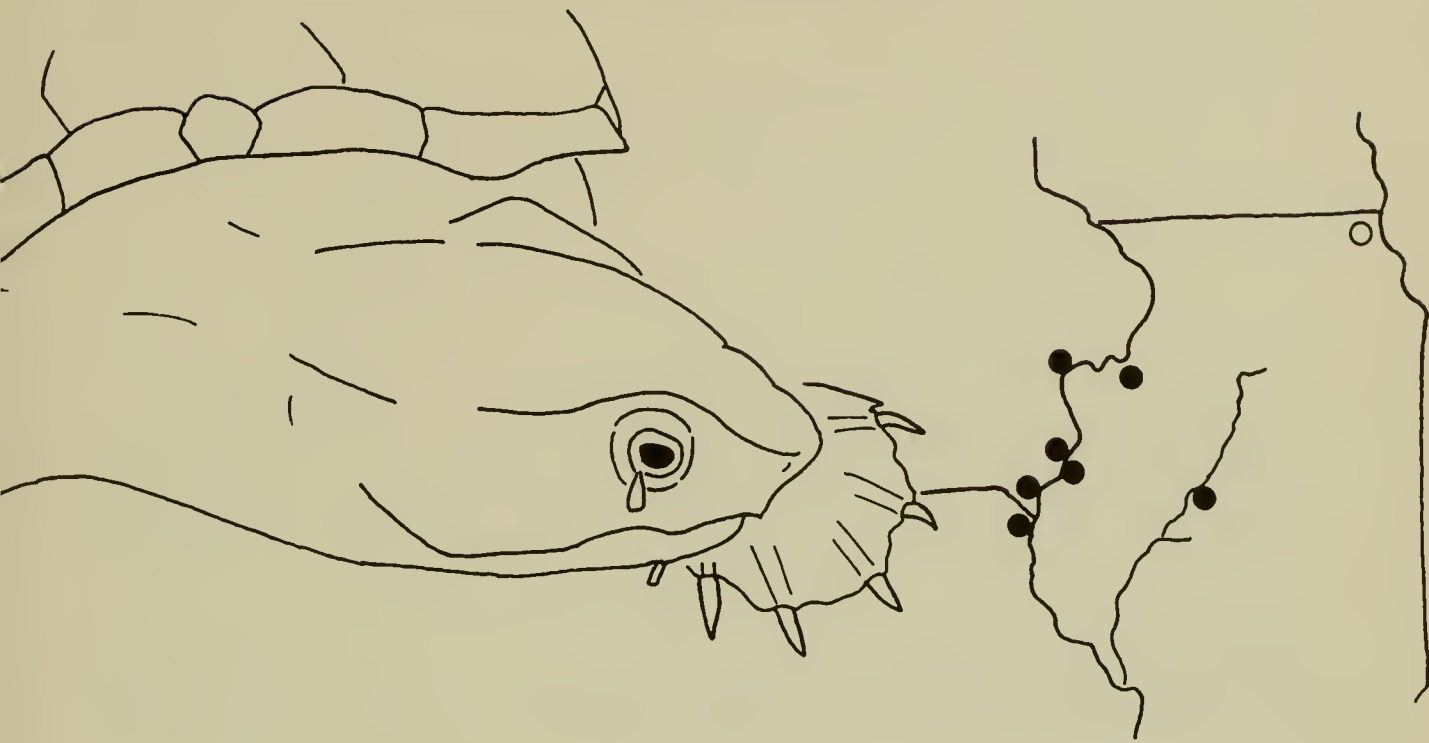


A CONTROVERSY SURROUNDING AN ENDANGERED SPECIES LISTING:
THE CASE OF THE ILLINOIS MUD TURTLE



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INTRODUCTION

The Illinois mud turtle, *Kinosternon flavescens spooneri*, is a small, dark brown turtle (adults approximately 7.5-13 cm carapace length) confined to a few scattered localities in the North American Midwest. Cooper (1975) was apparently the first to publish concerns about the continued survival of the Illinois mud turtle, although James Christiansen, in a letter to the then Bureau of Sport Fisheries and Wildlife, voiced concern for survival of this subspecies in Iowa as early as 1971. Others reached similar conclusions: Moll and Brown (1976) in Illinois, Cooper (1977) in Iowa and Missouri, and Murphy and Corn (1977) in Iowa. In early 1977, Dr. Lauren Brown (Illinois State University) contacted the Office of Endangered Species of the U.S. Fish and Wildlife Service and questioned if the turtle might qualify for the U.S. List of Endangered and Threatened Wildlife and Plants. At that time, I was preparing lists of amphibians and reptiles which might be candidates for federal protection but for which little supporting data were on file. At Dr. Brown's suggestion, the Illinois mud turtle was placed on a Notice of Review of various turtles (Dodd, 1977). At the same time, Dr. Brown was requested to prepare a status report on the species. This report (Brown and Moll, 1978) summarized available information used to propose the Illinois mud turtle as an endangered species under provisions of the U.S. Endangered Species Act of 1973, as amended (Dodd, 1978). This paper summarizes the natural history, conservation activities, proposed federal listing, and controversy surrounding the proposed listing. Information on taxonomic status, population estimates, distribution, and threats have been summarized elsewhere (Dodd, ms.). The opinions expressed are those of the author and not of the U.S. Fish and Wildlife Service or Smithsonian Institution.

NATURAL HISTORY

The following is a brief summary of the natural history and ecology of the Illinois mud turtle. Detailed accounts are in Cooper (1975), Springer and Gallaway (1979, 1980) and Kangas et al. (1980).

After reviewing the biological and physical characteristics of known habitats, Brown and Moll (1978) concluded that the Illinois mud turtle required five prerequisites for viable populations: 1) a sand substrate, 2) a sand prairie-scrub oak vegetation association of which bunch grasses, prickly pear cactus, blackjack oak, and black oak were the most important vegetational components, 3) a relatively flat topography, with low sand dunes desirable, 4) a lentic water source, that is, marsh, semi-permanent pond, or slough, and 5) the absence of human related modifications. Cooper (1975) stated that shallow permanent turbid ponds with organic bottoms were necessary; such ponds could serve as feeding areas.

