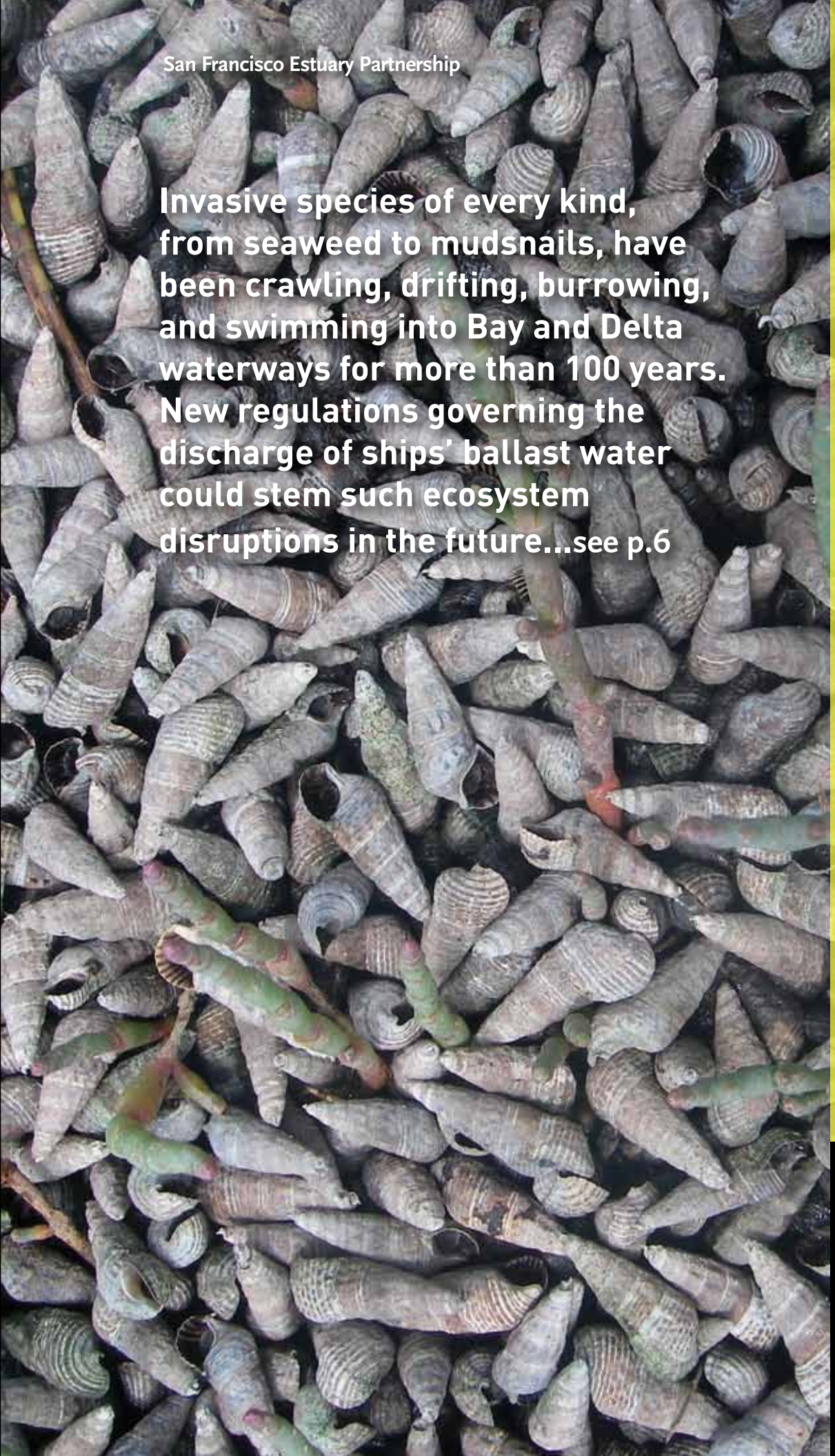
San Francisco Estuary Partnership



Invasive species of every kind, from seaweed to mudsnails, have been crawling, drifting, burrowing, and swimming into Bay and Delta waterways for more than 100 years. New regulations governing the discharge of ships' ballast water could stem such ecosystem disruptions in the future...**see p.6**

ESTUARY NEWS

SCIENCE • RESTORATION • WATERSHED • POLITICS • SPECIES • BAY

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B R I E F S

Around the Bay

NEW SIGNS ON BAY FISH RISK
More than 60 new signs detailing updated information about the perils of eating bay-caught fish were posted at several dozen fishing locations this summer by the California Department of Public Health. The signs spread the word about new guidelines from the state's environmental health hazard experts concerning just how unhealthy various Bay fish are to eat. The good news seems to be that consumers can eat more fish reeled in from the Bay than previously thought healthy, but some fish should still be avoided due to high mercury or PCB levels. **MORE**: www.oehha.ca.gov/fish/nor_cal/2011SFbay.html

SPORT FISH CONTAMINATION STATEWIDE — The results of the largest ever statewide survey of contaminants in coastal sport fish were recently released by a State Water Board monitoring program (SWAMP), including new data from 26 locations. The data show relatively high methylmercury concentrations on the Central and North coasts. Another round of sampling to be reported in May 2013 evaluated contamination in fish from California rivers and streams. The public can access results for individual fishing locations at www.waterboards.ca.gov/mywaterquality
MORE: www.sfei.org/news_items/swamp-report-contaminants-fish-california-coast
STORY SOURCE: *SFEI/ASC Quarterly Newsletter* 2012, Attachment 9.

COVER PHOTO: These Japanese mudsnails invaded a San Rafael marina in the 2000s. Photo by Julia Stalker.

