ESTUARY NEWS

Bay-Delta News and Views from the San Francisco Estuary Partnership | Volume 18, No. 6 | December 2009

TRASH CRACKDOWN

More than a million pounds of garbage from Bay Area streets, lots, and yards makes its way annually into storm drains and creeks and then to the Bay and ocean, where it fouls shorelines, endangers wildlife, and damages boats; some of it even winds up in a Texas-sized patch of trash floating in the Pacific Ocean. But on October 14, the S.F. Regional Water Quality Control Board adopted a precedent-setting stormwater permit that will reduce that tonnage dramatically.

Under the new Municipal Regional Permit, municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the cities of Fairfield, Suisun City, and Vallejo, will be required to cut their stormwater garbage content by 40% within four years, and eliminate it completely in 12 years. (San Francisco and Marin are covered under separate permits.) "This is the first permit of its kind in California," says David Lewis of Save the Bay, which had pressed for the new rules for several years. "These mandates are aggressive and achievable; the key is compliance and enforcement."

The first steps for cities will be to determine how much trash they are discharging and equip stormdrains with trash capture devices (TCDs) capable of trapping debris as small as a cigarette butt. They can also deploy additional methods of garbage capture, such as street sweeping, and source reduction strategies such as plastic-bag bans. In addition, each city must identify trash "hot spots," places where garbage accumulates in waterways, and take steps to clean them up.

Installing the required TCDs alone is expected to cost the 70-plus cities covered by the permit between $25 million and $26 million, according to the Regional Board's Dale Bowyer. The Estuary Partner-

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SPILL FUELS BOOM QUESTIONS

It's cheap, it's dirty, and it soiled close to 100 water and shorebirds in the October 30 *Dubai Star* spill in San Francisco Bay. "It" is bunker fuel, and it has some environmental organizations calling for a ban on its use, or at the very least, for better protective measures—like surrounding ships with boom before fuel transfers take place.

Birds oiled by the *Dubai Star* arrived at WildCare in these boxes. Photo by Melanie Piazza.

"Why have a reg on the books if you're never going to use it?"—Jackie Dragon, Pacific Environment

"Pre-booming should be required in San Francisco Bay. Right now, ships can choose another option, one that seems to have resulted in oiled beaches and dead birds in this case," says Friends of the Earth's Marcie Keever. Ships in the Bay are encouraged to either pre-boom when fueling OR respond with 600 feet of boom within 30 minutes of a spill and an additional 600 feet in one hour, according to Pacific Environment's Jackie Dragon. Yet pre-booming is never done in the Bay, she says. "It's optional. Why have a reg on the books if you're never going to use it? As a result, we do not have skilled personnel at the ready deploying boom."

The *Dubai Star* did not pre-boom, nor does it appear to have responded within 30 minutes, based on the amount of oil that washed ashore at Crown Beach and other sections of the East Bay shoreline—and as evidenced by the oiled wildlife. The spill occurred at 6:48 a.m. while the *Dubai Star* was refueling at Anchorage 9 two miles south of the Bay Bridge, but the first boom was not deployed until 1:00 p.m., over six hours later, according to the Coast Guard's Lt. Simone Mauz.

Says Carol Singleton of the California Office of Oil Spill Prevention and Response (OSPR), "I've heard environmental groups say that it took too long to boom. But maybe booming wasn't going to work. The response contractor had skimmers out there. We have to look at the big picture–the weather, the safety of the workers, whether they had appropriate emergency measures in place, and whether they performed. Of course we don't want to see oil washing up on the shore. We're going to look at all of that, and we monitor the performance of the response contractors."

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ship has received a $5 million trash capture federal stimulus grant, which it will distribute to cities to help defray the cost.

Geoff Brosseau of the Bay Area Stormwater Management Agencies Association—which has long used trash as a "poster pollutant" in its public outreach programs—says that although he is generally supportive of the new permit provisions, he is not sure how cities are going to come up with the funds to make up the difference. "This is coming at a bad time," he says, noting that the permit also includes new restrictions on mercury and PCBs, as well as new development requirements. "Cities have less money now, and the public has not shown much interest in paying for new stormwater programs through additional taxes," he says. "In the end it all goes back to public education; trash is a good way to help people understand stormwater protection."

CONTACT: Dale Bowyer, dbowyer@waterboards.ca.gov CHT

The initial response contractors in the Dubai spill were the O'Brien Group (the same company called in after the *Cosco Busan* spill), Marine Spill Response Company, and NRC Environmental Services. The exact volume of the spill was still undetermined weeks later, with estimates ranging from 400 to 800 gallons; according to an OSPR press release, over 5,825 gallons of "an oily-water mixture" were recovered.

> "This is a ship getting gas; it happens every day, every hour in the Bay."—Marcie Keever, Friends of the Earth

In the *Dubai Star* spill, the bunker oil clearly got away from the ship, with photos and real-time on-line videos showing a mile-wide sheen traveling south. Although exactly what went wrong is still under investigation by the Coast Guard, OSPR, and others, the ship itself tells a story. "In the photos I saw, oil was dribbling down the side of the vessel," says Washington Department of Ecology's Dave Byers, who heads up spill response for his state. "That points to a transfer error, a mechanical or procedural error, probably no one knows yet. From the deck of the ship, the oil fills up to a certain height and dribbles over the side into the water." Keever likens it to filling your car's tank at the gas station. "This is a ship getting gas; it happens every day, every hour in the Bay. These are the times when you have to put protective measures in place because spills are going to happen when ships fuel–think about fueling your own vehicle and the potential for spilling some gas on the ground."

OSPR later said that the ship was carrying enough boom but did not deploy it in time because workers did not see the spill happening.

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The *Dubai Star*, refueling. Photo courtesy of OSPR.

Our Actions: Our Estuary

9th Biennial State of the San Francisco Estuary Conference, 2009

THE HEAT IS ON

"In the 1970s, environmental problems could be touched, seen, and smelled. Now the challenges are different."
—Lisa Jackson, U.S. EPA

Lisa Jackson, the new head of the U.S. Environmental Protection Agency, kicked off the first day of the 9th biennial State of the Estuary conference on September 29, addressing over 500 resource managers, environmentalists, scientists, planners, consultants, and others. Said Jackson, "In eight months, the EPA has accomplished more than in the previous eight years. A lot of that follows the leads of states like California. In the 1970s, environmental problems could be touched, seen, and smelled. Now the challenges are different." Strategies for adaptation to climate change, including a Climate Ready Estuary Program, are on the table. "Please stay tuned," Jackson concluded. "We're looking to strengthen our work on the Bay-Delta. Look for evidence of that very soon."

For the remainder of Day One, scientists and policy-makers explored the many-faceted challenge of climate change—not just sea-level rise, but interactions among climate-driven processes in the Pacific Ocean, the San Francisco Estuary, and the entire watershed. From seabird nesting failures on the Farallons to fluctuating Dungeness crab numbers in the Bay to the crash of Sacramento River fall-run Chinook, some presenters sketched the links in a complex ecological web being further complicated by climate change. Others described how ongoing wetlands restoration projects are incorporating the realities of climate change.

A member of the Intergovernmental Panel on Climate Change and author of *Science as a Contact Sport*, Stanford University's Stephen Schneider posed the question of whether the science on global warming is settled enough for policy. Every science is made up of well-established components, competing explanations, and speculative components, Schneider said. "No complex science is ever settled. There are legitimate and considerable uncertainties. The issue is not consensus over our conclusions but over how much confidence we have in the conclusions." That confidence can range from the unequivocal fact that global climate change is happening to lesser degrees of certainty over smaller-scale effects, like the frequency and intensity of forest fires, said Schneider. "We're on a planet with no driver and no idea whether it has brakes," Schneider continued. "You don't know you've reached a tipping point until farther down the road."

Public perceptions of the crisis are not helped by the disinformation peddled by climate change deniers: "Too many people are getting their information from Professor Limbaugh. The job of the 'skeptics' is to optimize conditions for their clients, not to tell the truth." Education is key: "People have to not be afraid of changing the way they see the world when they have new information." If scientists present the risks, policy-makers will be better equipped to manage them. "Look for win-wins that do multiple things

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Estuary Partnership director Judy Kelly and U.S EPA Administrator Lisa Jackson at the conference. Photo by Athena Honore.

at once," Schneider recommended. "Start with shared values and work to where we disagree." He warned against embracing technological fixes as a panacea: "Geoengineering is planetary methadone, a desperate last-ditch resort with lots of side effects."

Heather Cooley of the Pacific Institute brought the climate change issue home with a graphic look at the likely impacts of projected sea level rise on the Bay Area (see "Rise Risk", page 6.)

A self-described "swamp rat" from South Carolina, Margaret Davidson of the National Oceanic and Atmospheric Administration's Coastal Services Center said she had been involved in climate change issues since 1983. Davidson focused on infrastructure issues: "Addressing where we site our publicly funded infrastructure, including publicly subsidized private development, is a critical issue. But green infrastructure—wetlands, river corridors—can be just important as hard physical infrastructure. We tend to discount the value of ecosystem services." Beyond creating new wetlands as a way to increase resiliency to climate change, she mentioned policy options like climate impact fees for developers and buyouts of damaged coastal properties. Davidson said the Obama administration "talks a lot about climate mitigation and adaptation—but it may not survive long enough for us to see a sea change." And she's dubious about the climate legislation that cleared the House of Representatives: "All the hooha about cap-and-trade is a distraction from adaptation now."

In the panel discussion that followed Davidson's talk, the Bay Conversation and Development Commission's Will Travis touched on the lessons of the Dutch experience, and their limits: "It's impossible to take a solution from one culture and apply it to another without thinking about the differences." Like the Pacific Institute's Heather Cooley, Travis said adapting to climate change may require a triage approach: "We need to balance dealing with sea level rise without pulling back from all coastal locations. Some places are too valuable to lose. Our partnership with the Dutch provides inspiration, leadership, and ideas that will mitigate the impact of climate change."

The first afternoon session covered ocean-estuary-watershed linkages affecting aquatic resources. Leading off, Jaime Jahncke of

Dungeness crab numbers in San Francisco Bay vary with ocean conditions. Photo by Dave Parker.

PRBO Conservation Science traced the connections between the nesting success of Farallon Islands seabirds—Cassin's auklets, common murres, and Brandt's cormorants—and changing oceanic conditions. Jahncke described decades-long increasing trends in ocean temperatures and upwelling intensity, and the earlier transition between winter and spring regimes. Each of the three bird species reacts in its own way to these changes. The krill-eating auklet breeds earlier in cold-water years and more productively in years of strong upwelling. In 2005-6, when winds and upwelling were weak, the auklets had their worst recorded breeding season. They've since rebounded, but this year the absence of juvenile rockfish hurt the cormorants and murres. The common factor: "Variation in ocean conditions causes rapid changes in the zooplankton community and decline in many taxa," with ripple effects through crustaceans, fish, and seabirds.

