

Harry S. Truman Dam and Reservoir—A Case History of Problems in Fish and Wildlife Coordination

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Introduction

The Harry S. Truman Dam and Reservoir project (HST) in west-central Missouri resulted from plans for dams in the Osage River Basin proposed in the early 1930s as part of a system to alleviate flood conditions on the lower Missouri and Mississippi Rivers (U.S. Congress, House 1934). Studies of the Osage Basin were conducted in the 40s and 50s, and the Kaysinger Bluff Reservoir (renamed HST in 1968) was authorized by Congress in 1954 as a single-purpose flood control structure (U.S. Congress, House 1954). In 1962, the project became "multiple-purpose" with the addition of a 1,040,000 acre-foot permanent pool for recreation and hydropower purposes (U.S. Congress, House 1962). This transition from a flood control structure to a complex project with a 55,600 acre (22,120 ha) permanent pool, and a flood pool that will extend to more than 209,000 (83,600 ha) acres suddenly made this project a major threat to significant natural resources of a magnitude surpassed by few other water resource projects in the United States.

The HST project is complex in every way: in its political background, its engineering aspects, the magnitude of its biological resources, its socioeconomic conflicts, and virtually all of the other classic problems with water developments as outlined in *Water Policies for the Future*, the 1973 Report of the National Water Commission. Few projects have been as clearly documented prior to completion as the HST project, and many more need public exposure to ensure that future development decisions are not at the expense of our natural resources.

Only selected references will be cited here because the public record on the HST project contains thousands of standard references, plus letters, agency reports, and affidavits of numerous experts. Most of the documentation is filed in the United States District Court, Western District of Missouri, and in the United States Court of Appeals for the Eighth Circuit, in St. Louis, Missouri. The HST project was under litigation during 1972 and 1973 in a lawsuit brought by the Environmental Defense Fund, Missouri Chapter of The Wildlife Society, and several citizens of Missouri.

The objectives of this paper are to: (1) summarize the nature and magnitude of resources to be lost or adversely affected; (2) identify major questionable aspects of the project, including socioeconomic problems; (3) identify major problems in coordination efforts between agencies responsible for fish and wildlife resources; and (4) relate this case history to other regional and national resource development problems.

The record upon which this paper is based was provided by experts from many disciplines across the United States. Some of the wording is taken directly from documents prepared for input into the *Environmental Statement (EIS), Harry S.*

Truman Dam and Reservoir, Kansas City District, Corps of Engineers, January 1973. My involvement occurred while I was Assistant Leader, Missouri Cooperative Wildlife Research Unit.

Natural Resources Affected by the Project

Terrestrial Wildlife and Their Habitats

The area to be flooded by HST includes two ecological types, the Western Prairies (tallgrass prairie) and the Western Ozark Border (oak-hickory hills), which meet in a broad ecotone across the project area. Five basic plant communities provide a proliferation of edges between habitat types, to produce a diversity of habitats not duplicated elsewhere in Missouri

The diversity of habitat types provides an environment inhabited by approximately 145 species of nesting birds, 95 species of wintering birds, 90 additional migrant species of birds, 19 species of resident amphibians, up to 46 species of resident reptiles, and approximately 55 species of mammals, of which 12 are bats which may migrate. Species of note in the project area include the bald eagle (*Haeleatus leucocephalus*) and up to 22 bird species found on *The Blue List* of declining species prepared by the National Audubon Society. Many species common to the project area are dependent upon bottomland forest habitats, and will vanish from the region with inundation of the bottomland (U.S. Army Corps of Engineers 1973b: Appendix D: 10–15).

A new dimension was added to the controversy over biological resources at the HST project site in 1976, when the presence of a maternity colony of gray bats (*Myotis grisescens*) was confirmed well within the flood pool. This species is listed as an endangered species under the 1973 Endangered Species Act. Preliminary estimates of population density in this colony range between 18,000 and 35,000 individuals, and bat experts believe that flooding of this colony's cave would result in high mortality (LaVal 1976). As a clear indication of the widespread effects of inundation of river bottom habitats, the gray bat is also a central issue in the controversy over the Meramec Park Lake project in eastern Missouri.