WATERLESS WATER CLOSETS?
Never mind the wheel. According to the Bill and Melinda Gates Foundation, it's the toilet, an 18th-century anachronism, which needs reinventing. Last November, the tech tycoon's philanthropic project challenged 22 universities to develop a waterless, hygienic toilet that doesn't require a sewer connection and costs less than a nickel a day to operate. The goal is to meet the needs of the 2.6 billion people, mostly low-income city-dwellers, who lack access to sanitation. Experts guesstimate that more of the world's inhabitants have cell phones than toilets. The winning designs were announced August 15. Cal Tech received $100,000 for a solar-powered toilet that generates hydrogen and electricity. The second-place British prototype produces biological charcoal, minerals, and clean water. Stanford's proposal, one of the runners-up, also converted human waste into biological charcoal. Along with the awards, the Gates Foundation announced more grants to institutions in India, the UK, and the US. **MORE**: blogs.nature.com/news/2012/08/gates-foundation-backs-toilet-pioneers.html

SLOUGH MOVES FROM PORT TO PARK — This July, the Port of Oakland transferred nearly 8.5 acres of seasonal wetlands to East Bay Regional Parks, making Damon Slough the newest addition to the Martin Luther King Regional Shoreline. The port undertook the design, restoration and monitoring of the Damon Slough wetlands as mitigation for a runway overlay project at Oakland International Airport in 2002. The port's mitigation project, completed with the help of environmental groups and local agencies, not only enhanced and restored Damon Slough but also extended the Bay Trail 500 feet to connect to the slough trail, and created nesting and foraging habitat for wildlife with the addition of 7,000 new plants. The Port monitored the site for five years to ensure its viability as a seasonal wetland, then transferred it to East Bay Parks this summer.

SHARE YOUR NEWS? Tell us what's going on in your corner of the watershed, or send us a story idea. Ariel Okamoto: bayariel@sbcglobal.net or *Estuary News*, 1515 Clay Street, Suite 1400, Oakland, CA 94612

M A I N T E N A N C E

Health Care for Private Wetlands?

When Bay Area developers incorporated small freshwater wetlands into planned communities, it seemed like a good idea. Homeowners in developments like Chelsea-by-the-Bay in Hercules enjoyed viewing the ducks; some even appreciated the nightly chorus of the frogs. There's a problem, though: these pocket ponds aren't self-maintaining.

"We haven't really done much," says Chelsea resident Carol Arnold. "It's becoming overgrown and clogged up with cattails, willows, and other vegetation." The Homeowners Association is aware of the issue, but doesn't have the expertise or financial resources to handle it. "We're just volunteers trying to do our best. We have little areas of common landscape we maintain, [but to care for] the wetlands we'd have to increase association dues and put on a special assessment."

These days, with such an unstable housing market, the last thing HOAs need is another fee. "There have been lots of foreclosures throughout the HOAs in our city," says Arnold. People often stop paying their HOA dues long before they stop paying their mortgages. No help for the ponds and wetlands, meanwhile, is forthcoming from the cash-strapped city of Hercules.

The one public service available for these private wetlands is mosquito control. "Overgrown vegetation diminishes our access and effectiveness," says Carlos Sanabria of the Contra Costa Mosquito and Vector Control District. His agency will stock the ponds with mosquitofish and give technical advice to homeowners, but doesn't get involved in actual maintenance.

Other HOAs around the Bay Area likely face similar struggles. Perhaps these privately held pocket ponds, creek stretches and wetlands need a more public-spirited guardian, like a local land trust or the non-profit associations that help state parks. But nothing much seems to be on the horizon, and the habitat value of these isolated pockets, which are unlikely to have rare species or rich species assemblies, may be questionable in the big picture of regional habitat management.

Cattails and willows like wet spots, such as this HOA owned property at Chelsea by the Bay on the San Pablo Bay shoreline. Wetlands and riparian areas, public or private, can not only provide natural beauty in an urban or suburban landscape, but can also benefit watershed health. Photo by Carol Arnold.

"My guess is that since these residential ponds are primarily aesthetic amenities, there is little interest on the part of the usual agencies/organizations," says Marc Holmes of The Bay Institute. "Once again, developers drive alteration of the landscape purely to increase sales value, then walk away with the profits without any obligation for maintenance. The homeowners probably never even were apprised that maintenance would be required. Or, if they were, it was in the fine print." JE

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PUBLIC WORKS

Do's and Dont's of Dredging around Eelgrass

A new federal policy seeks to protect California's eelgrass meadows from the scoops and hoses of dredgers and other subtidal disturbances. The vulnerability of eelgrass (*Zostera marina*) to human activities like dredging prompted the National Oceanic and Atmospheric Administration's Fisheries Service (NMFS) to release a California Eelgrass Mitigation Policy in December 2011. The overall goal is no net loss of eelgrass habitat. The agency held public meetings on the draft policy in Eureka, Oakland, and Long Beach this June.

Eelgrass is one of San Francisco Bay's keystone organisms, sequestering carbon and providing food, shelter, and spawning grounds for a host of species, from tiny isopods to ducks and geese. The draft policy builds on successful restoration programs in Southern California. To minimize impacts, NMFS is recommending a ten-meter buffer zone around eelgrass beds. If damage is unavoidable, the draft proposes different initial compensatory mitigation ratio targets for each of four coastal regions. For the Bay, 3.01 square meters of new eelgrass habitat would have to be created for each square meter damaged. Ratios for other regions include 4.82 to 1 (from the Bay to the Oregon border) and 1.2 to 1 (from the Bay to Point Conception.) Statewide, the ultimate target is 1.2 to 1. "The higher initial ratios are insurance," explains NMFS' Korie Schaeffer.

The policy also suggests that transplants for restoration purposes be taken from similar donor sites. Locally, these would be carefully evaluated because of the highly variable genetic composition of the Bay's eelgrass beds. According to San Francisco State University biologist and eelgrass expert Katharyn Boyer, "Using more than one donor at a restoration or mitigation site is prudent to enhance genetic diversity and promote resilient restored beds." Indeed planting and seeding for the Bay's Living Shorelines Project in San Rafael and Hayward embraces this principle. Boyer supports the higher local mitigation ratio because there's still a lot to be learned about how to restore eelgrass in the Bay.

At the Oakland meeting, sponsored by the Bay Planning Coalition, the draft policy drew fire from port and marina operators who felt it would interfere with maintenance dredging, expand the accepted definition of an eelgrass bed, and require use of an excessively complex mitigation formula. The agency will address such concerns in its final report. JE

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Politicos Witness Live Birth

"And over here in this tank, we have a fish giving live birth," our instructor announced.

LIVE birth. Little did she know, this fish would become quite the center of attention during our trip around the Bay.

