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Biological Opinion

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In Reply Refer To:
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SEP 28 1979

Dr. Thomas H. Ripley
Director
Division of Forestry, Fisheries and
Wildlife Development
Tennessee Valley Authority
Norris, Tennessee 37828

FWS 10/9

Dear Dr. Ripley:

This responds further to the Tennessee Valley Authority's (TVA) January 5, 1979 request for reinitiation of Section 7 consultation pursuant to the Endangered Species Act of 1973, as amended, on alternatives to the Columbia Dam project and its impact on the Endangered birdwing pearly mussel (Conradilla caelata), the turgid-blossom pearly mussel (Epioblasma turgidula), the tan riffle shell clam (E. walkeri), the Cumberland monkey-face pearly mussel (Quadrula intermedia), and the pale lilliput pearly mussel (Toxolasma cylindrella).

PROJECT DESCRIPTION

Following approximately three years of planning by local leaders and citizen groups along with subsequent TVA involvement, a planning report was issued in August 1967, by TVA recommending the construction of a dam at the Columbia site on the Duck River in Maury County, Tennessee. Further studies suggested the feasibility of an additional dam at the Normandy site; the two dams of the project were proposed as units of the Upper Duck River Project in a 1968 report. Construction of Normandy Dam began in June 1972 and the dam was completed and closed in 1976, while construction at the Columbia site began in August 1973 and the entire project as now planned is 30 percent complete.

The Columbia Dam project as originally planned would be part of a multipurpose water control system for the upper Duck River area in middle Tennessee. The completed dam is to be located

on the Duck River at DRM 136.9, 112 miles downstream from the Normandy Dam and would create a 12,600 acre multipurpose reservoir at a normal summer pool elevation of 630 feet, which would affect water levels approximately 54 miles up the Duck River in Maury and Marshall Counties, Tennessee, to about DRM 191. The dam would consist of two rolled earth-fill embankments totalling 2,075 feet long and 80 feet high above the flood plain, and a concrete weir controlled by five 40-feet high by 40-feet wide radial gates.

The Columbia and Normandy dams were originally designed to be operated as a unit in a total water control system. TVA has outlined the following project objectives: reducing flooding on urban and agricultural lands; providing a more dependable supply of improved quality water; and creating new recreational opportunities. Additional and more detailed information regarding the project and specific potential objectives can be obtained from the "Final Environmental Statement, Duck River Project" of June 1974, the "Draft Report on Preliminary Studies of Columbia Dam Alternatives" of February 1979, and the "Report to OMB on Columbia Dam Alternatives" of April 1979, all three of which were prepared by TVA.

CONSULTATION HISTORY

On June 14, 1976 (41 FR 24064), several species of mussels, some of which were reported to have occurred in the upper Duck River, were listed as Endangered species in a final rulemaking. As a result of this rulemaking, TVA was advised on June 22, 1976 that the Columbia Dam project would impact four of these species, and they were requested to initiate consultation. On August 13, 1976, TVA requested consultation, specifically for one species, Conradilla caelata, and requested information on the occurrence of other species in the Duck River. A consultation meeting between the Fish and Wildlife Service (FWS) and TVA took place on January 12, 1977, and a biological opinion was rendered on February 16, 1977 stating that the project as planned was likely to jeopardize the continued existence of the birdwing pearly mussel (Conradilla caelata) and the Cumberland monkey-face pearly mussel (Quadrula intermedia). On April 19, 1978, the Corps of Engineers (COE) requested consultation on a Section 404 permit application for the project, and a biological opinion was rendered on May 26, 1978, stating that project completion was likely to jeopardize the two species referenced in the previous opinion to TVA as well as another species, the tan riffle shell clam (Epioblasma walkeri) (listed on August 23, 1977, 42 FR 42353).

On January 11, 1979, the Service received TVA's request to reinitiate consultation on the basis of new information and project alternatives that had been developed at the request of the Office of Management and Budget (OMB). On March 6, 1979, FWS personnel met with representatives of TVA for a ground and helicopter tour of the dam site, and again on March 7, 1979 to discuss alternatives to the original project as proposed by TVA and their possible effects on the referenced species of mussels. Again, on April 25, 1979, FWS personnel met with TVA personnel in Knoxville, Tennessee to discuss and clarify these alternatives as they appear in TVA's "Report to OMB on Columbia Dam Alternatives" of April 1979.