Permanent flooding will remove all wildlife which inhabit bottomland and associated upland in the 55,600 acres to be permanently flooded. Periodic flooding during the growing season will negatively affect formation and maintenance of stable plant associations or communities in the 153,400 acre (81,360 ha) flood pool area, and will correspondingly reduce wildlife populations and attendant recreational values. About 48,000 acres (19,200 ha) of the flood pool area will be inundated once every four years, and additional adverse effects may occur on the remaining 105,400 acres (42,160 ha) of flood pool habitat. For planning purposes, a 50 percent loss in productive capability of the flood pool area may be used to calculate potential wildlife production and its utilization, but the effects may be more severe on certain species (U.S. Army Corps of Engineers 1973b: Appendix D: 38–39).

The magnitude of the difference in productivity between bottomland and adjacent upland is important. For example, flood plains are characterized by bird densities of 400–500 pairs per hundred acres (40 ha), versus 300–350 pairs per hundred acres for upland forests, and species composition is more diverse (Karr 1968). Flood plain species would therefore be especially depressed by flooding.

Further, even highly mobile species, such as white-tailed deer (*Odocoileus virginianus*) and wild turkey (*Meleagris gallopavo*) may depend upon bottomland habitats for critical parts of their life cycle. The loss of bottomlands may therefore substantially decrease the carrying capacity of adjacent uplands, which is a significant secondary impact of inundation (U.S. Army Corps of Engineers 1973b: Appendix D: 38-39).

In 1970, data on deer harvest indicated that almost ten times as many deer were killed on bottomlands as on uplands in the project area. Turkey populations in the "Land Between the Lakes" area in Kentucky and Tennessee dropped from approximately one turkey per 16 acres (6.4 ha) to one turkey per 200-250 acres (80-100 ha) after two dams were constructed which destroyed bottomland habitat. Related secondary effects on turkey populations occurred around Lake of the Ozarks and Table Rock Lake in Missouri, where human disturbance due to resort and recreational development resulted in low turkey populations even though the area appeared to be good habitat (U.S. Army Corps of Engineers 1973b: Appendix D: 39-46).

The Missouri Department of Conservation (MDC) owns and operates the 8,633-acre (3465 ha) Schell Osage Wildlife Area, which lies largely within the flood pool. This area, with diverse habitats including open marsh, oxbows, croplands, flooded timber, upland forests and brushland is a vital public use area. More than 100,000 waterfowl wintering each year (one-third of the total state wintering population) depend on pin oak and pecan mast for food. Significant acreages of bottomland marshes and timber that flood periodically are located on private land and play a major role as waterfowl habitat in the project area. Reduction in the role of the Osage Basin as wintering habitat would be a serious loss, since wintering habitat has been drastically reduced throughout the Midwest.

Aquatic Life and Habitats

The Osage River above Lake of the Ozarks is the largest remaining stream in Missouri significantly unaltered by impoundment, channelization, or pollution. The large and diverse fish fauna supported by this stream reflect the diversity of habitats in the area, and at least 74 of the 103 species native to the Osage Basin occur in the upper Osage River (U.S. Army Corps of Engineers 1973b: Appendix D: 50-52; Pflieger 1975). Studies of other sites in Missouri indicate that the principal impact of HST on the aquatic fauna will be a marked reduction in faunal diversity among fishes, perhaps to less than half those now present.

The paddlefish (*Polyodon spathula*) is a unique element in the fish fauna of the upper Osage River where one of the few remaining stable populations of this species remains. Paddlefish were formerly abundant in most large rivers of the Mississippi Valley, but are now drastically depleted because of dams and other river modifications. Both the Lake of the Ozarks and the Osage River above the lake support substantial resident paddlefish populations, and sexually mature adults from the Lake of the Ozarks populations migrate into the Osage River during their spring spawning run and return to the Lake of the Ozarks once spawning is completed (Pflieger 1975). About 15-20,000 anglers annually snag for paddlefish in the Osage River and, in 1976, these anglers took 3,600 fish, averaging more than 30 pounds each (Missouri Department of Conservation News Release, October 1976). HST will inundate all of the known spawning areas for the

paddlefish in the Osage River Basin above Lake of the Ozarks, and thus will ultimately eliminate the fishery and significantly reduce the total paddlefish population.

Large populations of the blue catfish (*Ictalurus furcatus*), walleye (*Stizostedion vitreum*), and many other common game and forage fishes will change drastically. The invertebrate fauna of the upper Osage River is poorly known, but it supports a large freshwater mussel fauna, perhaps including some species that are considered to be endangered nationally (U.S. Army Corps of Engineers 1973c: E-9). Dams elsewhere have resulted in the extirpation of freshwater mussels, and this will likely occur once the Osage River basin is further inundated.