On June 25, 2012, my summer employer, the San Francisco Estuary Partnership, invited members of the Association of Bay Area Governments and other local elected officials to join them for a day on the Bay. Aboard the *R/V Robert G. Brownlee*, we learned about the health of the estuary and the importance of freshwater flows into the Bay. The part I found most interesting, however, was the more physical side of this trip.

The *R/V Robert G. Brownlee*, operated by the Marine Science Institute, is a vessel specifically designed for outdoor education. Most of the people they educate are kids. I had participated in a MSI program earlier this year at the age of eighteen, through my high school's environmental science class. While on the boat, my class learned how to trawl for organisms living in the bay water and scoop for organisms hidden along the bay's floor. This time, however, I helped pull ropes and yell 'heave ho' alongside full-grown adults, not dumpy teenagers. The sight was endearing.

To bring up the otter trawl net, we had to gather in a single file line and pull heavy ropes around and around in a circle. I was amazed at the variety of species we brought up to the deck. There were many silver fish (anchovies), a plainfin midshipman, baby crabs, a baby leopard shark and even a bat ray, as well as the small Shiner surf perch (*Cymatogaster aggregata*) nonchalantly giving birth to her little red baby. Forget the bat ray, the surf perch stole the show, with every person aboard stopping mid conversation to check her progress. I kept thinking more of the red baby would pop out, but the MSI instructor informed me that surf perch actually take a few days to give birth. "Ouch" is all I can say.

For Sepi Richardson, the former mayor of Brisbane and a current city

council member, this trip on the Bay was deeply moving. "As policymakers, we respond to the people in front of us, who ask questions. But on this trip I became aware of creatures in the water that have voices I'm not hearing, because they are not in front of me," said Richardson. "Now, when I'm thinking about the Bay, when I'm reading a chart, when I'm considering flows, I have a picture."

She's right. The MSI program is built around kinetic learning and exploration, a perfect excuse to get out of the cubicle on a Monday morning. It seems to me that much of policy making involves reams of paper and countless office hours. This trip provided the exact opposite experience.

When asked about the general level of awareness of bay issues among elected officials, Clayton Councilmember and ABAG Vice President Julie Pierce replied: "It's hard to remember how complex and fragile the ecosystem is until you see hundreds of different little fish come up in the net. Elected officials need to be reminded there's a whole ecosystem here that needs to be preserved, or we lose that delicate balance that makes it so special." I agree. Raised by two environmentally-driven health food freak parents, I learned at a very young age that an estuary is the meeting of a river with the ocean, resulting in brackish water wetland habitats easily disturbed by man's ever encroaching reach. Talk about fragile.

When you are out on the bay surrounded by soft rolling whitecaps, rather than looking out at them from the shore, your own insignificance comes to mind. "Undisturbed" also comes to my mind, although ironically the bay is a micro-managed waterway with ports and marinas and pollution.

John Reed, the Vice Mayor of Fairfax, shared an earlier experience at the Bay Model in Sausalito, which was originally built to test changes to the estuary like the building of a peripheral canal: "[The guide] talked about testing the salinity wedge as it moved up to a proposed canal. What they found, as soon as they started extracting any water from the model system, was that this was not a solution that was viable. [And now a similar diversion] is back on California's agenda." Reed alluded to the reality that our bay could change drastically in the coming years with the extraction of more water from the Sacramento River, via two new tunnels under the Delta, water that could have flowed to the Bay.

On a more positive note, John Gioia of the Contra Costa Board of Supervisors and the ABAG Executive Board, reflected on his boat trip experience by stating: "I do think that being out, seeing, and touching helps put the larger policies in perspective. That's why this is really useful."

As we headed back to the Berkeley Marina, I said goodbye to the surf perch giving birth, wishing her baby a safe arrival into the place we both call home. **TO**

Tira Okamoto is an SFEP intern heading to UCLA as a freshman this fall. To see a video of a live surf perch birth go to: www.youtube.com/watch?v=pPwMf6t8YnQ

A Mouthful of Resilience

Coyote Creek is a modest waterway, originating at 700 feet in the Marin Headlands and sprinting 2.5 miles to the Bay. Yet the mouth of the creek, where it drains into Bothin Marsh, is among the Bay Area's biological hotspots. There, fresh and salt water mix to produce a fertile aquatic nursery and habitat for hundreds of native and migratory species.

More than eighty creeks feed directly into the San Francisco Estuary, not including the Delta. Coyote Creek and Bothin Marsh are among the healthiest, but all play a valuable role in the larger ecosystem by invigorating the Bay with sediment and fresh water. In recent years, another important function has emerged. "A good creek mouth, a good, healthy wetland, will be the first barrier against sea-level rise," explains Adrien Baudrimont with the San Francisco Estuary Partnership.

French expat and urban planner Baudrimont, who formerly interned with the S.F. Bay Conservation and Development Commission, may soon know more about the Bay's creek mouths than just about anyone else. Six weeks ago, he assumed the considerable task of cataloging all existing information about them — including details like substrate quality, vegetation condition, nearest upstream barrier, and site history — in order to help prioritize restoration projects.

Most creek mouths enjoy numerous stakeholders and interested parties, and Baudrimont's aim is to organize data from each in a central place that's easily accessible to cities, agencies, and members of the public. He's also on the lookout for restoration triggers like endangered species or upstream steelhead spawning habitat. The assessment is part of the Estuary Partnership's larger watershed program and could take up to a year to complete.

Among the many groups contributing to Baudrimont's inventory is the San Francisco Estuary Institute, which is leading several studies of the bay's resilience to sea-level rise. "This could be a really great database for all of these other projects," says environmental scientist Julie Beagle. "It's a neat start to something that I think can be very useful." **NS**

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Photo: Julia Stalker

Mouth of Coyote Creek, Marin County

Citizen Science

On a rocky outcrop overlooking the Pacific Ocean, a small group of volunteers is gathering plants. Jewelflower, mariposa lily, *brodiaea* and many more are carefully identified, photographed, and placed in plant presses. Elsewhere on Marin's Mt. Tamalpais, similar groups are doing the same thing.

