

SE 7-2-8-1a

BIOLOGICAL OPINION, COLUMBIA DAM PROJECT, MARCH 26, 1979,
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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 through November 10, 1978 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).

The following is a brief chronology of events leading to the initiation of construction on the project and subsequent consultations of the U.S. Fish and Wildlife Service (FWS) relative to the project.

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 building 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 dam project was proposed as units of the Upper Duck River Project in a 1968 report. Construction of Normandy Dam began in June 1972 and was completed in 1976, while construction at the Columbia site began in August 1973 and the dam and reservoir are now about 30% 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 and will create a 12,600 acre multipurpose reservoir at a normal summer pool elevation of 630 ft., which would extend 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^{cu.} ft and 80 ft. above the flood plain, and a concrete weir controlled by five 40-ft-high by 40-ft-wide radial gates. The Columbia Dam would be located approximately 112 miles downstream from the Normandy Dam, completed and closed in January 1976, the two of which were originally to be operated as a unit in a total water control system. This water control system would contribute to area development by: 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, and the "Draft Report on Preliminary Studies of Columbia Dam Alternatives" of February 1979 provided by TVA.

On June 14, 1976 (41 FR 24064) several species of mussels were listed as endangered species in a final rulemaking, several of which were reported to have occurred in the upper Duck River.

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 agreed to consult, specifically ^Csiting one species, Conradilla caelata, and requesting information on the occurrence of other species in the Duck River. A consultation meeting between FWS and TVA took place on January 12, 1977 with a biological opinion being 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 404 permit application for the project, for which 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).

On January 11, 1979 TVA requested that consultation be reinitiated to consider project alternatives that had been developed.

A consultation team was appointed by memorandum on January 29, 1979 comprised of Mr. Robert Jacobsen, Chief, Branch of Management Operations, Office of Endangered Species (Washington, D.C.), team leader Dr. Wayne Lm Milstead, Section 7 Team Leader, Office of Endangered Species (Washington, D.C.); Mr. Robert Cooke, Endangered Species ^{Section 7 Team Leader} Specialist (Regional office, Atlanta, GA); Mr. Gary Henry, Endangered Species ^{Section 7 Team Leader} (Asheville Area Office, Asheville, N.C.); and Mr. Charles Kaiser, Solicitor, Dept. of Interior Solicitor's Office (Washington, D.C.). On March 6, 1979 the

consultation team met with representatives of TVA for a tour of the dam site on the ground and by helicopter, 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. A list of TVA and FWS personnel attending these two meetings is enclosed.

The consultation team reviewed information contained in the Environmental Impact Statement titled "Final Environmental Statement Duck River Project", April 28, 1972; in the "Supplement to Final Environmental Statement Duck River Project", June, 1974; and in the "Report on Preliminary Studies of Columbia Dam Alternatives", 1979; 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.

A summary of the biological data considered during this consultation and an indication of the probable affect of completion of the project as originally planned on each species is provided below:

Conradilla caelata - birdwing pearly mussel.

C. caelata was determined to be endangered on June 14, 1976 but (41 FR 24064) critical habitat has not yet been determined for the species. The birdwing pearly mussel was originally described by Conrad in 1834. The historical range has been reported to include the Powell, Clinch, Holston, Elk, Duck,

and Tennessee Rivers (Mussel Shoals), and in Flint Creek in Alabama. The Duck River sites were at Columbia (DRM 131), Leftwich (DRM 156), Sowell Ford (DRM 160) and Lillard Mill (DRM 179). Recent surveys (1978) suggest that the species probably only occurs at the Lillard Mill site in the Duck River, although a few specimens have been observed from the lower Clinch River and populations are reported to exist in the lower Powell River. Density levels for the birdwing pearly mussel at Lillard Mill were determined in 1976 to be 1.7 individuals per square meter and in 1978 to be 1.4 per square meter, both of which suggest that the mussel is quite abundant at this site. The construction of Columbia Dam as originally planned would inundate Lillard Mill (DRM 179) and therefore would adversely effect the species.

Epioblasma turgidula - turgid-blossom pearly mussel.

E. turgidula was determined to be endangered on June 14, 1976 (41 FR 24064) and was added to the U.S. List of Endangered and Threatened Wildlife and Plants. Critical habitat has not yet been determined for the species. E. turgidula was originally described by Lea in 1858, and has been reported in the past to occur in the Holston, Emory, Tennessee and Duck Rivers, and in Shoal and Bear Creeks (Alabama). The Duck River sites are Columbia (DRM 131), Shelbyville (DRM 221), Dement Bridge (DRM 243), Normandy (DRM 245), and Normandy (DRM 250). In 1971 one worker assumed that the species was extinct. The most recent collection of the species was from 11.5 miles east of Shelbyville, Bedford Co., TN in 1972 but no specimens ^{were found} in surveys made in 1976 and 1978. Some recent sites have now been covered by Normandy

reservoir. This species appears to be highly intolerant of the kinds of environmental changes being affected by man in the area. The construction of high dams as planned at Normandy and Columbia on the Duck River and the combined threats from increasing varieties and amounts of pollutants may ~~severely~~ ^{adversely} affect the survival of this species. The construction of Normandy Dam has inundated the Duck River upstream from ^{approximately} DRM 250 and water quality seems to have been affected downstream as far as DRM 221. The construction of Columbia Dam would probably affect water quality downstream ⁴ as mile 131, an old site reported for the species.

