

The long-awaited restoration of the tidal marshes on the Bay side of Hamilton Field finally got under way this April, when the Army Corps of Engineers began pumping dredged material from Bel Marin Keys onto the former airstrip. After the ground surface has been raised to sea level, requiring 7 million cubic yards of sediment, levees will be breached to let in the waters of San Pablo Bay. The ultimate goal: recreating habitat for California clapper rails, black rails, and other sensitive species.

But the former Air Force base has a full complement of other avian residents as well. Acorn woodpeckers, western bluebirds, American kestrels, and other species frequent Hamilton's oak-covered hills. Barn and cliff swallows attach their mud nests to building exteriors. And two of the old hangars that once housed B-17s are now roosting sites for barn owls. The nocturnal raptors nest in Canary Island date palms near the hangars.

"Hamilton after dark is full of the screeches, screams, squawks, and clicks of the barn owl," says Maggie Rufo with Marin WildCare's Hungry Owl Project. WildCare and HOP have taken care of juvenile owls that have fallen from the palm trees— attractive but unsafe nesting sites.

Most of Hamilton's hangars have been converted into commercial or public spaces. With those last two slated for conversion, HOP has been working with the developer, Barker Pacific, and the City of Novato to provide alternate housing for the owls, to encourage them to stick around. They'll pay their "rent" in pest-control services: a family of five can consume 3,000 rodents in one nesting season.

Next boxes custom-built for barn owls have been installed on Reservoir Hill and at the old base hospital. There are owl boxes at the Novato Charter School and the Unity in Marin spiritual community. Rufo says there's a high occupancy rate; owls have moved into 75-80% of the dozen boxes set up so far.

For more information on barn owls and owl boxes, visit [www.hungryowl.org](http://www.hungryowl.org). JE

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# WOOLY MAMMOTH MARSH

Maps don't lie, and the one Peggy Olofson points to—of restoration and mitigation wetlands around the Bay that have been invaded by Atlantic cordgrass—tells a gruesome story. "We have a history of wetland restoration projects over the last 30 years in large part being responsible for the rapid spread of invasive spartina," declared the Invasive Spartina Project's Olofson at a recent status report meeting on the Estuary. *Spartina alterniflora* was likely introduced for the first time in the 1970s when the Army Corps created a large wetland dredge disposal project ("Pond 3") adjacent to the Alameda Creek flood control channel in the South Bay. From there the seeds traveled to nearby wetlands, and ultimately to more recent restoration projects such as Eden Landing and Cooley Landing. In 1998, Cargill Salt created a mitigation marsh; by 2002, it contained over 50% hybrid spartina species, says Olofson.

For now (and through 2011), the Invasive Spartina Project is acting as "cleanup crew," attempting to stem, with the help of the herbicide imazapyr, what Olofson calls the "hybrid swarm," the virulent spread of *S. alterniflora* and hybrids. The plants reproduce readily and spread easily, like a virus gone wild or something out of a 1950s horror show. Olofson explains that *S. alterniflora* sets seed within two years, produces pollen after its second year, and then pollinates the natives around it, leading to hybrid spartina species that are even more invasive than pure *S. alterniflora*. "The parent plants—one *S. alterniflora* and one *S. foliosa*—cross-pollinate; their offspring [a hybrid] backcrosses with the parents, and then with each other; you've got genes in all combinations, combinations that have never been dreamed of before. It's a great lesson in genetic adaptation." Ironically, all of the recent restoration activity has helped facilitate spread of the plants. "Restoration sites are perfect incubators," says Olofson. The bare, moist, newly graded soils are an open invitation to invasives.

Invasive spartina can completely change the character of a marsh, says wetlands ecologist Peter Baye. It raises the elevation of the marsh, changes its overall profile, and encourages marsh growth toward the Bay even where an area is eroding, because it tolerates higher wave energy and traps sediment more efficiently than the native *S. foliosa*. The marsh then grows at a higher elevation than the tidal flats, says Baye. Two marshes that have been greatly altered are Arrowhead Marsh, which formerly had "lots of sinuous channels, marsh plains and pans," according to Olofson, and Martin Luther King marsh. Arrowhead had a few patches of invasive spartina, says Olofson, but when MLK Marsh was created nearby (mitigation for the Port of Oakland's dredging activities), *S. alterniflora* and hybrids made their way into MLK and then started pumping additional seed back out into Arrowhead, San Leandro Creek, and the surrounding shoreline marshes, exacerbating the problem throughout San Leandro Bay. MLK Marsh is so thick with spartina it looks like a "wooly mammoth," says Olofson, while the increased growth of invasive spartina at Arrowhead altered the hundred-year old marsh, says Olofson. "You're never going to see those marsh pans again."

Pans are part of the unique ecology of a West Coast tidal marsh—containing (moving landward) tidal flats, native cordgrass (*Spartina foliosa*), pickleweed and other marsh plants, and uplands—that animals like the California clapper rail, salt marsh harvest mouse, many shorebirds, and others are adapted to. Clapper rails forage in the dendritic channels of the marsh while shorebirds pluck their way through the mudflats. Although clapper rails have taken a liking to the thick cover of *S. alterniflora* in some areas, in the long run, dense meadows of the long grass could harm the rails and other species, says wetlands biologist Phyllis Faber.