This is a "bioblitz" that was organized in partnership by the Marin Municipal Water District, which manages a number of reservoirs in the Mt. Tamalpais watershed, and the California Academy of Sciences in June. On a single day, over 30 volunteers gathered with the goal of collecting as many species as possible. This trove of specimens is ultimately destined for the Cal Academy herbarium in San Francisco.

Photo: Jacoba Charles

"The idea of creating a 'snapshot in time' to document everything that you've got is a big push throughout the world right now — I think in recognition of the rapid pace of change and species loss," says Janet Klein, the water district's natural resources program manager. "We're creating something tangible that somebody can go back and look at 100 years in the future."

In an era of reduced budgets, June's bioblitz is an example of a growing "citizen science" movement in which government agencies, land managers and others enlist everyday volunteers and educated amateurs to collect substantial scientific information.

Mt. Tamalpais is a valuable place to gather data, says Klein. Though it comprises less than 0.01 percent of the landmass of California, it is home to 15 percent of the state's species, making it very rich in terms of biodiversity. The 2500-foot mountain is also topographically diverse, with shaded canyons and exposed ridges. In theory, this could let the mountain act as a refuge for plants and animals threatened by climate change.

"Even as the climate changes on the large scale, all these teeny tiny little microclimates should mean that there's less chance for species to actually go extinct here," says Klein. **JC**

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STATUS REPORT

Frontline Invaders

Where are they now? Over the years, many invasive aquatic species have had their moments in the spotlight. Some have been successfully eradicated; some faded out with no human intervention; some are still going strong.

INVASIVE CRITTERS

Chinese mitten crab *(Eriocheir sinensis).* This bait-stealing, levee-burrowing, pump-clogging crab was first detected in the San Francisco estuary in the 1990s. California Department of Fish and Game biologist Kathy Hieb says the population peaked in 1998 and has been declining since 2001. "They're not really on anyone's radar now," she adds. The crab was never the target of an eradication program; Hieb hypothesizes that low freshwater flows had a negative effect on recruitment.

Overbite clam *(Corbula amurensis).* Populations of this Asian clam, present since at least 1986, have fluctuated with flow conditions. "They backed off a bit in 2011 because of increased freshwater flows," says US Geological Survey scientist Jan Thompson. "But they're back." She says they disappeared in San Pablo Bay in 2008/2009, then "came back gangbusters." In the South Bay, there's evidence that increased numbers of juvenile bottom-feeding fish, crabs, and shrimp keep the clams down in good offshore upwelling years. What about eradication? "It's not seriously contemplated. They have millions and millions of babies per individual."

Pacific oyster *(Crassostrea gigas).* This alien mollusk, native to East Asia, had been cultivated in Tomales Bay and elsewhere for years but only showed up in the South Bay in 2005. Mare Island has another population. "If it becomes abundant, it could massively change the ecology of the Bay," says Andrew Cohen

continued to next page

REGULATION

Taking the Measure of Ship's Ballast

The devil is in the details, everyone says, as California debates new regulations and new technologies for stanching the flood of invaders arriving here in the ballast water of ships. The debates revolve around two questions. First, which ballast water quality standard — the local one, the federal one, or the international one — is both the most protective and most feasible for California to embrace? And second, which is more viable, treating ballast water on ships or on shore? Whatever the details bedeviling the scientists, administrators and shippers involved, California has to get its act together soon.

For anyone not familiar with the basics, the water that ships pump into their ballast tanks in one port and discharge in another is a major vector for invasive aquatic organisms.

San Francisco Bay has already been dubbed the world's most-invaded estuary, and no one wants to see more exotic species moving in and disrupting local ecosystems in unpredictable ways. Killing the exotics before they're discharged in California's coastal waters is the best bet.

At this time, most of the rest of the world has gone to shipboard treatment, according to S.F. Estuary Partnership environmental planner Karen McDowell. But shipboard treatment technology, in terms of what California has in mind, is still far from perfect. One system has a water-spinning chamber to eliminate larger organisms and ultraviolet (UV) irradiation for the smaller ones; another combines mechanical filtration with UV treatment. Still others zap ballast water with ozone or chlorine dioxide, remove the oxygen from it, or use ultrasound, electro-ionization, or heat to kill microscopic hitchhikers. On the whole, treatment devices can be bulky and expensive. Shippers are reluctant to invest in systems that might not meet future performance standards.

As for the shore-based option, existing drinking water and wastewater treatment plants use many of the same technologies and tools needed to treat ballast water. Some combination of small new facilities, and new connection hoses and pipes from ship to shore, and existing treatment systems might be worked out. Planners are also looking at mobile treatment barges as another tool in the state's box.

In terms of the regulatory standards any treatment option, ship or shore, will be required to meet, there's a variety on the table. Standards address a range of size classes and taxonomic categories of aquatic organisms (see chart.) The international, federal Coast Guard, and California standards differ in which organisms are covered, and in what numbers or concentrations of organisms in treated ballast water, if any, are considered acceptable for discharge.

Since 2004, the United Nations' International Maritime Organization has been pushing a model standard as part of a convention not ratified by the US and not yet in force. Despite these ambiguities in international negotiations, the US Coast Guard has embraced this model, implementing the IMO standard earlier this year. The US Environmental Protection Agency, currently revising the Vessel General Permit required under the Clean Water Act, may either follow the Coast Guard or choose a different standard. Finally, California and a few other states have enacted standards that are more stringent than the IMO version. California's were developed by the State Lands Commission and incorporated in SB 497, which amended the Marine Invasive Species Act in 2006.

"At the time there was a recognition that there was no technology available to actually meet the California standards," says John Berge of the Pacific Merchant Shipping Association. "They were aspirational in nature." (An SLC report called them "technology-forcing.") "We believe existing technology can't meet the state standard," he adds.

Lisa Swanson of Matson Navigation agrees. "We're hoping California aligns with the Coast Guard standard. If you read the EPA's Scientific Advisory Board report, there seems to be a big concern that you can't actually measure the levels they're talking about in California." In terms of the federal Clean Water Act, setting a target of "below detection" is nothing new, however.