The FWS reviewed information contained in the Environmental Impact Statement titled: "Final Environmental Statement Duck River Project", April 28, 1972; the "Supplement to Final Environmental Statement Duck River Project", June, 1974; the "Report on Preliminary Studies of Columbia Dam Alternatives", April, 1979; "An Evaluation of Mussel Populations in the Powell River, Tennessee and Virginia", June, 1979; "An Evaluation of Mussel Populations in the Clinch River, Tennessee and Virginia", 1960-1978; as well as other information provided by TVA, academic and private sources, and other information available within the FWS. Copies of pertinent sources of information are included in an administrative record maintained in the Office of Endangered Species.

TVA ALTERNATIVES

Since the FWS has already rendered a biological opinion on the Columbia Dam project as originally planned (February 16, 1977), the reinitiation of consultation necessitating this biological opinion was based on a series of TVA developed alternatives which constitute a modification of the project as originally planned. Three alternatives were presented by TVA in the draft document titled, "Report on Preliminary Studies of Columbia Dam Alternatives", February 1979. These alternatives were presented to the FWS at the March 7, 1979 meeting, and were subsequently modified and presented in the "Report to OMB on Columbia Dam Alternatives" of April 1979. Details covering the alternatives can be found in these documents. In summary, the three TVA alternatives are as follows:

1. Project as planned - with conservation. Under this alternative, TVA would complete the Columbia Project as originally planned, moving forward immediately with full construction - completing the dam, diverting the water through it, completing highway and other relocation work and acquiring the remaining land. River diversion would continue through the two open spillway bays in a self-regulating manner until the Department of Interior determines that various conservation measures directed at listed mussels have been carried out, at which point spillway bays would be completed as originally planned and the reservoir would be filled. (See April 1979 Report to OMB). As a self-regulation dam, normal flows backwater would extend from elevation 571 feet at the dam upstream to about Duck River Mile 156 (just below Leftwich).

Conservation measures would in most cases follow a series of base-line studies on the biology and habitat requirements of listed mussels found to occur in the project area. The following conservation measures would be carried out to assure habitat for the mussels:

a. Water quality and habitat improvement. In order to restore the natural biota of the river, it will be necessary to reproduce, as much as possible, the natural water quality and habitat conditions of centuries ago. Once completed and filled, the dam will be operated to ensure the release of high quality water. Additionally, dischargers of effluents to the river will be expected to provide waste water treatment at levels necessary to maintain the stream use classifications of the river as designated by the Tennessee Water Quality Control Board.

b. Low dams. Reconstruction and renovation of old mill dams at historic sites and construction of new low-level dams or similar structures would create habitats more likely to be colonized by freshwater mussels.

c. Shoal areas. Natural shoals in the river will be protected from gravel dredging and other adverse impacts.

d. Transplants. It may be desirable to transplant all the freshwater mussels from the section of the river to be impounded to other locations, either in the Duck River

(e.g., downstream from the Shelbyville Dam) or elsewhere to ensure the continued existence of these species.

e. Regulatory measures. Working through appropriate State agencies, additional regulatory measures will be promoted to control the protection, taking, or disturbance of certain freshwater mussel species. This would include financial assistance to State law enforcement programs if necessary. Also, it will be proposed to appropriate State agencies that sanctuaries be created in the Clinch, Powell, North Fork--Holston Rivers and in other areas in the Tennessee Valley where mussel populations that include the referenced species occur. Special programs will be developed to abate existing environmental problems on these rivers to include actual reclamation of disturbed land areas, upgrading of municipal waste treatment systems, and improving soil erosion control practices in the Clinch-Powell watersheds.

2. Low pool - downstream relocation. The project would be completed in such a manner as to be operated at a low pool level so that the reservoir would stop short of the large mussel population just downstream from the Lillard Mill Dam at DRM 179. The low pool would serve as an alternate to Normandy Reservoir as a source of water supply but would more likely be used to serve the water needs of Columbia by supplementing and regulating flows from Normandy. This alternative would provide similar recreation, wildlife management, and other development benefits as the original plan but at a reduced scale. Flood control would be provided by a downstream relocation and protection program of some structures on the floodplain at the city of Columbia.

