Arizona Riparian Council

Volume 12, Number 3 September 1999

SUDDEN IMPACT: MONSOONS AND WATERSHED BIOTA CAUSE RAPID CHANGES AT TEMPE TOWN LAKE

Frederick A. Amalfi, Aquatic Consulting & Testing, Inc., Tempe, Arizona

On June 2 water was released from the Salt River Project (SRP) forebay near Papago Park and into a portion of the Salt River bed known as Tempe Town Lake. Impounded by two inflatable dams, Tempe's Town Lake covers nearly 2 miles of the Salt River channel and over 200 surface acres. Lake depth ranges from about 7.5 feet at the upstream dam to nearly 19 feet at the downstream dam. It is bordered by the river bed which has been channelized with concrete ledges and steep slopes to prevent access and plant growth. Riparian vegetation also occurs immediately upstream and downstream. Urban development borders Tempe Town Lake to the north and south. The lake is the focal point for future commercial development and a park system above the river flood plain, and will serve as a recreational and aesthetic amenity to the City and surrounding municipalities.

Experience with other urban impoundments, chemical analyses of lake water sources, and biological analyses of the watershed identified few problems that might rapidly affect the aesthetic quality of the lake or impact quality-of-life issues in the vicinity. Nonetheless, detailed procedures for managing such situations were included in the Town Lake Operations and Maintenance (O&M) Manual. Lake designers and managers believed that there would be a "honeymoon" period of at least a year before potential problems such as planktonic algae growth or nuisance insects would reach levels worthy of initiating active management activities. Although there was consideration given to delaying filling of the lake until autumn 1999, the earlier fill date was selected to provide time to slowly monitor and learn how the lake would respond to watershed and climatic influences. Then came the monsoons of July and August. The honeymoon ended abruptly, the O&M manual procedures were initiated, and the learning curve experienced a dramatic increase in slope.

EARLY WARNING SIGNS AND STRATEGIES

Water quality and nuisance and vector insect investigations had been conducted for nearly a year preceding lake filling. SRP water sources were found to be acceptable for filling the lake in terms of nitrogen and phosphorus content and likelihood to rapidly create nuisance aquatic plant growths. Storm water runoff was shown to have high nutrient and bacteria concentrations. In response, major storm drains

(Cont. pg. 3...Town Lake)

Inside This Issue

PRESIDENT'S MESSAGE

In the next few months there are several local and national conferences dealing with restoration of wetland and riparian habitats. This topic is receiving a great deal of attention from federal agencies such as the Environmental Protection Agency, Bureau of Reclamation and even the U.S. Army Corps of Engineers. Our own Arizona Department of Water Resources with the Water Protection Fund Commission and Arizona Game and Fish Department with the Heritage Grant program are on the restoration bandwagon.

In Arizona, with so many of our riparian systems either lost or degraded, restoration projects are being conducted to try to bring these systems back. Every project is a learning experience. Information needs to be shared on methods that work, kinda work, "it worked over there but not here," or don't work. Let's hope people are not thinking that riparian systems can be altered because scientists know how to fix them. Restoration seems like a noble goal. Many times restoration fails because the original stressor was not changed or removed.

Restoration of riparian ecosystems is not just a topic for scientists and planners; it's a philosophical and a quality of life topic as well. In late March or April, the Council will sponsor a conference with the Arizona Water Protection Fund Commission dealing with restoration. The Arizona Water Protection Fund (AWPF) portion of the meeting will occur the day before the Council's annual meeting. Grantees who are or have received AWPF grants will provide information on their projects and there will be discussion groups on various aspects of doing restoration projects such as project management, permit process, and practical methods for restoration. The Arizona Riparian Council is also working with the Arizona Floodplain Managers Association (AFMA) in putting together a conference which explores balancing flood protection with other management objectives such as riparian enhancement and restoration, recharge, recreation and water quality improvement. This conference will be April 3, 4, and 5, 2000 in Phoenix.

The Council is involved in both of these conferences because one of our missions is to bring people together to communicate ideas and to share experiences. Cindy Zisner and myself are involved in both of these conferences and can provide you with additional information. Give us a call if you want more information.

Kris Randall, President

(Town Lake. cont. from pg. 1)

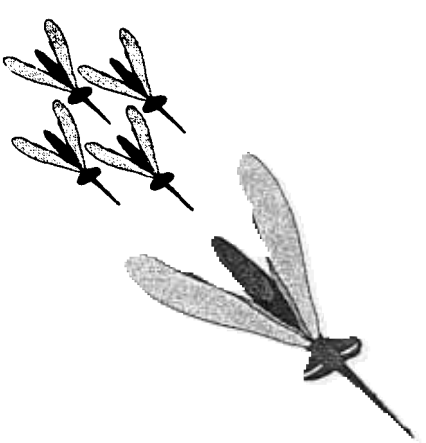
were either completely diverted away from the lake or were modified to divert the more contaminated first-flush waters. Adult midge flies, nonbiting nuisance Dipterans, were collected at monitoring stations along the river, but numbers were below levels considered potentially problematic. Midge habitat was limited to pooled water some distance east and west of the lake site, outside the jurisdiction of the City of Tempe. High densities of midge fly larvae (3000/m^2) were recovered from the sediments below the eastern pools. Concern was raised that these populations would move into the lake once partial or full-pool operation was initiated. As anticipated, an initial midge fly infestation at the downstream dam occurred during the initial lake filling process, but was quickly eliminated by application of bacterial larvicide in the return water channel and accumulated lake water above the dam. Mosquito monitoring along the potential lake and east of the upstream dam showed negligible numbers. The riparian area west of the downstream dam had mid-summer counts as high as 300 adult mosquitoes per evening, but few larvae were recovered from the limited number of shallow pools about 0.5-1.0 mile from the lake site. The stagnant water, vector-associated, *Culex* mosquito was the dominant form. Management plans to minimize accumulation of water above and below the dams were developed to prevent expansion of midge and mosquito habitat.