On the California front, the State Lands Commission (SLC) reported last year that ten shipboard systems had demonstrated the potential in at least one test to meet the state's standards. Five, all commercially available, were found to have the potential to meet California standards more than 50 percent of the time over multiple tests; each used a different mix of treatment methods. A Chinese system combining filtration, electrolysis, and ultrasound had a perfect score in shipboard testing. A new technology assessment will be released this fall. "The number of systems out there and the quality of the data have continued to increase," says Chris Scianni of the SLC's Marine Invasive Species Program, which is moving ahead with assessment protocols for shipboard treatment.

Despite the "groupthink" around shipboard systems that seems to be gaining hearts and minds in the industry and California government, assessments done on the federal side have been more equivocal. The EPA's science advisory board review concluded that while evolving shipboard technologies could meet the basic IMO standards,

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IMO & CA STANDARDS COMPARISON

Organism Class Size	IMO Standard	CA Standard	IMO:CA Ratio
> 50µm	<10/m³	no detectable living organisms	not comparable
10-50µm	<10/ml	<0.01/ml	1000
bacteria	–	<1000/100ml	not comparable
viruses	–	<10,000/100ml	not comparable
E. coli	<250 cfu/100ml	<126cfu/100ml	2
intestinal enterococci	<100cfu/100ml	<33cfu/100ml	3
toxicogenic Vibrio choleroe	<1cfu/100ml	<1cfu/100ml	1

Standards address several classes of aquatic organisms: zooplankton (over 50 microns in width), phytoplankton (10-50 microns in width), and for some standards, bacteria and viruses. Standards also zero in on three specific kinds of bacteria that are human pathogens or indicators of fecal contamination. Measurements: µm refers to micrometer (1 millionth of a meter); cfu refers to colony forming units.

continued from page 6

of the Center for Research on Aquatic Bioinvasions, referring to the oyster's potential impacts on habitat structure and phytoplankton supply. "Eradication work in the South Bay was highly successful, but we need to keep an eye on the need for more work in the future," he says.

European periwinkle *(Littorina littorea).* The periwinkle has had a serious impact on East Coast ecosystems, which did not deter unknown parties from intentionally releasing it in the Bay. The exotic snails are now collected and sold in local Asian markets. "The potential risk from both this periwinkle and the Pacific oyster is so large that you shouldn't have to rely on happenstance funding to eradicate them," says Andrew Cohen. "We did what we could, but stopped before completely cleaning up the biggest population."

East European zebra mussel *(Dreissena polymorpha).* Zebra and quagga mussels *(D. bugensis)* have been found only in freshwater streams (the Colorado River system) and reservoirs. Both are checked by their limited tolerance for salinity and their need for calcium for early development and reproduction. The Delta has very variable calcium levels because it's influenced by numerous different rivers and ocean tides. "The Delta doesn't have the biggest risk of invasion in the state, but the risk is hard to quantify, and impacts on the water diversion system could be large," says Andrew Cohen. After arriving in the Great Lakes region, the tzebra mussel quickly spread to 20 states, clogging water pipelines, intakes, and cooling systems. The US Fish and Wildlife Service has a Bay Delta Rapid Response Plan for the mussels. Since the mollusks can survive out of water for a short time, state and federal agencies are most concerned about mussels hitching rise on boats being transported from infested sites to the Bay. Cohen has a third bivalve on his radar, the Asian golden mussel *(Limnoperna fortunei).* With a broader range of ecological tolerances than the two *Dreissenas*, it could be big trouble if it reached California waters. JE

INVASIVE PLANTS

Sea Lavender *(Limonium sp.).* An innocent-looking sea lavender from the Mediterranean that competes with native plants has infested tidal marshes around San Francisco Bay and in southern California, from Morro Bay to the Tijuana River estuary. The taxonomy is confusing; at least two species may be involved. Mike Perlmutter of the Bay Area Early Detection Network says the densest local population is near the San Francisco Airport. The invasive species has been mistaken for a native relative *(L. californicum)* and inadvertently planted at shoreline restoration sites. With funding from the San Francisco Bay Joint Venture, BAEDN has enlisted volunteer groups—Marin Audubon, California Native Plant Society chapters, Friends of Five Creeks—in hand-removal efforts at 14 sites, beginning last year: "There have been some reductions, but it comes back," he says.

Caulerpa taxifolia This invasive, smothering alga is a rare California success story. Introduced through the aquarium trade, it was spotted at two coastal locations in Orange County and San Diego County in 2000. Quick action by the Southern California *Caulerpa* Action Team got rid of it; surveillance continues, and importation and sale of the species has been banned.

Wakame *(Undaria pinnatifida).* A newer arrival, this algal alien is used in Japanese cuisine. *Undaria* fouls boat hulls, docks, and aquaculture operations, and has displaced native kelp and altered ecosystems in the wild. Smithsonian Environmental Research Center and UC Davis marine ecologist Chela Zabin has been keeping tabs on it in San Francisco Bay and Half Moon Bay, where it was first found in 2009. Budget constraints have limited removal efforts. Small recreational craft are a major vector. "There have been no new occurrences inside the Bay, but we haven't been able to resurvey," says Zabin. One of its two alternate life stages can stay dormant on the Bay floor for up to two years. In anticipation of its spread to Tomales Bay and elsewhere, a website with reporting tools has been set up (undaria.nisbase.org.) The bottom line, according to Zabin: "Eradication is doable if we decide it's important enough."

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RESEARCH ROUND UP

SALMON SLOWED BY COPPER:
Copper from brake pads and linings, pesticides, building materials, and other sources can make juvenile salmon more vulnerable to predators, according to a Washington State University study. Small traces of copper were known to affect the sense of smell in salmon. Post-doc Jenifer McIntyre found that juvenile coho salmon exposed to copper ignored the chemical signal produced when a fish is physically attacked. The test subjects failed to take evasive action against predatory cutthroat trout in the same tank; 30 percent of the salmon were captured on a trout's first strike. McIntyre's findings prompted action by the Washington State legislature to phase out the use of copper in brakes.
MORE: wsutoday.wsu.edu/pages/Publications.asp?Action=Detail&PublicationID=32116&PageID=21

