

# NEWSLETTER

Readers are encouraged to submit brief articles or ideas for articles. Correspondence, including requests for changes in the mailing list, should be addressed to Randy Brown, California Department of Water Resources, 3251 S Street, Sacramento, CA 95816-7017.

## SAN FRANCISCO BAY — AN ESTUARY DOMINATED BY CHANGE

Zachary Hymanson, DWR

It has been said that change is the only permanent thing in this world. This seems particularly true for San Francisco Bay. Man-made and natural changes have impacted virtually every aspect of this estuary at one time or another. The more obvious changes such as urban development, "reclamation" of marshlands, and diversion of fresh water have all been well documented. But other, less obvious, changes that also have substantial impacts continue to occur.

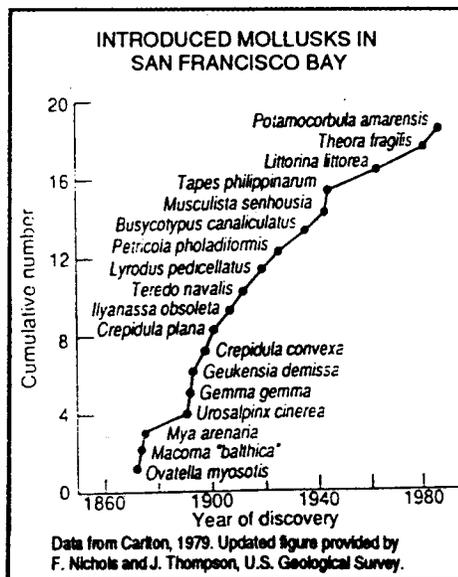
The introduction of exotic organisms, which has occurred numerous times, is one such less obvious change. In fact, exotic organisms have become established in this estuary with such frequency that it is safe to say San Francisco Bay is now among the most cosmopolitan estuaries in the United States, as well as among the most modified. Documented introductions to this estuary began soon after establishment of Europeans and, as shown in the table on page 3, continue to occur unchecked. Several of these organisms (particularly fish and oysters) were introduced

intentionally to provide new and desirable food sources in the estuary. The early success of these species was quickly accommodated with establishment of new commercial and sport fisheries in the case of fish and aquaculture enterprises in the case of oysters. Most of the introductions were not desirable, however, and many have had substantial economic or ecologic impact.

Benthic organisms in general, and mollusks in particular, have entered the Golden Gate with almost regular frequency (see figure at right). Only introductions we know about are listed, of course, and it is quite likely that many others have either gone undiscovered or the organisms were unable to become established.

Whether intentional or accidental, introduction of exotic organisms constitutes biological pollution, with many of the same effects as other, more familiar forms of pollution. The most recent example of such impacts is the introduction and establishment of the Asian

clam, *Potamocorbula amurensis* (Nichols 1990). In little more than 4 years after it was first detected, this clam has become the most abundant benthic organism in several regions of the upper estuary and is among the most widely distributed. This clam has altered trophic dynamics by adding a new, abundant food source for bottom-feeding organisms and by competing with other benthic organisms for space and food and with other



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pelagic organisms for food. Additionally, this clam can bioaccumulate high concentrations of selenium, which could result in higher tissue concentrations in

organisms that feed on this clam (Urquhart *et al* 1991).

As we deal with the problems in this estuary it is hard not to become overwhelmed by the number and complexity of issues. Change

is a common feature to all these problems, and there is no doubt introduced organisms have contributed to numerous changes in San Francisco Bay.

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## Use of Sound to Move Fish

During mid-March, biologists and acoustic technicians tested the use of sound waves to repel (or attract) several species of fish. The study, conducted in DWR's Clifton Court Forebay, was jointly funded by USACE offices in Portland, Oregon, and the Vicksburg, Mississippi, Waterways Experiment Station. The USBR Denver and Sacramento offices, DFG, and DWR provided staff support. Many of the local arrangements were handled by Scott Barrow, DFG, and Lloyd Hess, USBR.

Paul Loeffelman of American Electric Power was on site to test a system he had invented in which sounds are tailor-made for species and life stages of concern. At a March 17 workshop he described how the system worked well for adult salmonids on the St. Joseph River in Michigan. Laboratory tests also showed that 80 to 90 per-

cent of steelhead and Chinook salmon juveniles could potentially be diverted by such a system.