After Olofson spoke at the report card session, there was a palpable pall in the room, and

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**BURNINGISSUE**

**SMELT HELP**

A multi-pronged effort to save the rapidly dwindling Delta smelt population is under way in courtrooms, laboratories, and along the banks of the Delta itself. One such attempt was a groundbreaking legal decision, in late August, in which U.S. District Court Judge Oliver Wanger ordered state and federal water agencies to either reduce pumping or release more water upstream of the Delta to maintain a flow sufficient to keep smelt from being sucked into the pumps. The ruling could cut the amount of water diverted from the Delta by one-third. And that will most certainly mean that users up and down the state will have to conserve water in what has been a very dry year.

Dry years like this one confuse the smelt, says the U.S. EPA's Bruce Herbold. The smelt swim in bursts to get to areas of the Delta where they can drift toward the Bay and feed. They determine when they swim according to signals—cooler water or higher salt content—that send them toward Suisun Bay. "In a wet year, the flows through the Delta and out to the Bay provide lots of cues about where to go, but in a dry year, these signals are reduced," he says. This means that more smelt end up at the pumps, says Herbold.

The pumps are but one part of the puzzle researchers are trying to decipher as to the cause of the precipitous decline of the smelt. Other possible culprits include toxic runoff from industry as well as from agriculture, and unregulated pumping and diversions from farmers. Invasive species may be crowding out the smelt's traditional food sources.

The San Francisco Bay Delta is the only place where the Delta smelt is found; it is adapted to the Delta's brackish waters and variable currents. The Romberg Tiburon Center's Lindsay Sullivan is investigating the smelt's unique lifestyle. She believes she has the answer to one question about the tiny fish that may surprise some people: It appears to eat a tiny, invasive copepod called *Limnoithona tetraspina*: good news because the smelt's preferred diet—two larger zooplankton called *Pseudodiaptomus forbesi* and *Eurytemorea affinis*—are disappearing. But with this discovery come more questions that Sullivan hopes to probe with the help of U.C. Davis' Fish Conservation and Culture Lab.

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**HOW I SEE IT**



**REGULATORS NEED TO STOP THE TOXIC TRESPASS**

I was a biologist with the U.S. Fish & Wildlife Service assigned to look into emerging issues surrounding agricultural drainage and wastewater. In 1983 I held in my hand the first deformed migratory bird, an American coot hatchling, found at Kesterson National Wildlife Refuge. The cause of the deformity was selenium toxicity. Selenium at very low concentrations was accumulating to toxic levels in the aquatic food chain in the evaporation ponds where the adult birds fed.

In 1984, the State Water Resources Control Board stated that "[f]ailure to take appropriate measures to minimize excess application, excess incidental losses, or degradation of water quality constitutes unreasonable use of water." In 1985, it found that agricultural drainage and wastewater reaching Kesterson Reservoir resulted in dead and deformed hatchlings of migratory birds. The State Board said that the agricultural drainage "is creating and threatening to create conditions of pollution and nuisance" and warned that if Kesterson-like situations continued to occur, irrigating saline seleniferous soils could constitute an unreasonable use of water.

Almost 10 years ago, the State Board set total maximum daily load (TMDL) standards for selenium in agricultural drainage. But a selenium TMDL is not a good indicator of safety because many organisms bioaccumulate selenium to many times the concentration in the surrounding water. A slight increase of selenium in the surrounding environment can cause a disproportionate increase of selenium in organisms, rapidly crossing the threshold from benign nutrient to deadly toxin. Research findings indicate that a selenium concentration of 5 to 30 ppb in water could increase by 500 to 800 times in plankton; by 200 to 400 times in sediment; by 800 to 2,000 times in benthic invertebrates, and by 1,000 to 35,000 times in fish tissue (depending on the species).

Today, irrigating highly saline seleniferous soils continues to create conditions of pollution and nuisance. Wastewater from these soils contains selenium, boron, other trace elements, and chloride and sulfate salts. This agricultural sewage is entering and polluting the waterways of the San Joaquin River and its west side tributaries. Deformed bird embryos were documented at San Joaquin Valley sampling sites in 1983, 1984, 1985, 1987, 1988, 1989, 1991, 1992, 1993, 1995, 1996, 2000, 2001, 2002, and 2003. Fish & Wildlife has a very good basis for knowing what kind of harm is occurring based solely on measures of selenium concentrations in the birds' eggs. Fish & Wildlife, university researchers, or private consultants have measured the selenium concentrations in eggs at one or more sampling

sites within the San Joaquin Valley since 1983. Every year from 1983 to 2006, eggs exceeding the Fish & Wildlife selenium toxicity threshold criteria have been documented.

At the same time, four species of small mammals have been found to have both sexes. Fish populations have been impacted by reduced growth and partial or complete reproductive failure. Water rights have been rendered unusable. Public trust properties and interests have been degraded, and the viability of the San Joaquin River and its tributaries impaired. This pollution creates multiple long-term problems for water supply, water quality, and the viability of aquatic resources and ecosystems, and degrades public trust assets and beneficial uses. Can a partial cause of the Delta's pelagic organism decline be traced to a selenium-contaminated habitat?

When a use of water degrades the sustainability of a downstream ecosystem or a component of that ecosystem so that it is unsuitable for sustaining viable agriculture or populations of wildlife, fish and other aquatic life; or that results in fish unsuitable for human consumption; or that is a hazard to other fish and wildlife; or that degrades ecological, aesthetic, and recreational uses and scenic values, it is inconsistent with public trust protection and the reasonable use of water. When selenium enters the bodies of women of childbearing age or children, or enters the domestic or wildlife food supply to toxic levels without our consent, it is a trespass.

