

The river's end

Dr Karl Flessa discusses collaborative efforts to understand the far-reaching impacts of manmade changes to our ecosystems and improve the science behind transboundary water and environmental policy



Could you begin by elaborating on the central goals of your research and what inspired you to instigate this initiative?

We work to stimulate and facilitate interdisciplinary and international research on the Colorado River delta. The delta was once subject to the river's strongly seasonal flow and year-to-year variation in snowfall in the Rocky Mountains. In less than 100 years, control over the variation in flow of the Colorado River at its delta has passed into human hands. Now, the Colorado River no longer reaches the sea. Upstream dams and water diversions divert the river's water to the farms and cities of the U.S. and Mexico. The Colorado River delta is a natural laboratory for studying the transformation of the Earth's surface for human needs.

How do you propose to improve collaboration and cooperation of research efforts among disciplines; between U.S. and Mexican scientists; and among academic, agency and NGO scientists?

A mixture of big meetings (100 or so participants), specialised workshops on

topics or for writing proposals, field trips, and one-on-one exchange visits seems to work best. Involving students in such meetings is especially important – they contribute a great deal, learn a lot, and develop the contacts that ensure the future of scientific collaboration across the border.

What progress have you made in determining the volume, quality and timing of delivery of the water required to restore critical habitats?

We've learned that: a little bit of water can have extremely beneficial effects; even small-scale floods restore a lot of riverbank trees; the rare flows that reach the sea cause increased shrimp catches in subsequent years; even low-quality water can restore important habitats; and simulating the annual spring floods with controlled releases has multiple beneficial effects. Allocating between 1-10 per cent of the river's annual flow to support ecosystem services would sustain and restore a lot of the delta's habitats. That's still a pretty broad range, but it's real progress. We are working on gaining more precise estimates for particular parts of the system.

Given the socioeconomic and political pressures, how quickly can decisive action be taken?

The existing framework of interstate and international water allocations tends to slow things down – as do the competing demands for the river's water. Nevertheless, a lot of progress is being made: there is now a precedent for providing some transboundary water for ecosystems; a water trust has been established in Mexico to allocate water for restoration; and water agencies are finding that working with NGOs and academic scientists can be a good way to solve or avoid problems. Sometimes a crisis like the current drought or the prospect of less water because

of global warming can speed up problem solving. Progress is incremental: patience is required.

The project spans the U.S. and Mexican border. Have you encountered any political problems in your research due to working on both sides of these boundaries? If so, how have you overcome these issues?

We have not had any significant problems because of the international nature of our efforts. We have a wonderful, free-flowing exchange of information, facilities, scientists and students. Government agencies on both sides of the border have also been very cooperative. We all get a bit annoyed at delays at border-crossings, but that's really a very minor problem in the grand scheme of things.

Thinking back on the RCN-CRD's work so far, have there been any surprises?

Two come to mind. First, because of the objectivity of academic scientists and the respect that we have among agencies and NGOs, we discovered that we can play an important role in environmental disputes. We can gather and analyse a common set of data that can then be used to avoid or solve environmental problems. People can always argue over interpretations of the data, but there really shouldn't be arguments over the data itself. Second, I've been pleasantly surprised about how easy this work has been. The experience has taught me that people, organisations, and regional agencies along the border can collaborate to solve common problems. We share an environment and can collaborate in solving problems and making scientific progress. Our two central governments have provided vital resources to help us conduct our work, but this sort of research and problem solving has been successful because of the delta region's network of really committed people.

Divided waters

An assembly of researchers known as the **Research Coordination Network – Colorado River Delta** is dedicated to discovering how best to sustain and enhance environmental, cultural and economic values of the region

FOR THE FARMS and cities based in the arid desert regions of the southwestern U.S. and northwestern Mexico, the Colorado River is the single most important source of water. The river begins its journey in the Rocky Mountains of Colorado and flows through seven U.S. states before crossing the border into Mexico. The river's discharge once created wetlands, a riparian corridor and an estuary that extended 70 kilometres from the river's mouth. The river supported ecosystem services such as a habitat for the spawning, development and subsistence of commercially important fish and shrimp; habitats for migratory and resident birds; pollutant filtration; recreation; and subsistence for indigenous people. Over the past century, humans have altered the natural habitats through regulation and diversion of the Colorado River. Today, the U.S. diverts around 90 per cent of the river's flow before it can cross the Mexican border. Mexico uses its share for its farms and cities. These diversions have served local and

distant communities well by improving irrigation and providing urban areas (including LA, Las Vegas and Phoenix) with water. But the downstream effects have been extensive. In most years, water flow does not reach the river's estuary in the Gulf of California, and if it does, the water is of a very low standard, typically runoff from farmers' fields and effluent from water-treatment plants.

This transboundary river and the ecosystems it supports brings into question the value placed on water and our natural resources. With these concerns in mind, the Research Coordination Network – Colorado River Delta (RCN-CRD) was formed. Dr Karl Flessa, project coordinator, explains the policies and attitudes of the past that have prompted the need for action in this day and age: "100 years ago, the prevailing philosophy was that any drop of water that ran to the sea was wasted because it wasn't directly used for economic development. Interstate agreements in the U.S. and the water treaty with

Mexico don't recognise nature as a rightful user of water".