3. No impoundment - downstream relocation. The earthen portion of the present dam would be removed, no water would be impounded, the upstream portions of the Duck River corridor in the project area would be developed in a planned manner, and a relocation and protection program would be developed for the city of Columbia as in the second alternative described above. Three levels of potential river corridor development were presented.

CUMULATIVE IMPACTS

The Fish and Wildlife Service has also examined other public and private activities or programs which might have cumulative impacts on the subject species. Because the distribution of the five species of mussels since 1960 seems to center around the Clinch, Powell, and Holston River system(s) in Tennessee and Virginia in addition to the Duck River in Tennessee, these areas were examined to ascertain possible cumulative effects. Through FWS area and regional offices, information was obtained on existing and proposed projects on or in the vicinity of these rivers that involve the COE, the Soil Conservation Service, the Federal Energy Regulatory Commission, the Environmental Protection Agency, the Office of Surface Mining, and the Virginia Division of Mined Land Reclamation. The purpose of this review was to determine whether TVA's proposals, when examined in the more dynamic context of these other projects, may jeopardize the continued existence of these mussel species.

A consideration of these projects, most of which occur on or near the Clinch and Powell Rivers in Virginia and northern Tennessee, indicates that many could have a negative cumulative effect on some of these mussel species. The birdwing pearly mussel occurs in middle reaches of both the Clinch and Powell Rivers, and the Cumberland monkey-face pearly mussel occurs in middle reaches of the Powell River. Potential negative effects include possible increases in erosion, siltation, and a general degradation of water quality associated with channel realignment, strip mining activities, and the possible development of pumped storage hydroelectric generating facilities along these rivers. Additional information concerning these projects is contained in the administrative record for this consultation.

On the basis of this review, I have determined that the cumulative effects of these activities are minimal but that they constitute a factor that must be considered in rendering my biological opinion.

BIOLOGICAL OPINION

Based on our review of the above information and other information and data available to FWS, it is my biological opinion that the first and second alternatives proposed by TVA are likely to jeopardize the continued existence of two of the five subject mussel species, the

birdwing pearly mussel (Conradilla caelata) and the Cumberland monkey-face pearly mussel (Quadrula intermedia), whereas the third proposed alternative is not likely to jeopardize the continued existence of any of the Endangered mussel species.

It is my biological opinion that completion of the full project as planned would not jeopardize the continued existence of the two species if, prior to inundation, TVA were to assure the FWS that it had completed, with proven success, the conservation program described in parts 1 to 5 below.

As presently written, TVA's first alternative is likely to jeopardize the continued existence of the two referenced mussel species since it provides only that TVA carry out the conservation program and does not require the success of that program before completing the project as planned. For example, this alternative would require TVA only to conduct mussel transplants prior to project completion not to achieve proven successful transplants.

The average inundation resulting from alternative two, impounding water to within five miles of the shoal at Lillard Mill, is also likely to jeopardize the continued existence of the two mussel species due to the effects of inundation of portions of the population between approximately DRM 132 and 173, possible predation from fish in the reservoir on the host fish for the mussel in upstream portions of the population (especially during periods of high flow when the level of water would be allowed to rise), possible affect on the life cycle of the unknown host fish for the mussel, and possible alterations in water chemistry in the vicinity of the mussel shoals due to the close proximity of still water. Again, the jeopardy caused by these eventualities might be overcome by the successful completion of a conservation program as described under this alternative.

It is our understanding that TVA only considers their first alternative to be consistent with project objectives. We will first address that alternative. TVA may continue with some facets of the total project, such as land acquisition, road realignment, etc., as long as they determine that these actions do not constitute an irreversible and irretrievable commitment of resources which have the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would avoid jeopardizing the continued existence of the referenced mussel species.

