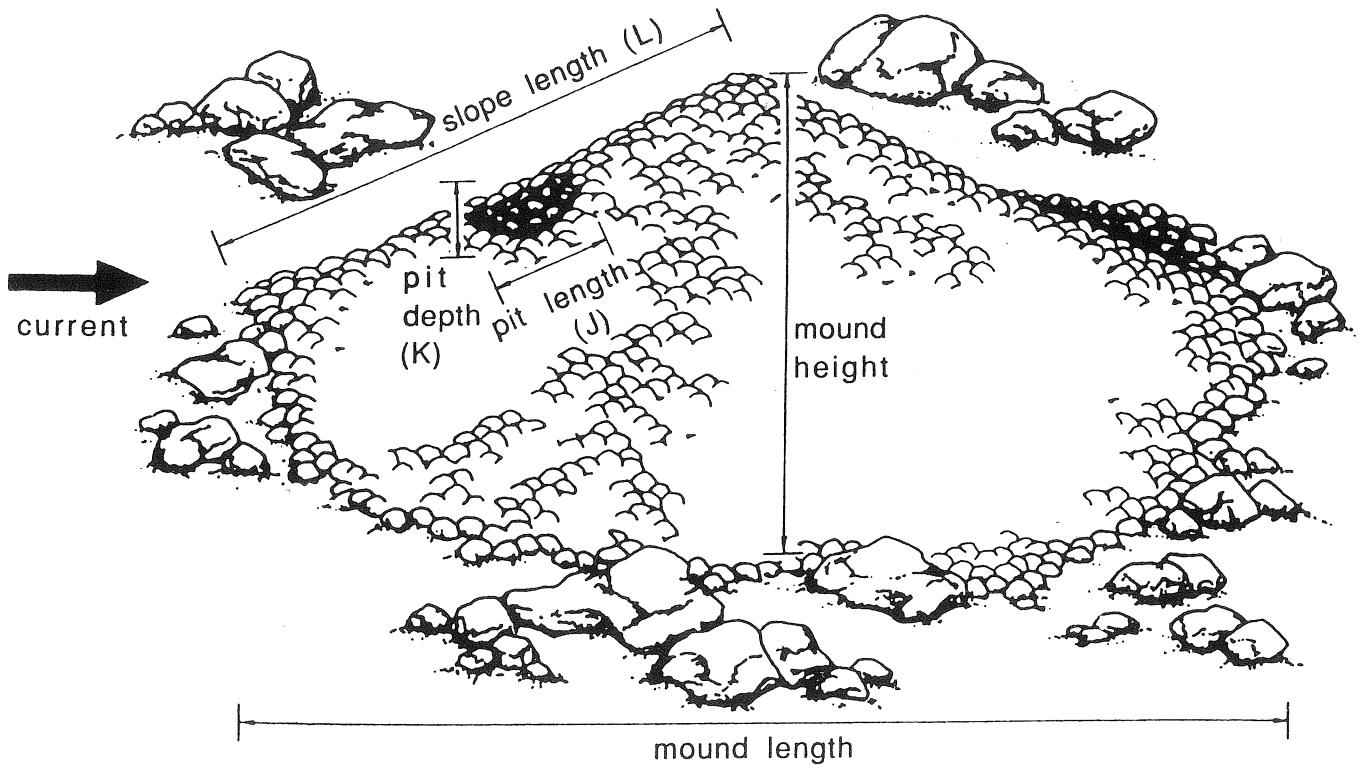

Fig. 1. Mound characteristics of *Nocomis leptocephalus* pebble nests. Mound width, not illustrated, was measured at widest part of nest.

Table 2. Results of backward stepwise regression (SAS, 1985) for effects of water depth and current velocity, and nest characteristics on current velocity in spawning pits on upstream slopes of pebbles nests of *Nocomis leptocephalus*. Widths of streams, nests, and pits are not applicable.