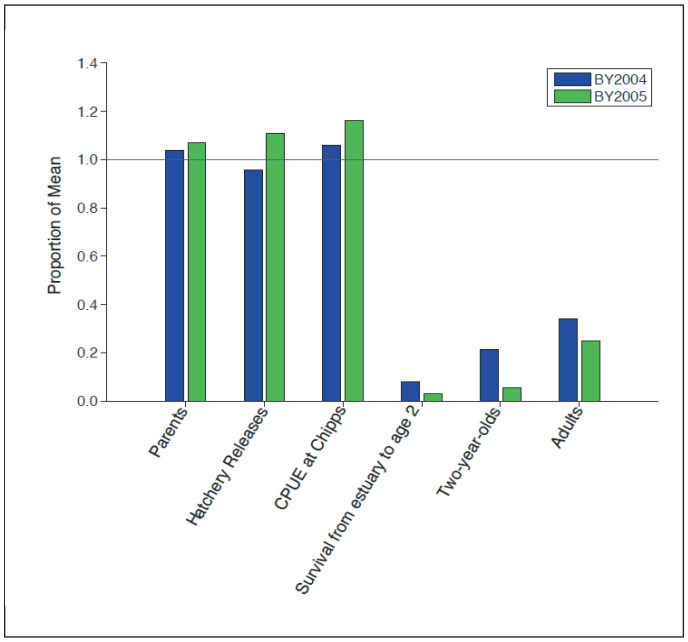
The U.S. Geological Survey's Jim Cloern followed with his analysis of the synchrony between oceanic cycles and the fish and crustacean communities of San Francisco Bay. In 1979, Cloern said, marine biologist Joel Hedgpeth had called San Francisco Bay-Delta "among the last [estuarine systems] to be critically studied by scientists." But thanks to 30 years of monitoring, the Bay system is much better understood. Data on trawl-sampled bottom-dwelling fish and crustaceans, Cloern explained, points to a "possible major restructuring of biological communities" after 1998-99. This happens to be the point at which the North Pacific Gyre Oscillation ("NPGO") flipped from a negative to positive

The future of fall run Chinook salmon like this adult male appears precarious. Photo courtesy of USGS.

state, with a stronger California current and deeper upwellings. "It's fascinating to see this strength in synchronicity," said Cloern. "Biological change in San Francisco Bay coincided with a large-scale climate shift. As the NPGO shifts from negative to positive we expect cooling of the coastal ocean." Among other species, this would benefit the cold-water-adapted Dungeness crab, whose larvae rear in the Estuary. Cooler water spurs phytoplankton productivity and larger numbers of prey species like krill and copepods. "We need to look at the consequences of global warming for the intensity and periodicity of multidecadal oscillations related to the way atmospheric pressure is distributed across the Pacific," he concluded.

NOAA's Steve Lindley made the case for an oceanic connection with the precipitous decline of the Sacramento River fall Chinook run. He said he had analyzed over 80 possible candidates for the cause of the collapse, tracing through salmon life stages and looking for "failures in the survival process and things

Fate of 2004-2005 Fall Run Chinook Hatchlings



NOAA

This plot shows various indices of abundance and survival scaled to their average values over the period of record. The numbers of parents, hatchery releases, and the catch of juvenile salmon were very near normal levels. An estimate of survival from release in the bay to recruitment in fisheries at age 2 was very low, as was the abundance of older life stages. This strongly suggests that something happened to these cohorts sometime between entering the bay and age 2. Freshwater causes are unlikely, because hatchery fish released to the bay are not affected by that environment, and counts at Chipps were high.

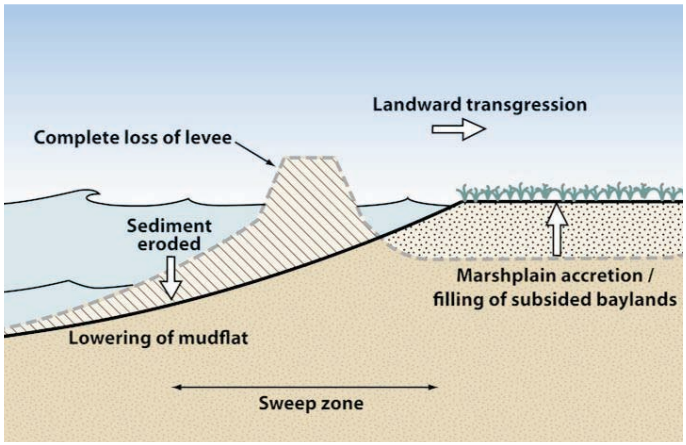
going on in the environment. This time I think we found the smoking gun." The weak upwelling of 2005 and warm surface temperatures, Lindley said, may have deprived juvenile salmon of their customary prey. "We concluded with great confidence that the proximal cause [of the decline] was poor feeding conditions in the ocean," he said—part of a pattern of "decadal-scale variability that seems to be increasing in amplitude." He discounted watershed influences like record-high pumping levels. In hindsight, said Lindley, the high proportion of hatchery stock may have reduced the overall fitness of fall-run Chinook. He was pessimistic about the future: "They're trying to get more hatchery fish out there for the fishery, but it's the wrong thing to be doing, going further down the path to extinction."

Another USGS scientist, Larry Brown, provided an update on pelagic organism decline (POD) studies that have been attempting to solve the riddle of drastic decreases in Delta smelt, striped bass, and other estuarine fish. "Things are not getting any better," he said, with the smelt at its lowest levels and the bass still low. Brown discussed new modeling results that identify a big change for the POD species in 2002 without implicating a causal variable: "It's not just one thing; it's many things going on at the same time." Some research directions (ammonia and ammonium) have been productive; others (predation by largemouth bass) less so. Like Bill Bennett (see "Delta Dilemmas," page 8), Brown raised the possibility of a regime change in the Delta, which would immensely complicate any attempt at restoration.

"Do we become more interventionist to save marshes like Richardson Bay by putting mud on the mudflat?"
—Steve Crooks, PWA

The final set of presentations shifted the spotlight to the fate of Bay-Delta wetlands in an era of climate change. Michelle Orr and Steve Crooks of Phillip Williams & Associates looked at the role of sediment management in helping wetlands adapt to rising tides. "We have a window of opportunity to increase wetland resiliency," said Orr. "If there's enough sediment, even at high sea level the marshes can keep pace with sea level rise." The catch: the sediment supply is diminishing as the Gold Rush pulse makes its way out of the system. Crooks looked at three Bay subregions—Richardson Bay, San Pablo Bay, and Petaluma—that differ in wave energy and sediment supply. Petaluma, he said, will be more resilient than sediment-starved Richardson Bay. "Do we become more interventionist to save marshes like Richardson Bay by putting mud on the mudflat?" Both said vegetated wetlands would remain sustainable in some parts of the Bay. But Crooks invoked the triage model: do we hold the line by armoring shorelines, retreat, or change land use? "It's going to get complicated to move forward," he said. "We started restoration in the easiest places."

Reconnecting Mudflat to Marsh



PWA

With levees removed, sediment builds tidal marshland.

"Plants have a really important role in maintaining wetlands in the face of climate change," said John Callaway of the University of San Francisco. "We need plants to keep the wetlands in place." Sediment-building affects the kind of plants we have, he explained, and plants affect sediment dynamics. Callaway referred to studies of sedimentation rates and vegetation establishment after Pond A21 in the South Bay Salt Pond Restoration area was breached.

The phase of marsh development matters, with the accumulation of organic material becoming more important in established marshes.

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Revegetation of Marsh, Pond A21

Vegetation takes hold at Pond A21. Left: April 2008. Right: September 2009. Kite photos by Chris Benton.

But salt marshes, unlike freshwater marshes, can't survive on organic matter alone: "Salt marshes have lower organic content and higher bulk density than freshwater marshes. As the marsh gets saltier, it will need more sediment to maintain the same elevations."

Finally, Steve Ritchie, formerly with the State Coastal Conservancy, examined wetlands in a flood-protection context.

"Habitat restoration and flood management go hand in hand," he said. "Miles of tidal marsh will be a big buffer in the South Bay against sea level rise and storm surge." Some of that marsh has developed naturally as land has subsided. Levees will play a crucial role in flood protection as restoration progresses; the South Bay project is working out the specifics with the Army Corps of Engineers. "I have two words of advice to restorationists," Ritchie concluded. "Don't dawdle!" JE

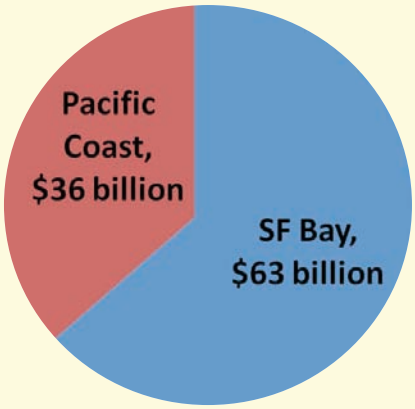
> "Miles of tidal marsh will be a big buffer in the South Bay against sea level rise and storm surge."—Steve Ritchie

RISE RISK

How will projected increases in sea level affect the Bay Area? Heather Cooley of the Pacific Institute, co-author of *The Impacts of Sea-Level Rise on the California Coast,* forecast sobering consequences, social and economic as well as environmental. Her projections were based on Scripps Institution of Oceanography research predicting sea level rise of 1.4 meters (55 inches) by 2100 with a conservative, medium-high emissions scenario. It might be worse: greenhouse gas emissions already exceed even the highest projections by the Intergovernmental Panel on Climate Change.

The human cost of flooding is an obvious concern. Cooley said 270,000 Bay Area residents would be at risk of a hundred-year flood—"not as rare an event as the name suggests," she added. "That includes large numbers of low-income people and communities of color. These populations may not have vehicles or flood insurance and may not be able to recover as well after a disaster." Vital infrastructure will be vulnerable to flooding: 22 wastewater treatment plants, 20 police and fire stations, 81 schools, and 42 health care facilities are in the projected hundred-year-flood zone. Cooley estimated the cost of replacing property in areas likely to flood as $62 billion in 2000 dollars.

Property at Risk of Flooding



Value of building and contents: year 2000 dollars.

Flooding at the projected level would also impact existing wetlands. "They may be submerged, go through vertical accretion, or move landward," Cooley explained. Although development has left no room for landward migration in some areas, her study found that 60% of adjacent lands would make viable wetland habitat.

There are important lessons here for regional planners, local governments, and developers. "We have a significant opportunity to reduce risk," said Cooley. "We need to integrate sea level rise into the development of all coastal structures. Placement of new structures must be based on estimates of risk. We can limit new development in high-risk areas through local and statewide legislation, insurance policies, and conservation easements." Rolling easements, allowing development for a limited period of time, could be a useful tool. Cooley also stressed the need to protect potential wetland migration paths. And community buy-in is crucial: "Communities that will be the most vulnerable must be meaningfully involved in developing preparation and adaptation strategies."

Concluding that "climate change will change the character of the Bay Area," Cooley warned that hard choices lie ahead: "Some of the necessary adaptation planning will be easy, some much more complicated. We may choose not to protect some areas. We need to begin planning now."

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A CAUTIONARY TALE FROM THE SWAMP

"Ecosystem restoration is humanity's chance to clean up our own messes, to live in harmony with nature."—Michael Grunwald, TIME magazine

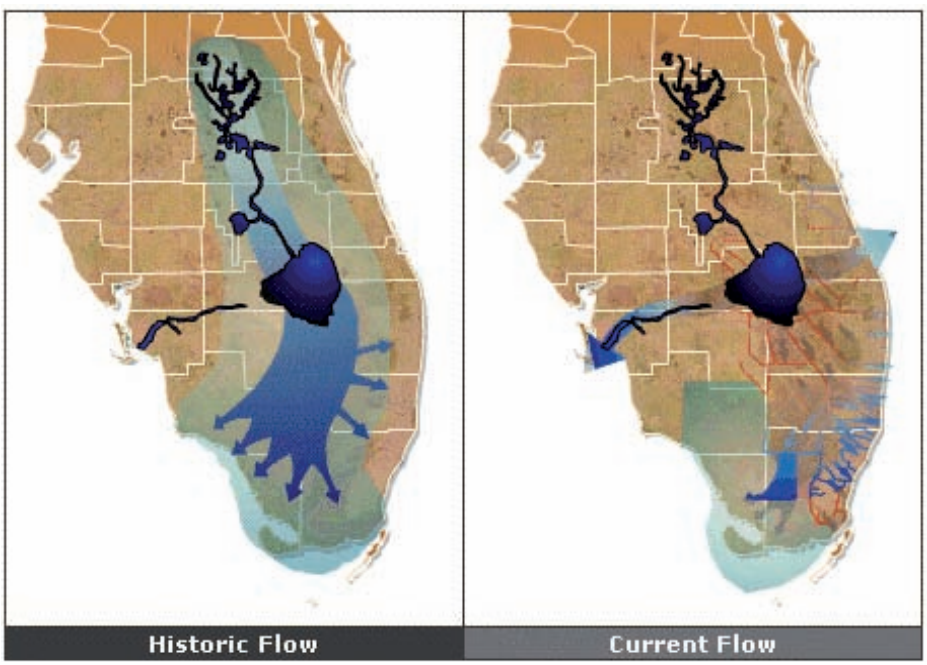
TIME magazine's Michael Grunwald, author of *The Swamp*, gave the keynote address, sharing stories and warnings about the limits of consensus-based planning from the Everglades restoration process. Declared Grunwald, "Ecosystem restoration is humanity's chance to clean up our own messes, to live in harmony with nature, not just for endangered species, but for our own." With an $8 billion price tag, he said, the Everglades plan is the largest restoration program in the history of the planet, to happen smack in the middle of a Disneyworld/Jiffy Lube/Taco Bell-coated landscape of "unchecked exurban sprawl…swarming with red-roofed houses, 8 million residents, and 50 million annual tourists." Ironically, the Florida Panthers ice hockey arena, plopped down on the edge of the Everglades, helped "destroy the real Florida panther," said Grunwald. "We don't realize that we are in the gators' back yard."