REASONABLE AND PRUDENT ALTERNATIVES

In order to avoid jeopardizing the continued existence of the Endangered species, the conservation measures associated with the first alternative identified by TVA (a-e on pages 4 and 5) should be modified in the following manner:

1. TVA must, in coordination and with the assistance of the FWS, develop, carry out, and complete with proven success a conservation program for the birdwing pearly mussel and the cumberland monkey-face mussel. Each of these activities must occur prior to final closure of the dam and determination of the extent of water impoundment. This alternative presumes that the Columbia Dam project could be completed as originally planned and would provide some or all of the original objectives without causing jeopardy to the continued existence of the two species of mussels.

2. Construction of the dam may continue to the point where it can be operated as a self-regulation dam by rerouting water through the open spillways as illustrated in Fugure 3b of the "Report to OMB on Columbia Dam Alternatives", April, 1979. However, while operating the dam as a self-regulating structure, water should not be impounded to a level so high as to disrupt natural flow levels now experienced at Leftwich (approximately DRM 156). While this phase of construction and preparation is underway, TVA should immediately start studies to identify the host fish species necessary for continued development of glochidia of the two referenced mussel species.

3. At this point, the dam may be operated as a self-regulation project while additional studies are conducted that are designed to describe the biotic and abiotic characteristics of sites where the two mussel species occur in the Duck River as well as the habitats at sites on the Clinch and Powell Rivers in Tennessee and Virginia where the listed mussels are known or found to occur. Similar studies should be carried out in those parts of the Duck, Clinch, Powell, and Holston Rivers which would appear to be potential transplant sites for the mussel. Parameters to be measured or studied at each site would be such as:

   water quality including heavy metals;

   streamflows;

   depth regime;

   substrate morphology and composition;

   planktonic communities;

aquatic invert rate communities;

aquatic vertebrate communities; and

macrophyte communities.

4. In addition to efforts at identifying the host fish for the birdwing pearly mussel and the Cumberland monkey-face pearly mussel, the following life history parameters should be measured or studied at the Lillard Mill site and at sites on the Clinch and Powell Rivers where the species occurs:

population assessment including density, standing stock, spatial limits, substrate, current and depth associations, age class composition, and sex ratio;

host fish identification and relationships including species composition, distribution and behavior of candidate fish, and fish community comparisons;

reproductive processes including spawning period, gonad development and fecundity;

food habits related to food abundance and composition; and

predation levels.

The purpose of these studies will be to characterize the habitat and life history of the two Endangered species found to be extant in the Duck River as a step toward identifying possible transplant sites and/or habitat manipulations that might be necessary to insure the continued existence of the mussels in these rivers. Once sufficient baseline habitat and life history information has been obtained and potential transplant sites in the Duck and possibly the Clinch, Powell, and Holston Rivers have been selected and prepared, initial transplants of listed mussels from the Lillard Mill site may be made. Because of the possible present importance of the Lillard Mill populations of these species, no more than one-fourth of the estimated population at the time of transplant should be removed until the entire conservation program has been insured. Final stages of this conservation program will consist of evaluating the success of transplanted populations.

5. Other measures in addition to the conservation measures outlined above may also be necessary. These include the application of stringent pollution standards on effluent dischargers into these rivers; the reconstruction and renovation of old mill dams; construction of new low-level dams or similar structures; protection of natural shoals from adverse impacts such as gravel dredging; sanctuary proposals; special programs to abate existing severe environmental problems including reclamation of disturbed areas, upgrading of municipal waste treatment systems, and improving soil erosion control practices; and the promotion of additional regulatory measures.

   Although the steps in this alternative have been outlined in some detail, it will be necessary for TVA to inform and coordinate with FWS on various stages in the development and implementation of these conservation measures.

   Once sufficient evidence is obtained and presented to the FWS that shows that a strong conservation program has been completed and has proven successful to the point where completion of the project would not jeopardize the two species, TVA would meet the requirement of this alternative. In fact, if successful, this could result in the establishment of mussel populations in a superior condition to what now exists.

An additional separate reasonable and prudent alternative would essentially involve the first step in alternative two--that is, construction of the dam may continue to the point where it can be operated as a self-regulation dam by rerouting water through the open spillways at a water elevation of approximately 571 feet at the dam. At the same time host fish studies should be initiated as previously mentioned. If TVA decides on this alternative, to operate the dam solely as a dedicated self-regulating structure, then TVA would have met the requirements of this alternative and would have eliminated jeopardy to the two mussel species.

