

## PUTTING THE BRAKES ON COPPER

Every time Bay Area drivers tapped their brakes this year, they deposited enough copper in the Bay to equal \$2 million in pennies, according to TDC Environmental's Kelly Moran. Whenever brakes are applied, a little piece of the copper-containing pad can wear off, blow around, and land on the ground, where it is then washed by rainwater or other runoff into creeks, rivers, and the Bay. In the Bay, the copper can harm mussels and phytoplankton at the base of the food chain, deaden the sense of smell in salmon, and interfere with their reproduction, ability to avoid predators, and schooling behavior. But the Bay's copper load will soon get lighter, as the result of AB 346, sponsored by Sustainable Conservation and the Brake Pad Partnership initiated years ago by the Estuary Partnership, carried by Christine Kehoe (D-San Diego), and signed by the Governor in late September. The bill will allow no more than 5% copper in brake pads in vehicles sold starting in 2021 and phase out brake pad copper completely starting in 2025. The long phase-out time gives vehicle and brake pad manufacturers time to evaluate safety issues, although Moran says copper-free brake pads are already in use in some vehicles, and she is unaware of any safety issues.

The bill also phases out other heavy metals and asbestos and requires new formulations to be screened to avoid creating new human health or environmental problems. Moran says salmon and the Bay are not the only beneficiaries of the bill. "This isn't just a win for the environment—it's also a win for California local governments since federal Clean Water Act requirements for cleaning up watershed copper fall on cities and counties." Moran says she estimated that removing copper with land-intensive treatment systems would cost cities and counties more than \$100 billion statewide.

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# ESTUARY NEWS

Bay-Delta News and Views from the San Francisco Estuary Partnership | Volume 19, No.6 | DECEMBER 2010

## BAY SAND IN THE RED?

A recent study by Patrick Barnard and Rikk Kvitek of the US Geological Survey, published in the on-line journal *San Francisco Estuary & Watershed Science*, reports that sand removed by mining in San Francisco Bay is not being fully replaced through natural deposition. Barnard and Kvitek also see a possible connection between the Bay's sediment deficit and the erosion of beaches on the outer coast.

Barnard and Kvitek make a strong case that mining is accelerating the rate of sandy sediment loss, at least in the Central Bay. Barnard and Kvitek compared the results of two multibeam sonar surveys of west-central San Francisco Bay conducted in 1997 and 2008, the second funded by the sand-mining firm Hanson Marine Operations.

The comparison showed a loss of 14.1 million cubic meters of sediment over the 11-year period, with the rate of loss in the mining lease areas five times higher than the remainder. Moreover, the loss for the entire study area in the Central Bay is occurring three times faster than during the period from 1947 to 1979 (with the caveat that earlier bathymetric studies were less technologically sophisticated than the multibeam scans of 1997 and 2008). Within the Central Bay lease sites, 85% of the sediment removed by aggregate mining between 1997 and 2008 was not replenished. "The study locally shows mining is a factor in sediment loss," Barnard explains. "The data demonstrate that the local impacts are clear and irrefutable and that the sediment is not coming back at a significant rate."

The report was published just in time to be submitted to the State Lands Commission in response to a Draft Environmental Impact Report on a request from Hanson and Jerico Products for a 10-year extension of sand-mining leases in west-Central San Francisco Bay, Suisun Bay, and the western Delta. Critics like coastal ecologist Peter Baye question the conclusions of the DEIR on the direct and cumulative impacts of continued mining. To Baye, the Barnard-Kvitek study provides an "abundant, comprehensive empirical analysis" of the Bay's sediment budget, contrary to the DEIR's statement that sediment flux "has yet to be reliably quantified or estimated."

At least 200 million cubic meters of sediment have been removed from the Bay in three different kinds of operations over the last century. The Army Corps of Engineers dredges channels to keep shipping lanes open, although only part of the dredged material leaves the Bay. Historically,



Sand dredge offload and stockpile area at Pier 94 N, Port of San Francisco. Photo courtesy Peter Baye.

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## BAY SAND IN THE RED?

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borrow pit mining was a significant factor: the dredge-and-fill procedure that built Treasure Island and the San Francisco Marina. But nothing on that scale has been done recently. It's the third process, commercial mining, that accounts for the lion's share of sand extraction over the last decade.



Sand stockpiles at Pier 94, San Francisco. Photo courtesy Peter Baye.