Florida has many parallels with California, not the least of which is its "spectacular agricultural boom." Four hundred thousand acres of pond-apple forest were converted to sugarcane fields, and the plumbing that enabled that transformation also helped create an "uninterrupted megalopolis from Naples to Palm Beach." As a result, said Grunwald, the Everglades today is "half development/half ecological mess." The consensus-based restoration plan involves creating 180 acres of reservoirs and storage aquifers to redistribute water to farms, cities, and the Everglades, restoring 50,000 acres of "marginal sugar fields" back to wetlands. But "there is nothing to ensure that the water actually gets to the Everglades," said Grunwald. "And we're telling the Corps of Engineers to paint a masterpiece while we're shrinking the canvas." A National Academy of Sciences report also found that there has been no environmental progress in eight years, said Grunwald, which he attributes to the limits of consensus and to scientists' being drawn away from their focus on science. "It's a real mistake to start everybody out thinking they can get everything they want. Once the process begins, the deck gets stacked. And if it doesn't work, you always get adaptive management, an excuse for a weak plan."

Grunwald said another lesson learned is that plans must start with a clear restoration mission. "Only the needs of economic interests were made crystal clear [in the Everglades plan]. The environment being good for the economy has been twisted to mean what's good for the economy is good for the environment. It's turned into a water supply boondoggle with some environmental benefits."

One bright spot has been the restoration of a portion of the Kissimmee River from an engineered channel back to a wild and wandering waterway. "If you put the environment first and get out of Mother Nature's way, the birds will come back," said Grunwald. "The gators are back, the river is back, the fish are back." The bottom line, offered Grunwald, is that the "Pottery Barn rule is true for ecosystems too. We broke these places; it's up to us to fix them." What has been most effective to date in the Everglades? Said Grunwald, "Litigation works: it focuses the mind." LOV

Alteration of Everglades Hydrology



DELTA DILEMMAS

"Right now we are managed right to the edge of our water supply. We need enough water in play so that we can adjust…" —Sam Luoma, UC Davis, USGS

The Delta—in its current and possible future incarnations—was the subject of two conference sessions, the first one focusing on lessons learned in other areas that might be useful in dealing with the battle-worn Delta.

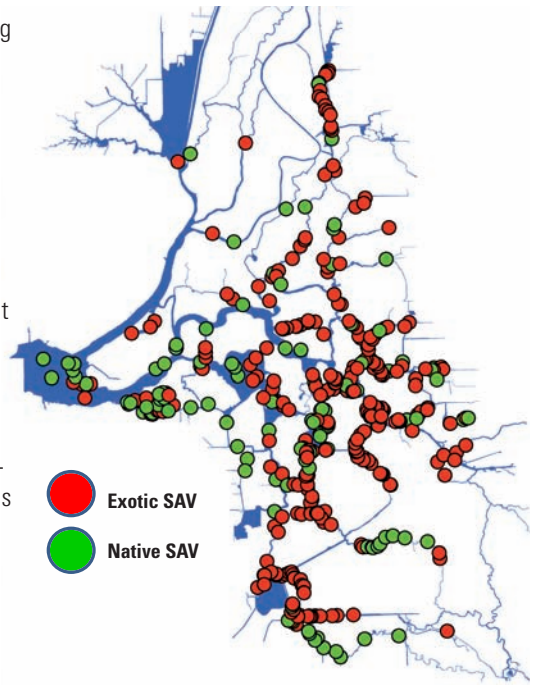
CALFED lead scientist Cliff Dahm shared lessons learned in watershed planning from Southeast Queensland, Australia during a 15-year drought. In a watershed two and a half times the size of California, the Murray-Darling Basin, stakeholders are working on a plan for a "healthy living ecosystem that supports the livelihoods and lifestyles of the people who live there," said Dahm. As part of a yearly media event, the health of the ecosystem is given a grade ranging from A to F. That process has focused where restoration money goes, said Dahm, who thinks adaptive management must be an integral part of any governance structure, along with high quality monitoring and science—and good communication.

Good communication of science is critical, said University of New Orleans' Denise Reid, but how to do that when the future is so uncertain, especially in a place like the Delta? Based on her experience in Louisiana, said Reid, "We have to have a specific vision translated into targets—my advice to scientists is to articulate the uncertainties explicitly." Reid also suggested identifying projects that move us forward despite uncertainty. "Dump research tools for planning tools in the implementation phase. Ask: what do we want to get out of these projects?" And perhaps most importantly, she added in the panel discussion following the talks, "It's about managing expectations and doing a better job of communicating the magnitude of the problem to the public. And we need to celebrate small victories better."

UC Davis/USGS's Sam Luoma cited the progress made by CALFED to date as a first step toward a sustainable water strategy, one that is implemented over time, incrementally. He likened the process to a road trip: "You have to have goals and know where you are going. You also need the flexibility and courage to reverse course if you take a wrong turn." In the meantime, there are obstacles in the road. "Right now we are managed right to the edge of our water supply. We need enough water in play so that we can adjust," said Luoma. "We've made several wrong turns, over-relied on conventional judgment guiding ecological management, and we've had difficulty communicating accomplishments to resource managers." But the biggest challenge ahead, he said, is not succumbing to society's need for immediate gratification. "Do we take big giant steps or careful, smaller steps moving forward?" Luoma also mentioned the challenge in dealing with the "frenetic nature of policy" versus the slower pace of science. "We can't do reactive science."

The Delta of the future "after the inevitable transition" was the focus of a special session on the third day by UC Davis scientists. Robyn Suddyth, who described the transformation of the Delta's 700,000 acres of mostly freshwater tidal marsh (the "dynamic and self-adapting" Delta of the past) to a "static and homogenous system kept fresh for irrigation," with 1,100 miles of levees separating land from water and a 50% decline in inflows. While inflows and native species have declined, flood risk—due to increased subsidence and pressure on levees—has increased, said Suddyth. Using models based on economic data and failure risk, Jeff Mount and Suddyth evaluated 34 subsided agricultural islands and found that based on the cost of repair and the probability of failure, 18 islands should not be repaired—and that even when the models were tweaked to favor repair, nine still should not be repaired.

Flooded Delta islands could provide a much-needed expanse of wildlife habitat and possibly boost declining native fish populations (see map, next page), but "there is pushback against taking control of island flooding," said Suddyth. There are policy hurdles too, including conflicting, unclear language in the California Water Code and concerns about the social impacts of flooding, private property issues, invasive organisms, water quality, wind and wave action, and the possibility of a "big gulp"—saltwater moving farther into the Delta. "The truth is, we don't know if water quality will be better or worse with flooding the islands," said Suddyth. "We



Submerged aquatic vegetation (SAV) filed point samples from June 2008. Red points indicate exotic submerged aquatic vegetation (SAV) species (as of June 2008). Green points indicate native SAV species. All points were collected from airboat and propeller motor boats using differential GPS (<1m accuracy). Species were identified in the field using threshing rakes; identification was confirmed with field photos taken concurrent with GPS recordings. Field work conducted by CSTARS (Center for Spatial Technologies and Remote Sensing, UC Davis, PI: Susan L. Ustin).

still need more research. It won't necessarily be bad; it could be good for species of concern."

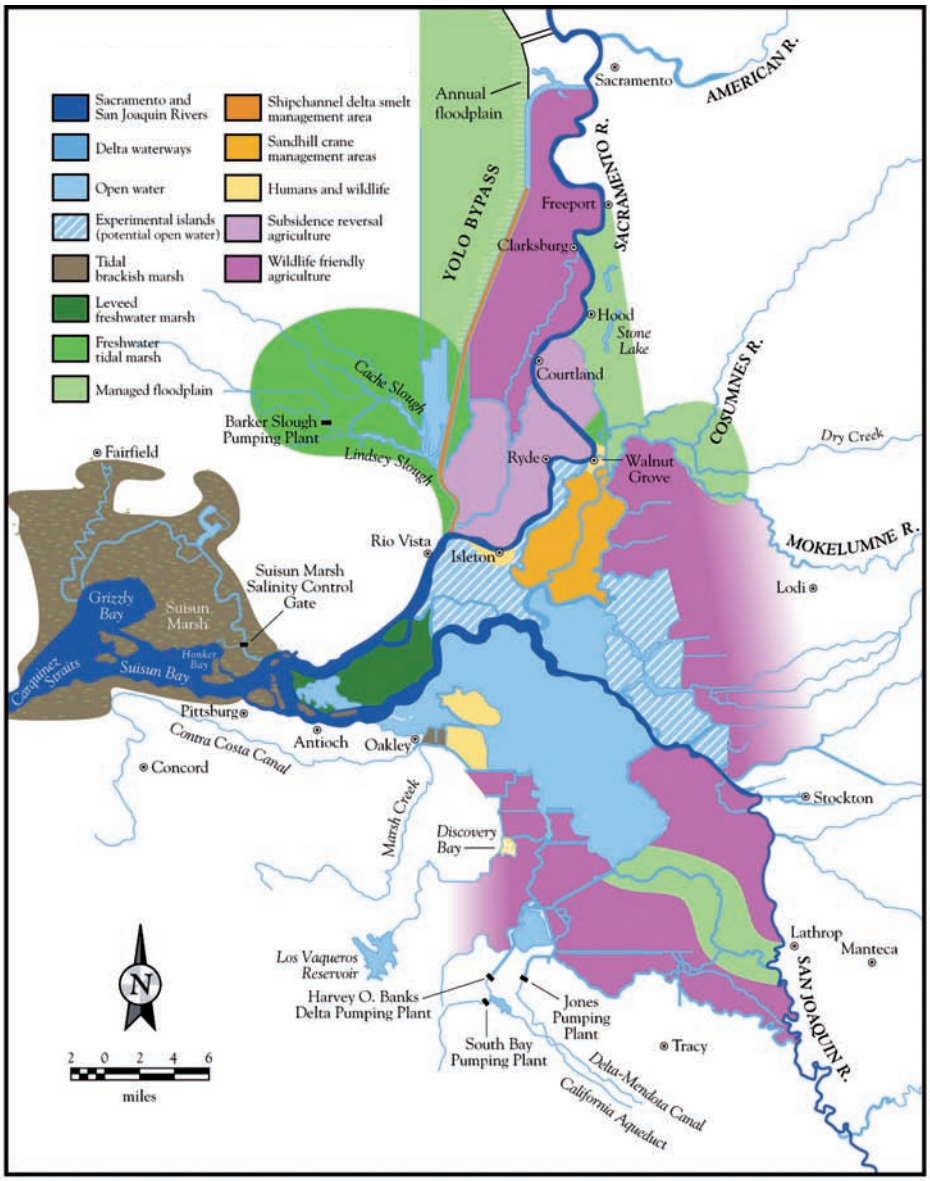
One thing that is certain about the Delta, said Bill Bennett, is that it is changing from a variable, complex ecosystem to a greatly simplified one. The hydrodynamic and physical changes that have been made to the Delta—long-term, physical, "slow" changes and more recent "fast" biological ones—have set the stage for a "regime change," which he likened to a train wreck. "Once you jump to a new stable regime, it's hard to go back to the old one," said Bennett. One sign of this shift is a tremendous increase in centrarchid fishes like largemouth bass and sunfish since 2000, an increase in non-native water weeds (see map, opposite page), and the decline of native fish. "It will be really difficult to push the system back to have pelagic fishes," said Bennett. "We've maintained the Delta to favor non-natives; there's no way we'll get rid of them. We need to generate environmental conditions that favor natives, make sure we instill in the Delta the appropriate configuration of islands, connections, and corridors, and push things in the right direction." By encouraging more variability and complexity in the system, said Bennett, we stand the best change of maintaining what's left of our native fish. "Alternative conveyance—and not pumping—would help."