Even though this alternative would not require that TVA undertake further extensive conservation measures for the mussels beyond their present responsibilities to Endangered species, under the Endangered Species Act, they would be encouraged to pursue such measures as already described under our second alternative since, as pointed out in TVA's "Report to OMB on Columbia Dam Alternatives", April, 1979: "Indications are that unless steps are taken they (the mussel species) would probably eventually become extinct."

A summary of the biological data and information considered during this consultation and the probable affect of completion of the project according to TVA's alternative one and/or two is provided below:

Conradilla caelata - birdwing pearly mussel. C. caelata was determined to be Endangered on June 14, 1976 (41 FR 14064), but Critical Habitat has not yet been determined for the species. The birdwing pearly mussel was originally described by Conrad (1834). The historical range has been reported to include the Powell, Clinch, North Fork Holston, Elk, Duck, and Tennessee Rivers (Mussel Shoals), and the Paint Rock River, Jackson County, and Flint Creek (Alabama). The Duck River sites included Columbia (DRM 131), Leftwich (DRM 156), Sowell Ford (DRM 160), and Lillard Mill (DRM 179). Recent surveys indicate that this species still occurs in at least the Duck, Clinch, and Powell Rivers, with undoubtedly the largest population occurring in the Duck River, largely between DRM 160 and 179. Out of 91 sites sampled in a 116-mile stretch of this river in 1979 by TVA, Conradilla caelata specimens were found at 23 at densities ranging from 0.20 to 1.38 individuals per square meter. Estimates of population sizes for this species in the Duck run at least as high as 1400 individuals at one site alone. In contrast, in the Powell River the species was found at only five sites out of 77 sampled in numbers judged too low or that were too low to appear in quantitative samples taken. Similarly, in the Clinch River, Conradilla caelata has been reported from only two sites out of 44 locations reported in the literature, and at one site at a density of only 0.08 individuals per square meter. TVA's alternatives one and two (project as planned and the low pool impoundment) would inundate substantial numbers of populations and habitats of this species. Based on the relative estimate of numbers of individuals derived from TVA's 1979 survey, the low pool would cover approximately 45 percent of the individuals in the Duck River and the full project as planned would cover 100 percent of known populations in this river. Considering the apparent low densities of this species in the Clinch and Powell Rivers, the full project as planned would probably inundate at least 75 percent of all the known individuals of the birdwing pearly mussel. Creating a reservoir over or in close proximity to mussel populations could affect their continued existence by the deposition of sedimentation, a reduction in the flow of organic nutrients over mussel beds, disruption of the mussel's life cycle through an adverse affect on the host fish, or by

altering the physical habitat necessary for young mussels to continue growth after parasitizing the host fish, possible predation from fish in the reservoir on the host fish for the mussel in upstream portions of the mussel's distribution, and possible alterations in water chemistry in the vicinity of the mussel shoals due to the close proximity of still water. Threats to the species would also be exacerbated by adverse cumulative impacts.

Epioblasma turgidula turgidblossom pearly mussel. E. turgidula was determined to be Endangered on August 23, 1977, (42 FR 42353). Critical Habitat has not been determined for the species. E. turgidula was originally described by Lea (1858), and has been reported in the past to occur in the Holston, Emory and Duck Rivers; in Shoal and Bear Creeks, and the Tennessee River (Alabama); and in Mission and Spring Creeks and the White and Black Rivers (Arkansas). The Duck River sites include Columbia (DRM 131), Shelbyville (DRM 221), Dement Bridge (DRM 243), Normandy (DRM 245), and Riverside (DRM 250). In 1971, one worker assumed that the species was extinct. The most recent collection of the species was from Riverside (DRM 250) in 1972 (now inundated by Normandy Reservoir). No specimens were found in TVA surveys made in 1976, 1978, and 1979 and it would now appear that this species no longer exists in the Duck River.