FEELING THE EFFECTS

The RCN-CRD project enlists a binational community of academic, NGO and agency biologists, geologists, hydrologists, oceanographers, historians, social scientists, legal scholars, and policy analysts dedicated to facilitating research and understanding of the impact that humans have had in transforming the natural habitats of the Colorado River delta. Whilst one of the end-goals of the project is to establish the most efficient ways to actively manage water in order to protect and preserve ecosystems surrounding the delta, the project members acknowledge that achieving full restoration of the river is out of the question. Instead, they are focusing their efforts on a smaller scale, with the hope of generating larger domino effects in the future. Research has shown that improving freshwater delivery to the delta by as little as 25 cubic metres per second is enough to reverse some of the negative impacts felt by the river's vegetation and wildlife.

The effects of upstream diversions include changes to the water, land, and species that depend on a healthy river flow for their wellbeing. For example, in the upper Gulf of California, less river flow has resulted in anti-estuarine circulation, a process in which the water with a high salinity (formed by the evaporation of seawater in the confines of the river's mouth) sinks and flows seaward and seawater flows toward the mouth at the surface. Upstream dams have also trapped most of the river's sediment, meaning that over the past 100 years, the delta has slowly been retreating toward the mainland.

As a result of the region's changing landscape, many rare and endangered species' habitats are changing or disappearing, putting the species at



The Colorado delta clam was abundant when the river flowed all the way to the Gulf of California. It is now rare.



The U.S. diverts around 90 per cent of the river's flow with upstream dams before it can cross the Mexican border

INTELLIGENCE

THE COLORADO RIVER DELTA RESEARCH COORDINATION NETWORK

OBJECTIVES

To establish a network of natural scientists, social scientists and legal scholars to facilitate interdisciplinary, inter-institutional, and international research on the Colorado River delta of the U.S. and Mexico.

The project supports workshops, exchange visits, and websites. Financial support is provided by the National Science Foundation and many NGOs and agencies.

PARTNERS

For a full list of participants in the Network, please visit:

www.geo.arizona.edu/rcncrd/network_participants.html

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CONTACT

Karl W Flessa

Department of Geosciences
University of Arizona
Tucson
AZ 85721
USA

T +1 520 621 6000
E kflessa@email.arizona.edu

www.geo.arizona.edu/rcncrd

KARL FLESSA is Director of the School of Earth and Environmental Sciences and Professor and Head of the Department of Geosciences at the University of Arizona, Tucson, Arizona. A paleontologist by training, he has been studying the conservation biology of the Colorado River delta since 1992.

a higher risk of extinction. The totoaba, a large predatory fish native to the Gulf of California, relies on the river's estuary for breeding and nursery grounds. The wetlands are also nesting grounds for approximately 90 per cent of the population of the Yuma Clapper Rail, a rare marsh bird species. Other rare species reliant on the Colorado River include desert pupfish, southwestern willow flycatcher, and an endemic species of salt marsh grass. Additionally, the remaining wetlands serve as a vital stopping-over and resupply point for hundreds of thousands of migratory birds travelling on the Pacific Flyway. The migratory birds that depend on the delta provide benefits to people who live very far away. "The delta's habitats support endangered species – animals and plants that society values so much that they are protected by law," Flessa highlights. "People have been part of the delta for at least 4,000 years; protecting and restoring delta habitats helps people – both in the region and at a distance."

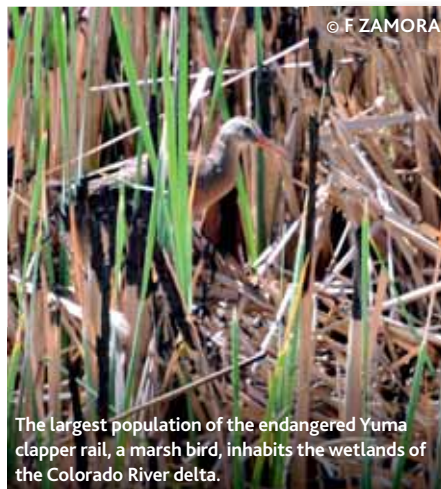
Finding solutions to the problems caused by upstream diversions will serve both the U.S. and Mexico financially in the future. Mexico's economy can expect a boost from an improved fishing industry, an important economic activity in the region. Consequently, the U.S. will benefit from having a nearby source of seafood and fewer immigrants will be looking for work in the U.S. since an increased flow will result in more catch, meaning more jobs in the region.

THE RESTORATION PROCESS

Past efforts to resolve the discrepancy between supply and demand for water focused on increasing the river's storage and supply to solve shortages. Those days are gone. Decreasing demand by increasing efficiency can make more water available for both people and nature. And making better use of low-quality water is reaping benefits: diverting slightly salty agricultural wastewater to maintain wetlands has proven successful. Further progress has been made by allocating treated effluent from cities to restore riverbank habitats and by acquiring water rights from farmers.

RCN-CRD has also developed the field of conservation paleobiology to determine the characteristics of species and habitats prior to human influences. This work involves gathering shells, bones and other remains for analysis and helps to compensate for the lack of scientific surveys prior to human activity in the area. Flessa elaborates on the advantages of this innovative approach: "The geochemical and paleoecological study of shell accumulations and bones have given us a glimpse into the delta's past, established environmental baselines, set targets for restoration, and provided estimates of the amounts of water needed for some species to thrive".

RCN-CRD understands the importance of raising awareness with the general public both in the U.S. and Mexico. The project keeps its community in touch via its website, newsletters and e-mail announcements, in addition to publishing their findings in journals and books, presenting at conferences, and media coverage. These efforts help people to better understand the human-induced challenges facing our ecosystems today. As Flessa sums up: "We need to reconnect the people who depend on the river for its water with the river itself – to help them see how decisions made far from the river affect the river, its delta and the wildlife and people who live there".



The largest population of the endangered Yuma clapper rail, a marsh bird, inhabits the wetlands of the Colorado River delta.



Shaping the Future of the West