Laura Doyle tried to figure out how the configuration of breached, flooded Delta islands could benefit or harm the pelagic food web, modeling each potentially-flooded island and its breach channel. "The Delta islands give us a unique opportunity to promote shallow-water habitat," said Doyle. "But not all islands are created equal." Doyle modeled islands flooded at different depths and in different configurations, finding that islands oriented parallel to wind direction produced a greater flux of chlorophyll between the island and its channel. "To enhance primary productivity, islands need to support algal production and mix regularly with their channels," said Doyle.

Bill Fleenor addressed flows for fish, comparing unimpaired flows in the years 1921-2003 to historical flows when fish were doing better (1949-1968), historical flows when fish were declining (1986-2005), and prescribed flows based on recent literature. Fleenor found that even when fish were doing better in 1949-68, "we had already started reducing winter and spring flows and increasing late summer and fall flows, and this trend increased through the later 1986-2005 period when fish did even worse."

Jay Lund wrapped up the session by reminding the audience that "with sufficient sea level rise and island flooding, we will see diminishing water exports from the Delta. Most reliable high-quality water exports would have to be via a peripheral canal." LOV

A Multipurpose, Eco-Friendly Delta



NOTES: The key aspects of this map include: (1) protecting levees in the western Delta to allow for at least opportunistic through-Delta pumping; (2) large expanses of pelagic, open water habitat; (3) large areas maintained for environmentally friendly agriculture; (4) Suisun Marsh recreated as a brackish water tidal marsh; (5) large areas of freshwater tidal marsh; (6) the Sacramento ship channel and deep areas of Cache Slough managed for delta smelt spawning; (7) large expanses of floodplain, with annual floodplain created along the eastern edge of the Yolo Bypass; (8) the Stockton ship channel maintained through a larger area of open water (shown here as the San Joaquin River); (9) the integrity of the Sacramento River maintained through the Delta for salmon migration; and (10) islands reserved for experimental use, including flooding.

From *Comparing Futures for the Sacramento-San Joaquin Delta by* Jay Lund, Ellen Hanak, William Fleenor, William Bennett, Richard Howitt, Jeffrey Mount, and Peter Moyle.

WATERSHED WORK

"After a quarter century of advocacy, we're finally in a place where we're poised to restore steelhead and salmon passage to 20 miles of suitable habitat."—Jeff Miller, Alameda Creek Alliance

Day 3, Track C spotlighted watershed activists and agencies from around the Bay. The S.F. Bay Regional Board's Dale Hopkins introduced the Bay Area Watershed Network (BAWN), spawned in 2006 when a group of 50 folks met in Oakland to talk about interest in and need for a regional group to represent watershed issues and interests. Today BAWN has over 180 members, including watershed activists, restoration practitioners, planners, consultants, NGO representatives, scientists, and community organizers, with six working groups ranging from assessment and monitoring to policy, education and outreach, land and water use, and coordination with IRWMP (the Integrated Regional Water Management Program).

Ten watershed groups then gave a virtual tour of their work, starting in the North Bay. The Sonoma Ecology Center's Caitlin Cornwall described her organization's efforts to work with over 400 streamside landowners. "We're in it for the long haul," said Cornwall. Patrick Lowe discussed the on-line Watershed Information Center & Conservancy of Napa County (www.napawatersheds.org), which aims to "educate and support the community." The organization is developing a watershed assessment framework and holding watershed symposiums. The Solano Land Trust's Benjamin Wallace said his organization tries to "increase watershed health" through the acquisition of open space—including core conservation areas and conservation easements.

Members of the Alameda Creek Alliance carry fish past barriers. Photo courtesy of ACA.

Moving to the south, the Contra Costa County Resource Conservation District's Carol Arnold described her agency's partnership with the Friends of Pinole Creek: "We're working to restore the native steelhead population by removing barriers that prevent fish from making it upstream to good spawning habitat." Salmonids were also the focus of the Alameda Creek Alliance's Jeff Miller's talk. "After a quarter century of advocacy, we're finally in a place where we're poised to restore steelhead and salmon passage to 20 miles of suitable habitat," said Miller. His agency has partnered in removing five small and medium dams, plus removed four additional barriers and built two fish ladders, with four more underway. Ongoing threats include the retrofit of Calaveras Dam. "We're working to ensure that the new dam is operated in a beneficial way for fish," said Miller. "Alameda Creek is a potential urban stream success story. It's an 'anchor watershed' that will help overall recovery of central coast steelhead."

The North Richmond Shoreline Open Space Alliance's Whitney Dotson said his organization also formed in response to threats—primarily from proposed developments—to some of the last remaining wetlands on the east shore of San Pablo Bay: "There are ongoing threats. Chevron still wants to build a deep water port." On Wildcat and San Pablo Creeks just to the south along the same shoreline, the Wildcat-San Pablo Creeks Watershed Council formed 24 years ago in response to a different threat—an Army Corps flood control channel proposed for lower Wildcat Creek. Residents came up with an alternative design, and the group continues its work today, said the Council's Tim Jensen. It also works to establish regional trails and access along the creeks and shoreline, engages local youth, and helps the community plan, among other efforts.

The Urban Creeks Council, in Berkeley in the central part of the Bay, works on many of the streams that drain to the Bay. UCC's Phil Stevens told the audience that his agency "invests in the future of communities, creates wild spaces in cities, increases property values by decreasing erosion, offers technical stream assistance, and helps cure 'nature deficit disorder.'"

Mondy Lariz of the Santa Clara County Creeks Coalition said his agency is trying to

The Urban Creeks Council stabilizes a creek bank using soil bioengineering. Photo courtesy of UCC.

"rebuild capacity in the South Bay," including sponsoring a large creek/watershed conference, and transforming degraded waterways into "living streams," while Joanne McFarlin of the Stevens and Permanente Creeks Watershed Council described the council's ongoing water quality monitoring efforts. "We're monitoring benthic macroinvertebrates and finding some big and beautiful bugs."

The SFPUC may be a water supply and treatment agency, said its Carla Schultheis, but it also works to improve its watersheds "above and beyond mitigation." Those efforts include developing watershed management plans for Alameda Creek, Pilarcitos Creek, the San Francisco Peninsula, and Lake Merced, said Schultheis.

From hands-on activities and plans, the talks moved to policy and monitoring needs. Commenting on the previous talks, attorney John McCaull said, "We're seeing a huge range of activities, by people and organizations who know what they want to do in their communities—or are figuring it out. There's the on-the-ground organizing scale, and then there's the Bay Area layered with organizing frameworks. There are strengths in partnerships, but it can be confusing: who's doing what, and what do we do now to get to the next level?" One of BAWN's goals is to disseminate information about funding opportunities to its members. Said McCaull, "I think the game is changing again when it comes to state funding. The days of passing large bonds are over; the state is in a complete state of disruption. We need to band together." McCaull said that while "we don't know yet when and where money will be available," it is likely that getting funding will be more of an ad hoc process, with smaller pots of money. "How do these ten stories we've just heard fit together?" asked McCaull. "The answer is that they all need sustainable vs. sporadic funding." He suggested that if voters can be convinced, local governments with local funding mechanisms "may be the way to go" in the future.

> "How do these ten stories fit together? They all need sustainable vs. sporadic funding." –John McCaull, BAWN

FarWest Restoration Engineering's Roger Leventhal and Stillwater Sciences' Peter Downs are trying to "connect design/build people with project developers" and "practitioners with the regulatory community." "Good projects need to start with good proposals, and to be scoped well," recommended Leventhal. "Restoration started with practitioners; there was no standard framework for restoration. The BAWN monitoring work group is a forum for bringing people together to discuss what we should be monitoring for, what type of data is needed, and priorities for developing appropriate restoration tools." Said Downs, "We need to act locally and think regionally." One way to do that is by developing "regional curves," said Leventhal, data that characterizes the geomorphic properties of Bay Area creeks and how they vary from county to county. The biggest challenge with monitoring? Said Downs, "There's always money for implementation, but at some point it runs out. We should really monitor for at least 10 years, especially with climate change." Often monitoring isn't done at all, or isn't reported in a way so that people can compare data, said Downs.

Environmental education and outreach to kids of all ages was the focus of the last four talks of the day, with educational tools ranging from rap songs about sustainability to wetland podcasts to pounding willow stakes into stream banks.

The San Francisco Bay Joint Venture gears its outreach efforts to the general public, through audio and internet-based programs that teach about the wetlands ringing the Bay (www.yourwetlands.org). "We want to have audio tours that cover projects all throughout the Bay, private natural history tours where people can pull over when they are driving and stop, listen, and learn," said the Joint Venture's Caroline Warner. Current tours include three sites in the South Bay and a 20-mile drive along Highway 37 in the North Bay featuring 40,000 acres of restored or protected wetlands. Podcasts range from profiles of Bay activists to features on wildlife and habitat.

Earth Team's Lana Husser also uses new technology in working with high school students to create rap songs, e-newsletters, and videos about environmental topics. "First I have to get their attention. They want music, social networking, blogs, podcasts,

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An Earth Team student tours a recycling center.

An Earth Team student films a "green screen" episode.

STRAW students install a willow wall to restore a creek.

North Bay Conservation Corps members stabilize a creek bank using coir (coconut fiber) rolls.

"Community-based restoration works. Don't underestimate it."—Laurette Rogers, The Bay Institute STRAW program

Twitter," said Husser. Her "green screen" students create DVDs of their peers' hands-on environmental work that are sent to local schools while other students produce an on-line magazine. "The students become the educators," said Husser. "We treat them as if they are who they want to become." Husser showed a 15-year old's clever animation about what happens when oil leaks from a car into the Bay.

The Bay Institute's STRAW (Students and Teachers Restoring a Watershed) program's Laurette Rogers says the goal of her hands-on program is to give her students "a sense of connection to place." Over 100 K-12 classes have completed 270 restoration projects, said Rogers, usually in partnership with ranchers, to revegetate and restore degraded stream banks. With help from PRBO Conservation Science, Rogers' students monitor their sites. One site's bird tally jumped from eight species of birds pre-restoration to 28 afterwards. "Community-based restoration works," said Rogers. "Don't underestimate it. Kids can do it, and they want to, they like to contribute. Students are empowered and communities reconnected."

A North Bay Conservation Corps member gets ready to plant.

And the North Bay Conservation Corps' Merilee Eckert puts "at-risk" and other young people to work restoring streams and wetlands, working on erosion control projects, monitoring wildlife, and fixing footbridges and trails. The Corps' members also lead community-based restoration events, and many go from the Corps into environmental work, said Eckert. Said StopWaste.org's Mark Spencer, "It's important that we build the next generation of environmentalists. We need to take the present work that's being done, and ensure there's someone to take that place." LOV

GREEN STREETS, PURPLE PIPES

"We can use the water we have over and over again. We should stop calling it recycled water and call it sustainable water."—Eric Rosenblum, City of San Jose

Water—drinking water, wastewater, and stormwater, now and in the future—was the focus of three talks and a panel discussion on the second day. Carollo Engineers' Steve McDonald called for managing our "water portfolio" more sustainably. "Wastewater treatment is the most highly leveraged and most chemically-dependent industry," said McDonald, which he attributes in part to old federal mandates for centralized treatment. "Distributed treatment might have made more sense," he said. New technologies like membrane treatment, advanced oxidation, and ozone disinfection will help reduce chemical and energy use. But finding the money to implement new treatments—and upgrade old plants—will be a continuing challenge for cities. "State and federal investments in infrastructure are probably gone, and the stimulus bill is minor," said McDonald.

Cities around the Bay will face new challenges as sea level rises due to climate change. San Francisco's large underground tunnels take combined treated wastewater and stormwater flows into the Bay but also let that water flow back in when tides get high enough, flooding city streets. "Over the last 50 years, high sea level events are increasing in frequency and duration at San Francisco," said McDonald, warning that in 40 years, the San Jose treatment plant, at the south end of the Bay, will be under water.