During much of the Bay Area's 20th-century buildup, sand and gravel (aggregate) for construction was quarried in the Livermore Valley and other inland locations. When residential sprawl after World War II made such operations less tenable, miners turned to underwater sand as an alternative. Hanson, a British-based company, acquired two local sand-mining operations in 1999. Recently acquired by HeidelbergCement, Hanson remains the biggest player. Sand and gravel suctioned up by their dredging equipment is barged to port sites in San Francisco, Oakland, and Martinez to be processed for use in concrete and other building materials. According to the DEIR, Hanson's current permits allow for the extraction of 1,390,000 cubic yards of sediment per year from state land leases in the Central Bay, with another 100,000 from Suisun Bay.

Approving a mining lease on state-owned subtidal land is a Byzantine process. The State Lands Commission, which issued the DEIR, is the lead agency for California Environmental Quality Act purposes. "The Bay Conservation and Development Commission requires a lease in place before we give a permit," explains BCDC's Brenda Goeden. "The state Department of Minerals and Geology does a regional plan, and the state Water Board looks at turbidity issues." Because of

potential impact to the endangered longfin smelt, Cal Fish & Game and the US Fish & Wildlife Service would also be involved.

The DEIR, prepared by the environmental consulting firm ESA, finds no significant impact on sand resources from the proposed Hanson/Jerico lease extension. The Hydrology section of the report incorporates the conclusion of a report by Coast and Harbor Engineers, a contractor for Hanson: "Net bottom erosion due to sand mining [in the Central Bay] has been largely contained within the lease and immediately adjacent areas... Since the vast majority of the mined material has been accounted for immediately adjacent to the lease areas, it appears that sand mining in Central Bay is not likely to cause measurable sediment depletion in areas outside the mining areas." Baye, in a statement to the SLC, called the DEIR's analysis of sediment dynamics "woefully inadequate" and its conclusions on potential adverse impacts on hydrology and geomorphology "fatally flawed."

A related and even more controversial question is whether mining in the Bay affects sediment dynamics on the outer coast. In a still unpublished study, Barnard and associates used hydrodynamic modeling to demonstrate "a net potential export of sand-sized sediment from San Francisco Bay to the ocean" such that limits to the Central Bay's sand supply could limit in turn the sand supply to Ocean Beach and other open-coast beaches. These beaches have experienced severe erosion over several decades.

"Previous studies suggested a net influx of sediment into the Bay [from the ocean]," Barnard continues. "Our three-dimensional numerical modeling, coupled with direct measurements of tidal currents and suspended sediment transport, suggest the opposite." To pin down that connection, he's following up with a provenance study of Bay and beach sand: "We're looking at the geochemical signatures of sediment found throughout the entire San Francisco Bay coastal system, including the mining areas, the mouth of the Bay, and open-coast beaches—isotopes, heavy minerals, rare earth elements, x-ray diffraction, and even foraminifera that lived in distinctive environments. Thus far our research suggests that the net flux of sediment is out through the Golden Gate. If we can tie that in with the geochemical signatures we can say that definitively."

This is where industry sources part company with the USGS scientists. "USGS did a good job," says Barry Keller, a consultant for Hanson. "What is presented is valid. There appears to be a strong connection with sand loss in the immediate vicinity of sand mining." But for sand budgets outside the immediate lease study area, "they speculated that may be happening. They refer to numbers from a study not yet published. They have not documented that this is the case, whereas the DEIR concluded that is not the case."

Hanson executive Bill Butler plays down concerns about depleting the resource. Butler cites what he calls a very conservative estimate of sand reserves in the Central Bay lease areas analyzed for the DEIR: "If we use that estimate and the average annual extraction rate that Barnard used over a 10-year period, we would use less than 20% of the resource that is there." The consultant's estimate, he says, accounts only for sand down to a depth of 90 feet below mean low low water; he believes actual resources extend much deeper. Butler calls Bay sand "a local resource essential to infrastructure and quality of life in the Bay Area." Compared with quarrying, he says mining Bay sand is environmentally friendly. With quarries an average of 44 miles away from processing sites, "one barge load of sand, equivalent to 108 truckloads, eliminates 9,500 truck miles and the impact of vehicular emissions."