In Iowa, Illinois mud turtles emerge from hibernation from late April to early May. They initially may be somewhat terrestrial, but by mid-May through mid-July, they are primarily aquatic. As summer temperatures increase and ephemeral ponds begin drying, the turtles again leave

the water and begin looking for terrestrial sites to spend the latter part of summer. At this time, turtles may move from one burrow site to another, or may burrow into the sand and remain in one location. In Iowa, Cooper (1975) observed turtles in early August, and Springer and Gallaway (1979, 1980) saw their last turtle in September, thus indicating to them that activity patterns may be bimodal. Indeed, terrestrial captures may occasionally occur throughout the summer months. Cooper (1975) caught animals on land primarily between 1500-1900 h in May and 1300-1600 h in June; the later in the season, the earlier the time of encounter as temperatures became warmer.

Kangas et al. (1980), monitoring 12 radio transmitted turtles in Missouri, also noted that turtles moved on land, although generally near water, from the time of emergence through about mid-June when they settled in one location. They reported one turtle in a marsh in September, thus also suggesting a second period of activity. Because of the long winter hibernation and summer aestivation, the Illinois mud turtle is considered fossorial, but whether it is more fossorial than other subspecies of *K. flavescens* is unknown. Mahmoud (1969) reported a roughly similar activity pattern for *K. f. flavescens* in Oklahoma although Christiansen and Dunham (1972) did not observe aestivation in New Mexico. In Iowa, there are roughly 106 days of annual activity, an extremely short amount of time for turtles (Cooper, 1975).

Upon emergence in spring, Illinois mud turtles spend considerable amounts of time basking, occurring primarily between 1100-1500 h (Cooper, 1975). As the season progresses, basking becomes less frequent until daily terrestrial activity takes on an early morning/evening and night pattern (Kangas et al., 1980).

Copulation begins in May and has been observed into July; it takes place both on land and in water (Kangas et al., 1980; Cooper, 1975). Nesting begins in mid-June. At this time, the female completely encloses herself in a subterranean nest where she lays her eggs. Smith (1961) reported clutches of 3-4, whereas Cooper (1977) estimated 2-6 and Kangas et al. (1980) 2-8 with a mean of about four. Springer and Gallaway (1979, 1980) observed two clutches, one with four eggs, the other with six, and Kangas et al. (1980) found one radio transmitted female in a nest with six eggs. Nests may be difficult to find. In spite of thorough searches, Christiansen and Haglan (1980) found no nests in the 1980 field season at Big Sand Mound.

While the age structures of the populations are unclear, especially the subadult classes, maturity is thought to occur by the 4th year in Missouri (Kangas et al., 1980) and the 5th year in Iowa (Springer and Gallaway, 1979, 1980). The sex ratio at Rose Pond, Missouri, is 1:1 (Kangas et al., 1980).

In Missouri, hatching appears to occur in early May and by June, hatchlings have arrived in the ponds (Kangas et al., 1980). Generally,

they have been caught in drift fences as they move to or from water, although they have occasionally been seined (Kangas et al., 1980; Bickham and Gallaway, 1980; Christiansen and Haglan, 1980); hatchlings are rarely otherwise encountered. Christiansen and Haglan (1980) suggested that hatchlings may overwinter in ponds in the bottom muck and debris. As might be suspected, mortality rates for hatchlings are thought to be potentially high (Bickham and Gallaway, 1980) and it is presently unknown what percentage reaches adult size. It is likely that the severity of the winter plays a significant role in survivorship of hatchlings, as it is thought to with adult survivorship. Winter kill is thought to significantly affect this subspecies (Christiansen, pers. comm.).

The Illinois mud turtle is quite adept at traveling over land for considerable distances. Kangas et al. (1980) noted that hatchlings were found as much as 600+ m from water in nearby agricultural fields. Cooper (1975) reported adults moving a maximum of 700 m and Springer and Gallaway (1979, 1980), monitoring radio transmitted turtles, gave 300-500 m from water as a general figure of distance traveled to hibernation sites; they also suggested periods of heavy rainfall may stimulate movements. Kangas et al. (1980) provided a detailed account of the movements of their 12 turtles; generally, movements also averaged several hundred meters. However, two turtles moved considerably further (3.2 and 7.7 km). The longest move was between Rose Pond and Logan's Marsh, thus indicating that turtles will move between distant ponds. Whether this was directed movement and what cues the turtle used to navigate is unknown. A displaced transmitted turtle followed by E. Moll (undated) did not orient to its capture site.

The diet of this turtle consists primarily of invertebrates, principally beetles (Coleoptera), snails, and crayfish. Fish may at times provide a major food source, especially fish trapped by drying ponds. It seems likely that this subspecies is an opportunistic feeder and scavenger. Laboratory evidence indicates that it feeds while underground in its burrows (D. Moll, 1979).

Although parasites and disease are largely unknown, Wacha and Christiansen (1976) reported parasitic protozoans from K. flavescens in Iowa. The light coloration of the carapace of some turtles reported by Brown and Moll (1978) at Big Sand Mound and then thought to be the result of chemical contamination is now thought to be caused by fungi (Aspergillus and Penicillium) (Springer and Gallaway, 1979, 1980). Why some turtles are susceptible to these organisms is unknown.

NON-FEDERAL CONSERVATION ACTIVITIES

Iowa-Illinois Gas and Electric Co. (IIGE).