Monsoon and Watershed Impacts

Precipitation associated with the July monsoons resulted in a substantial discharge of storm water runoff into the lake, predominantly from the Indian Bend Wash. The runoff carried high levels of nutrients (1 mg/L P and 3 mg/L N) into the impoundment. Within two weeks algal densities increased an order of magnitude and lake transparency decreased by approximately 50%. The reduction in aesthetic quality was not accompanied by any sustained public health-related or surface water quality standard deterioration; accordingly, no remedial activities were initiated.

The July precipitation also resulted in encroachment of the pooled water east of the lake to the edge of the upstream dam. Concurrently numerous additional pools and expansion of previously existing pools of water formed in the riparian vegetation west of the downstream dam. Within one week of the rainfall, midge fly adult numbers increased to nearly 4,000 per trap and mosquito adult numbers rose to as high as 900 per trap. The riparian pools, in areas sheltered by saltcedar, contained observable quantities of mosquito larvae and midge fly larvae counts were in the thousands per square meter. A number of complaints regarding mosquitoes were recorded by Maricopa County Vector Control from residents about 0.5 mile west of the downstream dam. City and County analyses concluded that the major threat was the presence of *C. tarsalis*, a mosquito associated with Western Equine Encephalitis. Concurrently, the City of Tempe received several complaints from commuters regarding midge flies near the upstream dam.

In response to these events, Maricopa County applied larvicide oils and growth-regulators for larvae control and adulticides (fogs) for mosquito control in riparian areas east and west of Town Lake. The City of Tempe, initiated larvicide applications to the lake for management of resident midge flies, and has planned similar future treatments to adjacent riparian zones within their jurisdiction for both midge fly and mosquito larvae control. The selected larvicide is a bacterium specifically toxic to midges, mosquitoes, and black flies. Additional plans are being considered to manage nuisance and vector insect numbers, including (a) stocking the lake with predacious fish that are compatible with future recreational plans for the impoundment and that are protective of downstream



native fisheries, (b) re-grading and vegetation thinning of downstream riparian areas for vector and nuisance insect habitat reduction, and improved access and pesticide treatment efficiency, and (c) using, on an as-needed basis, adulticides and larvicides that pose minimal threat to non-target organisms.

A Lesson to Be Learned

The events described above have far-reaching impacts, beyond the success of Tempe Town Lake alone. Several municipalities, the Army Corps of Engineers, and US Bureau of Reclamation have plans to re-establish riparian habitat above and below the lake. These plans need to take into consideration those lessons that have been already learned during the infancy of Tempe Town Lake. These riparian zones will be designed to supply habitat for native species and serve as an educational and aesthetic resource to the community. Design and operation of constructed riparian habitats must concurrently establish methods of reducing potential habitat for nuisance and vector insects. Vegetation density must be carefully controlled to reduce shelter for mosquitoes. Wetting and drying cycles, and water flows must be established which are not conducive to invasion by flood water mosquitoes (e.g., *Aedes* and *Psorophora*). Nutrient-laden discharges that create aesthetically deteriorating algae growths and odors upon senescence must be diverted or eliminated. Aquatic plant growths can also produce ideal organically rich habitats for benthic organisms as midge fly larvae and attract stagnant water mosquitoes. Methods for managing numbers of insects need to be developed should unplanned infestations occur.

EPA Updates Annual List of Fish Advisories and Makes Fish Advisories Available on the Internet

EPA is making it easier for the public to find out if the fish they catch is safe to eat. Check for local fish consumption warnings on any river, lake or stream through EPA's national list of fish advisories at: http://www.epa.gov/ost/fish.

This information was provided by the River Network's email list, rivernet-info.

Colorado Plateau Research

The Fifth Biennial Conference of Research on the Colorado Plateau will be held at the du Bois Center, Oct. 25-28. The conference is a scientific forum for research related to the biological, paleontological, cultural, physical, and social sciences on the Colorado Plateau. The conference will open with a symposium *Past, Present & Future Impacts of Anthropogenic and Natural Climate Change on Ecosystems of the Colorado Plateau.* The conference is a collaboration among various Northern Arizona University (NAU) departments and the US Geological Survey Biological Resources Division. This year's theme celebrates NAU's centennial year and 150 years of the U.S. Department of the Interior. Additional details on the conference including a registration form and the current program can be found at *http://www.usgs.nau.edu/conference.*



SPECIES PROFILE



AN INTRODUCTION TO ARIZONA'S CRAYFISH WITH AN EMPHASIS ON *ORCONECTES VIRILIS*

by Terry C. Inman, Chandler, Arizona

Crayfishes inhabit freshwater ecosystems on every continent except for Africa and Antarctica. Despite a near worldwide distribution, crayfishes display their greatest diversity in North America north of Mexico where there are 308 recognized species (Taylor et al. 1996). Diversity in the U.S. is greatest in eastern, southern, and central regions, while only one genus is native to the Pacific slope drainages.