The researchers used the relatively quiet water of the Italian Slough area of the forebay for the tests. Loeffelman and his crew tested the juveniles of several fish species, including coho salmon, Chinook salmon, squawfish, catfish, and steelhead. In the first part of the test Loeffelman used a hydrophone to record sounds produced by each species. Next the technicians developed acoustic signals considered likely to move each species.

The test itself consisted of observing the response to the sound waves by each species. High tech underwater speakers produced the low frequency sounds directed toward fish held in submerged cages. Operators in boats observed fish response by use of portable

hydroacoustic equipment that uses sonar-like technology to detect and record underwater targets.

Although analysis is far from complete, test results were somewhat mixed. Several species apparently responded to the signal, but it was not always a clear directional response; *ie*, they didn't move toward or away from the signal source. Juvenile steelhead exhibited the strongest response and white catfish the weakest. Although showing promise, much additional site- and species-specific testing in California is needed before such an acoustic process is accepted technology for preventing fish losses to diversions.

USACE will write the final report on this experiment and will distribute copies to those interested. When available, the report will be announced in the *Newsletter*.

GENERAL CHARACTERISTICS OF INTRODUCED ORGANISMS IN SAN FRANCISCO BAY  
(Adapted from information compiled by F. Nichols and J. Thompson, U.S. Geological Survey)

Common Name (Scientific Name)	Descriptor	Date of Introduction	Origin	Mode of Introduction	Economic/Ecologic Impact
Isopod ( <i>Sphaeroma quoyanum</i> )	Pillbug	1850-90	Australasia	Shipping	Bores and weakens dikes and banks
Eastern Oyster ( <i>Crassostrea virginica</i> )	Oyster	1869	Atlantic	Intentional/Railroad	Commercial aquaculture
American Shad ( <i>Alosa sapidissima</i> )	Fish	1871	Eastern No. America	Intentional/Railroad	Commercial/ sport fishery
Gribbles ( <i>Limnoria</i> spp.)	Pillbug	1873	Unknown	Shipping	Destruction of wood structures
Soft Shell Clam ( <i>Mya arenaria</i> )	Clam	1874	Atlantic	Accidental with oysters	Sport fishery
Striped Bass ( <i>Morone saxatilis</i> )	Fish	1879	Eastern No. America	Intentional/Railroad	Commercial/sport fishery
Shipworm ( <i>Teredo navalis</i> )	Boring Clam	1913	Atlantic	Shipping	Destruction of wood structures
Japanese Oyster ( <i>Crassostrea gigas</i> )	Oyster	1930	Japan	Intentional/Shipping	Commercial aquaculture
Japanese Littleneck ( <i>Tapes japonica</i> )	Clam	1946	Japan	Accidental with oysters	Sport fishery
Asian Clam ( <i>Corbicula fluminea</i> )	Clam	1946	SE Asia	Ballast water or intentional	Commercial fishery; Fouls freshwater canals
Yellowfin Goby ( <i>Acanthogobius flavimanus</i> )	Fish	1963	Japan	Ballast water	Competes with native fish for food
Copepod ( <i>Oithona davisae</i> )	Zooplankton	1966	Japan	Ballast water	Unknown
Snail ( <i>Littorina littorea</i> )	Snail	1968	Atlantic	On algae used to pack eastern lobster	Unknown
Copepod ( <i>Sinocalanus doerrii</i> )	Zooplankton	1978	China	Ballast water	May compete with or prey upon other zooplankton
Copepod ( <i>Limnoithona sinensis</i> )	Zooplankton	1979	China	Ballast water	Unknown
Clam ( <i>Theora fragilis</i> )	Clam	1982	Japan	Ballast water	Unknown
Amphipod ( <i>Gammarus daiberi</i> )	Amphipod	1983	Eastern No. America	Unknown	Consumed by striped bass
Asian Clam ( <i>Potamocorbula amurensis</i> )	Clam	1986	Asia	Ballast water	Alters food chain
Crustacean ( <i>Hemileucon hinumensis</i> )	Crustacean	1986	Japan	Ballast water	Unknown
Copepod ( <i>Pseudodiaptomus marinus</i> )	Zooplankton	1986	Japan	Ballast water	Additional food source for fish
Copepod ( <i>Pseudodiaptomus forbesi</i> )	Zooplankton	1987	Asia	Ballast water	Additional food source for fish
Snail ( <i>Malanoides tuberculata</i> )	Snail	1988	Unknown*	Unknown	Unknown
Polychaete ( <i>Potamilla</i> sp.)	Worm	1989	Unknown**	Unknown	Unknown
European Green Crab ( <i>Carcinus maenas</i> )	Crab	1991	Atlantic	Unknown	Voracious predator of mollusks
Polychaete ( <i>Spionid</i> sp.)	Worm	1991	Unknown	Unknown	Unknown

