hearing and touch for the visually impaired and the use of sight and touch for the deaf. For the deaf student, for example, vibrations of strings and tuning forks are demonstrated in water waves and sand movement.

The results from evaluative tests given this spring in the mainstream classes are just being run through the computer at Berkeley. According to Hadary, who is an admittedly biased but certainly experienced observer, "My gut feeling is that the results are positive."

Those most active in science education for the handicapped are enthusiastic about the American University program and believe it is a way to educate the handicapped successfully in science. There is general agreement, however, that the already overburdened classroom teacher must be adequately trained to do the job and that school systems, many of which are now facing severe budget constraints, must find the resources to pay for the supporting staff and services that handicapped children require.

—EFTHALIA WALSH

Endangered Species: Review of Law Triggered by Tellico Impasse

To condense the evolution of life on Earth . . . suppose the whole history of the planet is contained within a single year. The conditions suitable for life do not develop until late June. The oldest known fossils are living creatures around mid-October, and life is abundant . . . by the end of that month. In mid-December, dinosaurs and other reptiles dominate the scene. Mammals . . . appear in large numbers only a little before Christmas. On New Year's Eve, at about five minutes to midnight, man emerges. . . . The period since 1600 A.D., when man-induced extinction began to increase rapidly, amounts to three seconds, and the quarter century just begun, when the disappearance of species may be on the scale of all the mass extinctions of the past put together, will take another sixth of a second–a twinkling of an eye in evolutionary time.–NORMAN MYERS, in *Natural Resources Defense Council Newsletter*

The Endangered Species Act of 1973, designed as it were to extend that twinkling by a millisecond or two, seems a pathetic instrument indeed to slow the rushing forces of species extinction. But judging from some of the rumblings in Congress, one might think it was intended to cast humankind back to the dark ages. The Tennessee delegation in particular is abuzz over the prospect that the Tennessee Valley Authority's almost-complete Tellico Dam will end up not as a focal point for new industrial development but as a vast, silent concrete monument to the tiny inhabitant of the Little Tennessee River known as the snail darter.

Last January, a federal appeals court ordered work on the dam halted, saying that it would destroy the only known habitat of the 3-inch snail-eating fish and, therefore, it was in violation of the Endangered Species Act.

The TVA, with $103 million sunk into the project, is predictably unwilling to let the matter rest. So, environmentalists and many others now fear that the Tellico controversy will trigger a congressional reassessment that could culminate in a drastic weakening of section 7, the most potent segment of the act, which prohibits federal agencies from jeopardizing endangered species or habitats that have been designated as "critical." Specifically, this section says projects carried out by federal departments and agencies must not "jeopardize the continued existence of . . . endangered species and threatened species or result in the destruction or modification of habitat of such species which is determined . . . to be critical."

Section 7, with its unqualified admonition, has proved to be a remarkably powerful, and therefore controversial, component of the Endangered Species Act. Since the act's passage, there have been many hundreds of consultations between federal construction and land management agencies and the Department of the Interior's U.S. Fish and Wildlife Service, where the Office of Endangered Species (OES) is located. In the vast majority of cases it has been determined that no endangered species are jeopardized. Indeed, in fewer than 100 projects has it been necessary to make alterations in the plans to accommodate the law. And, despite the fact that the only way to compel an agency to abide by section 7 is to bring a case to court, there have thus far been only three lawsuits. One was over Missouri's proposed $100 million Meramec Park dam, in which the Sierra Club sued in order to save the Indiana bat and an endangered pearly mussel. (The court ruled in favor of the dam on the grounds there was insufficient evidence to do otherwise, but the project is in trouble now for other reasons.) Another suit, brought by the National Wildlife Federation, claimed the habitat of the Mississippi sandhill crane would be ruined by completion of Interstate Highway I-10. The court ordered modifications in the route. The last suit was Tellico.

Most of the serious conflicts between public works projects and endangered species appear to be posed by dams, which tend to be all-or-nothing affairs, not amenable to much modification or relocation, and extraordinarily disruptive of ecosystems both aquatic and terrestial. Dams are also big money and therefore intensely political projects. The only other project about which a suit is imminently threatened is another dam—the Columbia Dam on Tennessee's Duck River, whose construction threatens some endangered snails (the Environmental Defense Fund has served notice to the TVA that it intends to move on this one).