DROUGHTS NOTHING NEW:
New evidence for recurring droughts in the Sierra comes from a high-tech research project at Fallen Leaf Lake, south of Lake Tahoe. A team from the University of Nevada, Reno and Scripps Institution of Oceanography used side-scan sonar, remotely operated vehicles, and a manned submersible to examine drowned trees and ancient shorelines. Their data suggests severe droughts every 650 to 1150 years during the mid- and late Holocene, the most recent 750 years ago. Some lasted more than 200 years.
MORE: newsroom.unr.edu/2012/05/24/university-of-nevada-reno-scientists-confirm-sierra-nevada-medieval-megadroughts

SONGBIRD VISITORS:
In Central Valley floodplain forests, winter brings a new set of songbirds that breed to the north. Previous fieldwork had shown that restoration improves the survival odds for locally nesting songbirds; a new study by PRBO Conservation Science and the National Aviary extends that finding to winter visitors. Although most species occurred in equal numbers in older forests and restored forests, white-crowned and Lincoln's sparrows were more abundant in restored forests. JE
MORE: www.prbo.org/cms/664

Regulation, continued from page 7

they'd fall short of meeting California standards. Certainly shore-based systems have fewer physical restrictions. The board found them potentially "more reliable and readily adaptable than shipboard systems." Even some optimized version of what's called "conventional" water treatment — the gravity filtration followed by chlorine or UV processes that most water treatment plants already employ — would outperform shipboard options, the Board found. At a Ballast Water Briefing sponsored by the Bay Planning Coalition in June, one of the scientists on the panel, Andrew Cohen, cited economic studies done in Europe and Australia showing onshore treatment could be as cheap or cheaper than shipboard, and contended that regulation would be a much easier task on land.

The East Bay Municipal Utility District, which could theoretically end up treating ballast water for the Port of Oakland, isn't actively investigating the option, according to the agency's Jonathan Bauer. "The potential volume of ballast water would not have a significant impact on our wastewater treatment capacity" he says. "But it's an open question whether our treatment process would meet the numerical limits imposed by either the Coast Guard or the state."

Others, including shipping industry representatives, are dubious. Berge acknowledges that "in an ideal world" shore-based treatment could be more protective, but would require new infrastructure. Such investments might be problematic for financially struggling ports like Sacramento and Stockton, he says. Even larger, richer ports like Oakland are already having difficulty paying for retrofits required by new air emissions standards.

Even if existing shoreline treatment facilities could be used or adapted, many vessels would have to be retrofitted to be able to pump ballast water onshore and the salinity of ocean waters pumped into fresh water based systems could become an issue. It's possible shore-based treatment could be appropriate for vessels with fixed runs, such as oil tankers and cruise liners, says SFEP's McDowell, but California ports see a significant number of vessels that are not regular traffic. She thinks the best protection for California's aquatic ecosystem may come from a whole toolbox of treatment systems: ship, shore and mobile, tailored to different ships and shipping patterns.

David Kim, a long-serving field supervisor for oyster and Littorina *removal projects, searches shores near Dumbarton Bridge as part of an eradication effort funded by SFEP.*

State deadlines seem poised to demand tighter ships before federal EPA wrangling over where the Clean Water Act will come down on standards and best available technologies reaches closure. "There are compliance deadlines in laws implemented by the Coast Guard and SLC for ballast water treatment," California Water Resources Control Board member Steve Moore points out. "Without readily available onshore infrastructure, including dedicated alignments for piping and pumps, there is a practical constraint to implementing anything but shipboard treatment to meet those hard deadlines."

McDowell has a more global view. "There's no one size fits all when it comes to visiting international ports. If you have shipboard treatment you can treat anywhere or anytime." JE & ARO

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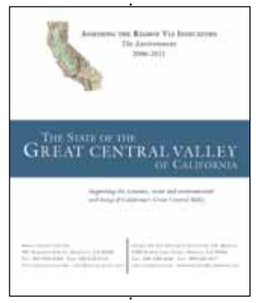
R E P O R T S

Great Valley Redux

It's hard to find anything good about the housing bust. But in California's Central Valley, where population is expected to double over the next four decades, people are seizing the chance to gain long-term benefits from a lull in the frenetic pace of growth.



A report released in July by The Great Valley Center in Sacramento, in cooperation with University of California in Merced, contained many hopeful signs, including improvements in the region's notoriously bad air quality and rebounding populations of imperiled birds and animals. Among the most significant news was the cooperation among former foes in efforts to plan for sustainable growth once the housing market revives.

What hasn't changed — yet — is the profound imbalance between supply and demand when it comes to water, the historic linchpin of Central Valley development. Climate change is already affecting water supplies, and as housing starts creep upwards, the Central Valley's ever-changing water equation will change yet again.

"Very slowly, the environment of the Central Valley is getting better, but the stewardship that takes place over the next decades will be crucial," says David Hosley, Executive Director of the Sierra Nevada Research Institute at UC-Merced and editor of the report, *The State of the Great Central Valley of California: Assessing the Region Via Indicators — the Environment 2006-2011.*

Despite record levels of some pollutants that made headlines last winter, carbon monoxide and ozone emissions have dropped, as well as particulate matter and toxic air contaminants. That's striking for the Central Valley, which has some of the worst air pollution in the U.S.

Although auto emissions are often blamed for Central Valley air pollution, agriculture is also a major contributor. But innovative programs are having a discernible impact. Crops are now being tilled in ways that reduce dust. Even more dramatically, a voluntary program included in the 2008 Farm Bill helps farmers replace old, polluting tractors. When all the contracts are in place, the reduction will be the equivalent of taking 500,000 cars off California highways.

Not all the news is good. Toxic air contaminants, including diesel emissions from trucks and formaldehyde from smog and household cleaning products have risen since 2005. Diesel pollution has been linked to the valley's high asthma rates: 12 out of 100 children in the Central Valley have asthma.

Water, the toughest issue of all, also remains unsolved. The Central

continued to back page

DREDGE SCOOP

Clarifying State Protocols for Wetlands

Anyone wanting to dredge and fill a wetland in California will soon be subject to a new, but familiar, set of hoops to jump through. Regulators are putting the finishing touches on a new policy that they say will improve wetland protection and create more consistency in how the regional water boards weigh in on dredge and fill projects. Until now, in the absence of statewide guidance, the regions have each been doing things their own way — driving some of those undertaking regular maintenance projects around the state nuts.