Ancient Humans and Associated Wildlife

Areas to be flooded permanently and periodically by the HST project contain about 4,000 vital archaeological and paleontological sites. Spring bog deposits in the Pomme de Terre Valley within the project site have an excellent record of Pleistocene and post-Pleistocene environments. Few places in the world have greater potential value for documenting climatic change as reflected in the flora and fauna, including humans, since the time of the Ice Ages. Because of its location at an interface between the tallgrass prairie and the Ozark Uplift, the archaeology and paleontology of the project site are unique (U.S. Army Corps of Engineers 1973c: Appendix D: 21-24). Some of the spring bog deposits along the Pomme de Terre River in the project site have yielded Ice Age mammal bones that rival in importance those of Rancho la Brea, California, and Big Bone Lick, Kentucky. These deposits are ideally suited for study and retain a remarkably complete record of organic life in the form of fossil plant remains, pollen, and mollusks, as well as the bones of large extinct animals. The long history of human habitation (10,500 years), coupled with an even longer record of plant and animal changes (40,000 years) make this an especially valuable area for further scientific study (U.S. Army Corps of Engineers 1973b: Appendix D: 21-24).

Of particular interest are questions regarding overlaps in time between representative species of flora and fauna in relation to climatic change. Cave deposits are dominated by the remains of dire wolves and extinct bears and peccaries. The faunal record of spring deposits includes mastodons, with 27 mastodon skeletons being recovered from only one spring. These specimens, together with those from unexcavated sites, could provide paleontologists with a unique sample for population studies (U.S. Army Corps of Engineers 1973b: Appendix D: 21-24).

The relationships between past human population growth, technological efficiency, and environmental potential are essential problems in understanding human development. The prehistoric cultures that occupied the proposed reservoir area were uniquely adapted to the local environment. Roger's Shelter, a habitation site within the project boundaries which was occupied by humans for more than 10,500 years, is on the National Register of Historic Places. Excavation of this site has been accelerated with Corps funding in an attempt to avoid total loss of its scientific potential.

Until HST was under litigation, very little funding was made available for archaeological and paleontological research. Under the influence of NEPA and litigation, more funds have been supplied, especially for research at Roger's Shelter (U.S. Army Corps of Engineers 1973c: Exhibit 10). Accelerated salvage pro-

grams will be unable to fully utilize the archaeological and paleontological resources of the entire project area, since analysis is limited to current techniques and concepts.

Questionable Aspects of the Project

Flood Control

The HST project is a component in a flood control plan for St. Louis and other downstream flood plains which was part of the so-called "Pick-Sloan Plan" proposed in 1944 for the entire Missouri River basin (U.S. Congress, Senate 1944). The basic reliance upon structures such as dams and levees, which offer a false sense of security to residents below dams or behind levees, has generally induced development and occupation of flood plains. Such general policies have been identified as economically and socially disastrous by the 1973 Report of the National Water Commission and numerous other large-scale federal studies. The Black Hills flood of June 1972 (Orr 1972), Tropical Storm Agnes (New York Times 1972), and the 1973 flood on the Missouri and Mississippi River (Belt 1975) have added additional support to these conclusions.

Agricultural areas along the lower Osage and Missouri Rivers are part of the area to be protected by the HST project. Dollar benefits over 100-year projections are calculated as benefits to be accrued from flood protection, but few dollar values are similarly assessed as losses, and thus project costs, for the many potential uses of the area to be inundated, or from downstream areas that will be developed for urban uses. The major urban area, St. Louis, has developed its flood plains unwisely as, for example, "Earth City" which has recently begun to cover several thousand acres of bottomland with industrial and other urban uses. These unwise developments in the flood plain now add to project justification, continuing the circular pattern.

The "Standard Project Flood" used for hypothetical flood planning for the St. Louis area, and thus for HST, is one which will be equaled or exceeded approximately once in 5,880 years on the average (Eisel 1972). Since flood control is one of the major reasons for development of this project, congressional or agency decision makers should be well aware of this planning framework, but they are not. Other planning efforts for flood control in the United States currently use the approximate 100-year average flood frequency. A GAO report (1975) concluded that national attempts to reduce losses from floods by controlling the uses of flood-prone lands have met with only limited success, and that such efforts should be intensified to decrease flood losses. This is a desirable alternative to dams and structural protection.