Aside from the research activities undertaken by various scientists and graduate students in universities, the earliest conservation efforts

directed at the management of the Illinois mud turtle, and the entire Big Sand Mound ecosystem, were started by the Iowa-Illinois Gas and Electric Co. when they purchased roughly 1650 acres of land, including approximately 420 acres of the future Big Sand Mound Nature Reserve, from the DuPont Company in the mid-1970's. Prior to IIGE's purchase, the land had been leased to a hunting club which, although restricting access somewhat, provided little protection for the Big Sand Mound ecosystem. IIGE recognized the uniqueness of the area and decided to take an ecosystem approach in management and protection. Beginning in 1976, IIGE has funded yearly biological studies on the area's fauna and flora, with special emphasis on rare and endangered species. The Illinois mud turtle was singled out as a species of particular concern. It is noteworthy that research and conservation activities for the Illinois mud turtle were begun prior to state protection and subsequent proposals for federal protection.

Beginning in 1978, IIGE contracted with Drake University of Des Moines, Iowa, to monitor the biological status of organisms at Big Sand Mound for a period of five years. Periodic reports have been issued and a final summary report is expected in 1983. IIGE intends to use the results of the report, along with recommendations of the Louisa Ecological Advisory Committee, to establish a master plan for the "Sand Mound Nature Reserve." This plan is being drafted with the intention of protecting the area on a long-term basis (50 years).

In 1977, IIGE established the Louisa Ecological Advisory Committee (LEAC). The purpose of LEAC is to act as an advisory group for the management of the entire Big Sand Mound ecosystem. It is composed of 12 members representing private, county, state and federal representatives and its goals are to preserve and protect Big Sand Mound, to initiate cooperative efforts with IIGE, and to advise the company on management of the reserve. In general, LEAC meets every 6-8 weeks to review information pertaining to Big Sand Mound.

In addition to funding research, the creation of the nature reserve, and the development of LEAC, IIGE has provided strict limitations on access to the reserve. A fence was erected on the western and southern portions at a cost of \$87,000. Access is allowed only for those activities not in conflict with the purposes of the reserve. IIGE has carefully planned the development of their coal-fired power plant in ways that should minimize disturbance, and has assisted in the predator relocation and exotic plant species eradication programs. According to C. Gollhofer (IIGE Environmental Services Division, pers. comm.), IIGE intends to maintain its commitment to the protection of this remnant ecosystem.

Monsanto Agricultural Products Co.

Monsanto became involved with research efforts on K. f. spooneri after the subspecies was proposed for federal endangered status in July 1978. They hired LGL Ecological Research Associates to conduct a number

of biological studies and make recommendations for management. After reviewing available data, LGL recommended four management practices that should be undertaken immediately and, after meeting with representatives of the U.S. Fish and Wildlife Service in September 1978 to outline their proposals, Monsanto carried out the recommendations. These included the construction of a dike to control waters that "might injure the turtle or adversely alter its environment," filling a potentially hazardous mud flat, assisting in the predator removal program, and pumping 80 million gallons of water into Spring Lake to raise the water level (Anon., undated). The latter occurred only once, and Spring Lake has been dry in 1980 and 1981. In February 1981, Monsanto contacted LEAC to offer assistance in the development of the nature reserve master plan and has included approximately 115 acres in the Sand Mound Nature Reserve. Monsanto estimated that it expended in excess of \$500,000 in all phases of work dealing with research and management of the turtle and Big Sand Mound (W. D. Carpenter, statement presented at the public meeting in Springfield, Illinois, January 30, 1980).

State activities.

All states that contain populations of the Illinois mud turtle protect the subspecies as endangered: Illinois (January 1978), Iowa (October 1977), Missouri (January 1979).

Illinois has perhaps been most active in conservation efforts. After the Brown and Moll (1978) report appeared, the Illinois Department of Conservation (IDC) issued a contract to Michael Morris of the Illinois Natural History Survey to review the turtle's status and distribution in Illinois. The results of that survey (Morris, 1978) turned up no turtles, but provided a description of previously known localities and documented habitat loss.

Brown and Moll (1978) pinpointed management practices at Sand Ridge State Forest that might prove detrimental to *K. f. spooneri* (Dodd, ms). IDC has funded E. Moll of Eastern Illinois University to collect ecological information, including movements, habitat use, density, diet, and the impact of pine plantings, for the design of a management program. In a preliminary report (E. Moll, undated), recommendations were made to remove pine stands in the vicinity of one pond, to establish a prairie corridor between ponds A and B, to restrict the use of heavy machinery, to not transplant adults as suggested by Brown and Moll (1978) between ponds, and to continue to monitor the population. IDC has developed a management plan for the Illinois mud turtles at Sand Ridge State Forest to include these recommendations (Becker, 1980). Morris and Smith (1981) provide an overview of the status of the subspecies in Illinois in a publication put out by IDC.

In Missouri, the Department of Conservation has encouraged and supported ecological studies, especially on movements and distribution, within the state and presently administers a contract from the U.S. Fish and Wildlife Service on the species. They have provided technical assistance to individual landowners and are pursuing the opportunity to purchase part of Rose Pond, the area with the largest number of turtles. Like Missouri, the Iowa Conservation Commission is monitoring the status of the turtle and has published an article that includes information on it (Roosa, 1978).

PROPOSED FEDERAL ENDANGERED STATUS

The Endangered Species Act of 1973 (PL. 93-205; Stat. 884) was signed into law December 28, 1973, to "provide a means whereby the ecosystem upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section;" such conventions include, for instance, the Convention on Trade in Endangered Species of Wild Fauna and Flora. In making determinations, the Secretary of the Interior is to use "the best scientific and commercial data available...." There are two protective categories, endangered and threatened. An endangered species is one "in danger of extinction throughout all or a significant portion of its range" while a threatened species is one that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Species, subspecies, and individual populations, except for plants and invertebrates, may be listed.

In making a determination of status, five criteria are to be used. These are: 1) the present or threatened destruction, modification, or curtailment of the species' habitat or range; 2) overutilization for commercial, sporting, scientific, or educational purposes; 3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; or 5) other natural or manmade factors affecting the species' continued existence. If a species is affected by any one of these factors so as to be endangered or threatened as defined by the Act, it is a candidate for listing. Dodd (1976) has provided a general review of the Act.