One tool for a more sustainable water portfolio is re-use, said San Jose's Eric Rosenblum. "We can use the water we have over and over again. We should stop calling it recycled water and call it sustainable water." Rosenblum read a description of a "water-sensitive city" initiative being worked on in Australia that he suggested Bay Area cities emulate: *"Imagine ..... a cool, green city with rain gardens, urban forests, and roof-top vegetable gardens ..... people, governments and industries working together for sustainable cities ..... healthy urban waterways fit for enjoyment and fishing, where native wildlife flourishes ..... city and country coexisting in harmony, leaving only tiny footprints on the planet ..... You have just imagined a Water Sensitive City."*

If there is a "water sensitive city" in the United States, it is probably Portland, Oregon. Portland's Tom Liptan, next up, a landscape architect and self-described "stormwater nerd," was working on stormwater management with city engineers when he thought, "Why don't we start using the landscape?"

One of Portland, Oregon's many eco-roofs, blooming with sedum. Photo by Tom Liptan.

Said Liptan, "I don't like pipes. They're not as attractive as dirt and plants." Since the late 1980s, Portland's "sustainable stormwater" team has been retrofitting the city with green infrastructure—stormwater planters, green streets with curb extensions, rain gardens, ecoroofs, bioswales, etc.—and monitoring their performance and cost. "Initially, it looked like the green approach would be more expensive," said Liptan. "But we have found LID [low-impact development] to be less expensive than conventional approaches."

Stormwater planters at Buckman Heights Apartments in Portland. Photos courtesy city of Portland.

Even Portland's "least effective" green stormwater facility reduced peak flow from a 25-year event by 80%, said Liptan. His team started with a demonstration project. "We promised we would go back in and repave the street if the green street approach didn't work. Well, it worked, and now we have a waiting list." Portland now has 606 green streets projects in the ground, plans for 300 more in the next five years, and 9.5 acres of ecoroofs, with plans for 49 total acres in five years.

A panel of local government and other "clean water champions" followed Liptan, with Emeryville and San Francisco following Portland's lead in retrofitting their built-out cities with green infrastructure. In Emeryville, "We're squeezing it in where we can," said Peter Schultze-Allen, and in San Francisco, "Our 30-year master plan uses green infrastructure as a tool to address flooding," said the SFPUC's Rosey Jencks. San Francisco is developing a "diverse water portfolio" that includes green stormwater, onsite rainwater

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harvesting, graywater for flushing toilets, and engaging the community in watershed stewardship, said Jencks. One problem is that the "field of public health has not caught up to decentralized water," she added. StopWaste.org's Gary Wolff described how his organization's "Bay-friendly" landscaping principles can help cities save water and treat stormwater, while Hercules' Steve Lawton described the challenges and opportunities in re-developing a former industrial area. EOA's Laura Prickett, stepping in for San Mateo County's Matt Fabry, suggested that green infrastructure can not only treat stormwater but also "bring communities together and calm traffic."

Jakada Imani of The Ella Baker Center for Human Rights closed the second day with a rousing call for employing residents of low-income and minority communities in new green jobs as well as including them in finding solutions to water shortages and climate-change-related disasters like Katrina. "Our folks are going to get it first and worst," said Imani.

The next morning, five new speakers addressed new ideas and existing projects that help increase both permeability and livability in cities and suburbs. San Jose State's Hilary Nixon first gave an overview of how post-World War II government policies encouraged suburban—and road—development. "We liked having the open space of yards and the freedom the auto gave us," said Nixon. But the problem for the Estuary is that, in addition to air pollution impacts on water, "spread-out development—even though it may look more pervious than dense development—requires more offsite impervious infrastructure."

The San Francisco Estuary Institute's Robin Grossinger suggested that "re-oaking" the suburbs could offer a way to decrease runoff and temperatures while restoring the diverse oak-based ecosystem that once existed. "Oak savannahs were one of the largest habitat types historically," said Grossinger, showing old images of Morgan Hill, Gilroy, and Oakland, all covered with immense oaks. When orchards were planted, the oaks were lost. Still, there are some remnants, said Grossinger, and planting more oaks—and other native trees like Western sycamores and California bays—could help reconnect cities and suburbs with habitat in the hills and riparian areas.

Especially inspiring was Plant SF.org's Jane Martin, an architect and "lifelong gardener" who began a program to "let the ground breathe"

Before and after: Shotwell Street, San Francisco. Photos by Jane Martin.

A remnant oak in the suburbs. Photo courtesy SFEI.

in San Francisco a few years ago. Martin works with communities to chop up concrete and asphalt and plant public rights-of-way, increasing permeability and addressing blighted, neglected areas. Martin helped the city develop a permit in 2006. "Since adjacent property owners must maintain their sidewalks, we could each then make our decision about what to do there—and that could include plants," said Martin. "Permeable landscapes are a neighborhood treasure."

H.T. Harvey and Associates' John Bourgeois showed how a "concrete flood control ditch" became a "thriving riparian corridor" in the South Bay (one downside is that the project used gabions, no longer acceptable to regulatory agencies due to their impacts on fish); while Design Ecology's Josiah Cain recommended incorporating "natural forms, geometry, and processes when building rainwater catchment systems. They can dramatically reduce stormwater runoff impacts to local creeks and streams." Cain summarized the points of several earlier speakers: "These living systems provide treatment in a more cost-effective manner than traditional engineered systems and also create an environmental amenity." LOV

BAYLANDS, BIRDS, AND BIVALVES

"Our motto is 'No Riparian Zone Left Behind.'"
Stuart Weiss, Creekside Center for Earth Observation

Habitat conservation and restoration was the organizing theme of one of the three tracks of presentations on Day 3. Speakers described tools for habitat conservation planning, hands-on restoration experiments, and, in one case, some unintended consequences of restoration.

First up, Josh Collins of the San Francisco Estuary Institute examined the need for regional ecological goals. Among other challenges, he mentioned administrative balkanization: "One agency wants to control pollutants and water supplies, another deals with endangered species. There's no watershed agency, so nobody's in control." Existing institutions can't match the speed of land-use and climate change, and conservation practitioners are falling behind ecosystem degradation, he said. His solution: project planning that scales up from places to landscapes to watersheds to regions, deals with multiple habitat types and corridors, and protects evolutionary processes. Studying the past—including indigenous land management practices—can reveal possible restoration palettes. "We often don't know what we've lost," said Collins. Planning also requires forecasting alternative futures and setting numerical goals for key ecosystem services. Advocating a climate-ready toolkit for local communities, Collins said the existing *Baylands Ecosystem Habitat Goals* planning document will need to be adjusted for the effects of climate change, as shorelines are altered and new risks and opportunities arise.

Others focused on specific habitat components. Stuart Weiss of the Creekside Center for Earth Observation walked the audience through the process of setting upland habitat goals. The project is about identifying a network of lands, including working landscapes, critical to the Bay Area's biodiversity, so the key pieces can be connected. To date, Weiss said, 1.2 million acres of such habitat have been identified. Goal-setting has involved mapping vegetation and defining landscape units, which are then ranked by rarity of vegetation types. Using a site-selection model, the lands are broken down into 250-acre hexagonal planning units. Fine-scale rankings are based on the presence of old growth redwoods, vernal pools, sensitive mammal and bird species, and anadromous fish. Weiss said connections between uplands and baylands were given high priority: "Our motto is 'No Riparian Zone Left Behind.'"

Then comes local implementation: massive riparian restoration, watershed planning, setting TMDL's. Weiss sees it as a long-term commitment: "It took over a hundred years to reach the current status, and it will take us decades at least to fix it."

Marilyn Latta of the State Coastal Conservancy and Ocean Protection Council spoke for

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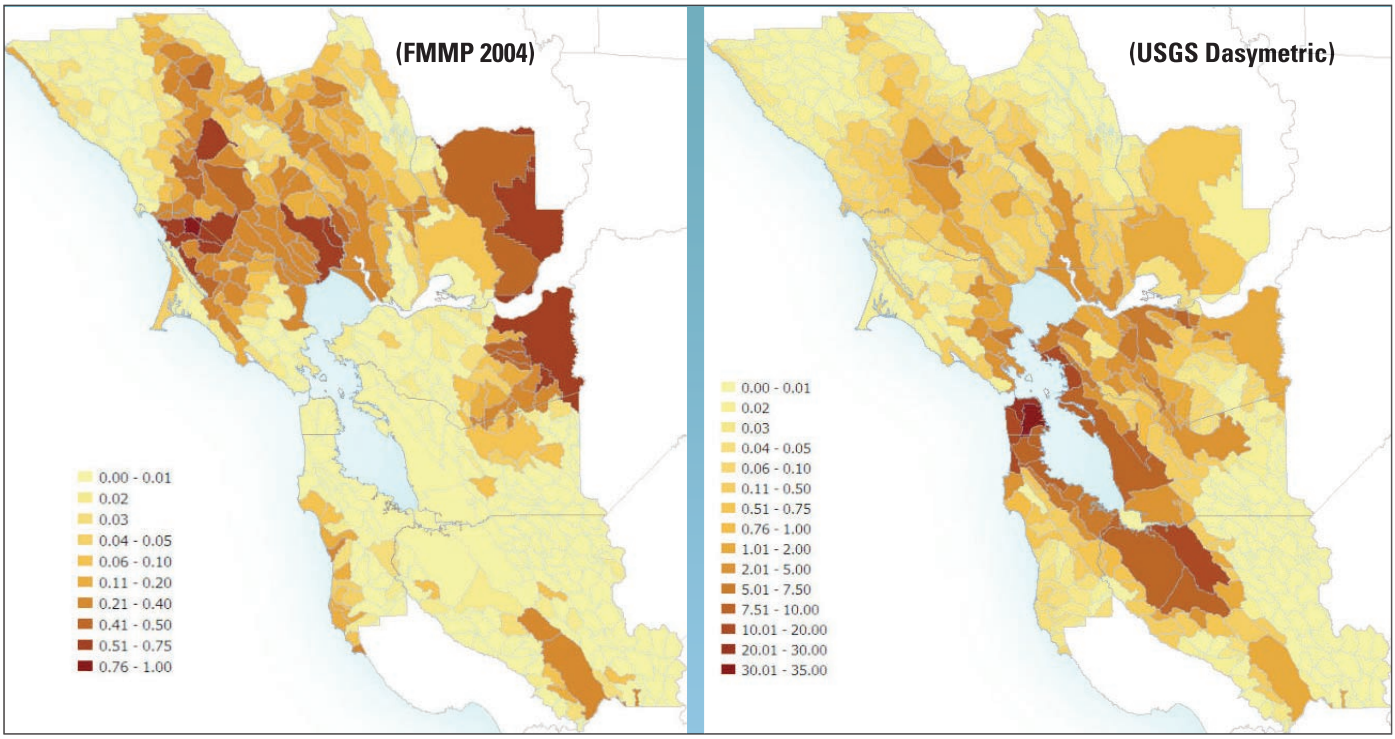
Human Impacts on Watershed Integrity



Mapping human impacts on Bay Area watersheds: agriculture (left) and population density (right).

GULL BOOM

Avocets pursue a gull that has taken their chick. Photo by Ken Phenicie, S.F. Bay Bird Observatory.

When San Francisco Bay Bird Observatory biologist Jill Demers sees a flock of seabirds, she does not wish they all could be California gulls. Her presentation was a reminder that not all problem species are invasive exotics.

It's hard to believe that this colonial waterbird was once listed as a state species of special concern. California gulls historically nested at interior saline lakes, like Mono Lake. Twenty-four nests were detected in the South Bay in 1980; then the population grew exponentially, to a peak of 46,000 in 2008. This year's estimate is slightly lower, at 43,000. There are 10 active colonies, the largest, with 20-25,000 gulls, at Pond A6—part of the South Bay Salt Pond Restoration Project.

The gull boom has been fueled in large part by garbage: Demers said they spend 15 to 20% of their time foraging at landfills. They show up when the landfills open and leave when they shut down. Unfortunately, California gulls are also voracious predators of shorebird chicks. In one study the gulls were found to have eaten 61% of a radio-tagged set of American avocet chicks, and 23% of a set of black-necked stilt chicks. The main conservation concern, though, is their impact on the endangered western snowy plover, which suffers significant nest depredation. Observers caught California gulls in the act at 2 of 24 monitored plover nests. The gulls also compete for nest sites with smaller colonial waterbirds like the Forster's tern.