\*Reported to have a nearly worldwide distribution.

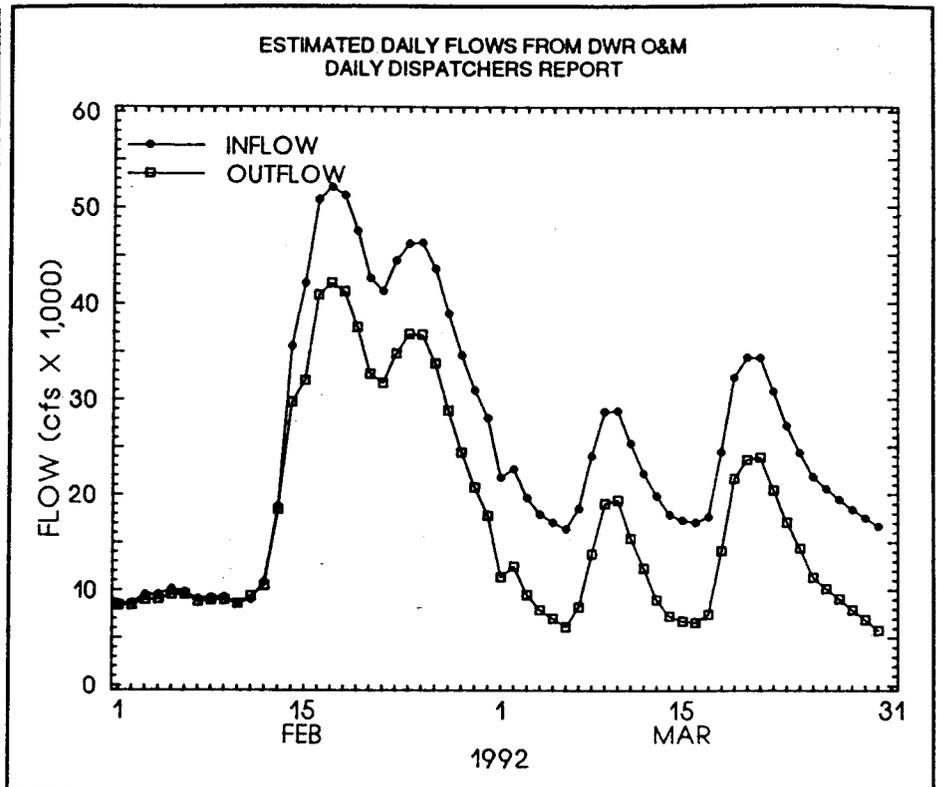
\*\*May be new to science.

## Delta Outflow

Precipitation during February and March has dramatically improved Delta outflow (measured inflow and calculated outflow; see figure at right). This is one of the largest outflow pulses since the February 1986 flood. It appears both February events were tied to effects of El Niño in the Pacific Ocean. In 1992 Southern California received the brunt of the storms.

On March 23, Maury Roos of DWR's Flood Management Office indicated that, even with the February/March precipitation, the 1991-92 water year will be critically dry and Sacramento River runoff is projected to be about 55 percent of normal.

Under the direction of Jim Cloern, the USGS took advantage of the first outflow peak by making an intensive sampling run on San Francisco Bay.



## Don Stevens Receives DFG Award

Don Stevens, a Fisheries Management Supervisor with DFG-Stockton, recently received a Director's Achievement Award from DFG Director Boyd Gibbons. Don was recognized for his work on developing a fishery model that describes causes for the decline in striped bass abundance. In a letter that accompanied the award, Director Gibbons noted:

*"This scientific accomplishment has significant political and management implications for water projects in California, and it demonstrates your superior analytical skills and your understanding of fishery biology."*

Don has worked on striped bass issues for 29 years and certainly deserves this award. Congratulations, Don.