In 1978, Congress passed amendments to the Endangered Species Act which substantially modified the procedures the U.S. Fish and Wildlife Service (which administers the Act in the Department of the Interior) must follow when designating "critical habitat." Section 4(f)(c) of the Act requires, to the maximum extent practicable, that any rule which determines critical habitat be accompanied by a brief description and evaluation of those activities which, in the opinion of the Director of the U.S. Fish and Wildlife Service, may adversely modify such habitat if undertaken, or may be impacted by such designation. Such activities were identified for the Illinois mud turtle as follows:

1. the development or modification of land adjoining ponds or wetlands thus leading to increased siltation or pollution of the water source,
2. the draining of ponds or wetlands known to contain this species,
3. the dumping of pollutants directly into ponds or wetlands,
4. an increased disturbance to nesting areas adjacent to ponds by humans and their pets, and
5. collection and harassment by people.

On June 6, 1977, the U.S. Fish and Wildlife Service published a notice that a review of the status of 12 species of turtles, including K. f. spooneri, was being conducted (Dodd, 1977). In response to the notice, comments were received from a number of biologists as to the precarious status of this subspecies. In addition, literature records were checked, persons familiar with the biology of the turtle were consulted, and the Brown and Moll (1978) report was carefully reviewed. As a consequence of this review, the Service proposed that the Illinois mud turtle be listed as endangered under provisions of the Act, and proposed to include areas on Big Sand Mound and in Sand Ridge State Forest as critical habitat (Dodd, 1978). Before final action could be taken on the proposal, however, Congress passed the Endangered Species Act Amendments of 1978 (PL. 95-632; 92 Stat. 3751).

On March 6, 1979, the Service withdrew all critical habitat proposals until such time as they could be repropoed in accordance with the 1978 amendments. On December 7, 1979, the Service repropoed critical habitat for the Illinois mud turtle to include an area slightly smaller than that in the original proposal for Big Sand Mound (Dodd, 1979). This revised area had been suggested by representatives of Iowa-Illinois Gas and Electric Co., LGL Ecological Research Associates, and Monsanto Inc. at a meeting with the Service in September 1978 at the Office of Endangered Species, and was based on information about land use and the movement of mud turtles on Big Sand Mound. At this meeting, the Service agreed that the suggested changes presented a more accurate delineation of critical habitat.

In conjunction with the repropoal for critical habitat, the Service held public meetings in Springfield, Illinois, on January 30, 1980, and at Muscatine, Iowa, on January 31, 1980, to explain the proposal, answer public questions, and to solicit additional information on the biology of the turtle and the economic effects of a critical habitat designation on federally authorized and funded projects in the area. No public hearings were requested on either the proposal or repropoal. All public comment periods closed on March 22, 1980.

A total of 136 comments were received in writing by the Service in response to the original proposal for endangered status and reproposal for critical habitat. Of the comments, 105 supported the proposal, including the Governors of Illinois and Missouri and the Directors of the Illinois Department of Conservation, the Iowa Conservation Commission, and the Missouri Department of Conservation, 3 opposed it, and 28 commented on some aspect of the biology of the turtle, such as its taxonomic status, distribution, or ecology, but did not state an opinion as to whether the subspecies should be added to the List of Endangered and Threatened Wildlife and Plants. A number of individuals submitted multiple comments during the course of the public comment period.

Executive Order 12044, dated March 23, 1978, required that each agency in the federal government establish criteria for identifying which of its regulations were significant. The Department of the Interior implemented this order by publishing its regulations in the Federal Register of December 13, 1978. Consequently, the U.S. Fish and Wildlife Service was required to document any impacts on state and local governments, acknowledge recordkeeping and recording burdens, document environmental considerations, discuss impacts on the other federal agencies and departmental programs, and analyze economic impacts of the reproposal of critical habitat. After reviewing all available data, including submissions by the Mason County recorder, the Southeast Iowa Area XVI Regional Commission, the Bi-State Metropolitan Planning Commission, the Iowa Department of Transportation, the Iowa Office of Planning and Programs, the U.S. Army Corps of Engineers, Iowa-Illinois Gas and Electric Co., and Monsanto Inc., the Service determined that the quantifiable economic impact was expected to fall well below \$10 million. Since this is less than the \$100 million considered as significant under departmental procedures, a "Determination of Significance" was signed on September 14, 1979, by the Assistant Secretary for Fish and Wildlife and Parks indicating that the proposed rule to determine critical habitat for the Illinois mud turtle was not a significant rule.

CONTROVERSY AND MISUNDERSTANDING

Given the highly visible nature of the Endangered Species Program and the many misunderstandings surrounding the determination of critical habitat, controversies involving the listing of endangered and threatened species are not uncommon. However, few proposed listings have met such opposition as the proposal to list the Illinois mud turtle as endangered. This opposition stemmed from Monsanto Agricultural Products Co., owner of about 20% of Big Sand Mound. Lipske (1980a, 1980b) provides some additional information to that presented below.

After K. f. spooneri was proposed on July 6, 1978 (Dodd, 1978), there was no indication to the U.S. Fish and Wildlife Service (FWS) of serious problems concerning the listing until July 27, 1979, when

representatives from Monsanto presented testimony at the Endangered Species Act oversight hearings for the subcommittee chaired by Congressman John Breaux. Prior to that date, Iowa-Illinois Gas and Electric Co. (in a letter dated August 23, 1978) and Monsanto (in a meeting at the Office of Endangered Species, Washington, D.C., in September) both recommended redrawing the boundaries of the proposed critical habitat to more accurately reflect the biological needs and habitat use of the turtle. As previously noted, Monsanto also outlined a series of management and research proposals suggested by their consultant, LGL Ecological Research Associates. The Service concurred with the need to slightly modify boundaries and with the management proposals as set forth.