Although Hanson has been shipping glacial sediment from British Columbia to Bay Area ports, Butler doesn't envision that source as a replacement for Bay sand: "It can be part of the solution but certainly not the whole solution and not one we could look at as a completely sustainable solution." Sustainability, he says, involves "utilizing a local resource that's an environmentally sound alternative" and leaving impacted land in acceptable condition: "There will still be sandy-bottom habitat that will support the benthic community that is there today."

BCDC's Brenda Goeden acknowledges that any decision on the future of sand mining will be a tough call: "I think sand mining in San Francisco Bay is one of the most economic ways of getting aggregate sand to concrete plants. It eliminates impacts of trucking and reduces damage at the quarry site. The mining industry also makes a pretty good argument that sand mining is a pretty

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# Conservation

## SHORT-LEGGED BIRD NEEDS SHALLOW WATER, STEPPING STONES

The secretive, seldom-seen, marsh-dwelling black rail—often described as a “chunky robin”—may find itself in trouble as sea level rises. The threatened rail, with its stubby legs, needs very shallow water—less than 1.2 inches—and wetlands that are connected to one another, possibly by smaller, “stepping stone” wetlands, says UC Berkeley’s Steve Beissinger, who has been studying rail populations around the Bay and in the Sierra foothills. Beissinger hopes that science can help inform conservation strategies for this threatened species as the climate changes and Bay waters rise.

In a poster at this fall’s Bay-Delta science conference, Beissinger described his recent research finding a genetic link between black rails in wetlands in the Sierra foothills and those in San Francisco Bay—a surprise since rails are thought to be poor fliers, making it difficult for them to disperse long distances.

“The study is preliminary, and we’re just opening the book here, but the genetic connectivity we found going on between the foothills and the Bay was surprising—we didn’t expect that. It looks to be recent, within the lifetime of the birds we captured,” says

Beissinger. In other words, at least one individual must have interbred with one from the population around the Bay, probably a foothills rail visiting the Bay. “They must be finding some sites where they can stopover—maybe the Yolo Bypass? That’s the paradox of rails—they don’t appear to be very good flyers; they’re walking around under the vegetation all the time. They fly like butterflies; they wobble around and try to go right down into the vegetation.” Yet rails have reached islands in the middle of oceans, so “they got there somehow,” says Beissinger.

The foothills population was discovered 15 years ago by Beissinger’s colleague, Jerry

Tecklin, when he found rails at the Berkeley research station and then started poking around on state-owned land and private ranches (with owner permission). Tecklin found rails in natural, spring-fed wetlands throughout the foothills in the oak woodland belt. But he also found them in small wetlands that had been created accidentally. “There’s a fair amount of water held back for irrigation purposes,” says Beissinger. “And the rails have benefited from that.”

Beissinger and colleagues’ genetics analyses revealed another surprise. “It suggests that the interchange of individuals within the Bay is less frequent than in the foothills—that the sites around the Bay, even though they are larger wetlands, are more isolated from each other. What we’ve learned from our foothill rails studies is that the more isolated the wetlands, the less likely they are to be colonized.” Beissinger says the genetics also show that the foothill population may have existed historically.

For now, he hopes to get more genetic material from Bay rails and to expand his study to the South Bay. He and his doctoral student Laurie Hall are also planning to analyze the DNA of museum specimens in to better understand rail gene flow around the Bay prior to the large-scale landscape changes that occurred with development. “That will give us clues as to the original population size as well as whether genetic diversity has been lost

with all of the changes to the Bay’s wetlands over the past century.”

Possibly most urgently, the studies will help resource managers plan for sea level rise. “As sea level rises, distances between wetland sites in the Bay will likely increase and they will become more isolated and reduced in size. We want to get a better handle on the dispersal ability of these rails so we can look at the role of different configurations of sites. As certain places are restored in the Bay, it will be very useful to think about creating shallow water areas that don’t get inundated.” This could mean possibly creating “stepping stone” wetlands



Out of 1,566 call surveys in recent years, researchers were only able to see black rails 16 times (about 1%) even though they could hear the rails as close as 5 feet away. Photo courtesy Steve Beissinger.

## speciesSpot

### THE HEAT UNDERNEATH

Since not all organisms respond to temperature increases in the same way, climate change has the potential to disrupt ecological communities.



The attractive native sea slug *Phyllaplysia*. Photo courtesy Jeffrey Lewis.

San Francisco State University graduate student Jeffrey Lewis reported on a potential case at the Bay-Delta science conference: the invertebrates (epifauna) that live on and in some cases feed on eelgrass (*Zostera marina*).