Epioblasma walkeri tan riffle shell clam. E. walkeri was determined to be Endangered on August 23, 1977 (42 FR 42353), but Critical Habitat has not yet been determined. The species was originally described by Wilson and Clark (1914). Its historical range included the Buffalo, Duck, Holston, Harpeth, Red, and Stones Rivers (Tennessee); Flint River and Hurricane and Limestone Creeks (Alabama); and the Middle and South Fork Holston River (Virginia). The Duck River sites include Columbia (DRM 131), Hardison Mill (DRM 172), Lillard Mill (DRM 179), and Wilhoite Mill (DRM 187). Since 1970, E. walkeri has been collected only from the Middle Fork Holston River (Virginia) and the lower Red River (Tennessee), although in 1978 a single specimen from Lillard Mill (DRM 179) was tentatively identified as belonging to the E. walkeri complex. Since the intensive surveys conducted by TVA in 1979 failed to uncover this species, it is assumed that it no longer occurs in the Duck and Powell Rivers.

Quadrula intermedia Cumberland monkeyface pearly mussel. Q. intermedia was determined to be Endangered on August 23, 1977, (42 FR 42353), but Critical Habitat has not yet been determined. The species was originally described by Conrad (1836), and its

historical range includes the Powell, Clinch, Holston, Nolichucky, Elk, Tennessee, and Duck Rivers. The Duck River sites include Columbia (DRM 131), Sowell Ford (DRM 160), Hardison Mill (DRM 172), and presumably, at Lillard Mill (DRM 179). Recent surveys indicate that this species still occurs in the Duck River in limited numbers and in the Powell River in somewhat greater abundance. One dead specimen was found in the Duck River in 1973 at DRM 179.5 whereas the rather intensive 1979 survey conducted by TVA revealed live specimens at three sites out of 91 examined over a 112mile stretch of the river plus valves at a fourth site. In the Powell River, specimens have been rather consistently collected over the years and the 1979 TVA survey turned up this species both alive and as fresh shells at 11 out of 77 sites examined over a 111mile stretch of the river. Even so, recent estimates suggest that in the Powell River populations may not exceed a few hundred individuals. As presently planned, the Columbia Dam reservoir would inundate all the known sites of Quadrula intermedia in the Duck River, and the Low Pool alternative proposed by TVA would also cover these populations by a reservoir. Even though the Duck River populations of this species apparently consist of fewer individuals than those of the Powell River, total numbers of the species are small and completion of the dam would significantly restrict the distribution of the species, appreciably reducing the likelihood of its survival and recovery. This effect would be exacerbated by specific cumulative impacts including increases, both present and proposed, of mining activities in the Powell River watershed and the release of sedimentation of various kinds into the Powell River, particularly those from coal washing facilities.

Toxolasma cylindrella - pale lilliput pearly mussel.
T. cylindrella was determined to be Endangered on August 23, 1977, (42 FR 42353), but Critical Habitat has not yet been determined. The species was originally described by Lea in 1868. Its historical range includes the Buffalo, Duck, and Elk Rivers and Indian Creek (Tennessee), and Paint Rock and Flint and Bear Creeks (Alabama). It is currently known from Larkin Fork (Alabama). Recorded sites in the Duck River include Columbia (DRM 131) and Riverside (DRM 250). There have been no verified collections of T. cylindrella in the Duck River since 1965 and surveys in 1979 failed to uncover any specimens. The presently planned Columbia Dam will create an impoundment that would inundate one of the historic locations on the Duck River.

The upstream location has been inundated by the Normandy Dam reservoir, and, if any populations still exist between the two recorded locations, the effects of TVA alternatives on this species would be the same as described for Conradilla caelata.

In addition to the consideration of these two listed mussel species, we will be in contact in the near future to provide you with information and comments regarding other species that may occur within the project area that have been proposed or are in preparation for proposal by the Service as Endangered or Threatened species.

Should any changes be made in the alternative courses of action, or the project is modified, or new species are listed that may be affected by the project, you must reinitiate consultation.

I want to express the Service's appreciation to the Tennessee Valley Authority for their assistance in this consultation and their efforts to meet responsibilities under the Endangered Species Act of 1973. Should you desire clarification of items in this opinion or desire further assistance, we will be pleased to respond. Also, should TVA desire to initiate the recommended studies and conservation measures, the Service stands ready to assist to the extent possible.

Sincerely,

(SGD) Lynn A. Greenwalt

Director

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