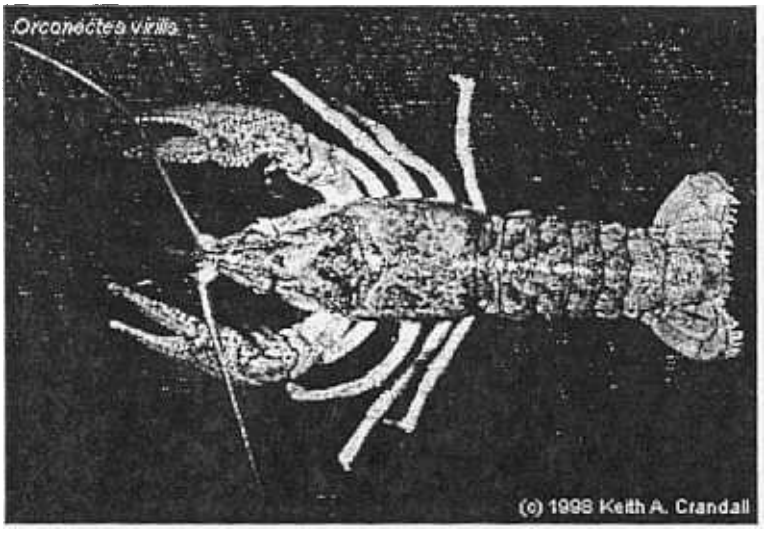
There is at least one native crayfish species in each of the contiguous 48 states except for Arizona, which has none (Hobbs 1991). Moreover, there are no known crayfishes indigenous to the entire Colorado River Basin, which encompasses parts of seven western states and Mexico. Crayfish first appeared in Arizona waters more than 30 years ago when they were stocked by the Arizona Game and Fish Department (AGFD) and the U.S. Fish and Wildlife Service (FWS) to control aquatic weeds and as forage for sport fish. Although the extent of the introductions by FWS is unknown, AGFD reported introductions at only three stream and lake sites in 1971 and 1991 (AGFD 1991). Other mechanisms by which crayfish are introduced to the wild include escapement or release from bait buckets and discard by aquarium enthusiasts — these combine to provide the most reasonable explanation for the present widespread distribution of non-native crayfishes in Arizona.

Two species, *Orconectes virilis* (northern crayfish) and *Procambarus clarki* (red swamp crayfish) are found in the wild in Arizona waters. Both are widespread, common to locally abundant, and occupy a broad array of natural and artificial habitats including reservoirs, lakes, stock ponds, rivers, streams, and canals. *P. clarki* appears restricted to a few locations within the Salt River Basin and along the main stream Colorado River from Lake Mead to below Yuma. Of the two, *O. virilis* displays the greatest distribution in Arizona ranging from low desert to high mountains within the Santa Cruz, Salt, Gila, and Little Colorado River drainages. With this in the mind the focus of this article will remain on *O. virilis*, the species the reader is most likely to encounter.

Orconectes virilis historically had an expansive range from eastern Alberta Canada, east to the southern boundary of Quebec, south to include New York, Ohio, Kentucky, Arkansas and Texas, west to include Colorado and Utah, and finally north through Wyoming and Montana. However the popularity of this species as a bait item (and to a lesser degree as aquatic weed control) has greatly increased its range to include 16 states to make *O. virilis* the most widely distributed crayfish in North America (Dean 1969, Hepworth and Duffield 1987, Momot 1988). Unlike *Procambarus clarki*, *O. virilis* has never caught on as a marketable, desirable food source for human consumption. Although *O. virilis* is quite palatable, its smaller size, slower rate of growth and shorter life span make it considerably less profitable and marketable for the food industry than the larger *P. clarki*. However, as a bait item *O. virilis* can be cultivated easily and cheaply with size and life span being less of an issue (Momot 1988).

General habitat preferences of *Orconectes virilis* include permanent well-oxygenated ponds, lakes, rivers, and streams with substrates of silt to cobble. *O. virilis* in lakes and ponds may occur in water as shallow as a few centimeters or as deep as 30 m (Savino and Miller 1991). *O. virilis* tolerates water temperatures ranging from 1 – 32° C (Dean 1969). In Arizona, it has been found at altitudes of about 300 m at Tempe to > 2,500 m in the eastern White Mountains.

Orconectes virilis has been observed to dig three types of burrows; each kind is usually less than 1-m in length. The most common and preferred type is under a rock imbedded in the substrate — if the rock is large enough it may conceal several burrows. The type is a simple hole in the bottom in the near-shore zone. This type of burrow is commonly used for over-winter hibernation and spring egg hatching. These first two kinds of burrows are readily abandoned after young become free living. The third burrow is excavated in autumn by young-of-year crayfish for hibernation, and typically is excavated just above the water line beneath rocks or grass-covered soil and usually extends several cm into the bank (Dean 1969). Few adult crayfish will hibernate during winter with many remaining active throughout the year even in the presence of ice.



Orconectes virilis is an opportunistic omnivore that feeds on a wide variety of living and dead plant and animal material. Under natural conditions it feeds on aquatic macrophytes (making it an excellent choice for control of nuisance plants), benthic and planktonic invertebrates, fish eggs, fish larvae, and dead or dying fishes (Minckley and Craddock 1961; Dean 1969; Hanson et al. 1990; Savino and Miller 1991). Under artificial conditions, *O. virilis* can be reared on fishmeal, soybean meal, cracked corn, and potatoes (Momot 1988).