U.S. Environmental Protection Agency, the California Environmental Protection Agency, and the State Board were established to protect the public interest and quality of our air, waters, and lands and their associated resources, uses, and values. In California, the U.S. EPA has extended its authority to implement the Clean Water Act to the State Board, yet it retains the authority to require the State Board to implement a stronger TMDL. Irrigating highly saline seleniferous soils with their toxic drainage constitutes an unreasonable use of water and a nuisance, therefore violating Article X, Section 2 of the California State Constitution. The State Board can take corrective action through its continuing authority, enforcement powers, and the public trust doctrine. The U.S. EPA can revisit and strengthen the existing TMDL. All that they need is the political will to do so. They should not look like shills for corporate farms, like Boswell Farms, or massive water districts like Westlands Water District.

—Felix E. Smith is retired from the U.S. Fish & Wildlife Service



Photo by Harry Ohlendorf

## SUPPLY

### EVERY LAST DROP

The San Francisco Public Utility Commission's proposed plan for upgrading and seismically retrofitting the Hetch Hetchy water system has Tuolumne River advocates seeing red.

Of particular concern in the \$4.3 billion reconstruction project is the draft environmental impact report outlining how the SFPUC intends to meet the water demands through 2030 of the 28 agencies it serves. The SFPUC anticipates that by 2030 it will deliver an average of 300 million gallons of water per day, an increase of 35 mgd over the current average.

The SFPUC says groundwater recycling and conservation will meet about one third of this new demand. But the majority of the increased deliveries will come through the diversion of an additional 25 mgd from the Tuolumne River. Taking more river water has the Tuolumne River Trust's Peter Drekmeier calling for better conservation. "Do we assume that it's a given to take every last drop from wild rivers, or do we look at the potential for conservation and recycling?" asks Drekmeier.

The SFPUC asserts that it is looking into conservation. "We've already built into supply projections recycled water measures, but are there things that we can do beyond that? That's what we're looking into," says the SFPUC's Michael Carlin.

The Tuolumne River Trust released a report in July based on an analysis of the SFPUC's plan as presented in a series of briefings. The report praised the overall dedication of funding to revamp the antiquated plumbing of the 167-mile aqueduct, including the restoration of wetlands and ecosystem improvement to address issues such as fish passage.

But on the issue of meeting increased demand, it took a dim view of facts such as that 60% of the increased demand for water is for outdoor use and that 100% of this increase is driven by SFPUC wholesale customers outside of San Francisco. Drekmeier says the SFPUC ignored its own conservation, efficiency, and recycling studies, which could offset the need to divert more water from the Tuolumne by at least 74%.

"It's a very lazy plan. The Tuolumne River District recycles 100% of its water, almost," says Drekmeier. "And here, we're talking 3% at 2030, that's extremely small."

The SFPUC developed its plan based on information from the agencies that receive its water. These agencies, which include the cities of Hayward, Santa Clara, and Milpitas, had to calculate future water use based on projections for growth. But these projections make assumptions about usage that are inadequate, says Heather

Cooley of the Pacific Institute. For instance, she says, the City of Hayward seemed to treat all non-residential growth the same—meaning that all entities would experience the same increase in water use. "When you're talking non-residential, you're including business, and different businesses use water in different ways," says Cooley. A computer chip manufacturer will use more water than a candy company, for example.

Alex Ameri of the City of Hayward says he understands these differences and that his city's projections were based on use patterns that have remained constant over many years. Hayward, a largely blue-collar town, did not experience the big growth that other cities did during the dot-com boom; they have long had many food packaging plants, soft drink bottlers, and similar industries. "Our growth has been much more measured and constant," Ameri says.

Along with that growth—and projected water use increase—is what Ameri says is a conservation program that has kept water use constant or even reduced it. "It's our culture. We have provided disincentives for use of too much," he says. Hayward has tiered rates for water based on customers' consumption levels. Those consuming the least—and conserving more—pay at the lowest rate. Those consuming the most pay at a higher rate. That can mean the difference between paying \$47 in the bi-monthly bill or \$100. This has been very effective, says Ameri, because, "Hayward doesn't have huge household incomes and so paying \$100 for water is a lot."

In other words, Hayward's customers are price sensitive. But SFPUC customers should show some sensitivity to price too, particularly since it's estimated that water prices will quadruple over a 12-year period, says the Pacific Institute's Cooley. "Yet, in a market economy, the PUC shows demand increasing," she adds, counter to how a market economy works: demand should drop as prices increase.

Another issue that worries watchdogs is the fact that outdoor use—landscaping—is the biggest driver of the increased demand in the 2030 projections. "There's a lot of waste in landscaping," says Drekmeier. Ameri concedes that Hayward is adding more landscaping, replacing concrete and pavement with plants, not only to transform neighborhoods, but also to help soak up stormwater runoff. "Any attempt to do neighborhood updating—including low-water use landscaping—results in additional water usage," Ameri says.

Carlin says he's confident that cities like Hayward and his agency are doing everything they can to find ways to save water. He points to the fact that in this dry year, SFPUC customers—through voluntary conservation—have managed to cut back usage 13%. And the SFPUC is looking for other sources to augment the Tuolumne.