Gull nest of scavenged chicken bones. Photo by Ken Phenicie, S.F. Bay Bird Observatory.

The A6 gull colony will be displaced when the pond is restored to tidal marsh. The big question: where will they go, and will they encroach on additional waterbird and shorebird habitat? Gulls from A6 have been marked with field-readable colored bands for tracking. Some have already shown up at other colonies, but these are on levees and islands with little space for newcomers.

Management of these birds, Demers conceded, is a problem. Lethal control of individuals hasn't worked, and addling their eggs is too labor-intensive. One local landfill has used an arsenal of harassment methods, including pyrotechnics, dogs, falcons, and all-terrain vehicles, with good results. But those gulls are just finding free lunches at other landfills. To make a real dent in landfill use, regionally-coordinated abatement may be needed.

CONTACT: Jill Demers, jdemers@sfbbo.org JE

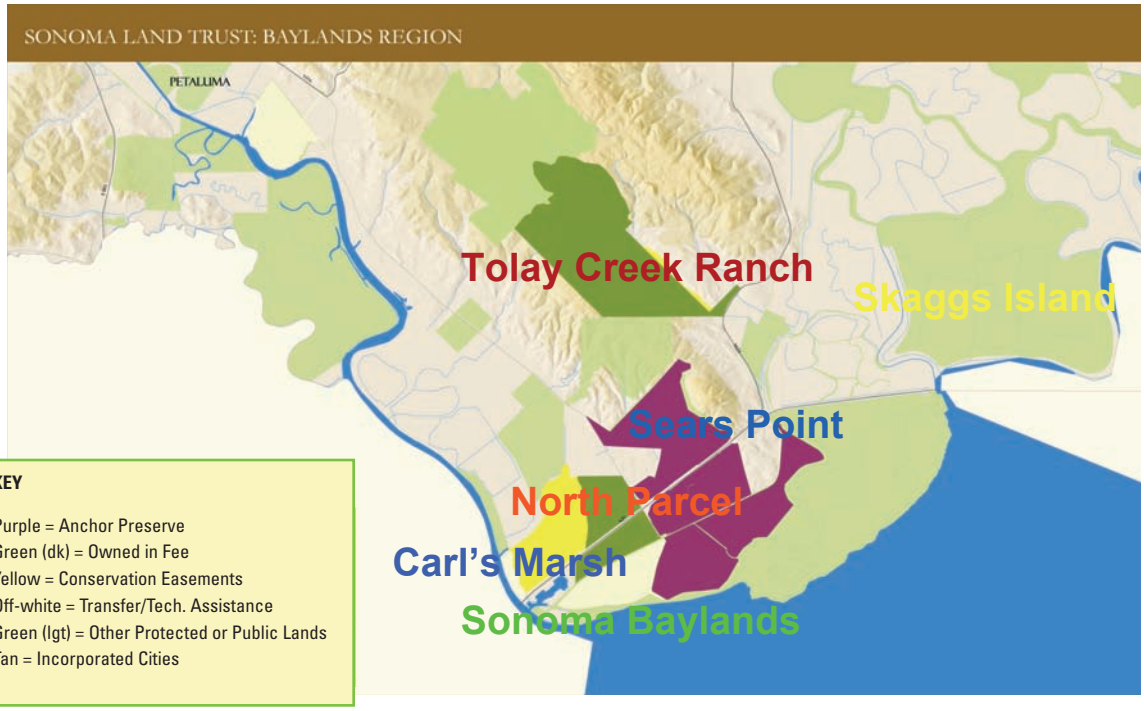
what she called "the hidden underbelly of the Bay:" intertidal and subtidal habitats. "It's a case of out of sight, out of mind," she said. Not just a featureless mud bottom, these submerged areas are a huge and productive component of the estuarine ecosystem. In the Subtidal Habitat Goals Project, GIS maps, and low-tide photography are helping categorize subtidal habitat types, identify stressors, and inform restoration site selection. Assessment projects are examining eelgrass and shellfish beds, creosoted pilings, and other structures. Tidal habitat restoration, she said, must be ecosystem-based, recognizing that different species use different depths and vegetation types. Local examples of such multi-habitat restoration projects include the South Bay Salt Ponds, Dutch Slough, and Sears Point.

Subtidal habitat in San Francisco Bay: what lies beneath. Photo by Greg Lorenz.

"Climate change increases the need to integrate project design and approaches," said Latta, factoring in not only sea level rise but also increased temperatures, lower salinity, and altered sediment dynamics. The ultimate goal would be a "living shoreline," a "soft form of bioengineering" that would increase subtidal diversity, stabilize sediment, and buffer wetlands.

The North Bay's experience with the Baylands Goals was the subject of John Brosnan's talk. Representing the Sonoma Land Trust, Brosnan reviewed lessons from past restoration projects and future challenges, and toured sites like Sonoma Baylands, Sears Point, Carl's Marsh, and Tolay Creek Ranch. Successful restoration, he said, has to address the relationship between seasonal wetlands and agriculture; farmers are encouraged to allow ponding in field depressions and vegetation growth to field edges, and to delay the spring oat-hay harvest to avoid impacting nesting waterfowl.

As for climate change, "we're trying to see around the corner." Managing for sea level rise, he said, will require a Habitat



Preserved habitat in the North Bay.

Goals-like consensus approach and the funding and political will to tackle upgrades to sea-level highway and railroad infrastructure. But Brosnan's organization is in it for the long haul: "We're the Land Trust. We're not going anywhere for a while."

BCDC's Steve Goldbeck used the Hamilton Field project as a case study of wetland restoration against a background of sea level rise. To convert the former air base into seasonal wetlands, 20 million cubic yards of sediment dredged from the Port of Oakland is being transported to San Pablo Bay on a barge and pumped up to seven miles across the mudflats. The pumping operation uses no diesel fuel; Goldbeck joked about "seven miles of extension cord from Hamilton." Sediment enhancement is intended to make the restored Hamilton Wetlands more resilient to sea level rise, in a region where most marsh habitats are vulnerable. Achieving that goal, Goldbeck said, will require adaptive management.

Dredged sediment from the Port of Oakland being used to build up Hamilton Wetlands. Photo courtesy of Manson/Dutra Joint Venture.

Summing up the accomplishments of the Invasive Spartina Project (see "Wooly Mammoth Marsh," ESTUARY NEWS, October 2007, available at www.sfestuary.org), Peggy Olofson looked back to the Goals Project and its inclusion of *Spartina* control. "We had a weed we suspected was going to take over the marshes we restored and turn them into something that wouldn't meet the objectives of a marsh," she recalled. "We didn't have something that was going to work to control it. The Coastal Conservancy took a very unpopular and risky action in funding the program."

At its maximum, invasive *Spartina* occupied up to 3,000 acres of bayland. "Now it's down to less than a hundred acres, maybe fifty, spread out over 50,000 acres," she said. "We've gotten rid of all the obvious plants, down to the ones where it's a coin toss whether they're hybrid or native." Even genetic identification of the hybrids is difficult. "We don't know what is the risk of these last cryptic hybrids: can we leave them in the marsh?" Olofson said imazapyr, the aquatic herbicide used to eradicate invasive *Spartina*, has spared native pickleweed: "Once you've released it from the cover of non-native Spartina, pickleweed grows back in a very robust way."

Julian Wood of PRBO Conservation Science reported on the status of sensitive tidal marsh birds: California clapper rail, California black rail, salt marsh common yellowthroat, and three endemic song sparrow subspecies. "They're all indicators of marsh health," he said. Song sparrows present a mixed picture, with negative trends in Suisun Bay and San Pablo Bay that may involve the spread of perennial pepperweed *(Lepidium).* Some of these birds are responding to marsh restoration: song sparrow, yellowthroat, and black rail densities have increased with restoration age. On the other hand, clapper rail censuses show an overall baywide decline from 2005 through 2008, with the biggest drop in 2008. Ironically, that drop may reflect the success of non-native *Spartina* removal. Clappers have been using the thick clumps of the invasive plant as refugia, and its growth may have driven a previous increase in rail numbers. "We need to understand the effects of *Spartina* removal," said Wood. "If that's not causing the sudden drop, we need to know what is." Other suspects include predation and adult rail mortality in winter storms.

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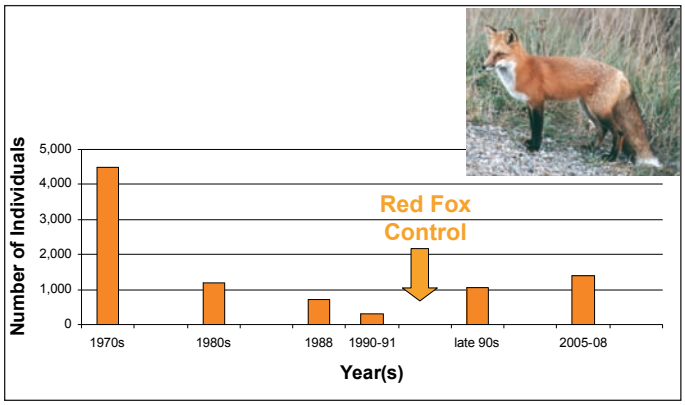
Historic Clapper Rail Estimates



PRBO

Two restoration success stories followed. San Francisco State University's Katharyn Boyer summarized her work with eelgrass, a critical and vulnerable component of estuarine ecosystems. "Ten years ago we knew hardly anything about eelgrass," said Boyer. Mitigation funding for the Bay Bridge retrofit changed that; she and her colleagues have mapped 3,000 acres of existing beds and identified more potential habitat. Boyer described ongoing experiments with eelgrass propagation. Dispersing seeds from floating buoys was found to be more effective than transplanting shoots or broadcasting seeds by hand. "We did the restoration work in a really experimental way and it taught us something about technology, donors, and site selection," Boyers summed up, noting potential synergy with other subtidal and intertidal projects like oyster restoration. Still on the research agenda: eelgrass's ecosystem services (Canada geese eat it) and effects on water flows, erosion, and sedimentation. (For more on eelgrass and Boyer's work, see "Bountiful Blades," ESTUARY NEWS, June 2009, available at www.sfestuary.org.)

Kathy Boyer with eelgrass. Photo by Stephanie Kiriakopolos.

Volunteers take cultch into the bay. Photo by Christine McGuiness.

Bud Abbott of ENVIRON International Corporation gave an account of attempts to restore native oysters at the Marin Rod and Gun Club, west of the Richmond-San Rafael Bridge. Oysters, Abbott explained, need vertical surfaces to attach to: "We've lost hundreds of miles of vertical surface in the process of reducing navigation hazards.

"We've lost hundreds of miles of vertical surface in the process of reducing navigation hazards."—Bud Abbott, ENVIRON

Now we have thousands of square miles of very soft mud." His solution: create artificial reefs. Abbott described experiments with different techniques, including casting heavy concrete reef balls. What seems to work best is bags of cultch (discarded oyster shell) pinned in place with rebar hooks. The cultch comes from Tom Lunny's controversial operation in Point Reyes National Seashore. Abbott said the reefs have attracted fish, crabs, shrimp, and birds. Herring and gobies have been observed spawning, and Chinook and coho salmon have visited, probably attracted by the goby larvae. There are plans for a second reef site at Berkeley's Cesar Chavez Park. (For more on Abbott's work, see "He Built It," ESTUARY NEWS, June 2009, available at www.sfestuary.org.)

In another third-day session, Tom Scheeler of the Port of West Sacramento and Brenda Goeden of BCDC looked at dredged material reuse as a component of restoration. "Reuse of dredged material is increasingly important," Scheeler said. "We're looking hard in terms of habitat creation and flood levee improvement. Upland capacity is finite. We need to find new projects that can use that material." That, he said, will require careful analysis of the material to be reused, as well as addressing "perception and liability issues."