(Perry Herrgesell, DFG)

## Noteworthy

- The Agency Directors met on March 9 and approved the 1991-92, 1992-93, and 1993-94 proposed budgets. The US Environmental Protection Agency officially became the eighth member of the Inter-agency Program.
- On March 18 the Fish Facilities Technical Committee met with a panel of invited experts to discuss the proposed program expansion. The Technical Committee will meet April 15 to review the comments and determine if program changes are needed.
- On February 25 and 26, Don Stevens and his staff hosted the annual striped bass workshop. On the 24th the Electric Power Research Institute held its annual meeting on Compensatory Mechanisms (COMPMECH) modeling efforts. Striped bass populations in the Hudson River, South Carolina, and in the Bay/Delta are part of this modeling effort.
- DWR's interagency effort is now part of the newly organized Environmental Services Office, which reports directly to the Deputy Director, Vera Tharp, who has been editing the *Newspaper* and Interagency technical reports, transferred from DWR's Central District to the new Environmental Services Office.

## Winter Run Chinook Salmon

During much of 1991, USBR and DWR were in formal Section 7 consultation regarding the impact of water project operation on winter run Chinook salmon. With only an estimated 190 adults returning in 1991, protection of this listed fish (endangered, state; threatened, federal) at this time is particularly important.

On February, 14 the National Marine Fishery Service released its Biological Opinion resulting from these consultations. The opinion concluded that CVP and SWP operation jeopardized the continued existence of the winter run but that reasonable and prudent alternatives would minimize any take. These measures include:

- Water temperature control at the spawning grounds to maximize survival of eggs and fry.
- Minimum flow standards in the upper Sacramento River.
- Closure of the Delta Cross Channel gates from February 2 through April 30.
- Closure of the Montezuma Slough Salinity Control Structure from March 1 through April 15. An alternative would be to have an enforceable agreement with Suisun Marsh diverters not to take water from unscreened diversions during this period. DFG developed a program to ensure compliance with this alternative, and the gates went back in operation on March 26.

- Institute such measures at the Delta fish protective facilities as predator removal and increased hauling to minimize take.
- Fund a study to determine when juvenile winter run salmon enter the Delta. A meeting is scheduled for early April to coordinate development and implementation of this program with DFG, NMFS, and USFWS. The USFWS Stockton office will take the lead in the study.

DWR and USBR have implemented all but the last of these measures.

The Biological Opinion covered only this year's operations. Consultation leading to long-term reasonable and prudent alternatives will begin in April.

## Personnel Notes

- On March 9 Leo Winternitz assumed responsibility for Interagency Program management at DWR. His first assignment involves developing protocol equipment and staff to study fish losses to Delta agricultural diversions. Leo came to DWR from SWRCB, where he worked mainly on the Bay/Delta hearings. Bellory Fong is moving from the Interagency Program to the new Environmental Compliance and Review Branch of the Environmental Services Office.
- Darryl Hayes has taken over DWR's engineering portion of the expanded fish facilities program. He will be working with the technical committee under Pat Coulston to plan and conduct the test program. Darryl came from DWR's Division of Design and Construction.
- Scott Cantrell has been hired as an Environmental Specialist in DWR's Suisun Marsh Monitoring and Analysis Section. Scott came to us from the Department of Parks and Recreation, where he has been a State Park Resource Ecologist since May 1988. He has conducted field studies in parks throughout California, including

Lake Tahoe Basin, Sacramento River near Chico's Landing, San Luis Island, and along the Navarro River corridor in Mendocino County. Scott's education and professional experience has emphasized the biological sciences, especially ecology and field biology.

- Katie Perry and Tim Heyne left the Young Striped Bass Investigations to take other positions in DFG. Katie is now working on the winter-run salmon project in Sacramento, and Tim is working for Region 4 in Fresno.
- Dorothy Platz, better known as "Dede", has been hired as a Fishery Biologist to be the lead person for DFG's large laboratory program. Dede has a degree in biology from Sacramento State University. She previously worked for the Fish Facilities Program at Bay/Delta as a Scientific Aid. She has also been a volunteer Park Ranger for USACE and has been a student trainee with the US Forest Service. Dede is supervising the processing of samples from the Delta smelt and striped bass egg and larva field programs and learning the egg and larva data management routines.