## BIRDWATCH

### SUPER RAIL

Rail #4286 could shatter the long-held stereotype of clapper rails as chunky, chicken-like

birds that don't ever wander very far from their home marsh. 4286 was one of several rails tagged last winter near Colma Creek Marsh as part of a study by the U.S. Geological Survey, the Invasive Spartina Project, U.S. Fish & Wildlife, U.C. Davis, and the East Bay Regional Parks District to better understand rail populations and movements in the Bay, and also to find out how herbicide treatment for invasive spartina (see cover story) might be affecting the rails. Thirty birds were tagged in Colma Creek Marsh, Cogswell Marsh, and Faber-Laumeister Marsh, all in the South Bay. When 4286's radio transmitter seemed to have stopped working in early April, biologists assumed that the transmitter had fallen off the bird, or that their radio was malfunctioning. But on a flight over the Bay six weeks later, they picked up a signal in Marin County, near where Gallinas Creek enters the Bay. USGS' Mike Casazza says he was "pretty shocked." He later identified the bird (which was doing fine) on the ground.

Although East Coast clapper rails are known to migrate, only one previous telemetry study on rails has been done in the Estuary, and that one showed no large-scale movements between marshes, says Casazza. "We know they can move, they have the ability to do it, but it's a hard thing to document it," says Casazza. "This movement—from Colma Creek to the North Bay—could have implications for restoration work and genetics." So far, however, 4286 is an anomaly. Most of the 29 other tagged birds have not strayed far from where they were tagged. Some have been caught by predators (one transmitter was found in a northern harrier nest). But a second bird that had been hanging out near 4286 disappeared at the same time 4286 did, and Casazza would like to find it. "Since these two were together and they disappeared within three days of each other, it might be that the second one dispersed and went north too," says Casazza. "We did a lot of searching for it; it's been kind of a mini 'CSI.'" So far, neither the bird nor its transmitter has made a peep.

See: [www.werc.usgs.gov/Dixon/rails](http://www.werc.usgs.gov/Dixon/rails)

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*A biologist measures a clapper rail's bill before it is fitted with a transmitter. Photo courtesy of USGS.*



## SMELT HELP CONTINUED

The lab, located near the pumps in Tracy, has become a hub for scientists trying to answer questions surrounding the decline of both the smelt population and the Delta's food web. For 15 years, the lab has raised smelt in captivity, collecting between 1,500 to 2,000 wild sub adult smelt each fall and then spawning them the following spring.

The researchers have learned a lot about smelt, including the fact that they tend to prefer sand and gravel to other surfaces like driftwood for spawning. This information is useful because scientists "have never found more than one egg in the wild," says U.C. Davis' Joan Lindberg.

"[Scientists] really don't know where [smelt] spawn in the wild, and that's problematic because they then can't monitor reproduction in the wild," says Lindberg.

Monitoring the smelt's reproductive behavior could enable researchers to find ways to protect the smelt's spawning habitat. But while the U.C. Davis lab is thriving, even expanding, the work on the smelt will change drastically this fall. The lab will not be able to collect any sub adults in the wild because of the decline. That means, says Lindberg, that the lab will raise a second generation in the lab. Multiple generations of smelt have not been raised in the lab before since "researchers want samples of the wild population," Lindberg says.

Next up for Sullivan is to look at whether the smaller copepods are able to satisfy the nutritional needs of the smelt as well as *P. forbesi* did. "Small copepods are much more abundant in the environment, so it could balance out in the end," says Sullivan. But she notes that the nutritional makeup of the smaller copepods could be different.

While Sullivan and others look to see how the smelt may or may not be adapting to changing Delta conditions, federal and state water agencies are working on a revised biological opinion to see how their operations can continue without causing more harm to the smelt. That opinion is expected a year from now.

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## ENVIRONMENT

## DEBUNKING LEVEE LORE

It looked like an environmental train wreck in the making. Earlier this year, the Army Corps gave local reclamation (flood control) districts a stark choice: comply with strict national standards for maintaining vegetation on levees or lose federal funding to rebuild after floods.

Thirty-two California districts had failed to meet national maintenance criteria and would be required to come into compliance by next March. The Army Corps guidelines, spelled out in an internal whitepaper, would have required removing all trees from the land side of levees and allowed no woody vegetation larger than two inches in diameter on the water side. Along the Sacramento and San Joaquin rivers, that would have affected a lot of riparian habitat—on what Mike Hoover of U.S. Fish & Wildlife calculated as 3,200 linear miles of federal project levees.

The Corps' new emphasis posed a dilemma for both the reclamation districts and state and federal resource agencies, which—with the Corps' blessing—had been using levee plantings to mitigate for lost riparian habitat. "Strictly applied in California, such compliance would undo decades of conservation programs," Department of Fish & Game's John McCamman told a *Sacramento Bee* reporter in July. Robert Van Antwerp, the Corps' national commander, hinted at possible flexibility with a statement of concern for habitat and endangered species. Other Corps officials took a harder line.

But on August 30, at an interagency summit following a symposium that brought scientists, conservationists, and policymakers together in Sacramento, the Corps dropped the compliance deadline for vegetation removal. (Reclamation districts are still required to remove fruit or nut trees that could attract burrowing rodents.) Tom Chapman of the Corps' Sacramento District promised a new and more flexible policy by the end of this year. "We hope we can be in alliance with all the science," he said.