Questions concerning data accuracy and taxonomic status were briefly raised, and the Service outlined its sources for listing and requested additional data if available. Representatives from Monsanto then presented a draft copy of Iverson's (1979) taxonomic review, stating that the data clearly showed that K. f. spooneri was not valid; in fact, this was in direct contrast to the conclusions of the paper. Two important points were made clear to Monsanto at the meeting: 1) that there were more data used in the proposal than sole reliance on the Brown and Moll (1978) report, and 2) that to qualify for listing, species, subspecies, or populations were eligible. Thus, taxonomic status might be an interesting biological problem if questions had been raised prior to proposal, but taxonomic uncertainty is not necessarily a weakness in a proposal, such that it should be invalidated. Disjunct populations of the American crocodile (Crocodylus acutus) and Pine Barrens treefrog (Hyla andersonii) had previously been listed under provisions of the Act.

In the Congressional oversight hearings, Monsanto severely criticized the U.S. Fish and Wildlife Service, claiming that documents used in the proposal were unscientific and full of suppositions, innuendoes, and speculation. It called the proposal "deplorable." In addition, Monsanto claimed that their proposals to change boundary lines, reports of work already completed, and their management recommendations, never were acknowledged. Such was not the case. Monsanto concluded their testimony, "It would appear that there should be some way to spend our resources on those problems that are worthy of immediate and long-range solution; the most important ones; and not expend our resources on some fringe matters." The conservation of K. f. spooneri was clearly perceived as a fringe matter.

A letter dated November 14, 1979, from Earl C. Spurrier, Director of Government Relations for Monsanto, to Hubert L. Harris, U.S. Assistant Director for Congressional Relations, gives the earliest indication that the results of the research of Monsanto's consultants may have been anticipated, in spite of the fact that the data were then not fully analyzed (letter dated February 29, 1980, from B. Gallaway, LGL, to Harold J. O'Connor, Acting Associate Director - Federal Assistance, U.S. Fish and Wildlife Service). In this letter, Mr. Spurrier states:

"In fact, the accumulation of 'scientific evidence' was so sparse and unsupportable that Monsanto undertook, with great financial expense, to create a truly scientific research program. This was done to study not only the habitat of the turtle, but also to observe the migratory and living habits of the turtle. Further, to determine if this turtle had any genetic relatives in other parts of the country, chemical determinations and other scientific evaluations were conducted on specimens of the turtles to further identify generic similarities or dissimilarities.

A very complete research report is being prepared for Monsanto which should give us a real indication as to true facts in the case.

Hugh, when we have our complete report, because of your personal interest, I will see to it that you have access to the information as I believe there may be other proposed species on the endangered list that have been placed there with insufficient data to support such a proposal."

Monsanto made a substantial number of contacts to local officials in Iowa and Illinois and the U.S. Senators and Representatives making similar statements and implying that the U.S. Fish and Wildlife Service was ignoring scientific data (an example is a letter dated January 16, 1980, to U.S. Senate staffer Clarence Thomas). By mid-January 1980, the Service had received a number of letters from U.S. Congressmen, including Senators John Culver (Iowa) and John Danforth (Missouri), and Representative J. Leach (Iowa), questioning FWS' activities with regard to the Illinois mud turtle. Danforth chided the Service for its "apparently shabby treatment" of Monsanto and stated that Monsanto had informed him that they had made available to FWS data which "refuted" the conclusions of the study on which the listing proposal was based. On February 4, 1980, Senator R. Jepsen (Iowa) met with then Interior Department Secretary Cecil Andrus in an attempt to dissuade the Department from proceeding with the listing.

Prior to October 1979, biologists at the Office of Endangered Species (OES) had received bi-weekly synopses of Monsanto's contractees work, but these reports represented raw unanalyzed data. They were examined as they were received and filed, but since a final report was due in October which would summarize all work, no decisions were made concerning future listing activities. No final report was received by FWS until January 1980.

The question of the timing of LGL's final report eventually became the focus of much misunderstanding. The following chronology is taken from a letter dated February 29, 1980, from B. Gallaway of LGL to Harold J. O'Connor of FWS. The first draft of the report detailing the results of

the distributional surveys and ecological work was completed in mid-November 1979. This draft was distributed without covers, abstract, color plates, or appendices to Monsanto and individuals who had been involved in the studies for LGL and was reviewed during the remainder of November and December. According to Gallaway, this draft contained no taxonomic conclusions as data analysis had not been completed. The completed report was expected to be available in late January. John Bickham was not even supposed to begin morphometric analysis until mid-December with completion expected the first week in January.

Unexpectedly however, LGL was requested to present its findings at the January 7 meeting of the Louisa Ecological Advisory Committee. Inasmuch as Bickham had just completed his preliminary analyses in late December, the final report was rewritten to include Bickham's conclusions but without any of his supporting data. This report was bound in pre-printed covers dated November 1979 and distributed at the January 7 meeting of LEAC (Springer and Gallaway, 1979). According to Gallaway, the report had still not been reviewed completely by LGL; therefore, the word "final" was scratched out and replaced by "draft." Representatives of an FWS regional office attended the meeting and the copy they received was indeed marked "draft." Thus, no one who attended the meeting expected this to be LGL's final report and thus available for public review and circulation. Gallaway expected a final version dated January to be ready for the public meetings on the proposal scheduled for January 30-31 (Springer and Gallaway, 1980). Monsanto received their copy January 6, 1980.

The FWS regional office contacted the Office of Endangered Species and notified them that a draft final report on LGL's work had been received at the LEAC meeting and requested whether it should be forwarded to Washington. They were told that since the true final report would be available at the public meeting and since there was no urgency to review the data, it would be acceptable to wait for the final report.