- Jane Arnold was hired as a Marine Biologist to oversee the midsummer striped bass towner survey and the fall midwater trawl programs. Jane has a Bachelor of Science degree from the University of Oklahoma and a Master's degree in fishery biology from Humboldt State University. Jane has a variety of experience in both fisheries and the academic environment. She has been a teaching assistant, a research assistant, a microtechnician, and aquaculturist at Humboldt State. Jane will be coming on board in mid-April.
- Holly Yue has returned to work at her job as Senior Laboratory Assistant at DFG after a leave for the birth of her daughter, Kathleen Taylor Yue. We are happy to have her back in charge of laboratory training, quality assurance work, and other duties.
- Ramiro Soto joined the Interagency Program in January as a Fish and Wildlife Assistant I working for DFG's Bay/Delta Fish Facility Unit. Ramiro came from Region 4, where he worked several farms as a seasonal aid. We will make use of Ramiro's ample fishery sampling expertise and equipment fabrication and maintenance skills.

## Unit of the Month

### USFWS Estuarine Salmon Study

The purpose of the Estuarine Salmon Study is to describe the life history of and evaluate factors influencing anadromous salmonid populations using the Bay/Delta. Resulting information is used to recommend management alternatives to improve salmonid protection through the Bay/Delta proceedings, Endangered Species Consultations, EIR/EIS process, and other regulatory activities.

The study was initiated in 1978 under leadership of the USFWS, with additional vessel operation and seasonal support by DFG employees. Technical coordination is provided by the Fishery/Water Quality Committee. Support for the work is provided by USBR, DWR, DFG, and USFWS.

The study is composed of two major components: (1) abundance and distribution monitoring, and (2) assessment of Chinook salmon fry and smolt survival under varied environmental and operational conditions, rearing habitats, and migration routes.

Fry monitoring during winter and spring uses 50-foot beach seine hauls in the lower Sacramento River and in the northern, central, and southern Delta as well as fyke traps in the Sacramento River at Sacramento.

Smolt and yearling monitoring is accomplished by midwater trawling at Sacramento and Chipps Island from April to June and at Sacramento during the winter. Trawling is done using the USFWS' 43-foot vessel, *RV Whitesel*, and DFG's *RV Alosa*. This work is supplemented by DFG-Region 4 Kodiak trawl sampling at Mossdale on the San Joaquin River.

Yearly mark/recovery efforts since 1978 using coded wire tagged fry and smolts at various release sites in the Bay/Delta have yielded useful data describing the importance of diversions, flow, water temperature, migration route, rearing location, and fish size on survival of juvenile Chinook salmon. Tagged fish recoveries are made via midwater trawl sampling at Chipps Island and in the ocean salmon fisheries.

Estuarine Salmon Study efforts will be expanded to achieve fall through early summer monitoring by a variety of techniques. Lower Sacramento River plus Delta monitoring will be coordinated with monitoring by other USFWS and DFG sampling in the upper Sacramento. This more comprehensive program is designed to further address the many critical management decisions facing fishery and developmental agencies that deal with salmonids.

The IESP Estuarine Salmon Study is managed under the USFWS Sacramento/San Joaquin Estuary Fishery Resource Office in Stockton and is housed with the DFG Bay/Delta project.

## Our Staff

- **Marty Kjelson, Fishery Biologist**, is the Station Project Leader. He is the USFWS IESP Coordinator, Chairman of the Fishery/Water Quality Committee, and a member of the other three technical committees. Marty came to the Stockton office in 1977 from the NMFS, Beaufort, NC. He has a BS from the University of Wisconsin and a Ph.D. from UC-Davis.
- **Patricia Brandes, Senior Staff Biologist**, has a BS in Fisheries Biology from Michigan State. She is responsible for planning and directing field programs, analyzing data, and writing progress reports and is a member of the IESP data management group. Patricia transferred to Stockton in 1983 from Senecaville National Fish Hatchery in Ohio.
- **Jim Craig, Fishery Biologist**, came to the Inter-agency Project in January 1992 from the USFWS Coastal Fishery Resource Office in Arcata. He is responsible for data analysis, report review, and various field activities. He has a BS from Humboldt State University.
- **Mark Pierce, Fishery Biologist**, is responsible for field operations, maintenance and inventories of equipment, recovery and reading of coded wire tags, and maintenance of data records. He has a BS in Biological Science from UC-Davis and came to us in 1991 from the DFG Bay/Delta Project.
- **Kathy Corbin, Fisheries Program Assistant**, is the principal source of administrative support in the business management of our efforts. She joined us in December 1991 from the General Services Administration.