Lewis measured the responses of seven eelgrass-associated arthropods and mollusks to simulated extreme heat events, up to 42° C. The normal range in eelgrass beds is 14–16° C, with extremes up to 30°. Test subjects included two invasive amphipods (*Ampithoe* and *Corophium*), a native isopod (*Idotea*), two skeleton shrimp (*Caprella*), a native sea slug (*Phyllaplysia*), and an introduced snail (*Ilyanassa*). “Most of what I was monitoring was oxygen consumption,” Lewis says. He’s using oxygen consumption rates to identify maximum critical temperatures for each organism.

Preliminary results indicate that some of the introduced species can take the heat better than the natives. *Ilyanassa*, a mudflat specialist, showed “basically no effect of increased temperature,” says Lewis.

“For the other introduced species, the optimum temperature tends to be in the low to mid 30s.” The native *Idotea* and *Phyllaplysia*, both beneficial to eelgrass, had optimal ranges in the low 20s.

Lewis has also set out patches of eelgrass from which all invertebrates have been removed at two Bay locations that vary in temperature extremes, depending on tidal exposure. The eelgrass at the cooler site was colonized by all seven of the test species; at the warmer site, only by *Ilyanassa* and *Corophium*.

“It’s expected that as an effect of climate change you’d see more extreme heat events and greater frequency of extreme heat events, which could cause a decline in some

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## RISE IMPACTS RAILS, MICE



Clapper rail. Photo courtesy Verne Nelson.

While it has long been predicted that coastal areas and estuaries will be among the first to feel the effects of climate change and sea level rise, new USGS models show that sea level rise in the Bay could impact salt marshes sooner than thought—and that the endangered species they are managed for—the California clapper rail, the black rail, and salt marsh harvest mouse—could suffer the most. The USGS study used RTK GPS elevation data, plant community characteristics, and habitat information to develop sea level rise impact models for the San Pablo Bay National Wildlife Refuge. In contrast to most other models and maps, which are based on mean tides, USGS looked at what will happen during high tides. "If you're talking about animals, you need to talk about tidal cycles," says USGS's Karen Thorne. "Animals don't live in means—it's the extremes that matter."

Thorne says maps and models based on mean tides predict that the refuges around the Bay will be inundated in around 100 years. But the USGS model indicates a much shorter time frame: "Instead of being completely flooded by 1 meter of sea level rise, we're looking at a half meter where you'll have all of the refuge under water during high tides" says Thorne. "It's much more imminent than 2100."

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## Innovation

## GREY HEAT

What do the compound eyes of a dragonfly have to do with greywater reuse? Making that unlikely connection won a UC Berkeley team—architect Maria-Paz Gutierrez, bioengineering professor Luke P. Lee, and civil engineer Slawomir Hermanowicz—a \$2 million National Science Foundation grant to develop a solar-powered greywater disinfection and heat management system for a new generation of sustainable buildings. The four-year project is called SOAP/GRIT: Solar Optics-based Active Pasteurization for Greywater Reuse and Integrated Thermal Building Control.

"What's pioneering about it is not just water recycling but the use of a very thin and light membrane using bioengineering principles," says Gutierrez. Advanced optical systems, drawing from Lee's work on artificial ommatidia (compound eyes), would be used to concentrate solar heat and disinfect water from kitchen sinks, showers, and washing machines. "It's exposed to sunlight and disinfected by day," she explains. At night we pass that water back, and the heat it has accumulated is used to heat back the building." "Light has to penetrate the water layer," says