Both male and female attain sexual maturity at about 2 years of age, with male sexual characteristics signified by a change in the first pleopods — the first pair of pleopods is the first set of appendages behind the last pair of walking legs (Dean 1969, Hobbs 1972, Momot 1988). Mating occurs during late summer to early autumn, although it also may occur to a limited extent during winter. Females with fertilized eggs may mate again in the spring prior to laying eggs (Dean 1969, Momot 1988). Sexually mature females mate and newly fertilized eggs develop internally throughout the winter until being laid and attached to the female pleopods in April or May, at which time the females may retreat into burrows (Dean 1969).

Depending on temperature, the eggs hatch about a month after being laid. After hatching, the young remain attached to the female for 7-12 days, molting at least twice (Dean 1969, Momot 1988). Once they become free living, the young spend most of their time feeding along the substrate in the littoral zone.

The majority of females move into shallow water and die after their eggs hatch, with few surviving to reproduce during a second season. Only about 12% of males survive beyond a third summer (Dean 1969), and maximum life span in nature is 3 years (Dean 1969, Momot 1988).

After autumn mating, surviving males molt into a non-breeding form characterized by a change in the appearance of the first pleopods. Males remain in this state until the females have hatched their brood. Males then will undergo another molt into the sexually enabled form (Hobbs 1972).

Coloration is typically muddy green to reddish-brown for all individuals, regardless of age, size or gender. The pincers are green to greenish blue with orange tips and may be studded with white knobs in adults (Pflieger 1987).

Arizona is unique in that it has no native crayfish species. However, introduced *Orconectes virilis* and *Procambarus clarki* now are established and are permanent residents in most Arizona waters. Overly abundant populations of *O. virilis* in certain areas are considered a nuisance — often stealing bait form fisherman's hooks, damaging fish on stringers, removing important

macrophyte cover for larval-to-juvenile fishes, and increasing turbidity. In an apparent attempt to help manage these nuisance populations the AGFD recently (August 1999) aired an episode of *Arizona Wildlife Views* expounding the untapped crayfish resource as a palatable food item and inviting fisherman to catch all they can eat. However, a more serious threat exists to at least one of Arizona's threatened native minnows. Population dynamics of the Little Colorado spinedace (*Lepidomeda vittata*) are both directly and indirectly affected by the presence of *O. virilis*, which feeds upon its eggs and, by influencing habitat availability, leaves the spinedace vulnerable to predation (White 1995). This may also be of concern in the protection and conservation of other endangered Arizona fishes such as spikedace (*Meda fulgida*) and desert pupfish (*Cyprinodon macularius*), which may directly compete with *O. virilis* for territory. With these things in mind, the need for future research on the roles of *O. virilis* in Arizona's aquatic ecosystems becomes apparent.

LITERATURE CITED

Arizona Game and Fish Department. 1991. Arizona stocking records for all aquatic species from 1931-1991. Arizona Game and Fish Department, Phoenix.

Dean, J. L. 1969. Biology of the crayfish *Orconectes causeyi* and its use for control of aquatic weeds in trout lakes. Technical paper 24: Bureau of Sport Fisheries and Wildlife. U. S. Fish and Wildlife Service. Washington D. C.

Hanson, J. M., P. A. Chambers, and E. E. Prepas. 1990. Selective foraging by the crayfish *Orconectes virilis* and its impact on macroinvertebrates. *Journal of Freshwater Biology* 24:69-80.

Hepworth, D. K. and D. J. Duffield. 1987. Interactions between an exotic crayfish and stocked rainbow trout in Newcastle Reservoir, Utah. North American *Journal of Fisheries Management* 7:554-561.

Hobbs, H. H., Jr. 1972. Crayfishes (Astacidae) of North and Middle America. U. S. Environmental Protection Agency, *Biota of Freshwater Ecosystems, Identification Manual* 9:1-173.

Hobbs, H. H., III. 1991. Decapoda. In J. H. Thorp and A. P. Covich, eds., *Ecology and Classification of North American Freshwater Invertebrates*. Academic Press, Inc. San Diego, CA.

Minckley, W. L. and J. E. Craddock. 1961. Active predation of crayfish on fishes. *The Progressive Fish-Culturist* 23:120-123

Momot, W. T. 1988. *Orconectes* in North America and elsewhere. In D. M. Holdich and R. S. Lowery, eds., *Freshwater Crayfish Biology, Management and Exploitation.* Croom Helm Ltd. London, England.

Savino, J. F. and J. E. Miller. 1991. Crayfish (*Orconectes virilis*) feeding on young lake trout (*Salvelinus namaycush*): effect of rock size. *Journal of Freshwater Ecology* 6:161-170.

Taylor, C. A., M. L. Warren, Jr., J. F. Fitzpatrick, Jr., H. H. Hobbs, III, R. F. Jezerinac, W. L. Pflieger, and H. W. Robison. 1996. Conservation status of crayfishes of the United States and Canada. *Fisheries* (Bethesda) 21:25-38.

White, J. N. 1995. *Indirect effects of predation by crayfish on Little Colorado spinedace*. Master of Science Thesis. Northern Arizona University, Flagstaff.

Editor's note: Terry C. Inman is a graduate of the Department of Biology, Arizona State University. For more information about crayfish check out the following web site: http://bioag.byu.edu/mlbean/crayfish/crayhome.htm

PAGE RAGE

by Tim Beynon, Senior Warden, Saltwells Local Nature Reserve, Pedmore Rd, Briereley Hill, Dudley DY5 1TS

Editor's Note: This article has been reproduced from Urban wildlife NEWS *13(2):1-2; 1996.*

We've all heard of Road Rage. Well I, and I confidently believe many of you, suffer from Page Rage. It is caused by two insidious viruses. The first and more virulent has recently become more widespread, and threatens to surpass the damage caused by imports such as *Sciurus carolinensis, Crassula helmsii,* and more recently *Artioposthia triangulata.* It has invaded many books and journals concerned with wildlife, and it threatens the sensible dissemination of knowledge.