Hydropower

Hydropower was authorized at the HST project by the Flood Control Act of 1962 although financial feasibility had not been demonstrated by the Corps in its authorizing study (U.S. Congress, House 1962). In 1966 the Corps approved the installation of turbines to provide a pump-back hydroelectric power unit at the HST site, even though revenues from the sale of power could not adequately recover the cost of the federal investment within the required 50-year repayment

period. The whole question of the suitability of hydropower at this project site is significant because the flow regime and operation of the reservoir will be influenced by the power unit.

It is expected that the power plant will generate power for 7 hours each week-day from June through September. Power may also be generated on demand during other times of the year, or during periods of high rainfall when excess water is available. Water will be run out of Truman Reservoir to turn the turbines, and be pumped back during the night. Water will enter the Lake of the Ozarks at 6 feet (2 m) per second and begin forming a wedge of water that will elevate Lake of the Ozarks waters about 5 to 6 feet (1.7–2 m) at the dam site, about 4½ feet (1.5 m) near the town site of Warsaw 2 miles downstream, and 1 to 1½ (.3–.5 m) feet 16 miles downstream (65 km). Needless to say, the level of Truman Reservoir will also drop as the water flows out, and then the reverse situation will occur at night during pump-back.

A 1970 study of HST projected power operations by Black and Veach, Consulting Engineers, revealed that Corps data indicate drawdowns which would reduce the permanent pool area by 30 percent on a weekly basis. Adverse effects would result on the entire littoral zone of the reservoir, exposing mudflats, affecting riparian vegetation, making fishery management uncertain, and greatly reducing recreational values. This flow regime may increase lake turbidity, and downstream fluctuations would have similar negative consequences for the Lake of the Ozarks and riverside habitats below the dam.

A General Accounting Office study dated January 24, 1973, of cost estimating procedures used by the Corps concluded on page 21 that "the Corps presented misleading data to Congress on estimated power costs and revenues for the Truman Reservoir and did not update and furnish full information of the recoverability of the power costs." The Southwestern Power Administration of the Department of the Interior generally concurred with GAO's findings, and suggested a review of the decision to go ahead with the power facilities at the HST site.

It is apparent that even though the hydropower unit will produce some of the most severe environmental hazards associated with the operation of the project and that costs may exceed benefits from power production, Congress was never presented with full information on which to base decisions which may have affected the viability of the entire project.

Recreational Markets and Transfer Use

The HST project will destroy 248 miles (397 km) of free-flowing water of the Osage River and its tributaries, and will adversely affect an additional 30 miles (48 km) of the river channel downstream. Additional adverse effects from the highly uncertain water flow may affect recreational values on Lake of the Ozarks. Recreational and aesthetic values for the existing riverine area are not adequately accounted for in balancing costs and benefits for this project, even though economic returns from recreation at the reservoir are projected over a 100-year period (U.S. Army Corps of Engineers 1973b: VIII–38). These one-sided projections provide one-quarter of the economic justification for the entire project (U.S. Army Corps of Engineers 1973c: 24).

Estimates by the Corps of Engineers for expected recreational usage of Truman Reservoir exemplify a serious problem with reservoir development throughout the country. Potential recreational use of a reservoir is difficult to estimate, and may be affected by such things as the character of the reservoir, the type of fishery it produces, and the proximity of other recreational attractions. Most serious in this case is the matter of "transfer use" from or to other existing reservoirs in the area, which means essentially that a substantial segment of the "demand" used as a basis for recreational projections would simply involve a transfer of use from one lake to another, such as from Lake of the Ozarks to Truman Reservoir.

Corps experience with 9 reservoirs near Tulsa and Oklahoma City, Oklahoma, and 10 reservoirs near Dallas and Fort Worth, Texas, led to the selection of a visitor days per person factor of 8.0 which was used to calculate projected visitations for the HST project, and many others in Kansas and Missouri. Details on Corps recreational projections are in an affidavit by Amos C. Griesel, dated May 24, 1972 and in the files of the United States District Court, Kansas City, Missouri. The diversity of recreation potentials available in Missouri does not occur near these large cities in either Oklahoma or Texas. Further, public land is so scarce in Texas that any kind of publicly available recreational resource will draw people out of proportion with the normal drawing power in areas of greater diversity. These examples are not representative of Missouri recreation potentials.