Characteristic	Estimate	Error	Sum of Squares	F	Prob>F
Intercept	0.31808135	0.14359135	0.00212328	4.91	0.0488
L	-0.00591095	0.00256533	0.00229729	5.31	0.0417
D	0.00936488	0.00410182	0.00225548	5.21	0.0433
Y/L	-0.59841891	0.26303164	0.00223966	5.18	0.0439
Angle	-0.23427993	0.11680643	0.00174070	4.02	0.0701
Water current (upstream of mound)	0.69314644	0.34858703	0.00171086	3.95	0.0722
D/K	–	–	–	0.73	0.4211
K/L	–	–	–	0.32	0.5879
J	–	–	–	0.27	0.6229
D/J	–	–	–	0.20	0.6655
K	–	–	–	0.10	0.7631
Y	–	–	–	0.002	0.9638

MINUTES

Business Meeting
17th Annual Meeting
Southeastern Fishes Council

The Southeastern Fishes Council met in the Broyhill East Room of the Broyhill Conference Center on the Campus of Appalachian State University at Boone, N.C. on April 11, 1991. Chairman Franklin F. Snelson, Jr. presided. The meeting was called to order at approximately 4:05 PM local time.

Committee Reports

1. Secretary's Report

The Minutes of the 1990 Business Meeting which appeared in Issue No. 23 of the SFC PROCEEDINGS were approved.

2. Treasurer's Report:

Checking Account Balance (6-1-90)		$2288.12
Dues & other contributions received (6-1-90 through 4-1-91)	344.00	
Expenses (6-1-90) through (4-1-91)		
PROCEEDINGS	(1,812.79)	
Accountant Fees	(250.00)	
Checking Account Balance (4-1-91)		569.33
Paine Webber Cash Fund (3-28-91)		2,081.95
TOTAL ASSETS (4-1-91)		$2,651.28

3. Historian's Report:

Don Cloutman passed out a draft of a "History of the Southeastrn Fishes Council, 1975-1991." The membership was asked to review this document and provide him with comments.

Election of Officers:

Fritz Rhode of the Nominating Committee presented the following slate of candidates. There were no additional nominations from the floor.

Chairman Elect:	David Heins	Bill Woolcott
Secretary/Treasurer:	Hank Bart	Steve Ross

The election was held and David Heins and Hank Bart were elected to their respective offices.

Old Business:

Report from Treasurer regarding Tax Status: After receiving records of the Paine Webber account and contacting the IRS Problems Resolution Office in Richmond, Virginia, and contacting the attorney (Joseph P. Congleton of Knoxville) which incorporated the SFC in the state of Tennessee, I have the following to report. The Taxpayer Identification Number (TIN) used for the Paine Webber Account appears to be ours. I say appears because the IRS has no record of this TIN. However, the Paine Webber account was opened on May 15, 1981, at which time a TIN was applied for and subsequently issued (to the SFC) for this account. The money placed into this account came from the sale of our Tennessee charter (after consulting with above attorney). Mr. Congleton informed that we did not file for 501(c) status at the time (tax exempt status). The CPA I retained (R. Allen Whiteside of Fredericksburg, Virginia) surmises the following to have occurred:

1) Although the account had a TIN the SFC was not filing tax returns. Therefore there was no "activity" regarding this number as far as the IRS was concerned. After several years of no transactions involving this TIN the IRS may have inactivated the TIN and deleted it from their records.

2) Changes in tax laws required dividend and interest paying counts to report these transactions to the IRS. No problem yet because the IRS could not match these reports with TIN on tax returns.

3) Using their new computers the IRS is now able to track and match dividend reports to income tax returns filed. Probably our TIN was "flagged" because there was no return filed using this number and being the name on the account I got a letter of inquiry.

Our CPA has now completed his examination of our financial records. In a letter he advises us of the following regarding our status on taxes and the IRS:

1) The SFC is in compliance with IRS regulations, etc....

2) The SFC's gross receipts in a taxable year are normally not more than $5,000 (normally less than $2,000). The SFC operates as a not-for-profit organization. Therefore the SFC does not have to file an annual return. IRC Sec 6033 (a) (2) (A) (ii).