## World Wildlife Fund Fourth Annual Innovation Grants

The World Wildlife Fund initiated the Innovation Grants program through a pilot program developed under the leadership of former Senior Associate Phyllis Myers. The program is made possible through the generous support of S.C. Johnson & Son, Inc. and with the assistance of the Sonoran Institute of Tucson, Arizona.

### Enlarged and Expanded for 1992

In 1992, WWF will again award small grants to local, regional, and statewide nonprofit organizations to help communities implement innovative strategies for the conservation of nature.

This year, the program is expanding substantially in size and scope. Funding will increase threefold. Grants will be awarded to support projects in the following categories:

- **Wetlands** conservation and restoration;
- **Endangered species** conservation;
- **Neotropical migratory bird** conservation;
- **Preservation of estuarine and coastal resources** from incompatible or unplanned growth and development (including projects along the Great Lakes);
- **Establishment of conservation and outdoor recreation areas** such as parks, wildlife refuges, and greenways, and the protection of these areas from incompatible adjacent development.

Innovation Grants provide seed money for efforts to reconcile protection of natural resources with sustainable development that can serve as models for other communities.

Innovation Grants further development of new grassroots conservation organizations and strengthen existing organizations working to protect a community's natural resources and quality of life.

### Project Criteria

Innovation Grants will be awarded on a competitive basis. Evaluation criteria are:

- Importance of the project to local, regional, or state efforts to conserve significant natural resources.
- Extent to which the project integrates conservation with efforts to ensure growth is sustainable.
- Demonstrated community support for the project.
- Originality of the idea within the community, region, or state.
- Potential to replicate the project beyond the project site.
- Extent to which grant funds will be leveraged, for example, with matching funds or other support from other private or public sources.
- Capacity of the organization to implement the project.
- Likelihood of tangible results.

Emphasis of the Innovation Grants program is to spur new approaches to conservation and sustainable development. As such, criteria are flexible. Creative proposals are encouraged.

### Program Highlights

**Eligible Expenses** — Administrative costs of undertaking the project; planning, technical assistance, legal, and other costs to facilitate acquisition of critical lands; retaining consultants and other experts; and preparing visual presentations, brochures, or other conservation publicity activities.

Examples of eligible projects are assessing natural resources, building public support for conservation, developing innovative regulatory mechanisms and cooperative management strategies, and forging partnerships to promote conservation and sustainable development.

Grants may *not* be used for: general institutional support; capital costs of buying land, buildings, or equipment; travel funds for attending conferences; academic research; or political activities.

**Eligible Applicants** — Grants will be awarded only to private local, regional, or statewide nonprofit organizations.

**Awards** — The maximum grant award is \$10,000. Grants will average between \$5,000 and \$7,500.

**Project Duration** — Grants are for one-year, as opposed to multi-year, projects.

**Deadlines** — Applications must be postmarked by July 1, 1992. Announcement of awards will be made in early October 1992.

### Information

For application guidelines and an application form, please contact:

Innovation Grants  
The Sonoran Institute  
6842 East Tanque Verde Road,  
Suite D  
Tucson, Arizona 85715

Prior to submitting an application, prospective applicants may seek preliminary advice about the eligibility of a project by sending a brief letter describing the project to Luther Propst, Executive Director, The Sonoran Institute, at the address above or by calling him at 602/290-0828.

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Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary

# ***NEWSLETTER***

A Cooperative Effort of:

California Department of Water Resources  
State Water Resources Control Board  
U.S. Bureau of Reclamation  
U.S. Army Corps of Engineers

California Department of Fish and Game  
U.S. Fish and Wildlife Service  
U.S. Geological Survey  
U.S. Environmental Protection Agency

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