The Tellico case is unusual in that it is an example of agency noncooperation—"the bad faith example that proves the rule," according to Tellico plaintiff Zygmunt Plater. The TVA has known about the snail darter since 1973 when it was discovered by a TVA zoologist. (It was officially put on the endangered species list in 1975.) The agency has expressed willingness to do anything to mitigate the situation—including relocating the darter to another river—except stop construction. Apparently it was confident it would win in a court confrontation, and indeed the first court ruling on the case last year was in TVA's favor. The appeals court, however, was not about to read equivocation into the act where it did not exist. The TVA was gambling that the advanced stage of the project would render it immune from tampering. But the court said: "Whether a dam is 50 percent or 90 percent completed is irrelevant in calculating the social and scientific costs attributable to the disappearance

of a unique form of life. Courts are ill-equipped to calculate how many dollars must be invested before the value of a dam exceeds that of the endangered species."

Some congressmen just cannot get used to the idea that a tiny little creature could stop a big important dam.

"Are you going to do anything to get the snail darter off our backs?" cried an Alabama congressman to Interior Secretary Cecil D. Andrus at House appropriations hearings earlier this year. As Andrus replied, he could do nothing—Congress's only recourse was to change the law. A number of amendments are already brewing. One, introduced by Representative John J. Duncan (R–Tenn.) would exempt Tellico from the act. Another, by Representative Robin L. Beard (R–Tenn.) would exempt Tellico, Columbia, and the problem-ridden Tennessee-Tombigbee waterway, as well as any federal water project that had been authorized before passage of the Endangered Species Act. There has also been talk of an amendment that would give the Interior Secretary authority to exempt a project from the act. Representative Robert L. Leggett (D–Calif.), chairman of the fish and wildlife subcommittee of the House Merchant Marine and Fisheries committee, has asked the General Accounting Office to report on the costs and benefits of the Tellico Dam before it takes any action on proposed amendments.

Meanwhile, of immediate interest are July hearings on the Tellico problem planned by the Senate Environment and Public Works Committee. Committee member Howard Baker (D–Tenn.), who is also minority leader of the Senate, is said to be particularly concerned about the turn events have taken. One of the original sponsors of the endangered species act, he apparently is now having second thoughts and wants to look into ways in which it can be made more "flexible," says a staffer. The staffer insists that Baker has an open mind about the project, but other observers are convinced that he wants to weaken section 7, perhaps by giving decision-makers more discretion to weigh the benefits of a project against the benefits of saving a particular species.

One thing that's certain is that, as the Baker aide says, "the endangered species Act has turned out to be more of a surprise" to Congress than most other pieces of environmental legislation. "I don't think Congress when they passed the bill realized its potential scope or breadth," he adds. Undoubtedly many members of Congress were thinking thoughts of brown-eyed creatures and soaring winged things when they cast their vote, and are now finding themselves confronted with a Pandora's box containing infinite numbers of creeping things they never dreamed existed.

At any rate, this summer should be a showdown for the act, and conservationists are hoping that if all goes well (for diversity of species) both Congress and the public will arrive at a deeper understanding of what the act is all about. It has recently been subjected to some frivolous attacks, notably in the case of the Dickey-Lincoln project, a proposed dam on the St. John River in Maine, to be constructed by the Corps of Engineers. Dickey-Lincoln is still in the environmental impact statement stage, a stage not due to be completed till the end of next year. But already there has been a hue and cry about the possibility that a humble plant, a member of the snapdragon family named the Furbish lousewort, will bring the project to its knees. This project is opposed for a number of reasons, and environmentalists do not want to bring suit to halt the dam on the basis of the Furbish lousewort, but some environmentalists say the Corps has been "crying wolf" over the plant (which is to be included in the first listing of endangered plants) in an attempt to cast ridicule on the act.