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 designated. The species was originally described by Wilson and Clark in 1914. It has been reported to occur in the Holston, Red, Stones, Harpeth, Flint, Buffalo, and Duck Rivers, and in Limestone Creek (Alabama). The Duck River sites were 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, although in 1978 a single specimen from Lillard Mill (DRM 178) was tentatively identified as belonging to the E. florentina - E. walkeri complex. Since all populations known in the Duck River occurred from Wilhoite Mill (DRM 187) downstream to the city of Columbia, the impoundment created by Columbia Dam if constructed as originally planned would adversely affect the species.

Quadrula intermedia - Cumberland monkey-face pearly mussel.

Q. intermedia was determined to be endangered on June 14, 1976 (41 FR 24064), but critical habitat has not yet been designated. The species was originally described by Conrad in 1836, and its historical range includes the Powell, Clinch, Holston, Nolichucky, Elk, Tennessee, and Duck Rivers.

The Duck River sites were Columbia (DRM 132), Sowell Ford (DRM 160), and Hardison Mill (DRM 172), and, presumable, at Lillard Mill (DRM 179.5). The last specimen taken from the Duck River was in 1973 from DRM 179.5 as a dead specimen. This species has never been found living in the ponded stretches of the river nor is it known from very small streams. The presently planned Columbia Dam would inundate the historic locations on the Duck River and, presuming that a population still exists there, then the Columbia Dam would adversely affect the species.

Toxolasma cylindrella - pale lilliput pearly mussel.

T. cylindrella was determined to be endangered on June 14, 1976 (41 FR 24064), but critical habitat has not yet been designated. The species was originally described by Lea in 1868.. Its historical range includes the Flint, Elk, Buffalo, and Duck Rivers. Recorded sites in the Duck River are Columbia (DRM 131) and Normandy (DRM 1250). There have been no verified collections of T. cylindrella in the Duck River since 1965. The presently planned Columbia Dam will create an impoundment that would inundate one of the historic locations on the Duck River. The other location has been inundated by ^{the} Normandy Dam reservoir.

The Fish and Wildlife Service has also examined other public and private activities or programs whose impacts might be cumulative on the subject species. Since the historical range of all five of these mussel species most often included the Clinch, Powell, and Holston Rivers in Tennessee and Virginia in addition to the Duck River in Tennessee, these were the areas 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 Corps of Engineers, the Soil Conservation Corps, 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, might 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, especially the birdwing pearly mussel where it occurs in the middle reaches of these rivers. Potential negative effects were most often the result of 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 on the Columbia Dam project maintained in the Office of Endangered Species. As a result of this review it appears that although the existing potential effects of other projects are minimal individually relative to the proposed Columbia Dam project, their cumulative effect on the birdwing pearly mussel could be of a serious magnitude.

Since the FWS has already rendered a biological opinion on the Columbia Dam project as originally planned (Feb. 16, 1977), the reinitiation of consultation necessitating this biological opinion was based on the development by TVA of a series of alternatives to the original plan. Three alternatives were presented by TVA in the draft document entitled " Report on Preliminary Studies of Columbia Dam Alternatives" dated February 1979. Details covering the alternatives can be found in this document. These alternatives were presented to the team at a meeting with TVA on March 7, 1979. In summary, the three TVA alternatives are as follows:

1. Complete the project as planned and mandate measures to assure habitat for the mussel populations of the Duck River superior to what presently exists.

Measures would also be mandated on the Clinch, Powell, and North Fork Holston Rivers to provide additional opportunities for survival and growth of endangered mussel species known from the Duck River in the recent past and possible still occurring there. The mandated measures to assure habitat for these mussels include the following:

- A) Water quality - The dam will be operated to simulate, as closely as possible, natural flow rates, temperature fluctuations,

silt loading and water quality conditions. Discharges of Effluents to the river will be required to meet stringent pollution standards. The criteria for dam operation and discharge control will be determined by detailed ecological studies of habitat requirements of existing healthy populations of the species previously inhabiting the area.

b) Low ~~pool~~^{dams} - Reconstruction and renovation of old mill dams and construction of new low-level dams or similar structures will be carried out to create habitats similar to those habitats now containing mussels in the Duck River, such as Lillard Mill.

c) Shoals - Natural shoals will be protected from adverse impacts such as gravel dredging in the Duck River and in other streams containing viable populations of Cumberlandian mussel species (specifically the five referenced species of this opinion), such as the Clinch, Powell, and North Fork Holston Rivers.

d) Transplants - All of the mussels in the section of the river to be impounded will be transplanted to suitable habitat elsewhere in the Duck River or other suitable streams such as the Clinch, Powell and North Fork Holston Rivers. Sanctuaries will be proposed to appropriate state agencies, protective measures will be supported and special programs to abate existing severe environmental problems will be developed, including reclamation of disturbed areas, upgrading of municipal waste treatment systems and improving soil erosion control practices.

e) Regulatory measures - Additional regulatory measures will be promoted by working through appropriate state agencies to

control taking or disturbance of mussels. This would include subsidizing state enforcement programs if necessary.