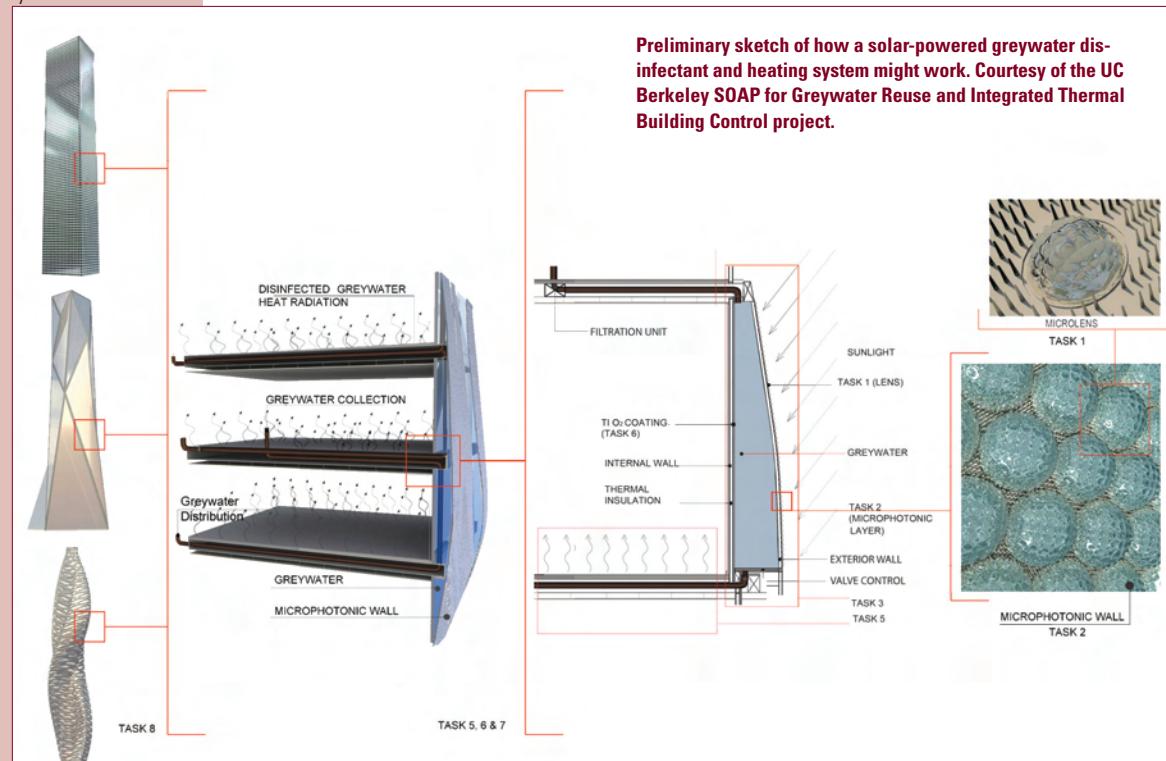
Hermanowicz. "We're working on innovative ways to accomplish that."

Lee also claims inspiration from the photosynthetic process in plants. He says microscale optical systems will allow for both photocatalytic greywater disinfection and efficient solar energy harvesting.

"The focus here is primarily on combining the architectural function with the water reuse," says Hermanowicz. "The initial idea of the team involved multi-story buildings. Energy issues in high-rise buildings are very important. A building system that can couple energy and thermal management provides multiple advantages."

Gutierrez, who has developed energy-efficient building systems in her native Chile and the US, emphasizes that the project is a team effort. "Ultimately my work has to do with finding interactive relationships between architecture and science," she says. "It's time to look at solutions in which the system itself allows it to work as a system, instead of having to rely on industrial mechanical components."

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Preliminary sketch of how a solar-powered greywater disinfectant and heating system might work. Courtesy of the UC Berkeley SOAP for Greywater Reuse and Integrated Thermal Building Control project.

# Environment

## GOVERNOR VETOES BOOM BILL

On the final day of this year's legislative session, Governor Schwarzenegger vetoed AB 234, Assemblymember Jared Huffman's (D-Marin) bill that would have required ships refueling in the open waters of the Bay to deploy boom in advance. In his veto letter, the Governor wrote that the bill was unnecessary because Cal Fish & Game's Office of Spill Prevention and Response is currently examining the issue.

The bill would have not only improved spill prevention through boom strategies, but would have also raised fees on imported oil

gram afloat, but no more than is necessary."

Jackie Dragon of Pacific Environment, the bill's sponsor, says, "The Governor has shirked our mandate to provide the 'best achievable protection' and, instead, left California unnecessarily vulnerable to future oil spills in our invaluable marine environment."