The control of levee vegetation is not a new issue. The S.F. Regional Board's river restoration advisor A. L. Riley says some resource managers thought it had been settled during the Jerry Brown administration, when the California

Reclamation Board adopted new vegetation management standards that attempted to balance safety, maintenance, and environmental needs. This meant more tolerance for woody vegetation on levees. Levee managers also switched from chemical warfare against burrowing rodents to an integrated pest management approach, which Riley helped implement during her tenure with the Department of Water Resources. The Corps, whose national maintenance standards were

developed in the Mississippi River system, did not force the vegetation issue with state agencies.

A Sacramento River study published in 1991 demonstrated a positive role for levee vegetation. Doug Shields of the U.S. Department of Agriculture's National Sedimentation Laboratory and

Donald H. Gray of the University of Michigan's Civil Engineering Department looked at a cross-section of a sandy levee between Sacramento and Woodland, recording root position and size. Their findings: roots reinforced the levee soil and increased resistance to shear forces. They concluded that woody shrubs and small trees would enhance a levee's structural integrity while providing environmental benefits. In a separate study, Shields showed that vegetation growing on revetments that armor riverbanks adjacent to levees reduced the probability of revetment damage during the 1986 flood.

But the Corps was unconvinced. In its recent whitepaper, it stresses the danger of windthrow, when trees are toppled by wind and their roots leave a hole in the soil, and contends that levee vegetation limits visual inspection and flood-fighting access; attracts burrowing rodents; and facilitates root-induced piping, with water entering root voids and blasting its way through the levee wall.

Critics have contested those claims. Gray, who calls the Corps' policy "draconian," suggests that visibility and access concerns can be met without wholesale vegetation removal. "You can prune, coppice, and thin woody vegetation, limit to low-growing trees, and plant to maintain viewing alleys," he says, adding that one flood control district has used goats to keep sightlines open.

As for root effects, Shields acknowledges piping as "a huge problem with earthen embankments." The question, he says, is whether roots contribute to piping potential,

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**"We hope we can be in alliance with all the science."**

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**—Tom Chapman,  
U.S. Army Corps**

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and that hasn't been studied in detail. Post-mortems don't help. "If an earthen structure fails, the evidence of what destroyed it is destroyed in the failure," he says. He notes that the Sacramento River levee-section study found that cavities left when roots decayed tended to fill up with sand.

Others minimize the piping danger. "The issue of root-initiated piping is really remote," says Tom Griggs of River Partners. "There's no science supporting it." Restorationist Jeff Hart calls piping "a sort of urban myth—theoretically possible but hardly demonstrated." He and others say tree roots are unlikely to grow deep enough to cause problems. "Roots are growing organisms that require oxygen. Growing conditions deep in the levee are not ideal," he says.

Ongoing research appears to have strengthened the case for planting levees. Working at U.C. Davis' J. Amorochio Hydraulics Laboratory, Stefan Lorenzato of the Department of Water Resources showed that sandbar willows help keep soil intact during high-velocity flows under simulated floodplain conditions. For bare soil, turbulence-generating roughness increased with velocity; with willows, which bend over and lay down in the flow, it decreased. "The benefits start kicking in at high flows," he told the *Sacramento Bee*. Lorenzato, who has worked with River Partners in a computer-designed restoration project on the Feather River, cautions that not all vegetation is equal: walnuts, often planted along levees, create more roughness than willows, as do oaks and mature cottonwoods. Meanwhile Shields has applied a computer model developed by his colleagues to simulate streambank stability under different vegetation conditions. He says the model results clearly support a beneficial role for vegetation.

The Corps cites a Federal Emergency Management Agency document, "Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams," as the technical basis for its vegetation standards. But Gray describes that document as a mass of unsupported assertions and anecdotal evidence. "A preconceived notion that trees are bad chases evidence to support it," he says. He also notes that earthen dams are subject to different kinds of hydraulic stresses than levees. The Corps has never cited any research challenging or refuting the Gray-Shields study although at the symposium the Corps' David Pezza explained that the Gray-Shields study had been discounted because "it didn't match what we found in the field" and "we did not find that the science was relevant to what we were doing."

One symposium presenter, U.C. Davis professor of plant sciences Alison Berry, presented her recent research on root architecture, based on a trench cut in a levee on the American River near

Mayhew and supplemental use of ground-penetrating radar. Although the soil type was different, Berry says her findings were similar to the 1991 Gray-Shields study; however, she says different soil conditions, as well as water table height and tree species, could produce different root patterns. She suggested structural fixes (soil compaction, keyhole and slurry trenches) to limit root penetration, and crown pruning to reduce the risk of windthrow.

U.C. Davis biologist Dirk Van Vuren addressed the rodent issue, explaining that some burrowing rodents would actually benefit from woody vegetation removal: California ground squirrels prefer open grassy habitat for food and visual detection of predators, and pocket gophers reach their highest densities in grasslands. In a later interview, Van Vuren noted that removing trees would reduce habitat for barn and great horned owls that prey on gophers.

The Corps' Meegan Nagy described a pilot inspection project on the lower American River that found significant unwanted vegetation, although the extent of the problem was not quantified. BurRec's William Bouley defended the controversial FEMA manual, noting that trees "tend to corkscrew their way into an embankment and that tends to loosen the soil." Hydraulic engineer Ken Rood estimated that 5,100 trees would have to come down in the Sacramento area alone if the guidelines were implemented.