Its common name is Creeping Lower-caseitis, or CLC. For example: common spotted orchid, *Dactylorhiza fuchsii.* Is this a widespread and numerous spotted orchid?

The common names of species are proper names, and as such require initial capital letters. I thought perhaps it might all be due to idle typesetters unwilling to operate the shift key, until I came across the following ludicrous examples in the Quarterly Journal of Forestry, (90.1, 1996): "...the Scotch annulet"; "...and cousin German"; "...Manchester treble-bar"; "...the November and winter moths".

CLC threatens sensible dissemination of information. In the context of the paragraph in which it occurs, the last example above could justifiably be thought to refer to those moths which occur in winter, unless the reader knew something about moths.

I am not sure when the virus first appeared, but it is certainly spreading rapidly. Even august publications, (yes the adjective not the month), like this very journal, have succumbed. In addition to being an outstanding magazine, *British Wildlife* appears to be one of the few which is immune. Long may it flourish.

The other illness is manifested by the use of wrong homonyms, caused perhaps by overuse of a Spellchecker and a shortage of sub-editorial blue pencils (or, dare I say it, poor education in English). A single example suffices: "...the plants faired much better in wet ground".

Although still uncommon in nature publications it is far more widespread generally, and sadly, I believe ineradicable.

But CLC is not. What lunatic first introduced the infection, and more to the point, why? It is, literally, senseless.

Come on, all you out there who care for the accuracy of language, particularly in texts purporting to be at least a little scientific, join SENSE, the Society for Eradication of NonSensical English. There is no subscription, but members undertake to write to offending editors.

The views expressed in this article are those of the author and do not necessarily reflect those of the statutory nature conservation agencies in the UK.

Ever diligent in the search for enlightenment and truth the Editor [of the *Urban wildlife NEWS*] made enquiries about the origins of the decision to use initial letter lower case in Agency publications for the names of plants and animals. Mike Henchman, who in those far-off days headed the Nature Conservancy Council's Interpretative Branch, supplies the following comment with – and so we should hope – apologies to Shakespeare:

Upper or lower case, that is the question.

Whether to soothe the eye with undulating waves of text, or to embark upon a raging sea of caps?

And how to cope with mindless inconsistency?

Why Blackbird, Buttercup or Lesser Celandine, lurking in groves of oak or ash or thorn?

Why are some thrice-blessed (or cursed) with caps but others, by mere convention, seeminly belittled in their usage?

And what of rocks and stones and aeons gone by, where masters of geology apply a set of rules, arcane to all but they?

Spare thought and care for editors of text, rampant with names so thickly packed the mind is fuddled by a set of 'rules' whose origins are lost in mists of time.

Spare thought for readers tired of eye, hiccoughing through a jungle densely spiked with vertical illogicality.

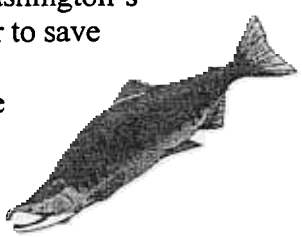
Spare thought for those – who write, design or print, who work against the clock and, unto whom, simplicity of rule speeds the process, practice and production.

Spare thought for every saving made to garner time and cash. Aye even ink, whose lower case minutely is its own conserver of the world's resource.

AMERICAN RIVERS' UPDATES

SNAKE RIVER

American Rivers is working hard to generate support for removing four federal dams on Washington's Snake River to save endangered salmon. The Emerald People's Utility District, a small electric utility district in west-central Oregon, is the first electrical utility to call for partial removal of the four federal dams on the lower Snake River. A spokesman for the utility said that cheap power is important, but "if the fish become extinct, the reparations would cost millions more than the Bonneville Power Administration could not fully absorb." The utility's board recently voted that partially removing the dams would be the best way to allow the salmon to recover, as well as to ensure the stability of future electricity rates.



The Idaho Chapter of the American Fisheries Society "overwhelmingly" approved a resolution on June 25 in support of breaching the four lower Snake River dams. Ninety-two percent of the 200 members voted in favor of the resolution. Ted Koch, society president said, "Even the most skeptical among us agreed that at a minimum, removing the dams would help salmon and steelhead greatly."

PROGRESS ON THE SAN PEDRO

The United States and Mexico have signed an agreement to coordinate efforts to save the San Pedro River, listed as one of the nation's most endangered rivers of 1999 by American Rivers. The San Pedro is Arizona's largest undammed river, and is a critical rest stop in southeastern Arizona for millions of migrating birds.

In addition, 52 river miles in the Southwest have been designated as critical habitat for the endangered Huachuca water umbel (a rare Arizona plant). The designation includes a long segment of the upper San Pedro River as well as portions of the Santa Cruz River, Sonoita Creek, and tributaries to the San Pedro. The protection forbids authorization, funding, or permitting by the federal government of any activity that will adversely modify critical habitat.