"My passion for dredged material reuse is similar to a cult, and I'm looking for recruits," said Goeden. "Wetlands can absorb storm surge, yet we struggle with using dredged material to raise subsided sites." She acknowledged the issue of legacy and emerging contaminants in dredged sediments and the Water Board's Total Maximum Daily Load standards. "Sometimes contaminated sediment is simply not dredged," she said. Goeden pointed to three successful beneficial reuse sites: Montezuma Wetlands, Bair Island, and Hamilton Field, where dredged sediment is being pumped onto the former airfield. Sediment management in the Bay, she said, is complicated by a diminishing supply of sediment from the Delta. This may spur a transition to regional sediment management, dealing with local tributaries and flood control waters laden with sediment, and sand mining. JE

SOFTER SHORES FOR RISING SEAS

Looking back at the Goals Project, coastal ecologist Peter Baye notices a remarkable complacency about sea level rise. "It just shows how much the science has changed in the last ten years," he said. One overlooked point was the need for conserving undeveloped uplands by the Bay to provide accommodation space for estuarine transgression: the landward movement of marsh vegetation in the tidal-terrestrial transition zone. That's a different concept than the idea of buffer zones, which were aimed more at wildlife protection, said Baye.

In most of the region, Baye said, shorelines are too armored and development-impacted to allow for this kind of natural transgression. Sonoma and Napa counties are seeing "the rampant spread of vineyards down to and even into diked baylands." He called East Suisun Marsh, bordered by grazing lands, "the last frontier and best opportunity for accommodating sea level rise."

Some unsung native plants may turn out to be allies in stabilizing the margins of the Bay. Baye said there are lessons to be learned from remnant pockets of once common tidal-terrestrial plant communities. Creeping wildrye grows in most of these relict ecotones, holding its own even against aggressive exotics like perennial peppergrass. Other clonal perennials like Baltic rush, Suisun aster, basket sedge, and marsh baccharis are locally important.

"When cows are removed at places like Rush Ranch, we see these species reclaim their positions," said Baye. "If you put the native competitors back in, they do well. Once introduced, creeping wildrye can establish dominance in ten years." Clonal perennials, he explained, grow early in spring, establishing a dense canopy that shades out invasive annuals like mustards and radishes. They're also able to transfer water and nutrients between portions of a clone, allowing them to straddle the high tide line.

Baye pointed to the ecosystem services of these plants: "They provide semi-evergreen canopies of high tide refuge cover" for sensitive species like the California clapper rail and salt marsh harvest mouse. Competing annual weeds aren't present during winter high tides. Creeping wildrye also stabilizes soil: one strain was developed by the Soil Conservation Service for that purpose. "It's self-regenerating," Baye said—and a natural alternative to riprap.

These plants can get a boost from a technique pioneered at the Alviso Environmental Education Center: using saline irrigation to kill annual weeds. Baye called it "a nice transition to revegetation," clearing the ground for relatively salt-tolerant natives. Pumping salt water from a borrow ditch onto a levee at Alviso resulted in 100% dieback of weeds, with residual effects for at least two years.

Gravel and sand beaches, Baye said, are another neglected possibility for a "soft" adaptation to sea level rise: "They can be both ecotones and wave buffers." Sediment nourishment may also help create artificial alluvial fans, like the ones at Sonoma Baylands: "Combining perennial vegetation and hydraulic deposition of mixed coarse and fine sediment…may be a way of incrementally raising levees and ecotone slopes while enhancing rather than disturbing habitat."

CONTACT: Baye@earthlink.net JE

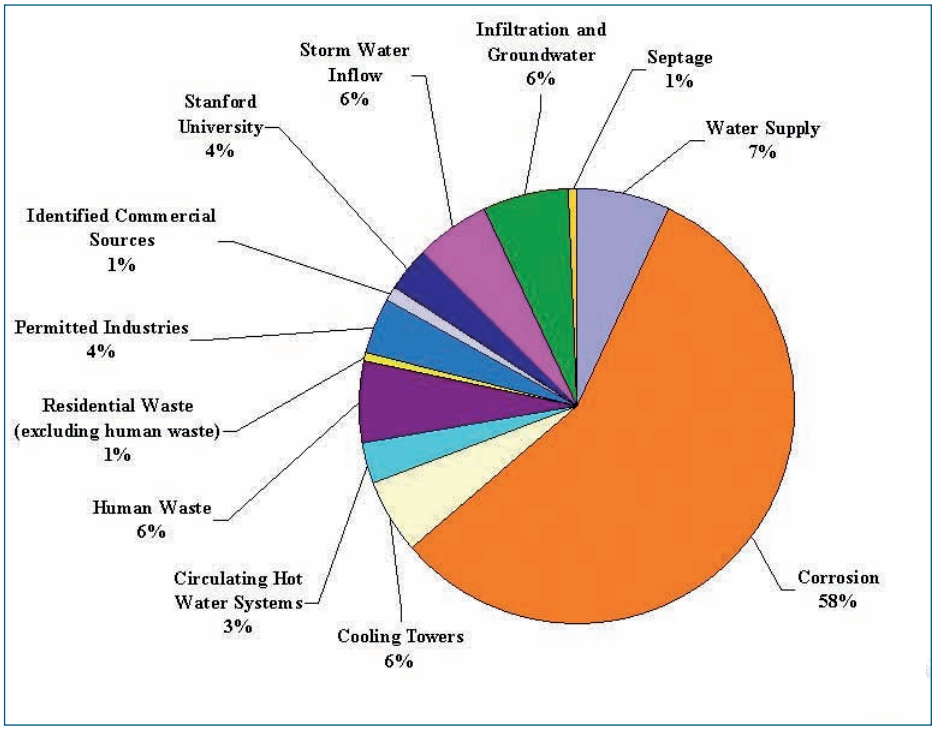
Creeping wildrye, here at China Camp, can hold its own against invasive exotics like perennial pepperweed. Photos by Peter Baye.

POLLUTION: PROGRESS AND PROBLEMS

"Fifty percent of the copper in San Francisco Bay comes from brake pads—there's no success story there."
—Phil Bobel, City of Palo Alto

Pollution and possible solutions were discussed in two sessions, starting with Palo Alto's Phil Bobel's overview of pollution prevention efforts around the Bay from the 1950s, when most cities tossed their trash, sewage, and cannery wastes straight into the Bay, through the present. Sewage treatment plants were a huge success story for the Bay, said Bobel, pointing out that most cities received 75% federal and 12.5% state funding to build them, money that is harder to come by today. "We had decreased organic loads tremendously by the 1970s," said Bobel. The next big pollutant to tackle was heavy metals from the high tech industry, another "success story" that started in the '70s and continued into the '80s, said Bobel. "But we're still working on copper today, looking for a way to put copper pipes together to minimize corrosion. Fifty percent of the copper in San Francisco Bay comes from brake pads—there's no success story there."

Copper Sources to the Palo Alto Regional Water Quality Control Plant



Clean Bay Plan

Another area where progress has been made is in reducing pesticide use; many cities are embracing integrated pest management (IPM), using goats to munch weeds, and trapping gophers instead of poisoning the food web. Other success stories include keeping mercury from going down the drain—and into the Bay—through mercury thermometer-collection programs and amalgam separators in dental offices. "In 2009, we had 100% compliance in dental offices," said Bobel.

But new issues constantly arise—a case in point is the new washing machines on the market that release silver ions to control bacteria (see "Silver Washout," ESTUARY NEWS, August 2008, available at www.sfestuary.org). "I'm skeptical that disease gets transmitted from clean clothes!" said Bobel. "It's completely unnecessary products like that where we ought to have some real success stories." And the constant influx of new chemicals into the market is "a huge task for us to get our arms around—it doesn't work chemical by chemical. We need a fundamentally different way of operating."

The S.F. Bay Regional Water Board's Dyan Whyte addressed the issue of "armoring" the Bay against problems like large oil and sewage spills. "The impacts to recreation, fisheries, and wildlife are obvious, but less obvious is how species will recover from these events or what kind of toxicity is left in the environment after a spill," said Whyte. The rate of sewage spilled in the Bay Area is double to that of the state overall, said Whyte, possibly due to aging infrastructure, soil types, seismicity, and maybe better reporting.

In the 2008/2009 wet season in the Bay region, said Whyte, 121 billion gallons of sewage were fully treated while around 280 million gallons were partially treated or blended and discharged. Historic data shows that while 80% of the number of spills were caused by blockages, approximately 40% of the volume of all spills combined was due to excess inflows and infiltration. "There is a need for better operation and maintenance of sewage collection systems," she said, referring to the 17,000 miles of public sewer pipes in the Bay Area plus 17,000 miles of privately-owned ("lateral") pipes that connect homes and other buildings to the public pipes.

One small component of sewage spills that can cause big trouble for fish and wildlife is hormones. While treatment plants remove, on average, 85% of natural and

Planting more elgrass beds can increase Estuary resilience. Photo by Kathy Boyer.

synthetic estrogens, greater concentrations can enter the Bay during a spill. Whyte cited a study in which tiny amounts of ethinyl estradiol introduced into a Canadian lake caused the collapse of the lake's fathead minnow population in just two years (see "Estrogenic Epidemic," ESTUARY NEWS, December 2008, available at www.sfestuary.org). Last year, $7 million in penalties was assessed for sewage spills, said Whyte, with $2 million going toward mitigation projects that help restore habitat and "increase estuary resilience." One such example is the effort to restore Aramburu Island, an island in the Bay used by wildlife as a refuge during the *Cosco Busan* oil spill. Restoring eelgrass beds is another way to increase resilience, Whyte pointed out (see "Bountiful Blades," ESTUARY NEWS, June 2009).

Other pollutants plaguing the Estuary—trash, particularly plastic—are highly visible and ubiquitous. Save the Bay's David Lewis kicked off his talk by showing his organization's YouTube hit, the "Bay vs. Bag" video. "There are over 100 bags in the Bay for every duck and pelican," said Lewis, adding that at least 1 million pounds of trash are picked up statewide during a one-day Coastal Cleanup event. "Trash is the low-hanging fruit we've never got around to picking. Despite extensive public campaigning, the Bay is still under assault." Lewis warned that with the population of the Bay Area expected to reach 8.1 million by 2020, the trash problem will only get worse if we don't take action.

On Day 3, the trash talk continued as Melody Tovar of San Jose's Department of Environmental Services reported on her city's multi-pronged efforts to keep trash out of the watershed. San Jose partners with the Santa Clara Valley Water District on homeless encampment cleanups, with support from city police and county social services, and has installed custom-made capture devices in 84 catch basins. Tovar saw the city council's recent action on banning single-use carryout bags as a hopeful development, although some aspects remain controversial. "'Fee' is the new F word," she joked.

From a Southern California perspective, city engineer Morad Sedrak told how Los Angeles has worked toward meeting trash TMDL requirements. GIS analysis helped the city prioritize by showing that 60% of its trash comes from 15% of its area. Los Angeles has improved its trash interception technology, moving toward vertical catch-basin inserts and screens that yield to heavy flow. Sedrak said the city has already reduced trash discharge into the Los Angeles River and Ballona Creek watersheds by 60% and hopes to beat the deadline for full compliance.

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DEALING WITH DIESEL

While water quality concerns dominated the pollution presentations, one panel took on an air quality issue. Federal and state regulators, a port administrator, and a neighborhood activist all weighed in on the problem of diesel exhaust and other contaminants from the Port of Oakland.

Jim Haussener of the California Marine Affairs and Navigation Conference sketched the Port's history: its role in the rise of containerized shipping, its recent decline in traffic, and its uncertain future. "We're looking at recognizing traffic impacts and using the river system," he said. "If we put agricultural commodities on barges in West Sacramento and Stockton, there would be less impact on the roads and less pollution."

Speaking for the Bay Area Air Quality Management District, Jean Roggenkamp described emissions from the port as a regulatory priority and a question of environmental justice: "Exposure to toxic air contaminants and diesel exhaust is a major driver for us. We recognize that some communities suffer more from air pollution than others: people who are more sensitive, the young, the old, those with respiratory diseases or poor access to health care." West Oakland, she reported, is exposed to diesel particulate matter concentrations three times higher than regional background levels, and it's been calculated that the Port of Oakland contributes 200 excess cancers per million within West Oakland. Roggenkamp said her agency is responding with regulatory and outreach programs for drayage truckers and grants to provide electrical shore power for oceangoing ships.