How much of a part the symposium played in the Corps' seeming retreat is unclear, and how flexible the Corps is prepared to be remains to be seen. For now, though, reclamation districts—which are responsible for funding maintenance—are off the hook, and wildlife agencies and riparian advocates have breathing room to explore less drastic options. "We have to treat riparian growth on levees as a kind of urban forest, with a higher level of management of the vegetation," Berry recommends.

"The farmers are caught between the wildlife agencies and the flood control agencies," says Jeff Hart, who has done his share of levee restoration. "We need a sensible solution in the middle, a managed plant community on the levees. And we need practical biologists and land managers to do it—not structural engineers."

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## NEWS SCIENCE

### FERTILE GROUND

Floodplains, natural or restored, are prime habitat for fish. A seven-year study recently published in the on-line journal *San Francisco Estuary and Watershed Science* reveals which fish species use this habitat, and when. Peter Moyle and Patrick Crain of U.C. Davis and Keith Whitener of The Nature Conservancy collected a total of 32 species in the restored Cosumnes River floodplain. They found native fishes predominating during early season flooding, aliens later in the year.

In the first wave, native Sacramento splittail, considered obligate floodplain spawners, breed in March and April, laying their eggs on flooded annual vegetation. Splittail recruitment correlates with the number of days of flooding, and young splittail grow better in floodplain than riverine habitats. Young-of-the-year leave the floodplain as inflows decline, and are gone by mid-May when the connection with the river is lost. The alien common carp is also a floodplain spawner.

Although they don't spawn there, Chinook salmon use the habitat for rearing and foraging. Floodplain-reared salmon grow faster and reach larger sizes than their counterparts in the main river.

By June, other floodplain foragers—alien centrarchids (largemouth bass, crappie, and sunfish)—have moved in through adjacent sloughs. They're joined by a native minnow, the Sacramento blackfish, survivor of a formerly rich slough fish fauna. The last arrivals, fast-reproducing alien western mosquitofish and inland silversides, may persist until the floodplain ponds dry up in August. The prevalence of alien species makes it difficult to reconstruct historic use patterns.

Moyle and his colleagues offer recommendations for restoring native fishes to floodplains. Early season flooding (January through April), which allows food supplies to build up, should be promoted. To minimize stranding, the floodplain should be designed to drain completely. The authors also suggest reducing permanent-water habitats to discourage alien species, maintaining a mosaic of habitats and a variable flood regime, and creating experimental habitats such as drainable ponds. Moyle says that with over 90% of California's functioning floodplains lost, much more restoration will be needed to recover native fish populations and fisheries.

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INVASIVE SPECIES

BOTHERSOME BIVALVE

The Pacific giant oyster (*Crassostrea gigas*) has been a staple of California mariculture since 1929, and is the most common species of oyster grown on the West Coast. Hatchery-spawned oysters are now raised in Tomales Bay and Drakes Estero. But *C. gigas* was undetected in S.F. Bay before 2004, when suspicious shells were found in the South Bay. Living oysters turned up two years later. The San Francisco Estuary Institute's Andrew Cohen says scientists are now scrambling to learn more about this newest invasive bivalve and control it before it becomes established.

How did it get here? Possibilities include a recent illegal planting near San Rafael; larvae drifting in from rearing sites or hitchhiking in ballast tanks; and, ironically, three programs that used live oysters in bioaccumulation studies. Genetic analysis should reveal the source population.

Although some studies indicate that *C. gigas* is temperature-limited in spawning, Cohen says the oysters spawn in S.F. Bay "and have all along." But the larvae haven't settled in at an effective rate until recently; isotopic analysis of oysters collected last year indicated they were four years old. Increased phytoplankton blooms in the South Bay may be a factor. The oysters may also prove to be a genetically distinct strain. "It could be a serendipitous sequence of events," Cohen says.

The 2006 survey, a volunteer effort, collected more than 260 giant oysters between the Dumbarton Bridge and the San Leandro Marina, probably just a fraction of the Bay's population. This year's oyster hunt, during low tides at the end of August, was funded by the California Coastal Conservancy, the Estuary Institute's Regional Monitoring Program, and the National Fish and Wildlife Foundation. The U.S. Geological Survey and U.S. Fish & Wildlife provided boats, supplementing shore-based volunteers. Preliminary results indicate no new invasion sites.

*C. gigas* is known to outcompete and overgrow other bivalve species, and could hinder efforts to restore the native *Ostrea conchaphila*. But Cohen's main concern is that these efficient filter feeders—like the clams *Corbula amurensis* and *Corbicula fluminea*—could hog estuarine food resources and cause a reduction in pelagic organisms. The good news? This may be a case where early detection helps stop a biological invasion in its tracks.

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WOOLY MAMMOTH MARSH CONTINUED

several participants (who declined to speak on the record for this story) expressed concerns with her position. Some suggested that perhaps it wouldn't be a worst case scenario if *S. alterniflora* were allowed to take over Bay marshes, particularly since it is such a robust plant, and establishes marsh so quickly—which could be helpful in combating sea and Bay level rise. Others expressed concern that if we don't act quickly to restore more wetlands, developers could swoop in and build strip malls on baylands, or that funding for restoration could screech to a halt.