Editor's Note: These updates were excerpted from the American Rivers, Summer 1999, Vol. XXVIII, No. 2, *newsletter with permission.*

Arizona Riparian Council Fall Campout and Get Together October 23-24, 1999

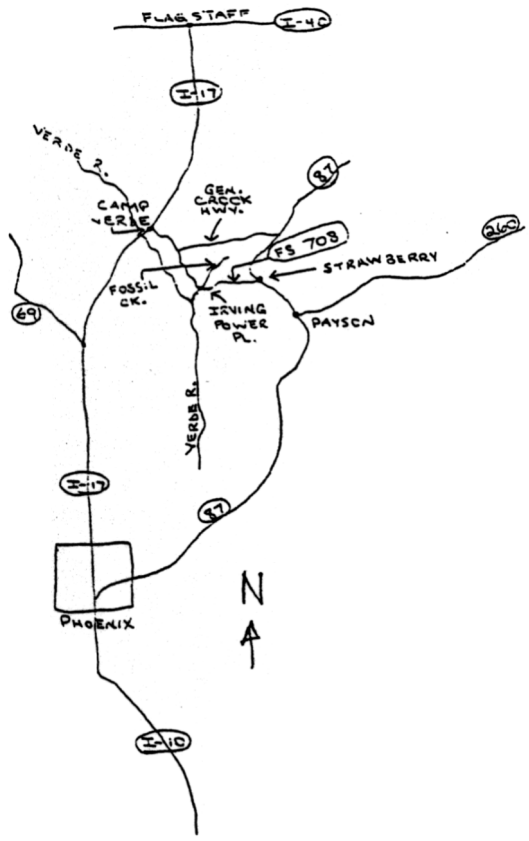
This year's fall campout and get together is a little late in planning, but is it going to happen! We have decided this year to return to Fossil Creek.

The last time we were at Fossil Creek was on October 18, 1992. At that time, we hiked up to the springs and had a discussion on relicensing of the Childs-Irving Hydroelectric Generating Plants. Once again, APS has allowed us to be able to go into the area. This will give us a good opportunity to see where we are 7 years later. We are putting together the plans and we intend to include a trip to the springs.

This is, as always, a family campout so bring the kids and your camping gear. Pitch your tents in the grassy area around the Irving Power Plant. You may also want to bring your swimsuit, Tevas or watershoes, and mask. The Council will provide dinner Saturday evening. You will be on your own for lunch and breakfast Sunday morning.

Please contact Cindy Zisner either by phone (480) 965-2490 or email Cindy.Zisner@asu.edu and let her know if you will attend and how many in your party so we can plan appropriately for dinner. Please also provide your fax number or email address. We will have a map available for those of you who do not know how to get there.

One of many springs entering Fossil Creek. Photo by Kris Randall, March 1994.



LEGAL ISSUES OF CONCERN

Richard T. Campbell, Law Offices of Storey and Pieroni

CRITICAL HABITAT DESIGNATION UNDER THE ENDANGERED SPECIES ACT: RECENT DEVELOPMENTS

The controversy over critical habitat designation under the Endangered Species Act (ESA) of endangered and threatened species by the U.S. Fish and Wildlife Service (FWS) is escalating. A recent attempt by FWS to clarify its role in designating critical habitat, and a U.S. Senate bill currently wending its way through Congress that addresses critical habitat, may result in significant changes to the manner in which critical habitat is designated. Environmentalists and development interests are at issue with FWS and each other over the future of critical habitat designation. Both are eagerly awaiting the outcome of the attempt by FWS to resolve the issues it has with the cost and effectiveness of critical habitat designation.

CRITICAL HABITAT AT PRESENT

Critical habitat is defined under the ESA as: (i) the specific areas within the geographical area currently occupied by a species, at the time it is listed in accordance with Section 4 of the Act, on which are found those physical or biological features (I) essential to the conservation of the species, and (II) which may require special management considerations or protections, and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. Critical habitat, if prudent and determinable, must be proposed and designated by FWS. The regulatory impact of critical habitat designation is that under ESA Section 7(a)(2), federal agencies must, in consultation with FWS, insure that any action they authorize, fund or carry out is not likely to result in the destruction or adverse modification of critical habitat.

FISH AND WILDLIFE'S "RECOVERY HABITAT"

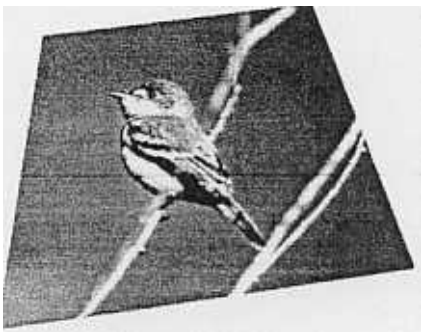
FWS recently reiterated its long-standing belief that while critical habitat in an important concept, "in most circumstances, the designation of "official" critical habitat is of little additional value for most listed species."(64 *Federal Register* 31871 [June 14, 1999]["Endangered and Threatened Wildlife and Plants; Notice of Intent To Clarify the Role of Habitat in Endangered Species Conservation"]). The primary reason provided by FWS for this conclusion is that, separate and apart from critical habitat designation under ESA Section 7(a)(2), the Act also requires federal agencies to consult with FWS regarding possible jeopardy to listed species and destruction or adverse modification of critical habitat under Section 7(b)-(d) of the Act. Since FWS interprets the adverse modification of critical habitat consultation standards as nearly identical to the jeopardy consultation standards, FWS is suggesting that the jeopardy standard alone can adequately protect species (*Id.* at 31872). Another reason to limit its role in separate critical habitat designation, according to FWS, is that "on private land, where no Federal involvement exists, a critical habitat designation has no regulatory impact" (*Id.*). In addition, FWS asserts that the expense of determining and designating critical habitat,

including the cost of defending critical habitat determinations in court, prevents FWS from using its limited resources in a manner more beneficial to imperiled species (*Id.* at 31873). Thus, FWS has solicited public comments on ways to change the current approach to designation critical habitat.