3) The SFC is a tax exempt organization under ICS Sec.501 (c) (3) as it is a publicly supported organization as described under IRC sec. 509 (a) (2).

4) As long as we maintain the present status we need not file a return or apply for tax exempt status. However, should our status change (i.e. gross receipts exceed $5,000) we need to file for tax exempt status.

I have communicated the above to Mr. Mikos with the IRS Problem Resolution Office. He later informed me that he agrees with the opinion of our CPA. However, the SFC must obtain a new TIN.

After some discussion it was determined that we would try to obtain tax exempt status if it could be done at little or no cost, otherwise we would file for a new TIN only.

New Business

PROCEEDINGS Committee: Bo reported that the committee plans to send out a questionnaire to the membership. A suggestion was made that we attempt to switch to recycled paper for the PROCEEDINGS in keeping with our conservation outlook. There was some discussion regarding this comment. Chairman Snelson suggested this be included in the questionnaire and pointed out that there were too few members present to make any major changes.

Passing of Gerald E. Gunning: Dr. Gunning recently passed away. He had been an active and respected colleague and will be missed by all.

Regional Reports:

Oral Regional Reports were given by the following members and will be forwarded to the Editor for inclusion in the PROCEEDINGS.

Fritz Rhode	–	Northeast
Noel Burkhead	–	Southeast (sent report)
David Etnier	–	North-Central (given by Peggy Shute)
Hank Bart	–	South-Central
Bob Cashner	–	Southwest (no report)
Henry Robinson	–	Northwest (no report)

A motion to adjourn the meeting was made. The motion passed and the meeting ended at 6:00 P.M.

Respectfully submitted,

Werner Wieland

Secretary/Treasurer

REGIONAL SFC REPORTS

REGION I – Northeast

Three state books are in various stages of completion. *The Fishes of Delaware* by Maynard Raasch, a retired chemist from Dupont, should be out by the end of June. It will consist of popular accounts with 100 color photographs and many references. Total length will be 170 pages and the cost will be $12. Bob Jenkins' *The Fishes of Virginia* will probably be out early in 1992. It will consist of 2400 pages and 750 illustrations. They're hoping to keep the cost down to around $50. And last but not least, Ed Menhinick's *The Freshwater Fishes of North Carolina* is being printed and will be out in June. Cost will be $37.50 and the book will be distributed by the Wildlife Resources Commission.

The Proceedings of the Virginia Endangered Symposium was published in April. It contains a synthesis of Bob and Noel Birkhead's work for the past 10 years. Bob is relinquishing his role as contact person for Virginia endangered fishes to Paul Angierman now at VPI. Paul has been conducting some surveys in warmwater streams. Bob is concerned that *Erimystax cahni* is not being found at sites from which it was known from during the last decade.

In North Carolina, the Scientific Council's report on the conservation status of NC freshwater fishes was submitted to the Wildlife Resources Commission (WRC) to be considered at their next meeting. Ed Menhinick is editor of the final report.

The WRC is currently stocking *Esox masquinongy* into the New River drainage. Alvin Braswell has been in touch with their biologists to discuss the folly of doing this. Another WRC introduction, *Micropterus punctulatus*, poses some problems. It has been expanding its range in the Cape Fear River and could possibly reach Buckhorn Dam, putting in the same waters as *Notropis mekistocholas*.

Field work this year includes status surveys on *Etheostoma acuticeps* and *E. colis* by me, a survey this fall on the lower Pee Dee for *Moxostoma* by NC Division of Environmental Management, Alvin Braswell and me, and continued work on *Acipenser brevirostrum* and other anadromous fishes in the Cape Fear River by Mary Moser and Steve Ross.

Brimleyana is back in business and they guarantee two issues this year and in subsequent years. They need quality manuscripts to meet this goal.

The South Carolina Wildlife and Marine Resources Department is updating their endangered, threatened and special concern fishes list. This was sent out to interested ichthyologists for their comments. A final list will be sent to their Commission next year. The Department has a little money for surveys on nongame fishes. John Cely is the contact person.