With Texas- and Oklahoma-based visitation rates, the population of the Kansas City metropolitan area (about 2 million) is used as a major basis for projecting approximately 4 million visitor use days annually during the first years of the HST project, and up to 7 million per year later (U.S. Army Corps of Engineers 1973b: III-41). Lake of the Ozarks is assumed to receive approximately 4.5 million visitations annually and, within a 100-mile radius of Kansas City there are completed, under construction, or fully authorized 32 reservoirs which include recreation as a large measure of their justification. The population of the Kansas City metropolitan area is a major basis for recreation usage projections for all of these. If all of these reservoirs are built, they will provide more than 293,500 acres (117,400 ha) of water within 100 miles (160 km) of Kansas City. More than 120,000 acres (48,000 ha) are currently available for recreation within 100 miles of Kansas City, and about 187,000 acres (74,800 ha) will be available within a few years.

For 23 of the above mentioned 32 reservoirs, Corps data for expected annual visitation is in the neighborhood of 28 million visitor use days annually. Using the current population of the Kansas City metropolitan area, even if half of the estimated visitations were from outside the area *every* Kansas City resident would have to visit a reservoir about seven times a year. Substantial numbers of Kansas City people visit Oklahoma and south Missouri lakes each year, and like to do many things other than going to reservoirs. The Kansas City population is currently being used beyond any reasonable limits as the major factor in justifying reservoirs. The key to the problem is the re-use of this metropolitan area in an incremental fashion for each reservoir proposed, without attention to transfer use, as if only the single reservoir in question were to be available to water-hungry recreationists who have an insatiable demand for more flat water. These figures *do not include* Truman Reservoir, which would add 55,600 acres (22,240 ha) of water and is being estimated initially at 4 million visitor days use annually.

Effects on Local People and Their Economy

Many of the more than 500 farm families to be displaced by the HST project have family histories in the Osage Basin which go back more than 150 years. These people inhabit a pleasing and diverse landscape of cropland, pasture, woodland, overflow bottoms, and rivers and creeks. Their uses of the land are fairly stable, and it is unlikely that there would have been any acceleration in development for agriculture because of limitations in soil quality.

Corps data show that an estimated 2,341 families, representing almost 8,300 people, will be displaced by the project (U.S. Army Corps of Engineers 1973b: XIII-58). This is more people than 13 Missouri counties have within their boundaries. The first 685 families forced to leave their homes in the early stages of the project before 1971 were paid an average of \$390 in resettlement assistance (Corps' letter from Paul Barber, June 26, 1972). While this assistance has gone up in the later years of the project, no real provision has been made to attempt to accommodate the terrific shock to individuals, families, and communities in the project area. Previous experiences in the development of TVA lakes, and in the movement of native Americans from the river bottoms along the upper Missouri River indicate severe effects on people and social institutions in the area. No hard information is available on the fate of these people, but with the scarcity of land and lack of any significant assistance in relocation a tragic outcome is predictable.

Studies of the local economic effects of three lakes developed near the HST project in Missouri revealed that many of the benefits predicted by developers have not materialized (Campbell 1972). Short-term increases in local income and employment occurred in relation to construction of the projects, but the real effect on family incomes and occupations, and industry was not great. Related studies of reservoir effects in Illinois concluded that projected economic benefits may be largely imaginary (Ballard 1974). Real effects of large water projects on local people need to be examined closely.

Long- Versus Short-term Potentials

Project completion essentially removes all other future alternative uses of the area. Recreational values, flood control, hydropower, and all the economic aspects of the project are based on highly risky estimates of future "needs" which are subject to extreme variation. If benefits are to be calculated over 100 years of potential project life, so, too, should costs be calculated from loss of productivity of the land and its biota for that same 100 years. Socioeconomic studies are beginning to show that many promises of large Federal developments are never realized.

One resource in the Osage River Basin exemplifies development without clear appraisal of future potentials. With the first reservoir, the Missouri part of the Osage Basin lost 130 miles (208 km) of floatable stream. The second took 46 (73 km), the third 65 (104 km), and HST will take 150 (240 km) more. The Missouri part of the Osage Basin will now have one-third its original amount of floatable stream.

The Osage Basin covers slightly more than 15,000 square miles (39,000 km²), mainly in Missouri, but partly in Kansas. The HST project will be the sixth large project in the basin, with four others authorized. In a 1970 study of the "conserva-

tion needs" of the Osage Basin, the Soil Conservation Service identified 161 possible small reservoir sites on various parts of the basin. In the early 1970s, the Corps conducted studies and held public hearings on 12 additional reservoirs in the upper part of the Osage Basin. Fortunately, most of these will not be seriously considered.