In the meantime, some shoreline responders are preparing for the worst. In early October, the East Bay Regional Park District, City of Richmond Fire Department, and Contra Costa Hazmat held a hands-on, in-the-water, day-long training session on boom deployment at the Richmond Marina. The Park District's Kevin Takei explains that the agencies



**East Bay Regional Park District employees practice hands-on deployment of boom in the Richmond Marina. To protect the shoreline, the boom needs to be anchored and angled at a 2:1 or 3:1 slope. Photos by Lisa Owens Viani.**

to fund the state's spill prevention program and put plans and safeguards in place to prevent blowouts from offshore oil rigs. Huffman vows to pursue another bill next year. "The Governor ignores the fact that his own Administration projects that the oil spill prevention fund will soon go insolvent without AB234," says Huffman. "The bill would have raised the cap on the per-barrel fee from 5 cents to 6 cents, at OSPR's discretion—enough to keep the oil spill prevention pro-

wanted to do a joint training after receiving trailers of boom and other equipment as a result of legislation passed in 2008 after the *Cosco Busan* rammed into the Bay Bridge.

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*Ed's note: On November 7 a spill occurred during fuel transfer operations in Long Beach Harbor. The transfer was not pre-boomed.*

## birdwatch

### SCOTER STUDY

After the cargo ship *Cosco Busan* crashed into the Bay Bridge, spilling 58,000 gallons of oil into the Bay in November 2007, over 1,000 surf scoters were treated by the Oiled Wildlife Care Network in Cordelia. How

well did the ones that survived fare after rehabilitation and release? A study by USGS's Susan De La Cruz and colleagues from Humboldt State, Cal Fish & Game, and UC Davis between mid-December 2007 and early April 2008 used radio telemetry and modeling to compare the fate of 15 oiled, rehabbed scoters with 18 non-oiled, rehabbed scoters and 22 scoters that were captured, radio-tagged, and released immediately after tagging.

"The birds that were not rehabilitated survived the best," says De La Cruz, "while the unoiled birds who went through the rehab process [they were wild-caught and then put through the same washing and rehabbing process as the oiled birds] did almost as well as the birds that weren't rehabilitated." Because of the small sample size, she adds, it was difficult to tell the difference in survival rates between rehabbed, non-oiled birds, and tagged/immediately released birds (62% vs. 73%). It does suggest that the rehab process itself does not seem to lower survival much, says De La Cruz. Thirty-seven percent of the oiled, rehabbed birds survived. De La Cruz says the lower survival rate may be explained by the severity of the oiling, the condition of the bird when it came into the rehab center, and the length of time it spent in rehab. "All of those things may come into play in determining how the bird will survive," says De La Cruz. "There may be things that can be done in rehabilitation to reduce the stress and to improve the turnaround time and get them out the door more quickly. They are not an easy bird to work with."

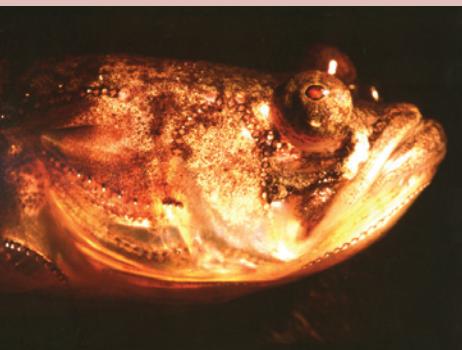
CONTACT: sdelacruz@usgs.gov **LOV**



**An oiled scoter being treated at WildCare. Photo courtesy Alison Hermance, WildCare.**

**TEMPS AND TIDES DRIVE HUM**

Remember the humming toadfish of Sausalito? Although they're no longer honored by a local parade, they're still humming. San Francisco State University physicist Roger Bland has been using a new underwater acoustic recording station at the Romberg Tiburon Center, the first in the Bay, to monitor and analyze their vocalizations.



**Photo by Margaret Marchaterre © 1998.**

More properly known as plainfin midshipmen (*Porichthys notatus*), these bottom-dwellers have been described as having the face of a hungover Cheshire Cat. Among other oddities, they have photophores that glow in the dark. On summer nights, territorial ("Type I") males produce a loud sustained hum with the muscles of their swim bladders to attract females. "The site is just booming and loud with midshipman calls," Bland says. If all goes well, a male will fertilize a female's eggs and guard them until they hatch. But he has to compete with smaller "Type II" males who use their resemblance to females to reach the eggs first.