Most of these dredge and fill projects involve activities like shoring up levees, stabilizing streambanks, replacing culverts, building docks, changing out telephone poles, or cleaning out flood channels. To undertake such projects, Californians must apply for a US Army Corps "404" permit that includes a state water board 401 certification permit. In the mid 2000s, however, Supreme Court challenges to federal jurisdiction over certain waters — especially those not draining into the nation's navigable waterways — worried California legislators. So they asked the State Water Resources Control Board to firm up California's own protections without stepping on federal toes or creating unnecessary complications for permittees.

"At the practitioner level, the wetlands process is not going to be any different than what's going on now," says Bill Orme of the State Board. The policy includes a wetland definition similar to the one used by the Army Corps, and requires the same procedures for identifying wetlands in the field. In addition, the policy mirrors the 404's established permitting procedures. According to Orme, "the greatest hurdle" for applicants is still showing that you considered all avoidance and minimization measures such as other alternative locations before disturbing your particular wetland or riparian

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SCIENCE

Not So Hardheaded about Heat

Like most minnows, the hardhead (*Mylopharodon conocephalus*) doesn't get a lot of respect—even though it's a big minnow. No, that's not an oxymoron. A mature hardhead can reach a length of two feet, historically three. "It's interesting with non-salmonids, tricky to get funding," says Lisa Thompson of UC Davis. Fortunately, she was able to get a grant from the California Energy Commission to study this California endemic, a Species of Special Concern. Thompson and colleagues Nann Fangue and Joseph Cech, Jr. are just wrapping up a three-year project in which they tested wild-caught hardheads at the Center for Aquatic Biology and Aquaculture's Conservation Physiology Lab to determine water temperature preferences and tolerances.

The project was prompted by concerns about how hardheads are coping with warm water temperatures in reservoirs, a preview of stream temperatures with global climate change. In some California streams, the future has arrived. "I've seen streams already over 92°F when entering the mainstem Sacramento," Thompson recalls.

Hardhead occur in reservoirs on several Sacramento River tributaries—the Pit, the Feather, and the South Fork of the American — where they are subject to temperature extremes and fluctuations different from those in undammed streams. Researchers hope their work will provide a comprehensive understanding of hardhead thermal physiology and behavior so that those managing reservoirs and flows can better balance the needs of people and fish.

Results of the temperature tolerance experiments suggest that hardheads can handle water ranging from 46° to 82°F. Findings from the experiments, conducted by Felipe La Luz and Dennis Cocherell of the UC Davis research team, also suggest hardhead may even be able to tolerate more extreme temperatures for short periods, or if given time to acclimate. "We haven't been looking at how long they can tolerate peak temperatures," Thompson explains.

The temperature preference experiments use an annular chamber, a donut-shaped tank fed by cool and warm water, to let the fish tell the scientists where they want to be. They favor a range between 64° and 68°F. "They never stay long in the really hot sections. They're avoiding the peaks," says Thompson. It's possible that hardheads move between warmer and cooler water in the wild. "Some fish digest food better if they're slightly cooler. They may be willing to feed in an uncomfortably hot area, then retreat to a cooler area to rest and digest," she says.

In general, researchers are finding pronounced differences in hardhead behavior depending on temperature. "They go from sluggish to perky," says Thompson. One discovery was unexpected, however. Researchers noted that juvenile hardheads held at very low temperatures wouldn't swim in the test chamber. "Their swimming ability is quite compromised if it's cold. If reservoir operators are pulsing cold water through in summer when the water is normally warm, the juveniles may not be able to swim as well and may be more vulnerable to predators," says Thompson. These fish appear to need a Goldilocks thermal zone: not too warm, not too cool. JE

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Photo: Lisa Thompson

Hardhead hang out in the parts of this donut shaped research tank at UC Davis where the water temperature agrees with them. Note, numbers on the rim do not refer to temperatures.

LIFE HISTORY

The Big Minnow

Some things about the hardhead minnow remain mysterious, despite years of scrutiny by UC Davis researchers. "We don't know where the adults go to spawn," says scientist Lisa Thompson. Many minnow species go upstream to spawn. But when Thompson's research team took a look in streams feeding reservoirs, at a time when other species were making their spawning runs, they didn't find any hardheads. "Maybe they go to the highest parts of the system where there's no dam upstream. Or they may be broadcast spawners, putting eggs out near the bottom of the reservoirs," she says.

Wherever their mysterious spawning sites, scientists do know these fish are prolific; females can produce up to 24,000 eggs per year. Once hatched, young hardhead use their needle-like teeth to prey on aquatic insects. Older individuals have blunt teeth adapted for crushing the shells of crayfish.

To gather experimental subjects, Thompson's team went fishing in the hardhead's core range, which extends from the Pit River south to the Kern, with small populations in the Napa and Russian Rivers. Trout flies didn't seem to work, but earthworms did prove an effective bait when Thompson went angling for test fish. JE

FOLLOW UP

Water Trail Ramping Up

Access for everyone really must mean everyone. That's what San Francisco Bay Area Water Trail planners have learned over the past eight months. Conceived in 2000 as a network of boat launches and landings for small, nonmotorized craft — kayaks, canoes, windsurfers, and the like — the trail was intended to improve access to bay waters for the little guy.


Photo: Julia Stalker

The original planning document specified that the sites should be accessible to people with disabilities whenever possible. However, it didn't offer much guidance beyond that, an oversight that has surfaced only recently. When *Estuary News* reported on the trail in April 2009, discussion centered on its potential to disrupt shorebirds and waterfowl. Today, with a programmatic environmental impact report completed, the last remaining piece is programmatic compliance with the American Disabilities Act.

Planners with the California Coastal Conservancy and ABAG are now developing a comprehensive Accessibility Plan that could offer a blueprint to the nation's 400 to 500 other water trails, said project manager Ann Buell. "We feel that making the San Francisco Bay Area Water Trail program accessible to the community at large could be an incredible model for the rest of the country." While many different types of accessibility plans exist across the country, this effort marks the first time that an organization has created one for a large system of sites it does not own.