This incremental nature of water developments is a serious problem in balancing long-term versus short-term use potentials. Whereas, a single reservoir in the Osage Basin might be justified on the basis of flood control, recreation, and production of hydroelectric power, the HST project is part of a developmental overkill which continues to foreclose future options.

Efforts Toward Fish and Wildlife Coordination

Agency Participation in HST Planning

The HST project was originally planned under a land acquisition policy of minimum fee-title purchase, with emphasis on flowage easement (U.S. Congress, House 1954). Residents of the basin and responsible state agencies involved in project studies approved the project plans expecting a single-purpose flood control structure, minimum permanent pool size, little or no acquisition of privately owned land, and substantial mitigation for wildlife and recreation values in the form of land for management and a large waterfowl refuge. When the project was redesigned in 1962, it included the 55,600 acre (22,240 ha) permanent pool, but Corps policies had switched to include fee-title acquisition at project sites, and the proposed federal waterfowl refuge was deleted from requests for project authorization (U.S. Congress, House 1962). At this point this project became very controversial.

In correspondence files of the Missouri Department of Conservation, Conservation Federation of Missouri, U.S. Fish and Wildlife Service (FWS), and other agencies there are written records which reflect the consistent lack of coordination as required by law under the Fish and Wildlife Coordination Act (16 U.S. Code 661-667e).¹

The failure to afford equal consideration to fish and wildlife resources was not the fault of any single agency. Political activity not in the public record contributed to coordination problems which influenced key decisions about development of the HST project. I have interpreted only those highlights of project history which are available in the public record, and which bear directly on requirements of the Coordination Act.

As early as March 1960, representatives of the Missouri Department of Conservation (MDC) wrote the Corps of Engineers to ask if rumors about a proposed dramatic increase in the size of the project were true, and expressed concern about the effects of the project on the Schell-Osage Wildlife Area. By November 6, 1961, MDC still had not received complete information from the Corps, and again expressed its concern in writing. By late-November, 1961 the Conservation Department had concluded "it is very possible the (Schell-Osage) Area may be totally destroyed with regard to operating it for the purposes intended." On De-

¹Copies of much of this correspondence are also available in the files of the United States District Court, Western District of Missouri, Kansas City, Missouri, as a part of the court record in the HST litigation.

ember 26, 1961, the FWS² expressed concern to the Corps for the impact upon the "unique paddlefish fishery," and indicated that spawning areas used by the paddlefish would be destroyed. The FWS also expressed concern over the general impact of the project, including the Schell-Osage Area.

On June 13, 1962, the Office of the Secretary of the Interior wrote to the Corps of Engineers and expressed regret that action by the Corps in requesting Congress to reauthorize the project with significant changes was done without allowing a reasonable time for FWS to complete its study of the effects of the new project, in order that FWS's detailed report, including a justification of the proposed waterfowl refuge, could have accompanied the final report that went to Congress. Such coordination is specifically required by Section 662(b) of the Coordination Act, but was not done in this case.

The proposed waterfowl refuge had been considered an essential component in nationwide plans for providing a secure network of wintering areas. All negotiations regarding the changing plans for reservoir development in the Osage Basin had included specific recommendations to include such a refuge in any water development in the basin. In a public statement at Warsaw, Missouri in 1963, the Missouri Conservation Commission stated that agreements between their agency, the Corps of Engineers, and the Fish and Wildlife Service regarding the project had included 120,000 acres (48,000 ha) of land for wildlife and recreation, and a 40,000 acre (16,000 ha) waterfowl refuge. Reports from Corps' field staff had recommended inclusion of the refuge, but the Chief of Engineers deleted the refuge request from the reauthorization proposal, and suggested that Congress should separately consider the refuge questions (U.S. Congress, House 1962: viii). The Office of Management and Budget concurred, and the refuge proposal for HST became hopelessly entangled in arguments over whether FWS should first develop a nationwide plan for its refuge system, whether the Corps had the original authority to request that the refuge be added to the project plans, and the new problems developing around land acquisition by fee-title rather than easement (U.S. Congress, House 1962: viii). This complicated failure of established coordination mechanisms precluded effective "equal consideration" as required by the Fish and Wildlife Coordination Act.

Again, on November 30, 1964, FWS complained in writing to the Corps that evaluations of the project had been hampered by a lack of data from the Corps, and by insufficient time in which to comment on project proposals. This report cited the Fish and Wildlife Coordination Act, and furnished detailed comments on problems of water quality releases from the reservoir, impact on the Schell-Osage Wildlife Area, effect on the paddlefish, and on other wildlife and recreational aspects of the project.