By mid-January, FWS began receiving letters and inquiries from U.S. Congressmen requesting an explanation as to why FWS was pursuing the proposal in light of the extensive work that had been funded by Monsanto which purported to show that the turtle was widespread and not even a valid subspecies. The FWS responded that only bi-weekly progress reports had been received by the Washington Office and requested clarification as to which data were being ignored. On January 11, a copy of Springer and Gallaway (1979) was given to FWS by staff members of the Senate Environment and Public Works Committee where it had been used as evidence of FWS' refusal to withdraw the proposal in spite of overwhelming evidence to the contrary. This copy, also dated November 1979, did not have the word "final" scratched out, thus giving a false impression about the contents and implying that FWS had had the results for over two months.

Fearing that the credibility of FWS had been compromised, it was decided to send the report to nine turtle specialists for evaluation.

Peer review of reports is often utilized by FWS, although it is by no means mandatory. All respondents severely criticized the many conclusions with little or no supporting data. Thus, at the public meetings in late January, FWS representatives were disturbed at the way the report of Springer and Gallaway (1979) had been used against the listing; at the same time, LGL was disturbed that FWS had sent their draft report to specialists when it had thought clear that FWS knew the report preliminary. FWS was not aware that LGL knew nothing of the circulation of its report marked "final." And since the report had been put to Congressmen as a final report which should be used as evidence of FWS incompetency, FWS felt obligated to have the report strictly scrutinized. Thus developed an aura of hard feelings between FWS and LGL.

In February and March, Monsanto continued to lobby to have the listing withdrawn. In a letter dated March 3, 1980, Monsanto submitted extensive comments to FWS in which they reiterated their position that the turtle did not warrant federal protection. They again took a point by point issue with nearly every statement in Brown and Moll (1978) concerning Big Sand Mound and praised the LGL work, but this time devoted extensive criticism of John Iverson's and OES' objectivity and credibility. The letter also stated that electrophoretic work involving analyses of proteins of heart, liver, kidney, and eye tissues had been investigated although the results were not completely analyzed. This letter is interesting because it first broaches the idea of an independent review panel. The letter states:

"Further, we are concerned about the disparity of treatment given LGL's Final Report as opposed to the status report prepared by Drs. Brown and Moll. We think it only fair that LGL's Final Report, together with the addendum and supportive data being supplied to the Service, be submitted to a blue-ribbon panel of disinterested scientists for critical evaluation. This same panel should also critically review the status report and the data Drs. Brown and Moll submitted to support the conclusions contained therein. We are prepared to accept the decision of that panel as to what constitutes the 'best scientific data' available as required by Section 4(b)(1) of the Endangered Species Act of 1973, as amended."

On March 6, 1980, representatives of FWS and LGL met to discuss the morphometric work conducted by John Bickham and his students. Copies of the report on the taxonomic work (Bickham and Gallaway, 1980) were submitted for the administrative record; this report only contained morphometric and karyological results.

Iowa-Illinois Gas and Electric Co., owner of 80% of Big Sand Mound, had been relatively neutral concerning the proposal and resulting controversy. On March 7, they submitted additional comments in which they

stated that they did not think listing would benefit K. f. spooneri any more than the protection it was already afforded on Big Sand Mound by IIGE. IIGE said that they would maintain the area as protected but feared additional regulatory burden. Areas outside Big Sand Mound were never addressed in IIGE submittals.

Evidence of lobbying continued. On March 13, James D. Webb, Deputy Assistant Secretary for Fish and Wildlife and Parks, informed the Director of FWS that the Congressional Office of Management and Budget, the agency responsible for the budgets of federal programs including the Endangered Species Program, had decided to make a "case study" of the proposed listing of the Illinois mud turtle to determine if proper compliance with Executive Order 12044 had been adhered to, the first such request ever received by FWS. Accordingly, a briefing statement dated March 19 was prepared by FWS; no irregularities or errors were found as a result of this review.

On March 19, a Freedom of Information Act request was filed with FWS by U.S. Senator Orrin Hatch, a close associate of Senator R. Jepsen. Subsequently, an aide from Senator Hatch's office visited the Office of Endangered Species of FWS to review all data, but could find no improprieties in FWS procedures or analysis of data (J. Black, pers. comm.). Senator Jepsen furnished a letter to Monsanto from Cecil Andrus, Secretary of the Interior, in response to his inquiries, which prompted another long letter from Monsanto dated March 25 in which essentially the same topics were discussed as in their March 3 letter.

When Congress passed the Endangered Species Act Amendments in 1978, it specified that a two year deadline be imposed on all proposals to list species as endangered or threatened. Consequently, the date July 7, 1980, assumed special importance to the Illinois mud turtle since the subspecies would have to be listed or withdrawn by that date. By March 22, 1980, however, all public comment periods, which had been specifically reopened at Monsanto's request to allow submission of LGL's and Bickham's final results, were closed. After extensive review by biologists both within and outside the Office of Endangered Species, it was decided that the Illinois mud turtle should be listed as an endangered species with the critical habitat modified as requested by industry. By this time, the population in Clark county, Missouri, had been discovered. However, because of the two year deadline imposed by Congress, it would have been impossible to propose this area as critical habitat in connection with the listing. Therefore, it was decided to propose this area at a later date after listing. This course of action was recommended to the State of Missouri, who concurred (T. Johnson, pers. comm.). By April 29, 1980, the final rule had been approved by the Office of Endangered Species.

Unbeknownst to biologists in OES, however, on April 15, 1980, Lynn Greenwalt, then Director of FWS, wrote a letter to Chester O. McCorkle, Jr.

of the National Academy of Sciences to request the assistance of the Academy in resolving the dispute. This course of action was recommended by Congressman John Breaux and first raised in Monsanto's letter of March 3. The Academy responded that it did not have sufficient time to set up such a panel, but recommended a number of turtle biologists and statisticians that would be qualified to serve. Thus the panel was not endorsed by the National Academy of Sciences, nor did it contain any Academy members.

On June 5-6, 1980, the panel was convened by FWS at the Patuxent Wildlife Research Center under the auspices of David Trauger, Chief of FWS' Wildlife Ecology Research Division. Trauger had no prior experience with the events surrounding the administrative record regarding K. f. spooneri, nor did he review any data in the files of OES. No one from OES was invited to the meeting to present information regarding the listing although the question was raised by one panel member (C. Ernst, pers. comm.). The panel consisted of the following members: James F. Berry, James L. Christiansen, Carl Ernst, J. Whitfield Gibbons, Paul N. Hinz, and John B. Iverson.