Boat launches in Oakland, Angel Island, and Palo Alto have already been conditionally designated into the network. Another five to ten "trail heads" should be set by late 2013. Ultimately, Buell said, the system may include as many as 100 waterfront sites distributed throughout the region. NS

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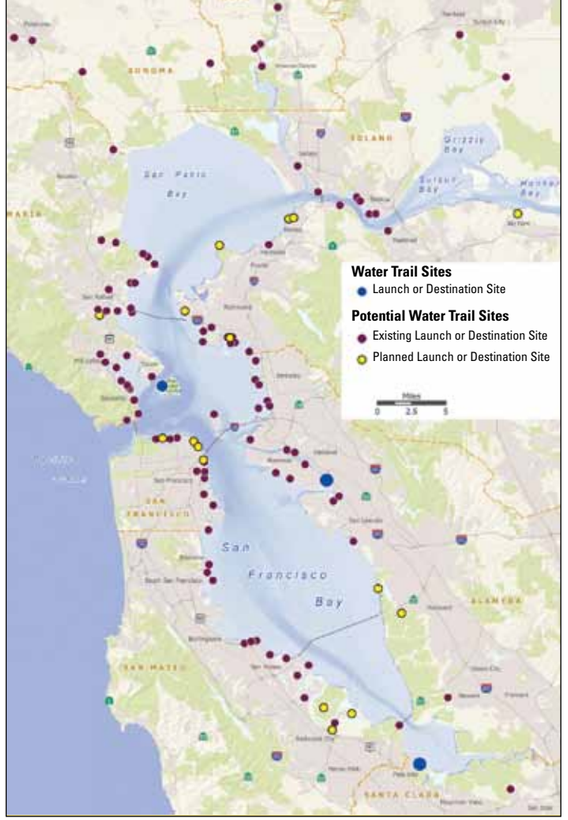
SAN FRANCISCO BAY AREA WATER TRAIL
A network of access sites for non-motorized small boats



Map: courtesy of SCC

Wetlands, continued from page 9

zone (a hoop called "LEDPA"). And like the federal process, the proposed state process has an "offramp" for projects with minimal impacts, he says.

What's different about the new state policy is that it covers wetlands special to California's drier climate, such as bare playas and mudflats (federal definitions only cover vegetated wetlands). It also covers wetlands that drain inland, not into federal navigable waters. With the help of a US EPA grant, a technical team of experts including Josh Collins of the S.F. Estuary Institute expanded definitions to encompass the drier wetland habitats based on soils and hydrology. "The science was straightforward and doable," says Collins. "The challenge is to align policy so it's based on the science."

Indeed the lion's share of Orme's work has been to carefully dovetail California's new protocols with existing Army Corps protocols for a seamless transition, to create statewide consistency, and to apply the more heavy hitting water quality mandates of the state's Porter Cologne Act. "In our policy, we have a catchall reminder that the water boards may chose to regulate these activities under other authorities of Porter Cologne," says Orme. "But nobody's going to have to get two permits."

Later this fall, the Board will release the new policy for a final round of public comments, but Orme thinks it's pretty "solid." The state has already plowed through five years of technical work, stakeholder meetings and interagency coordination. And the policy even embraces new statewide monitoring protocols for wetlands and riparian zones which have been percolating for a long time up from USEPA and SFEI, and were endorsed last year by California's Water Quality Monitoring Council. Orme says this policy is only the first of a three phase process. Once the policy is adopted, the next two phases will fill in more details on water quality objectives and riparian buffer zones. ARO

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San Francisco Bay and the Sacramento-San Joaquin River Delta comprise one of 28 "estuaries of national significance" recognized in the federal Clean Water Act. The San Francisco Estuary Partnership, a National Estuary Program, is partially funded by annual appropriations from Congress. The Partnership's mandate is to protect, restore, and enhance water quality and habitat in the Estuary. To accomplish this, the Partnership brings together resource agencies, non-profits, citizens, and scientists committed to the long-term health and preservation of this invaluable public resource. Our staff manages or oversees more than 50 projects ranging from supporting research into key water quality concerns to managing initiatives that prevent pollution, restore wetlands, or protect against the changes anticipated from climate change in our region. We have published *Estuary News* since 1993.

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REPORTS, *continued from page 9*

Valley is overdrawing its groundwater supplies at a rate of 18 percent, and climate change is diminishing the snowpack in the Sierra Nevada, which supplies two-thirds of the state's water.

Scientists and engineers are working on solutions. Renewable energy will help reduce costs for groundwater pumping, and researchers at UC-Merced are developing a monitoring system that will help water managers use both surface water and groundwater more efficiently.

But there's no denying that suburban sprawl can overwhelm even the most creative technological fixes. When that happens, there's nothing like political will — and David Hosley is hopeful that when the next boom comes along, collaborations formed during the bust will stay strong.

"We were under incredible pressure to build, build, build in the Central Valley," Hosley says. "But more recently, when there was less growth and construction, we began to see people on opposite sides of water issues try to get to know each other."

Inspired by a similar program in Utah — and funding from Caltrans — people in the Sacramento region in 2004 adopted growth guidelines that would funnel population to existing urban areas and their outskirts so farmland could be preserved. Shasta, Kern and Fresno counties soon followed.

Farmland may not be the only thing that needs to be protected from sprawl. Rivers too will need more room, especially as the ocean creeps inland with climate-changed sea levels, and Bay-Delta planners look for places to build more floodplain habitat for wildlife. As a result of recent changes in state law, the Great Valley has a reconstituted entity to answer to in that regard — the Central Valley Flood Protection Board (last known as the Reclamation Board). The Board adopted a new valley flood protection plan this June.

"Many parts of California turned their backs, literally, on their rivers when they became flood control projects," says newly appointed Board member Tim Ramirez, referring to the fenced concrete channels that run behind homes in most of Southern California, where he grew up. "Central Valley communities still have time to shape their futures and include more natural river features in their everyday built environment."

Ramirez appreciated the Great Valley report's attention to the Yolo bypass, one of the Valley's most ecologically rich flood zones. He hopes local governments will make the most of current opportunities to weave innovations in flood management into sustainable planning for urban growth, agriculture, the environment, and recreation. "Fundamentally, it's about people, and the people of the Valley are — or should be — the greatest champions for change," he says. **SZ & ARO**

REPORT http://snri.ucmerced.edu/