In 1969, the Bureau of the Budget requested a review of recreation benefit calculations for a number of Corps' projects, including HST. There was considerable confusion between state and federal agencies regarding responsibility for this restudy, and MDC had to ask to be included. In this restudy, the previous misuse of figures by the Corps as far back as the authorizing document (U.S. Congress, House 1962) was realized by all agencies involved. The study revealed that in 1966, when a Corps restudy of the project resulted in the recommendation to include pump-back power as a part of the project, the Corps did its own analysis of

²Then known as the Bureau of Sport Fisheries and Wildlife.

fish and wildlife and recreation costs and benefits, without incorporating the information available in the 1964 FWS report. Again, a significant change in the project which markedly affects all of the fish and wildlife resources was done without affording the responsible agencies the appropriate amount of information and the time frame in which to make detailed comments, as are prescribed by law under the Coordination Act.

In a joint report on the restudy by the Bureau of Outdoor Recreation (BOR) and FWS, dated July 8, 1970, the two agencies reviewed the past history of coordination on recreation evaluations, concluding that for at least two critical major reports to Congress requesting significant changes in the project, existing information in reports by FWS to the Corps were omitted in favor of separate evaluations done by the Corps. Further, this 1970 report concludes that the Corps overstated the overall recreational benefits of the project by approximately two-thirds. The BOR and FWS are the federal agencies with primary responsibility to evaluate recreational and fish and wildlife data. Normally, they are consulted by the Corps and the Congress for evaluation of these aspects of Corps projects. The Corps has disagreed with this restudy, even under duress of litigation and exposure of highly questionable methods of estimating recreational values.

Another example of continuing lack of effective coordination is the potential fate of the paddlefish. In 1961, FWS and MDC expressed their acute concern about the fate of the paddlefish, and recommended that a small hydroelectric dam at Osceola, Missouri, be removed to allow access by paddlefish to the upper Osage River. Upper river stretches may be the only chance for new spawning areas, although even these possibilities are not promising (Russell et al. 1976). The MDC has repeatedly asked for a 2-year period without the Osceola Dam in which to evaluate the potential for spawning. Part of Osceola Dam was removed in mid-February, 1977, probably not in time for study of even one complete reproductive cycle before closure of the HST dam. Low water this spring could prevent access by fish to the upper river, and preclude any evaluation of the potential for continued natural reproduction.

Possibilities for Meaningful Mitigation

The original Kaysinger Bluff project was accepted by state and federal conservation agencies partly because of promises of significant mitigation. The current mitigation plan provides a total of 30,800 acres (12,320 ha) in 13 areas for fish and wildlife management, and is not based on any known acceptable method for determining the need for mitigation lands. Further, 10 percent of the mitigation acreage would be water, 31 percent would be inundated every 5 years, and another 31 percent would be of low quality compared with the bottomland being lost to the project (U.S. Army Corps of Engineers 1973b: Appendix G). Current plans for mitigation ignore past promises and lengthy interactions of responsible agencies over several decades. They do not reflect the "equal consideration" clause in the Fish and Wildlife Coordination Act.

Under the influence of NEPA and litigation in the early 1970s, the Corps provided the first significant funding for research to try to alleviate the project's effects on paddlefish. Current research through the Missouri Department of Conservation has shown some potential for an artificial propagation program for the

paddlefish, but little promise for development of new spawning habitat (Russell et al. 1976). No further funding has been made available to develop reliable propagation methods, so the potential for mitigating the loss of the paddlefish fishery is highly uncertain.

There has been controversy since 1960 over the potential loss in productivity in bottomland hardwoods at the Schell-Osage Wildlife Area. Corps data show that frequency of flooding on the area will not change markedly. Of critical importance, however, is timing and duration of flooding—especially during the growing season. Recent studies by the Corps (1973) and MDC (Dellinger et al. in press) have shown that tree species vary considerably in their ability to withstand flooding. Pin oak are highly vulnerable, and pecan only slightly less so, and both are important mast producers.

Of great practical concern is the Corps' continuing inability to guarantee anything about flow regimes at midwestern reservoirs. Rathbun and Redrock in Iowa, and Carlyle and Shelbyville in Illinois have flooded for higher and longer periods than expected, causing significant tree mortality above, and flooding below the dam sites. If this is any indication, the fate of Schell-Osage is likely to be difficult to predict and realistic mitigation will be impossible.