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 operated to supplement and regulate flows from Normandy to serve the water needs of Columbia in a timely manner. 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.

Based on my consultation team's review of the above information and other information and data available to FES, it is my biological opinion that the first and second alternatives proposed by TVA are likely to jeopardize the continued existence

of the five subject mussel species, whereas the third proposed alternative is not likely to jeopardize the continued existence of these species. The first alternative does not provide adequate assurances that TVA can and will establish and provide the number and quality of suitable habitats in the Duck River and other streams necessary to assure the continued survival of the five referenced species of mussels in a superior condition than now exists before the final decision is made as to whether and when the dam is to be closed as originally planned. It provides no alternative but that the final project be as originally planned. The second alternative does not provide adequate safeguards against the possible negative effects on prime mussel habitat of impounding water to within a short distance of Lillard Mill in the absence of conservation measures for the five endangered mussel species.

However, a reasonable and prudent alternative to the first and second alternatives described above would seem to be for TVA to develop and implement successfully a series of studies and a conservation program for the five subject mussel species (especially the birdwing pearly mussel), in consultation with and with the assistance of the FES, as a precursor to final decisions regarding closure of the dam and the extent of water impoundment. This alternative presumes the possibility that the Columbia Dam project could eventually be completed to provide some or all of the original objectives without being likely to cause jeopardy to the continued existence of the birdwing pearly mussel, the turgid-blossom pearly mussel, the tan riffle shell clam, the Cumberland monkey-face pearly mussel, and the pale lilliput pearly mussel. Completion of the dam

should be held in abeyance until intensive surveys have satisfactorily established the presence or absence of the turgid-blossom pearly mussel, the tan riffle shell clam, the Cumberland monkey-face pearly mussel, and the pale lilliput pearly mussel in the project area, and the host fish species necessary for the development of birdwing pearly mussel glochidia has been identified. If it is found that the first four of the subject species listed above no longer occur in the Duck River, then subsequent studies and conservation measures will pertain only to the birdwing pearly mussel. Otherwise, those species still extant in the area will be treated similarly in studies and conservation programs. Once the identity of the host fish has been established along with its role in the life cycle of the birdwing pearly mussel, the TVA will consult with the FWS regarding the effect of completing the earthfill portion of the dam across the present diversion channel on the existence of this fish in the Duck River where the birdwing pearly mussel occurs. If, at this point it is mutually agreed that this portion of the dam might be completed, water could be rerouted through the dam site for re-regulation purposes utilizing the spillways as illustrated in figure 3b of the "Report on Preliminary Studies of Columbia Dam Alternatives" at elevation 568 or at an elevation that is determined would not impound water above the natural flow levels now experienced at Leftwich (approximately DRM 156). Otherwise, ~~the~~ the third alternative proposed by TVA and previously summarized here might remain as the only alternative to jeopardizing the continued existence of the birdwing pearly mussel. The dam might then

be operated as a re-regulation project until additional studies are conducted that are designed to describe the biotic and abiotic characteristics of the Lillard Mill aquatic habitat on the Duck River as well as the habitats at sites on the Clinch and Powell Rivers in Tennessee and Virginia where the birdwing pearly mussel is known to occur. Similar studies will 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 invertebrate communities;
- aquatic vertebrate communities; and
- macrophyte communities.

In addition to efforts at identifying the host fish for the birdwing 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.

fish with birdwing pearly mussel glochidia;
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 birdwing pearly mussel as a step toward identifying possible transplant sites and/or habitat manipulations that might be necessary to assure the continued existence of the mussel in these rivers. Once sufficient baseline habitat and life history information has been obtained and potential transplant sites in the Duck and possible the Clinck, Powell and Holston Rivers have been selected and prepared, initial transplants of birdwing pearly mussels from the Lillard Mill site may be made. But, because of the present importance of the Lillard Mill population of this 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 completed and the success of transplants has been assured. Final stages of this conservation program will consist of evaluations of transplant populations to determine success of these efforts. If sufficient evidence is obtained to show conclusively that birdwing pearly mussel populations at transplant sites are surviving and in a superior condition than now exists at known sites, then a re-evaluation will be made through consultations between the FWS and TVA of the effects of various levels of closure of the dam and impoundment on the continued existence of the species.

Other measures in addition to the conservation measures outlined above may also be necessary. These include the application of stringent pollution standards on effluent discharges 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 consult with the Service on various stages in the development and implementation of these conservation measures.