But Olofson is not asking for a moratorium on wetland restoration, far from it. "I've spent years of my life protecting and helping wetlands," she says. Along with Fish & Wildlife, the Coastal Conservancy, and others, Olofson is drafting a set of "Best Practices" for wetland restoration. Before a project could proceed, *S. alterniflora* would have to be eradicated within a certain radius of the project, as a permit condition. Currently, two miles is being considered, "but we know the seeds can travel 15-20 miles," says Olofson. The Best Practices would also require some form of monitoring for *S. alterniflora* and hybrids, according to the Conservancy's Amy Hutzel. "It's not a show stopper," says Olofson. "We're suggesting that

projects don't make that tidal connection until the invasive spartina has been killed and the seed source stopped within a certain distance. We're just asking that people wait until we have a clean slate. You can do all the prep work, acquire the land, the uplands, etc. But just don't make that tidal connection until the site is clear within a certain distance." Olofson also wants to see wetland mitigation projects more carefully regulated. "We're letting developers off the hook by allowing them to do these projects without better oversight."

Olofson points out that the goal of preserving native tidal salt marshes and their ecology and geomorphology has been agreed upon for some time (and is memorialized in the Baylands Ecosystem Habitat Goals report). "If people decide they want an East Coast marsh, then we'll work for that," she says, half jokingly.

To date, the attitude among some resource managers toward wetland restoration and spartina has been a kind of denial, says Olofson. "People want to see results, and they want to see them fast. But people haven't wanted to believe that [spartina] is an issue; they just wanted to do their projects and hope for the best." Olofson says wetland restoration projects can no longer be managed in a vacuum.

The Conservancy's salt pond project manager Steve Ritchie says he supports the Best Practices and is working to incorporate them into the salt pond project, although he worries—as a former regulator—that regulation can sometimes have unintended consequences. "Sometimes your best intentions don't turn out how you hoped. Regulation alters behavior, but the resulting behavior might be something you don't want. In this case, it could be less appetite for engaging in land acquisition and restoration."

But Ritchie points out that the Invasive Spartina Project cannot continue to "clean up" forever. "What if we all agree that it's worth taking a risk [going ahead without completely eradicating *S. alterniflora* and hybrids] and it still gets in there? Who's responsible? Everybody involved needs to stop and look at each other and say, 'what resources do we have to correct the situation?'" Ritchie also says that while the Invasive Spartina Project hopes to have *S. alterniflora* eradicated Bay-wide by 2011, other efforts to eliminate invasive species—i.e., the pike in Lake Davis—have failed. "What's going to happen if there's a recurrence? We should have a contingency plan."

Fish and Game's Carl Wilcox says *S. alterniflora* would "definitely change the hydrology, the vegetative composition,

Map courtesy of the Invasive Spartina Project.





# PLACES TO GO & THINGS TO DO



## CONFERENCES & WORKSHOPS

NOV

5-7  
MON.-WEDS

### AMPHIBIAN DECLINES & CHYTRIDIOMYCOSIS

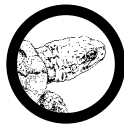
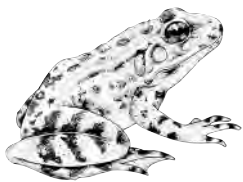
**TOPIC:** Translating Science into Urgent Action  
**LOCATION:** Tempe, AZ  
**SPONSOR:** Partners in Amphibian and Reptile Conservation  
[http://www.parcplace.org/Bd\\_conference.html](http://www.parcplace.org/Bd_conference.html)  
Tala Woodward, [tala@meyersalterman.com](mailto:tala@meyersalterman.com)

DEC

4-6  
TUES.-THURS

### RIPARIAN HABITAT JOINT VENTURE CONFERENCE

**TOPIC:** Integrating Riparian Habitat and Flood Management in California  
**LOCATION:** Sacramento  
**SPONSORS:** Various state and federal agencies  
<http://www.prbo.org/calpif/htmldocs/rhvj/>



## HANDS ON

OCT

6  
SATURDAY

### OCEANFEST

**TOPIC:** Sustainable gourmet seafood, live music, children's activities.  
**LOCATION:** San Francisco  
**SPONSORS:** Gulf of the Farallones and the National Marine Sanctuaries (415)561-6625x315

OCT

11  
THURSDAY

### BAY INTERPRETIVE TRAINING PROGRAM

**TOPIC:** Learn about San Francisco Bay wildlife and teach children.  
**LOCATION:** Berkeley  
**SPONSOR:** Shorebird Park Nature Center  
Dara Rossoff, (510)981-6720  
[www.cityofberkeley.info/marina](http://www.cityofberkeley.info/marina)

OCT

THURSDAYS & SATURDAYS

### BIRD CENSUS

**TOPIC:** Learn about bird life and collect important data and information about the bay.  
**LOCATION:** Richmond  
**SPONSOR:** Golden Gate Audubon Michael Martin, [mmartin@goldengateaudubon.org](mailto:mmartin@goldengateaudubon.org), (510)843-7295

NOV

4  
SUNDAY

### NAPA RIVER BIRD CRUISE

**TOPIC:** Birding from a boat  
**LOCATION:** Departs from Vallejo  
**SPONSOR:** Golden Gate Audubon Kristen Bunting, Golden Gate Audubon (510)843-2222

## IT'S HERE! 8TH BIENNIAL STATE OF THE ESTUARY CONFERENCE 2007

October 16, 17, and 18, 2007 | Scottish Rite Center | 1547 Lakeside Drive Drive, Oakland  
short walk from public transit! <http://sfep.abag.ca.gov/soe/> | (510)622-2398

## EVERY LAST DROP CONTINUED

"We have been exploring desalination with other utilities and looking at groundwater use to make the system sustainable in the future and protect resources," says Carlin.