The essential issue raised by the fuss

Mollusc Expert Resists Transfer

The Office of Endangered Species (OES) is thought by some to be engaging in foot-dragging in the listing of endangered species. Environmentalists have been critical in particular of associate fish and wildlife director Keith M. Schreiner, an old-time Interior hand who they believe is excessively cautious and overly attuned to political expediency. Differences came to light in May when Schreiner ordered the transfer of the office's only malacologist, Marc Imlay, to a research outpost in Missouri.

A malacologist is someone who knows about molluscs, the second largest phylum in the animal kingdom. Imlay has been struggling with endangered molluscs at the OES for 5 years. Last May 17 he got a notice from his superiors that he was to be transferred to the Fish Pesticide Research Laboratory in Columbia, Missouri, to do toxicity studies on molluscs. "If you decline to accept the position . . . action will be initiated to effect your removal from the Service . . .," wrote Schreiner.

Imlay was upset by this. He believes that Schreiner's decision to transfer him is a ploy to get him out of the office because he wants to hurry ahead with listings and the office wants to go slow. He says the order reflects a difference of opinion on whether speeding up the listings will act as a magnet to draw political opposition to the Endangered Species Act. Schreiner's attitude, he says, is that if we lie low, Congress won't amend the act. Imlay's view is that more activity will help stir up more public support. In short, Imlay thinks the transfer is to get him out of the way.

Schreiner emphatically says this is not the case. He says that "we already have the data to list several hundred molluscs," and that all the office needs now is a general biologist who is a good writer to get the pending molluscs onto the final list. He says he would love to have two malacologists, one in Missouri and one in the OES, but since the office can only afford one, Imlay is desperately needed in Missouri.

Imlay has filed a complaint, saying the proposed transfer is harassment," partially inspired by the fact his name has appeared in several newspaper articles critical of Schreiner. Another Interior official chalked up the problem to personality differences, and vouchsafed, "if Marc weren't in this situation I don't think they'd be looking for someone to do toxicity studies on molluscs [in Missouri]."

Says Zygmunt Plater, a lawyer who was a plaintiff in the Tellico case: "You have to have specialists all along the way to ward off the inevitable attacks [on proposed listings]. To replace Marc with a general biologist smacks of gross impracticality or an attempt to subvert the program."

Wayne Grimm of the National Museum of Canada, also a malacologist, is more emphatic. "If I had Marc's job it would take me 2 or 3 years to know enough to do what he is doing . . . losing someone with that kind of experience would be devastatingly bad . . . Marc Imlay is the only malacologist in North America keeping tabs on endangered species."—C.H.

over the act is: How far did Congress intend to go in protecting endangered species? The act as written is open-ended. It was clearly not intended to protect microorganisms whose populations and range would be impossible to measure fully, but since the law defines "species" as including subspecies, lesser taxa, and unique endemic populations, any organism for which it is possible to gather meaningful data (with the exception of "injurious" insects such as boll weevils) qualify for protection.

To some scientists, there is no place to draw the line on what merits protection. Endangered species are almost always part of a "remnant ecosystem," says Marc Imlay, an OES malacologist. Species put on the endangered list are really "marker" organisms that signal the existence of an entire ecosystem that inevitably contains other equally rare organisms. Endangered species, says Wayne Grimm of the National Museum of Canada, "are the key to the evolutionary process of all living things in an area, they demonstrate the process of isolation, genetic drift, the emergence of hybrids. . . ." No compromises are possible, says Grimm, when the problem is stated in terms of the question: "Do organisms have the right to exist?"—which, logically extended, means: "Does life on earth have a right to exist?"

Yes, but . . .

It would be hard for Congress to answer "no" to that, but it might choose to change the question to "does the right of an organism to exist always supersede the right of people to have a dam they want?" If the existence of an unprepossessing organism is the only thing that appears to be at stake, it is difficult to imagine Congress choosing principles over practicalities. But the Endangered Species Act is part of a constellation of legislation, starting with the National Environmental Policy Act, that is forcing project designers to put unquantifiable or intangible benefits into their cost-benefit equations. Rare is the case where threats to the existence of an endangered species comprise the only major disbenefit of a project—although in some instances, like the Tellico case, the act may prove to be the most useful lever for mounting opposition. As Jim Williams of the OES points out. "This is not a 3-inch fish stopping a dam, this is a 3-inch fish that may be saving a river valley" with fertile farmland, good fishing, rich archeological sites, and prime recreational areas.