Bland, who has also studied whale vocalizations at the Pioneer Seamount 95 kilometers off San Francisco, presented his recent work at the Bay-Delta science conference. He has found that groups of male midshipmen call together, matching the same frequency, and that the consensus pitch varies with the water temperature. He's also looking at the timing of these choruses. Although the fish may call at night to minimize acoustic interference from ship traffic, Bland thinks it's more about light: "This July, instead of turning

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**Regulation****CAUGHT BETWEEN THE CORPS AND THE LAW**

Local and state officials, community activists, and a member of Congress gathered at Wildcat Creek in Richmond on October 10 to voice their opposition to the U.S. Army Corps of Engineers' proposed policies on levee vegetation. The Corps' draft guidelines, announced in February, mandate the removal of almost all shrubs and trees from California's levees, with marginal exceptions if local agencies follow a cumbersome variance process.

"We're calling on the Corps to cancel its clearcutting policy regarding vegetation on levees before we're all caught between conflicting state and federal laws," said Contra Costa County Supervisor John Gioia. "The resource agencies don't want us to cut the vegetation down, and scientific evidence says blanket clearcutting does not make sense."

Mitch Avalon of the Contra Costa County Flood Control and Water Conservation District summarized the dilemma: "If we don't cut down these trees we lose federal flood assistance funding, and FEMA will decertify our levees. If we do cut them down, we'll destroy habitat along the creek and quality of life for the community. And I'd be breaking state and federal environmental laws. The Corps designed this project with trees in mind and we have an agreement to maintain them. Now they've invalidated our past agreement."

From a state perspective, Bruce Wolfe of the SF Bay Regional Water Board pointed out that his agency "was required to protect and restore the beneficial uses of the waters

of the state for all the people ... The Corps policy is directly counter to that." Gary Barbini of the Department of Water Resources said the policy violated NEPA, CEQA, and the Endangered Species Act, and unfairly shifted responsibility to state and local government. Cal Fish & Game's Chuck Armor stressed the importance of preserving what little is left of riparian habitat, much of which is along levees, and urged the Corps to embrace the collaborative framework of the California Levee Roundtable. Speaking for the local community, Whitney Dotson of the North Richmond Shoreline Open Space Association said it was time to focus on shoreline restoration: "With complete restoration of shorelines, the problems the Corps has will basically disappear."

"The Corps is stuck some fifty years ago," charged Congressman John Garamendi (D-Walnut Creek). "They need to think about what is really essential for California and the nation as a whole. The problem, he said, is a blanket national policy implemented without regard to the nature of the individual levee, flood channel, or environment." His prediction: "If the Corps succeeds in stripping the levees of all vegetation, they'll have to come back in a couple of decades and replant them."

The Corps says it will issue its final policy—and a scientific review of the policy—at the end of 2010; public comments are available at [www.regulations.gov](http://www.regulations.gov), docket number COE-2010-0007. **JE**



**The SF Bay Regional Water Board's Bruce Wolfe says the Army Corps' levee vegetation policy violates his agency's mandate to protect and restore state waters' beneficial uses. Photo by Lisa Owens Viani.**

# Places to Go and Things to Do



## CONFERENCES, WORKSHOPS, EXHIBITS & TOURS

DECEMBER 1

WEDNESDAY

### SECOND CALIFORNIA CONNECTIVITY FORUM

TOPIC: Connecting ecosystems and communities  
LOCATION: UC Davis

SPONSORS: UC Davis Road Ecology Center, UC Davis Sustainable Transportation Center, and Defenders of Wildlife  
[roadecology.ucdavis.edu/meeting/2nd\\_CA\\_Connectivity\\_Forum.htm](http://roadecology.ucdavis.edu/meeting/2nd_CA_Connectivity_Forum.htm)

### BAY SAND IN THE RED? (CONTINUED FROM PAGE 2)

efficient operation. On the other hand, sand is a habitat, although more sparsely populated than muddy bottom. We still don't understand what species use it or how they use it."

"Barnard and Kvitek for the first time made a connection to the outer coast," says Goeden. "The SLC's CEQA document on sand mining did not make that connection because they didn't, however, need to look beyond the project area." She sees significant implications for the mining industry. "There's a huge effort nationwide to preserve beaches. Can we have mining and beaches? What level of mining? If you reduce the volume to a sustainable level you might eliminate the business altogether. I don't think Bay sand is renewable at the level that mining is going on. That's one of the things Barnard and Kvitek have shown for the Central Bay."

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### RISE IMPACTS RAILS, MICE

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Thorne says sea level rise will likely fragment habitat and make endangered species more vulnerable to predators, especially during the highest tides of the year. Right now those extreme events only happen a couple times a year, says Thorne, but as sea level rises, will happen more often. Thorne says USGS researchers have expanded their study to include 11 more marsh sites around San Francisco Bay, and found that some salt marshes are at much higher risk than others: a report will be released this spring. Thorne hopes her study will help resource managers save the rails and mice. "The bottom line, she says, is that "if you're worried about endangered species, you need to take high tides into account."