F. Rhode

REGION II – Southeast

Summary of research and conservation activities for freshwater fishes from coastal drainages between the Edisto and Appalachicola rivers.

Gary Meffe and Dean Fletcher (Savannah River Ecology Lab).

- Work continues on life history evolution in *Gambusia* (GM).
- A life history study on *Aphredoderus* has been initiated (GM, others).
- Work continues on the reproductive life history of *Notropis cummingsae* (DF).

Rick Eager (USFWS, Charleston).

- Reported ca. 5900 and 7300 hatchery reared *Acipenser brevirostrum* were tagged in the Savannah River in 1989 and 1990 – there have been no returns.

- However, two of three radio and sonic tagged wild *A. brevirostrum* were recaptured in the Savannah.

Mike Bentzien (USFWS, Jacksonville).

- *Acipenser oxyrhynchus desotoi* is swimming ever so slowly through the federal listing process for threatened status. The Gulf sturgeon should be officially listed by end 1991 or early 1992.

Noel Burkhead, Jim Clugston, Ann Foster, Dawn Jennings, and Jim Williams (USFWS, Gainesville).

- A ms describing the hybrid *Notemigonus crysoleucas* X *Scardinius erythophthalmus* is completed (NB now understands all of Etnier's complaints about JW).
- The third year of radio tracking of Gulf sturgeon is about to commence; last year's efforts project were very productive (AF, JC).
- A ms on the past and present distributional interactions of *Etheostoma okaloosae* and *E. edwini* is in preparation (NB and JW).
- A checklist of exotic fishes is an appendix in the forthcoming 1991 list of common and scientific names (DJ, JW, and the renowned Walt Courtenay).
- A ms on the distribution and dispersal of *Sarotherodon melanotheron*, the blackchin tilapia, in the Indian River system is nearly completed (DJ, JW).

Carter Gilber, George Burgess, and Steve Walsh (University of Florida).

- The fishes of Florida book is making steady progress (CG and Jim Williams).
- A note is being prepared on the spawning behavior of *Percina nigrofaciata* (SW with Noel Burkhead).

Buck Snelson (University of Central Florida).

- Studies are underway on *Elassoma*, including a phylogenetic analysis of *Elassoma* (nearly complete), and a life history study of *E. okefenokee*.

Walt Courtenay (Florida Atlantic University).

- Walt continues to write about the exotic fishes problem – the heartbreak of *Cichlasoma*, and so forth.

Bill Loftus (Everglades N.P.).

- Continuing studies on the effects of drought on fish communities. So far, three years of data have been collected at long-term sampling sites.
- Spin-off studies include how fishes use dry season refugia, and the interesting possibility that cavernous aquifers may act as subterranean refugia.
- *Belonesox belizanus* is benefiting from the drought.

N. Burkhead

REGION IV – South-central

Field offices of U.S. Fish and Wildlife Service in Vicksburg, MS, Daphne, AL, and Panama City, FL, have provided information on a number of projects which are either planned or already underway on streams in the South-Central Region and which will no doubt have accumulating adverse impacts on native fish and molluscan faunas. Special thanks to Danny Dunn of the Daphne office for supplying many of the details on projects in Alabama.

Lake Pontchartrain Basin: A number of rivers tributary to Lake Pontchartrain (principally the Amite and Tangipahoa Rivers) are experiencing serious head-cutting in their northern reaches with progressive channel widening and shallowing in their lower reaches. A similar problem in Bayou Pierre is causing species such as the bayou darter to move upstream with its shifting habitat.

Tombigbee River Basin: There are plans to modify 59 miles of the Buttahatchie River (channel straightening and desnagging). Camp Creek, a headwater tributary to the Buttahatchie River is receiving an estimated 27,000 tons of sediment annually from an abandoned kaolin clay mine. The Soil Conservation Service in Alabama has requested funds to stabilize the situation. There are plans to channelize and desnag Luxapallila Creek on the Mississippi side (the Alabama side has already been channelized). Channel modification has been authorized for an 84-mile section of the Sipsey River. The Sipsey River is also experiencing localized fish and mussel kills due to the illegal chemical dumping. There are reports of trucks dropping hoses over bridges and releasing chemicals into the river in full view of wading fishermen. The Alabama DOC is investigating and local opposition to the dumping and proposed channel modification is mounting. The SFC should consider lending its support to any Sipsey River conservation groups that emerge.