The panel was given five questions to respond to, including:

1. Were the survey procedures used by the parties furnishing information to the Fish and Wildlife Service on the proposed listing of the Illinois mud turtle accepted techniques and correctly conducted: Were they statistically valid?
2. Were the procedures utilized (such as electrophoresis) to determine the taxonomic status of the Illinois mud turtle valid for use on these turtles, and was the analysis of data from these procedures reasonable?
3. Does the information and analysis suggest that Kinosternon flavescens spooneri is a distinct subspecies?
4. Is it correct to assume in those cases where surveys found only a few turtles that sizeable populations were present under the water or under the ground?
5. Does analysis of the data imply that the Illinois mud turtle is a declining subspecies or population, a stable subspecies or population, or an increasing subspecies or population? Can any projection be made in regard to the total number of individuals in such subspecies or populations?

A final report was typed and signed by all members (Berry et al., 1980). It concluded, in part, that: 1) there was no attempt "to estimate the total population of Illinois mud turtles based on a statistically valid survey of Illinois mud turtle habitat" although estimates in areas

thoroughly sampled were conducted properly to derive population estimates; 2) the morphological analysis of LGL was reasonable and appropriate; 3) there had not been enough evidence presented to invalidate the trinomen K. f. spooneri; 4) it is possible to assume that more turtles may be indicated as present at a site on the basis of a few observed specimens; and 5) it is impossible to document a declining population although habitat alteration is a problem. The panel emphasized that the number of good habitats and their quality was declining. Three additional important recommendations were made:

- "1) In view of the present rates of habitat destruction and the population status of the Illinois Mud Turtle, there is a need for protection of this subspecies, especially the populations in Illinois.
- 2) Careful consideration of the most appropriate and effective strategies for protecting the Illinois Mud Turtle should be made at the local, state and/or federal levels. There exist several private and local efforts on behalf of this subspecies to serve as models.
- 3) There is a need for additional research to clarify the remaining questions concerning the taxonomic and population status of the Illinois Mud Turtle."

On June 11, 1980, a memorandum written by Trauger but signed by Richard N. Smith, Associate Director - Research, FWS, concluded:

"Based on the report of the Review Panel, insufficient information is available on the Illinois Mud Turtle to justify listing it as a threatened or endangered species by the U.S. Fish and Wildlife Service at this time. There is a need to conduct further research to clarify the complex taxonomic relationship and to estimate the total population of this subspecies. The Illinois Mud Turtle is considerably more abundant and widely distributed than previously thought. Local and private efforts should be encouraged to promote its conservation and to protect its habitat. The Panel favored this strategy as the one most likely to succeed."

This recommendation caused Director Greenwalt to withdraw the final rule which had been waiting in FWS' Solicitors office pending a decision. A notice withdrawing K. f. spooneri from consideration as a candidate for endangered status was published August 14, 1980, (Opler, 1980), 38 days after the proposal would have been withdrawn because of failure to comply with the Amendments of 1978. Biologists at OES refused to approve the withdrawal notice; indeed, a complete point by point refutation of Smith's June 11 memorandum was sent to the Director on June 19, 1980, but was ignored.

Prior to the withdrawal notice, IIGE had been informed of the panel's meeting only by rumor and that it was, indeed, a National Academy of Sciences panel (letter to FWS dated June 11, 1980). They expressed concern since "various reports have labeled the selection of the panel members as biased."

A number of scientists and conservationists took strong issue with the FWS' decision to withdraw the listing. However, FWS maintained almost verbatim the reasons outlined in Smith's June 11 memorandum although they did not represent the opinions of the panel (J. Berry, J. Christiansen, C. Ernst, J. Iverson, pers. comm.). In a letter dated July 11, 1980, to L. Regenstein, FWS conveyed the reasons for the panel's deliberations ("...there are those who questioned our ability to render an impartial decision concerning the listing of this species."). Only Monsanto questioned the objectivity of the FWS throughout the two years of deliberation.

After the withdrawal notice, the Illinois mud turtle question subsided since it was clear that the subspecies' would not be listed formally as endangered. However, on December 8, 1981, at the oversight hearings on the reauthorization of the Endangered Species Act before the U.S. Senate Environment and Public Works Committee, S. Boynton, in criticizing the Act, again chastised the U.S. Fish and Wildlife Service for its proposal of the Illinois mud turtle 3 1/2 years previous, stating that "those responsible in the Office of Endangered Species had not done a credible job...." In a letter dated January 8, 1982, Mr. Boynton again stated that there were insufficient data to support the original proposal; reviewed Monsanto's management plan; restated the unreviewed findings of LGL, including allegations that electrophoretic work conclusively demonstrated that *K. f. spooneri* was not a subspecies and that the results had been published in "key scientific journals;" and that a panel of the National Academy of Sciences stated that the information on which FWS based its original proposal was weak and inadequate, thus indicating an "indictment" of FWS. This information was taken from a booklet published by Monsanto (Anon., undated), a copy of which he supplied to the Committee. In a letter dated January 8, 1982, to Senator John Chafee, Chairman of the Committee, E. C. Spurrier of Monsanto stated that Mr. Boynton's testimony was "a statement of the facts." The controversy continues.

DISCUSSION AND CONCLUSIONS

There is a current feeling within certain segments of industry that environmental regulations are a luxury in a society facing economic problems. As such, any regulation that is deemed to provide stricter oversight of company activities is automatically opposed. Such is perhaps the case with Monsanto and the proposed listing of the Illinois mud turtle although it is impossible to ascertain motives. Certainly, the listing of the subspecies would not have seriously affected the operations of the Muscatine plant. FWS directed repeated inquiries to Monsanto requesting specific economic impacts but Monsanto only responded by indicating additional review would

be required of an already large number of permits. A list of these permits was requested in the hopes of quantifying economic burden, but careful review revealed that none would have been impacted by the determination of critical habitat.