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DECEMBER 8  
WEDNESDAY

### SOLSTICE PLANTING KICK-OFF AT EDEN LANDING ECOLOGICAL RESERVE

LOCATION: Eden Landing, Hayward/Union City  
SPONSOR: Save the Bay  
[www.savesfbay.org/](http://www.savesfbay.org/); (510)452-9261

JANUARY 5  
WEDNESDAY

### NATIONAL BIRD DAY AT THE MARTIN LUTHER KING JR. SHORELINE NURSERY

LOCATION: Martin Luther King Jr. Shoreline, Oakland  
SPONSOR: Save the Bay  
[www.savesfbay.org/](http://www.savesfbay.org/); (510)452-9261

## inprint & online

**Cities and Nature in the American West**, edited by Char Miller. University of Nevada Press, September 2010. [www.nvbooks.nevada.edu/NewForthcoming/Titles/Cities%20and%20Nature%20in%20the%20American%20West;2221?1](http://www.nvbooks.nevada.edu/NewForthcoming/Titles/Cities%20and%20Nature%20in%20the%20American%20West;2221?1)

**The Post Carbon Reader: Managing the 21st Century's Sustainability Crisis**, edited by Richard Heinberg and Daniel Lerch. University of California Press, October 2010. [www.ucpress.edu/book.php?isbn=9780970950062](http://www.ucpress.edu/book.php?isbn=9780970950062)

### HELP US MAKE GREEN STREETS GO VIRAL

Want to know more about green streets and what they can do for your city? Why are green stormwater retrofits important for the water quality in San Francisco Bay? How do they work? Check out the Estuary Partnership's library of green streets video podcasts—and other topics of interest—at <http://www.sfestuary.org/podcast/>

The Estuary Partnership invites Bay Area cities and counties to help us spread the word by using our Estuary Report video podcasts on your web sites. See how the city of Benicia did it at [http://www.ci.benicia.ca.us/index.asp?Type=B\\_BASIC&SEC={B8375E7B-4BA9-4AA6-8915-8F97102A02CF](http://www.ci.benicia.ca.us/index.asp?Type=B_BASIC&SEC={B8375E7B-4BA9-4AA6-8915-8F97102A02CF).

And check back soon for our Making of an El Cerrito Rain Garden podcast—to be published in December.

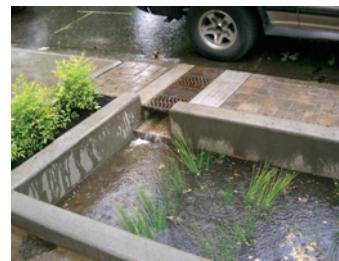


Photo courtesy of Kevin Robert Perry.

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# ESTUARY

NEWS

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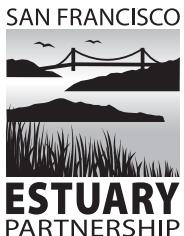
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## THE HEAT UNDERNEATH

(CONTINUED FROM SIDE PAGE 3)

populations of native invertebrates," says Lewis. "You might see mid-depth areas starting to experience extreme heat events."

"The San Francisco Bay Subtidal Habitat Goals Project has set ambitious goals for restoration of eelgrass," says Katharyn Boyer, Lewis's thesis adviser at SF State's Romberg Tiburon Center. "We really can't consider the roles of these species at natural or restored eelgrass beds without considering how their abundance and therefore effects will be influenced by predicted climate changes."

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## SHORT-LEGGED BIRD NEEDS SHALLOW WATER, STEPPING STONES

(CONTINUED FROM PAGE 3)

both within the Bay and east of the Delta, for example. Cal Fish & Game has already created artificial marshes for the rails in some state game management lands in the Sierra foothills that have been very successful, says Beissinger. Whatever happens, rails will feel the squeeze at both ends—around the Bay with its rising waters, and in the foothills, one of the fastest growing regions in the state. "It's possible that they will survive sea level rise in the Bay by distributing themselves farther inland," says Beissinger. "It may be that they can get around better than we had been thinking. But there is also a need to better plan for the location and connectivity of the sites we are restoring."

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