Correspondence during the period 1962–67 between the various state and federal agencies and private citizens concerned with the HST project revealed that accelerated land development for agriculture, the development of hunting clubs, and a general increase in land prices had made the potential acquisition of a waterfowl refuge highly unlikely for reasons of economy and public relations. Again, the original deletion of the refuge from the project authorization, and the ensuing controversy over who had the responsibility to even request authorization for it, precluded effective protection of wildlife resources. The dim prospects for the Schell-Osage Wildlife Area compound the impact.

Even under duress of litigation, with repeated careful inputs from agency experts and other citizens, all the years of planning have had little effect on the project, or on prospects for significant mitigation. In a 1973 letter responding to the Final EIS, MDC acknowledged the so-far unsuccessful attempts to solve the paddlefish and Schell-Osage problems, but concluded that the EIS presents a "lack of commitment to proceed with the evaluation and implementation of procedures and measures necessary to adequately mitigate other fish and wildlife losses." Likewise, the FWS review of the 1973 Final EIS concluded that lengthy, extensive efforts at coordination between conservation agencies and the Corps of Engineers to reduce adverse environmental effects of the project have been "essentially a fruitless exercise."

It clearly appears that agency interactions regarding the HST project under the Fish and Wildlife Coordination Act have been unsuccessful in providing equal consideration of fish and wildlife values. After 17 years of attempts at coordination and detailed NEPA review, no modifications have been made in plans for project implementation in order to alleviate potential impacts on fish and wildlife resources.

Relationship to Regional and National Developments

The extent of the problem with water resource development pressures on fish and wildlife habitats bears repeating here, even though it is well documented

elsewhere. Extensive Congressional hearings on channelization and other stream alteration practices, evaluations of principles and standards for water resource development done by the Water Resource Council, the June 1973 Report of the National Water Commission, the proliferation of environmental impact statements, and litigation by public interest groups and private citizens against government agencies have all focused public and agency attention on a variety of water resources problems. These problems continue in spite of all of this public exposure. At the 1974 North American Wildlife and Natural Resources Conference, General Morris of the Corps of Engineers stated that more than 5,000 projects costing more than \$19 billion were currently authorized for construction. Almost 9,000 small watersheds in this country have been designated by the SCS as needing PL-566 project developments. A recent report by the General Accounting Office disclosed that fish and wildlife resources have not received equal consideration in water project developments as is required under the Fish and Wildlife Coordination Act of 1958.

The significance of the resources to be lost to the HST project relates to much more than the single project. Adjacent areas in Kansas, Oklahoma, Arkansas, and Missouri include some of the most heavily developed areas of artificial reservoirs in the country. The Missouri River itself has been channelized, riprapped, and diked for more than 750 miles (1,200 km) of its length. Mainstem reservoirs up the Missouri have buried hundreds of thousands of acres of productive wildlife habitats and destroyed natural streams, with the result that flood plains continue to be developed and the American taxpayer continues to pay for any flood disasters associated with this development.

The certain loss of the tremendous resources to the HST project is only one increment in a much larger resource picture. The history of HST reinforces many current concerns about water resource development, and can serve as an example of what should be avoided in the future. When projects proposed decades before are finally constructed, they rarely meet current needs. Promises, compromises, and uncertainties at the time decisions are made about these projects haunt the people and resources of the project area when construction finally proceeds. Incremental consideration of single projects ignores adverse effects on natural resources over a wide area.

The Fish and Wildlife Coordination Act as amended in 1958 was an attempt to provide legislative guarantees for "equal consideration and coordination of wildlife conservation with other water resources development programs" (16 U.S. Code 661-667e). An important part of the Act, Sec. 662(b), provides that conservation agencies with responsibility for fish and wildlife resources must be consulted regarding any project development or major change in authorization, and that reports and recommendations from these agencies must be fully considered, and included where appropriate, in the request for project authorization and development. The example of the Harry S. Truman Dam and Reservoir project reveals ways in which this firmly stated protection has been unable to ensure that fish and wildlife resources receive equal consideration. While development agencies bear the brunt of criticism in such detailed analyses of individual projects, the fault is not theirs alone. The "system" established under the Fish and Wildlife Coordination Act is subject to political and other influences, and in this case the efforts of all responsible agencies have been deficient at certain times. Placing

blame for the shortcomings of the HST case is fruitless. The real lesson of this example is that the effectiveness of coordination must be strengthened through changes in the Coordination Act, and improved methodologies and functioning of all responsible agencies.

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