Black Warrior Basin: The City of Birmingham is planning to build a 3000 acre water supply reservoir on the Locust Fork River near the Blount/Jefferson County line. Local citizens groups are organizing to oppose the project as well, and this provides yet another opportunity for the SFC to lend support. In Mulberry Fork, wastes originating from catfish farms, chicken houses, and leaky septic tanks are killing mussels in droves. A joint Alabama Department of Environmental Management/Soil Conservation Service report lists animal wastes as the number one nonpoint pollution source in Alabama streams.

Cahaba River Basin: It is a wonder anything survives in the Cahaba. The basin is presently receiving discharge from 1 coalbed methane operation, 10 municipal waste facilities, 35 surface-mining operations, and approximately 67 other facilities. There are plans to build small scale impoundments on relatively pristine tribs in the headwaters for flow augmentation. As it now stands, sewage lagoons around Birmingham provide the primary source of flow in the river at certain times of the year.

Coosa/Tallapoosa River Basins: The U.S. Fish and Wildlife Service and the Alabama Power Company have reached an agreement that establishes a minimum flow standard of up to 1200 cfs for the tail waters of the Tallapoosa River below Thurlow Dam (previous standard was 80 cfs). Similar negotiations are underway for the tail waters of the Coosa River (the natural channel) below Jordan Dam. The endangered gastropod *Tulotoma magnifica* has recently been rediscovered in the tail section of the Coosa and would be affected by the minimum flow standards.

Four companies are proposing to build mills on the Tennessee River near Nickajack Port to "chip" hardwoods cut from a 75-mile radius of northeast Alabama, northwest Georgia and southcentral Tennessee, including the headwaters of the Coosa River and a substantial portion of the middle Tennessee River and its tributar-

ies. The Corps of Engineers and Tennessee Valley Authority are overseeing permitting of barge terminals at the mills. Much of the land is privately owned, and there is concern that the companies involved will simply clearcut the tracts without attention to best management practices. A number of environmental groups are calling for a careful study of the impacts and the SFC should join the chorus.

Bud Freeman reports that plans to impound the Tallapoosa River north of Tallapoosa, GA to create the West Georgia Regional Reservoir are on hold pending completion of an EIS. In fact, all other regional reservoir plans for the Coosa, Tallapoosa and Chattahoochee Rivers are being delayed until the Corps has had the chance to study the long range consequences for states involved. This inaction on regional water projects will not affect a number of smaller-scale projects that are being proposed by local interests in the region.

The Cobb Co./Marietta Water Authority has purchased land and is pursuing development of a water supply reservoir on Sharp Mountain Creek, a direct trib to the Etowah, to create a water supply reservoir. There are also plans to situate the nation's largest landfill on the Etowah River in the general vicinity of Sharp Mountain Creek. These recent projects join a growing list of developments on the Etowah and a number of its tributaries that could have disastrous consequences for species such as *Percina antesella* (Bud has discovered populations of the latter at 4 sites on the Etowah River and one sit on Sharp Mountain Creek) and the undescribed Cherokee darter. A landfill is also being proposed for Mill Creek, a direct trib to the Conasauga River in Bradley Co. TN. Finally, a private land owner has apparently constructed a makeshift stream channel to the Cartecay River and is diverting water from a trib through the channel, causing a tremendous sedimentation problem for goldline darters.

Choctawatchee River Basin: The Corps of Engineers and the Alabama Soil Conservation Service have been given the green light to conduct a basinwide study in the Choctawatchee/Pea river system to identify needs in the basin. The primary driving force for this action is to examine the feasibility of impounding the Pea River at Ariton to form a 5,000 to 12,00 acre lake for flood control, water supply, recreation, and water conservation. Past Corps studies estimated a benefit/cost ratio below unity, however indications are that the weight of local support is in favor of this project due to changing basin physiography and recent severe flooding downstream.