But Drekmeier and other river advocates would like to see these efforts reflected in the SFPUC's water supply proposal. And there's pressure mounting to make this happen. In June, the San Francisco Board of Supervisors, which works with the city's mayor to appoint commissioners to the SFPUC, passed a resolution capping the amount of water that can be diverted from the Tuolumne. They also requested the SFPUC to look into a water supply option that would meet all demand increases from sustainable sources such as groundwater. In 2006,

the SFPUC released a study outlining the results of its investigation, which found that 80% of its anticipated increased demand could be met through activities like consumer conservation and recycling. The findings from this study were not taken into account in the current proposal, and Drekmeier believes this could leave the SFPUC vulnerable to legal action challenging the environmental impact report. "This water grab threatens to delay a very important project, and we want to make sure this seismic retrofit takes place," says Drekmeier.

<http://www.tuolumne.org/content/article.php/sfreport>

CONTACT: Peter Drekmeier (650)248-8025; Michael Carlin (415)934-5787 **KC**

## NOW IN PRINT & ONLINE

**Draft Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program.** San Francisco Public Utilities Commission. June 2007.  
[http://www.sfgov.org/site/planning\\_index.asp?id=37672](http://www.sfgov.org/site/planning_index.asp?id=37672)

**A Field Guide to 100 Birds of Heron's Head.** City College of San Francisco Center for Habitat Restoration. Spring 2006. [http://www.theguardsman.com/etc/spring2006/HTML/8\\_wildside.htm](http://www.theguardsman.com/etc/spring2006/HTML/8_wildside.htm)

**Field Guide to Owls of California and the West** (California Natural History Guides). Hans J. Peeters. 2007. U.C. Press.

**Managing Water: Avoiding Crisis in California.** Dorothy Green. September 2007. U.C. Press.

**Quest for the Source: A Watershed Adventure.** Fall 2007. KQED and park agencies. (415)561-4449.

**Spartina Dispatch. Quarterly Newsletter of the San Francisco Estuary.** May 2007. Invasive Spartina Project. [www.spartina.org](http://www.spartina.org)

**Tennessee Hollow Environmental Assessment.** Summer 2007. Presidio Trust. [www.presidio.gov/trust/projects/tenn/](http://www.presidio.gov/trust/projects/tenn/)

**Urban Stormwater Retrofit Practices.** September 2007. Center for Watershed Protection. <http://www.cwp.org/>



## RECOGNITION

### DEADLINE: JANUARY 15, 2008

The National Wetlands Awards Program is calling for nominations of individuals who have demonstrated extraordinary commitment to the conservation and restoration of wetlands. Awards will be given in six categories: education and outreach, scientific research, conservation and restoration, landowner stewardship, state, tribal, and local program development, and wetland community leader.

[www.nationalwetlandsawards.org](http://www.nationalwetlandsawards.org) or contact us at:

(202) 939-3862, [wetland-sawards@eli.org](mailto:wetland-sawards@eli.org)

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ESTUARY is a bimonthly publication dedicated to providing an independent news source on Bay-Delta water issues, estuarine restoration efforts and implementation of the S.F. Estuary Project's *Comprehensive Conservation and Management Plan (CCMP)*. It seeks to represent the many voices and viewpoints that contributed to the CCMP's development. ESTUARY is funded by individual and organizational subscriptions and by grants from diverse state and federal government agencies and local interest groups. Administrative services are provided by the S.F. Estuary Project and Friends of the S.F. Estuary, a nonprofit corporation. Views expressed may not necessarily reflect those of staff, advisors or committee members.

## WOOLLY MAMMOTH MARSH, CONTINUED

and the dendritic nature of the Bay's marshes, but I don't know that it's going to be the end of the world if we don't control it." He also doesn't think it will destroy mudflats the way many people have predicted because it grows a little lower in the intertidal zone than *S. foliosa*. But for now Wilcox, too, supports the idea of implementing Best Practices. "We got pretty far behind the curve [in controlling *S. alterniflora* and hybrids], but we've started effective control and we need to see it through. As long as we're making progress, we should take it to the conclusion and see if we can't get rid of it."

Baye, who helped draft the Baylands Ecosystem Habitat Goals report recommendation that tidal marsh restoration not proceed until local infestations of invasive plants are suppressed (rather than eradicated), says he would now recant this more "permissive, tolerant" view. "There is no evidence or modeling I know of that makes it possible to establish *S. foliosa*

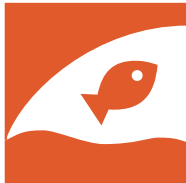
without having it backcross to a hybrid population with invasive ecological traits. Even a watered-down 'precautionary principle' would suggest that the search for a safe threshold of hybrid [spartina] population size or allele frequency would be like the promulgation of 'acceptable' levels of forest fire acreage in a windy summer of drought."

Baye thinks the strip mall worry is a "bogeyman." "I can see a real threat of time-sensitive windows of opportunity of establishing tidal marsh sooner than later along the accelerating sea-level rise curve," he says. But with the current fast pace of *S. alterniflora* and hybrids eradication—thanks to the new herbicide imazapyr—eradication may not be "as far off as the risk of the Greenland ice sheet collapse... which could make tidal restoration moot anyway."

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Photo by Don Freundt



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Send to [lowensvi@sbcglobal.net](mailto:lowensvi@sbcglobal.net)