Many opponents of Tellico therefore welcome the forthcoming Senate airing of the project, not so much in confidence that the value of species diversity will be affirmed but because they believe a thorough review of the facts will demonstrate the dam is not worth having by any standards.

The Tellico conflict is just what could be expected under the act, involving as it does the Southeast, dams, and aquatic life. According to fish and wildlife experts, there is an exceptional amount of variety in this part of the United States owing to the fact that it was not glaciated, and many pockets of unusual ecology remain. It has a lot of rivers and much rainfall, and is still underdeveloped compared to the rest of the country, so many aquatic organisms flourish there that may be threatened in the future by industrialization.

The Office of Endangered Species is engaged in a very real race against time to get endangered or threatened plants and animals listed in time to stabilize their conditions. The OES staff of specialists is far smaller than what biologists believe necessary, consisting of eight or ten experts in the fields of ichthyology, mammology, malacology, ornithology, herpetology, entomology, and botany. Evidence is gathered through contracts with universities and through petitions submitted by groups around the country as well as by research by staff scientists. Several thousand dollars' worth of work goes into the gathering of data for every species that finally makes the list. Half those under consideration fall by the wayside, says Imlay, as they "turn out to be already extinct, widespread, or invalid taxonomically."

A colossal amount of work remains to be done. Williams, an ichthyologist, estimates it will be 3 to 5 years before the office has succeeded in listing a substantial majority of all the fish in the country that are deemed endangered or threatened; there is no telling when the bulk of other animals and plants will achieve protected status—or when endangered populations will have been restored to the extent they can be taken off the list, which is the ultimate goal. One cannot list a species until detailed evidence of its rarity is gathered, remarks Williams, because "for every listing you have to think of yourself in a courtroom." The process can take years. Grimm says "it took 7 years to get one population with a 40-square-yard range on the list." He was referring to *Succinea chittenangoensis*, a Pleistocene relic land snail that used to be found in a range from Iowa to Southern Ontario, and which now hangs onto one niche under the spray of the Chittenango Falls in Madison County, New York.

Obtaining a "critical habitat" listing is even more difficult, because intricate knowledge of a species' life history and habits is required. At latest count, there were 38 mammals, 67 birds, 34 fish, 22 molluscs, and some reptiles and butterflies officially listed as either endangered or threatened in this country. Fourteen plants will soon join the list. Thousands more of everything are under consideration. Only six critical habitats have so far been listed, including miles 0.5 through 17 of the Little Tennessee River, home of the snail darter. Thirty-nine more are proposed.

Act Ahead of Its Time?

The Endangered Species Act is international in scope, requiring the listing of endangered species worldwide. But for this country, section 7 is the part that really shows. It's "the heart of the act . . . the real teeth of the act," says Keith Schreiner, associate director of the Fish and Wildlife Service. And it embodies sophisticated, far-seeing ecological goals that run smack in the face of the concerns that traditionally impel the reelection-oriented congressman—federal money and the promise of contracts and jobs.

This summer will give some indication of how deeply the populace, through their elected representatives, have absorbed the concept that sustaining diversity of species equates with sustaining life in general. The House Appropriations Committee has not figured things out yet, judging from their decision to appropriate $9 million, in a public works bill, for the purpose of relocating endangered species that lie in the path of several projects now under development. (Variously labeled "outrageous" and "ridiculous" by an Interior official and a congressional staffer, the concept, as any ecologist knows, is at best naive.)

Howard Baker's call for more "flexibility" in the act is looked on askance by government officials who believe the record of accommodations made so far shows the act is already flexible. Conservationists and others hope that if an amendment is passed, it will be one that makes a single exception for Tellico rather than one that weakens the act as a whole. The President, in his environmental message of 23 May, indicated the former approach was preferable: "Major projects now under way that are found to pose a serious threat to endangered species should be reassessed on a case-by-case basis," he said.

—CONSTANCE HOLDEN