FWS provides some suggestions of its own. First, FWS states that a more cost-effective manner of critical habitat designation would allow the Service to describe suitable habitat in "broader terms," e.g., "general habitat location delineations and broad descriptions of habitat types" (*Id.*) FWS also suggests the possibility of designating critical habitat at the stage it develops the recovery plan for a threatened or endangered species. This "recovery habitat" would be described in the recovery plan itself. *See* Testimony of Jamie Rappaport Clark, Director, FWS, Before the Senate Committee on Environment and Public Works (May 27, 1999). FWS reasons that listing focuses on threats to species, but in many instances the biological elements necessary for the conservation and eventual recovery of the species is not known until later in the conservation process, i.e., during the recovery phase. Thus, according to FWS, it is best to place critical habitat designation at this stage (*Id.* at 31873-74).

SENATE BILL 1100

U.S. Senate Bill 1100, which is currently wending its way through Congress, responds to the suggestion by FWS that critical habitat designation be moved to the recovery planning phase of the ESA. The bill, sponsored by Senator John Chaffee, would place critical habitat designation in the hands of a "Recovery Team" which would recommend critical habitat along with the recovery plan. The current version of the bill provides that a final recovery plan would be required within 30 months after listing of the endangered or threatened species. If the Secretary of the Interior determines that a recovery plan would not promote the conservation of an endangered species or a threatened species, FWS would designate critical habitat for the species not later than three years after making a determination that the species is an endangered or threatened species. (The bill does not specify when FWS would be required to designate critical habitat for species that currently have recovery plans.) According to Washington insiders, the bill has a better than average chance of becoming law.



Southwestern Willow Flycatcher.

Meanwhile, environmentalists want critical habitat designated sooner than later to provide as much protection as possible to species, especially on unoccupied habitat (the definition of critical habitat explicitly calls for protection of areas "outside the geographical area occupied by the species at the time it is listed"). Moreover, environmentalists believe that a critical habitat designation provides land managers the direction they need to preserve species. Some development interests have a similar argument: critical habitat designation draws clear lines on a map that provides developers the certainty they need to engage in development. On the other hand, critical habitat designation thwarts development in some instances. How Congress or FWS ultimately resolves the issues surrounding critical habitat designation will likely be very controversial because of the varied interests at stake.

NOTEWORTHY PUBLICATIONS

Michelle M. Oleksyszyn, Department of Plant Biology, Arizona State University

In the previous newsletter, I summarized articles that focused on a hot topic in science- invasive plants. In this edition, I chose to address yet another popular subject- the concept of River Health.

Karr, J. R. 1999. Defining and measuring river health. *Freshwater Biology* 41:221-234.

At the outset of the article, Karr asserts that evaluation and classification of river health will vary depending on who is asked. For example, a river deemed healthy by a fishery scientist may be labeled threatened by an invertebrate biologist. Karr proceeds to summarize the current controversy over use of the term health. He concludes that the value of the term lies in its familiarity. In selecting a term that we, the public, can empathize with, scientists can evoke our support and interest in the management and restoration of rivers. His discussion of river health implies a preference toward a landscape level approach in river assessment and the selection of a system of classification that incorporates human use of rivers and human values. He further encourages that rivers be evaluated, not solely on physical or chemical states, but also with an emphasis on biological impact. Lastly, he favors the incorporation of multiple types of measurements in health assessment. He explains a model for river health that would focus on the 5 stages listed below:

1. Classify to define homogeneous sets: This step involves the classification of rivers based on physical, chemical, and biological attributes. This would allow scientists to recognize and group rivers based on similar responses to perturbations.
2. Select appropriate metrics: The second stage consists of sampling areas within rivers that contain various levels of disturbance and establishing a relationship between effect and intensity of disturbance. He recommends determining these relationships through graphs and statistics, but he cautions that results must be interpreted with a thorough knowledge of natural history.
3. Develop sampling protocol: Karr concludes through his own work and evaluation that the actual method used is not nearly as important as consistency. His experience suggests that the best data can be attained by collecting samples in a narrow time window and avoiding sub-sampling.
4. Analyze data to reveal biological patterns: Here he reminds scientists not to rely on values to convey conclusions but rather to use information gathered to reveal trends. He suggests that graphs are often the best available tool to use toward this end.
5. Communicate biological condition: Karr stresses the necessity for scientists to be able to convey information effectively to decision-makers. In order to accomplish this, he recommends that scientists not focus on endless studies, enormous data sets, and perpetual research, but summarize the status of rivers and recognize trends in river response to disturbance.

Fairweather, P. G. 1999. State of environment indicators of 'river health': exploring the metaphor. *Freshwater Biology* 41: 211-220.

Fairweather emphasizes the necessity of acknowledging societal influence on indicator programs. The author discusses the PCR model that incorporates three types of indicators — those that measure pressure, condition and response. In this model, humans are the primary response indicators and it is our involvement at this stage, which will feedback upon and potentially change the pressure element. Karr juxtaposes river health with the broader concepts of ecosystem health and biodiversity assessment. In these comparisons, the author illustrates the similarity between using indicator species

in river assessment and using umbrella species in biodiversity assessment. Further ecosystem health and river health both involve ecology, ethics, and human interest. The majority of the paper examines the validity of the term health and the applications of the metaphor. Fairweather draws analogies between river health and general medical practitioners and veterinarians. Some shared elements are:

1. The need to use multiple measures to thoroughly evaluate condition (river evaluation uses water quality analysis and biotic inventories while doctors use temperature and pulse).
2. The need to be familiar with a variety of "beasts" (the river scientist needs to recognize different types of streams and the veterinarian needs to treat dogs as well as cats).
3. The value of performing initial rapid evaluation followed by specific examinations (where doctors check broad conditions in a first visit and if something appears wrong they conduct a more thorough, expensive and timely investigation. The author suggests that scientists broadly evaluate rivers then intensively study those that are 'unhealthy').