The significance of the controversy surrounding the proposal to list K. f. spooneri does not involve the failure to list one particular subspecies in need of protection. Instead, it involves the recognition of the precarious nature and foundation of laws designed to protect and preserve genetic diversity on a species by species approach. The Endangered Species Act of 1973 is a laudatory attempt to balance societal values with the tendency to view "non-significant" plants and animals as undeserving of much attention. However, by focusing attention on individual species, the ecosystems on which they depend, so dramatically emphasized in the purposes section of the Act, are ignored or at least overlooked.

The sand prairie, exemplified by the assemblage of plants and animals at Big Sand Mound, is indeed a unique ecosystem fast disappearing in the face of modern agricultural practices. As such, it is this ecosystem that is worth protecting, not just the Illinois mud turtle which depends on it. During the extensive deliberations between industry and the government, this idea seems to have been overlooked.

Almost the entire controversy focused on one particular area, Big Sand Mound, and indeed, only on 20% of Big Sand Mound. Regardless of motivations, this emphasis shifted focus from habitats containing far fewer numbers of turtles which are imminently threatened with modification. Unless attempts are made soon to halt this destruction, these island ecosystems will be lost. Methods for protection could include outright purchase, as the State of Missouri is contemplating at Rose Pond, cooperative management agreements between landowners and state and private conservation agencies such as The Nature Conservancy, tax incentives for not destroying wetland habitats, and education as to their importance. State and private agencies are free to pursue these goals without listing by the federal government, but additional incentive and priority would have been provided by doing so.

The controversy involving Big Sand Mound not only slighted the biological aspects of listing an endangered species, but also slighted another company's efforts on behalf of an ecosystem approach to management of unique areas. In all the press releases, newspaper and magazine articles (for instance, Berman, 1981), and testimony presented before the various committees of the U.S. Congress, the only company ever mentioned in Monsanto. This is in spite of the fact that Iowa-Illinois Gas and Electric Co. became involved in the conservation of Big Sand Mound, both by declaring it a reserve and by funding numerous biological studies, as soon as they had purchased the area and prior to any state or federal concern for the Illinois mud turtle. This commitment continues even though the subspecies has been withdrawn from consideration. To hear

testimony before Congress, Monsanto is the only company on Big Sand Mound, even though Spring Lake, nearly entirely on Monsanto property, has been dry the last two years.

Not only has IIGE been slighted, but state activities as well. Both Illinois and Missouri have undertaken aggressive research and/or management programs for the subspecies without federal prodding, although in some cases with federal money. In light of cutbacks in the federal Endangered Species Program, no further financial assistance can be offered to the states for the conservation of this federally unlisted subspecies. However, states have continued to protect K. f. spooneri as endangered and may be expected to continue their efforts within budgetary restraints.

There is a serious question regarding professional ethics in the Illinois mud turtle controversy. Data misrepresentation, omission, or overstatement has no place in scientific circles. As such, the peer review system is designed to insure accuracy and competence of data and its interpretation. All publications used by FWS in proposing the Illinois mud turtle were submitted to peer review and published by reputable journals prior to the decision in early 1980 to proceed with listing. On the contrary, all reports opposing listing, admittedly with LGL's qualifications concerning data analysis, were severely criticized by the majority of reviewers. Indeed, only one paper has been submitted and accepted for publication (Houseal et al., 1982), thus refuting the claim (Anon., undated) that the results of their funded studies have been published "in key scientific journals."

This is not to imply that LGL or its contractees in any way improperly collected or interpreted data during their studies; there is no indication that anyone involved was pressured to conform to a preconceived policy. However, it does mean that extreme care must be used whenever one's name is on a report or paper to insure that the contents are not misused, as was done with Springer and Gallaway (1979). In the long run, scientific validity will be determined by the review of other scientists of published data, but in the meantime, reputations may be marred which could be of much more importance. The implication of a National Academy of Science endorsement is unethical. Whether the Academy is aware of this is unknown.

The role of FWS throughout the Illinois mud turtle controversy must be questioned. Until late 1979, there was no indication to the Office of Endangered Species that the listing should be expected to encounter problems within the Department of the Interior, even though there had already been a number of contacts between Monsanto and the Director of FWS' office. When lobbying increased and in spite of biological data to the contrary, the Service stalled the listing focusing on the false issue of taxonomy until a panel could be convened. FWS then requested that the panel take up five ambiguous questions instead of reviewing all biological data, and not make additional comments or recommendations.

When the panel convened, no one from OES was allowed to attend to present the administrative and biological record. A memorandum from a FWS individual not having experience with turtles or their biology was used by the Director to stop listing, even though the memorandum misrepresented the panel's conclusions and ignored an extensive amount of biological data. As a result, FWS' credibility took a severe blow in the scientific community among those familiar with the data.

The Illinois mud turtle today is endangered by habitat alteration as recognized in the original proposal of 1978, as well as the decreasing water table levels which have become more of a problem since then (Dodd, ms.). It is not likely that listing under provisions of the Act would automatically have reversed this apparent decline, but it would have allowed strong federal protection, including the development of a recovery plan with some federal money, to supplement state and private conservation activities. Illinois, Missouri and IIGE are to be commended for their continuing involvement and commitment towards the subspecies' conservation. However, in spite of these efforts, the habitat and the turtle are in trouble. Unless suitable areas can be preserved, individual Illinois mud turtles may persist for many years, yet their fate will have been decided. As the largest population, Big Sand Mound must be preserved in perpetuity, for as C. Gollhofer of IIGE has noted (in a letter to FWS dated November 4, 1981), the policies of companies can change according to future needs and demands. Only long term protection can be expected to be effective.

In the Illinois mud turtle controversy, no one benefited, least of all K. f. spooneri.

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