Apalachicola Basin: The Corps of Engineers is looking favorably on a USFWS proposal to build a hatchery for Gulf sturgeon below Jim Woodrift Dam on the Apalachicola River.

Other tidbits: A status of federally threatened has now been officially proposed for the blue shiner. A status review on Alabama molluscs is due out soon (in agency review right now). It proposes 11 new endangered mussels, 9 new extinctions, and over 100 snails for the candidate species list (many believed extinct). In all, 80 Alabama mussels are either extinct or critically endangered.

H. Bart

NEWS NOTES

Wildbranch Workshop in Outdoor, Natural History and Environmental Writing is for people with either personal or professional interests. The workshop is a week of classes, lectures, discussion groups and readings in the craft and techniques of fine writing. The fifth-annual workshop will be offered June 21-27, 1992 at Sterling College, a small college in northern Vermont known for its hands-on approach to the study of natural resources.

This year's faculty will include outdoor writers Steve Bodio and Joe Vance; natural history writer Gale Lawrence; Ian and Margo Baldwin, publishers of Chelsea Green Press; Les Line, former editor of *Audubon*; environmental journalist Karl Grossman and journalists Richard and Joyce Wolkomir.

For additional information, contact, David W. Brown in care of Wilbranch, Sterling College, Craftsbury Common, VT 05827 or call 1-800-648-3591.

Available November 1991 from The McDonald & Woodward Publishing Company, P.O. Box 10308, Blacksburg, VA 24062-0308, (703) 951-9465: VIRGINIA'S ENDANGERED SPECIES *Produced in cooperation with Virginia Department of Game and Inland Fisheries, Virginia Department of Agriculture and Consumer Services, Virginia Department of Conservation and Recreation, Virginia Museum of Natural History, Karen Terwilliger, coordinator.*

Regarded by many as the best of statewide books treating threatened and endangered species, **Virginia's Endangered Species** is an attractive and up-to-date reference book on the rare and vulnerable plants and animals of Virginia. For each species covered the following information is provided: a description of the taxon; a written summary and a map of its distribution in Virginia and North America; an overview of its natural history; a synopsis of its legal and recommended statuses; a discussion of threats to its continued survival in Virginia; and recommendations for its conservation. Color plates illustrate most described taxa. Information is current through summer 1991.

The volume will be of value to scientists, educators, librarians, environmentalists, planners, attorneys, and all others who are involved with or concerned about the conservation of rare plants and animals. Its relevance is not limited to Virginia, but extends to throughout the middle Atlantic and middle Appalachian regions.

Only 2500 copies have been printed for general distribution.

viii + 672 pages, 229 color plates, 331 b/w figures, 44 tables, 8.5 x 11. Cloth (0-939923-16-5) price, $59.95. Paper (0-939923-17-3) price, $32.95

ROYALTIES GO TO THE NON-GAME AND ENDANGERED SPECIES FUND TO SUPPORT FUTURE CONSERVATION EFFORTS IN VIRGINIA.

ATTENTION

CHANGE IN TIME AND PLACE
SOUTHEASTER FISHES COUNCIL
BUSINESS MEETING

The SFC business meeting, originally scheduled for 4 pm Friday, 10 April 1992, has been rescheduled to follow immediately the Ichs. and Herps. business meeting that begins at 5 pm on 9 April 1992 in the Wilson Room of the Bryant Conference Center.

PROCEEDINGS is a publication of the Southeastern Fishes Council, Inc. and is published in New Orleans, Louisiana. Officers are: Bruce Bauer, Chairman; David Heins, Chairman-elect; Hank Bart, Secretary/Treasurer. Editor for the PROCEEDINGS is Michael M. Stevenson, Biological Sciences, University of New Orleans, LA 70148. Phone: (504) 286-7057.