Finally, Fairweather introduces a 4-stage hierarchical approach to using indicators.

1. Become aware of an alarming condition.
2. Have the necessary authorities perform an investigation and make initial assessments.
3. Perform a more specific investigation.
4. Use other types of indicators to assess the success or failure of an indicator program and continue monitoring.

Boulton, A. J. 1999. An overview of river health assessment: philosophies, practice, problems and prognosis. *Freshwater Biology* 41: 469-479.

Unique to Boulton's discussion is his statement that river health evaluation needs to be able to recognize and separate natural variation from that induced by human impact or disturbance. The author emphasizes that a valuable indicator should be predictive in nature and allow time for preventative action to occur. Boulton stresses the need to have a strong correlation between an indicator and the condition it is expressing — much like Karr called for a direct relationship between different levels of disturbance intensity and river response. Various categories of indicators are evaluated, but most of the author's support is given to synthetic approaches rather than single perspective approaches. In addition to the warning that spatial and temporal variability must be known and considered in the evaluation of river condition, Boulton suggests that effective models for assessing river health need to incorporate the influence of surrounding riparian or wetlands areas. This forces the evaluation to become a landscape level concern. His final comments conclude that although some consideration of particular species may be important, health is best studied through measurements that strike at patterns, processes and functions within rivers.

The Arizona Riparian Council (ARC) was formed in 1986 as a result of the increasing concern over the alarming rate of loss of Arizona's riparian areas. It is estimated that <10% of Arizona's original riparian acreage remains in its natural form. These habitats are considered Arizona's most rare natural communities.

The purpose of the Council is to provide for the exchange of information on the status, protection, and management of riparian systems in Arizona. The term "riparian" is intended to include vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage. Any person or organization interested in the management, protection, or scientific study of riparian systems, or some related phase of riparian conservation is eligible for membership. Annual dues (January-December) are $15. Additional contributions are gratefully accepted.

This newsletter is published three times a year to communicate current events, issues, problems, and progress involving riparian systems, to inform members about Council business, and to provide a forum for you to express your views or news about riparian topics. The next issue will be mailed in January, the deadline for submittal of articles December 15, 1999. Please call or write with suggestions, publications for review, announcements, articles, and/ or illustrations.

Paul C. Marsh
Department of Biology
Arizona State University
PO Box 871501
Tempe, AZ 85287-1501
(480) 965-2977; fish.dr@asu.edu
or
Cindy D. Zisner
Center for Environmental Studies
Arizona State University
PO Box 873211
Tempe AZ 85287-3211
(480) 965-2490; FAX (480) 965-8087
E-Mail: Cindy.Zisner@asu.edu

The Arizona Riparian Council

Officers

Kris Randall, President ..... (480) 831-8780
ecoplan@aol.com
Janet Johnson, Vice President ..... (602) 225-5255
jjohnson/r3_tonto@fs.fed.us
Cindy Zisner, Secretary ..... (480) 965-2490
Cindy.Zisner@asu.edu
Jeff Inwood, Treasurer ..... (602) 274-6725
jinwood@flusol.com

At-Large Board Members

Matt Chew ..... (602) 542-2148
mchew@pr.state.az.us
Barbara Heslin ..... (602) 789-3611
bheslin@gf.state.az.us
Susan Pierce ..... (602) 661-3825

Committee Chairs

Classification/Inventory
Roy Jemison ..... (505) 766-2017
rjemison/rmrs_albq@fs.fed.us
Education
Cindy Zisner ..... (480) 965-2490
Land Use
Marty Jakle ..... (602) 640-2720
Protection/Enhancement
Kris Randall ..... (480) 831-8780
Bill Werner ..... (602) 789-3607
bwerner@gf.state.az.us
Water Resources
Jeff Inwood ..... (602) 274-6725

CALENDAR

Wetlands & Remediation, An International Conference, November 16-17, Hilton Hotel, Salt Lake City, UT. Conference encompasses both the treatment and remediation of contaminated wetlands and the use of wetlands to treat and remediate contaminated water and wastewater. For registration information, (800) 783-6338 or conferencegroup@compuserve.com.

Rivers, Dams, and the Future of the West, November 18, 1999: Salt Lake City, UT. Second annual conference of the UT Wetlands and Riparian Center. Contact Jack Hamilton, (801) 581-6348, jack.hamilton@m.cc.utah.edu

Southwest River Management and Restoration: Nonstructural Approaches conference, April 3-5, 2000, Crowne Plaza Hotel, Phoenix, AZ. Conference will explore the increasingly valuable role of watercourses in our community. For more information contact Valerie Swick at (602) 506-4872.

WATERSHED 2000, July 9-12, 2000. Hotel Vancouver, Vancouver, British Columbia, Canada, WATERSHED 2000, to be held in the Pacific Northwest, will explore national and international challenges of managing watersheds. For registration information, call (800) 666-0206 or (703) 684-2452, E-mail: msc@wef.org).

BT5 1005
Center for Environmental Studies
Arizona Riparian Council
Arizona State University
PO Box 873211
Tempe, AZ 85287-3211

ASU
ARIZONA STATE UNIVERSITY