The US Environmental Protection Agency's Richard Grow mentioned an ongoing national Clean Diesel Campaign and federal stimulus funding for state pollution control efforts. His main focus was on process: how to ensure the meaningful involvement of local communities in decision-making. "The impacted community has to be at the table," Grow said. "Power sharing is a public health concept—it's basic environmental justice." That may mean leveling the table by providing technical and legal support so the community can participate fully. He praised the Port of Oakland's Maritime Air Quality Improvement plan as a model of true collaboration.

Speaking for the West Oakland community, Port Commissioner Margaret Gordon, former codirector of the West Oakland Indicators Project, put it bluntly: "Five of my eleven grandkids have asthma or allergies. When I moved to West Oakland, I was clueless about the port, truck traffic, and the freeway. The impact is on our local community—our lives, our public health. This is about justice, and the shipping industry is about making money. There are issues around who gets to sit at the table, to tell their story, and to make change."

"The port fully acknowledges its impact on public health," said Richard Sinkoff, the port's new director of environmental programs and planning. "We're moving forward with very specific programs in the face of a tremendous economic challenge. Environmental justice takes money. We really can't do it alone." In the near term, the port is helping drayage truckers meet a January 10, 2010 retrofit deadline. Also on the agenda: electrical connections at the terminal so docked ships won't have to run their auxiliary diesel engines. JE

Trash Sources and Pathways to Urban Creeks

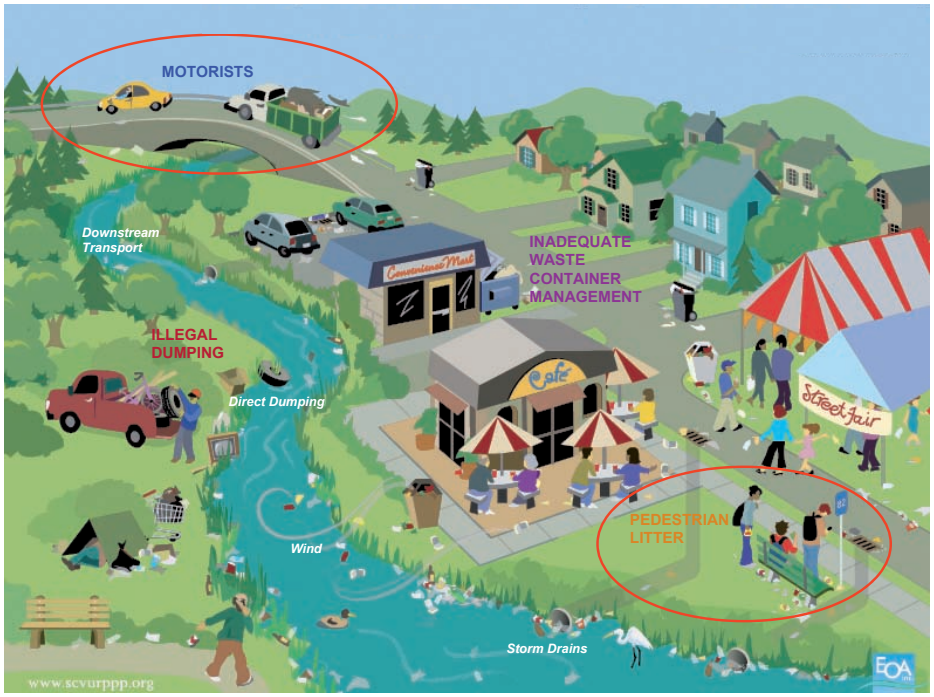


Illustration courtesy of Santa Clara Valley Urban Runoff Pollution Prevention Program.

"We need to update the trash BMP toolbox," said Chris Sommers with EOA, Inc. "Full capture alone may not get us there." He compared trash reduction approaches to littering by motorists: warnings in Texas, penalties in Ireland, public humiliation in Bangkok. Next: stocks in Stockton? (The only litter legal on California highways: clear water and feathers from live birds.)

There are still enough smokers around to contribute a major litter source—cigarette butts—but citywide programs have achieved reductions of up to 73%, said Sommers, adding that approaches that combine a focus on specific trash sources with public education seem to work best.

One of the fundamental laws of trash is that there's no such place as "away." What goes into creeks or the Bay may end up in the middle of the Pacific Ocean. Clean Water Action's Miriam Gordon told the audience that 85% of marine debris comes from land-based sources. Nine-tenths of that debris is plastic. "It's as much powder as pellets," Gordon said. "Plastic feedstock powder is a huge component of ocean pollution." Seabirds, turtles, and fish can ingest floating plastic, and debris transports invasive marine organisms and ambient pollutants. While it may not be feasible to vacuum the ocean, there are ways of attacking the problem at its source. According to Gordon, 3,200 pounds of waste are generated for every 100 pounds of product manufactured in the United States. Packaging waste constitutes about a third of the solid waste management stream. Recycling of plastics can't begin to keep up. Producer take-backs (implemented in Europe), fees, and bans on litter-prone items may be the best approach, and were featured in several legislative initiatives this year, although the plastics industry is fighting back. LOV/RS

Ed.'s note: Just a few weeks after the conference, the S.F. Bay Regional Water Board passed a new municipal regional permit that requires cities to reduce trash in stormwater (see "Trash Crackdown," cover sidebar).

Plastic from the Pacific Ocean garbage patch is ingested by albatrosses. Photo courtesy of CWA.

EASY COME, EASY GO?

Invasive exotic marine organisms have been described as "pollutants that reproduce." One conference presentation looked at San Francisco Bay's history as a gateway for marine invasives. Another described how predation by native species may be keeping one non-native organism in check.

Greg Ruiz of the Smithsonian Environmental Research Center presented data from his analysis of 300 species of non-native invertebrates and algae that have become established in western North America. California, he said, accounts for 81% of the first regional records for these organisms. Sixty percent were first detected in San Francisco Bay. "Both hull fouling and ballast are important means of introduction," Ruiz concluded. "We don't know the relative contribution of each. Many species could occur either on the hull or in the ballast tank at different life stages." He saw a dramatic increase in both of these vectors over time. While detection of invasives has historically focused on large commercial vessels, Ruiz said recreational vessels are as potentially important in the local and regional spread of invasives. Two pilot studies are beginning to get a handle on small-vessel traffic between ports and on hull maintenance practices.

The U.S. Geological Survey's Janet Thompson singled out the introduced overbite clam *(Corbula amurensis.)* Bivalves as a class, she said, are "critically important in food web issues and the trophic transfer of contaminants." Overbite clams have become abundant enough in the San Francisco Estuary to constrain phytoplankton productivity. But predation by diving ducks and bottom-feeding fish like sturgeons and bat rays can knock back the clam's numbers, allowing phytoplankton to rebound. "We're just starting to understand how predation affects phytoplankton resilience," said Thompson. "There's lots of variety between seasons, years, and bays. The bivalves dropped out in the South Bay. Can we make that happen in Suisun Bay?" In San Pablo Bay, the ducks are taking the bivalves out every fall: "We have no clams in the system come January and February." JE

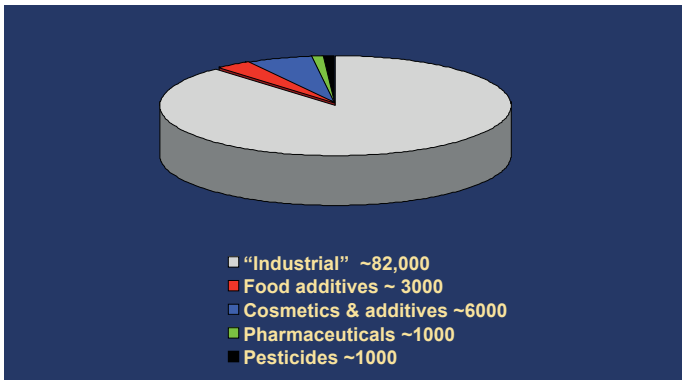
NEW WORRIES

"Do we need flame retardant chemicals? There's no evidence flammability standards are effective in preventing fire deaths."—Susan Klosterhaus, SFEI

Opening the session on contaminants of emerging concern, Tom Mumley of the San Francisco Bay Regional Water Board gave an overview of the challenges involved in regulating such diverse substances as PBDEs, pyrethroid pesticides, flame retardants, nanomaterials, and pharmaceuticals and personal care products. "There are very few standards for emerging contaminants," he said. "Knowledge is our big deficit." And over a thousand new chemicals are introduced every year, compounding the problem. Mumley discussed tiers of risk and regulation, the need to prioritize, and the value of looking at groups of chemicals with similar modes of action: "We don't want to play 'whack-a-mole.'"

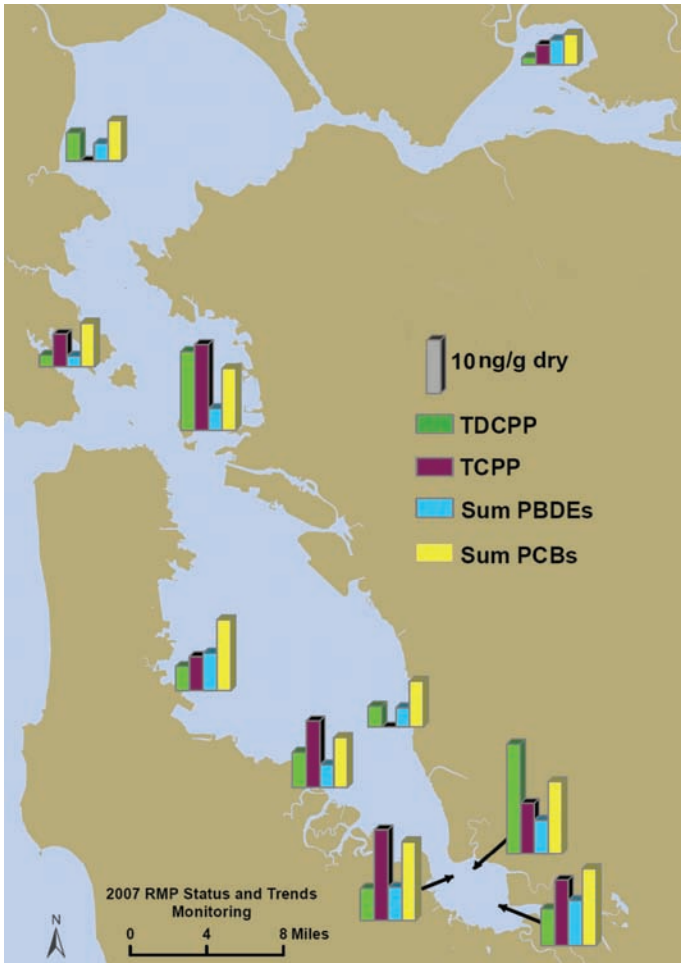
In addition to the Water Board, he said, regulation is divided among several state agencies, some with severe budget constraints. Mumley has high expectations for the Department of Toxic Substance Control's Green Chemical Initiative. He also reported that the Department of Pesticide Regulation is reevaluating pyrethroids, "the pesticide du jour of concern." Monitoring is crucial: "We monitor to make informed decisions."

New Chemicals Introduced in the U.S. Over the Past Thirty Years



Environmental Science and Technology

Organophosphates in Bay Sediments



SFEI

SFEI's Susan Klosterhaus looked at one major category of contaminants: flame retardants like chlorinated tris (see "Couch CSI," ESTUARY NEWS, August 2008, and "Pajama Contaminant in Bay Mud," October 2009.) "Do we need flame retardant chemicals?" Klosterhaus asked. "There's no evidence flammability standards are effective in preventing fire deaths. But the standards are what drive their use. The chemicals migrate out of products and are everywhere in the environment."

These products, she explained, were introduced as alternatives to polybrominated diphenyl ethers (PBDEs): "We typically think of them as new, but they're already legacy chemicals. PBDE concentrations in wildlife [including terns and sea lions] and people in California are among the highest in the world." Brominated chemical substitutes such as TBPH are also bioaccumulative, and possibly carcinogenic. "There's a lot we don't know, including the long-term effects of low concentrations," Klosterhaus added. She noted the difficulty of getting chemical information from manufacturers and the need for continued monitoring.

The organophosphate chlorinated tris (TDCPP), phased out in children's pajamas but still used in polyurethane furniture, textiles, and car phones, has been identified as a possible human carcinogen

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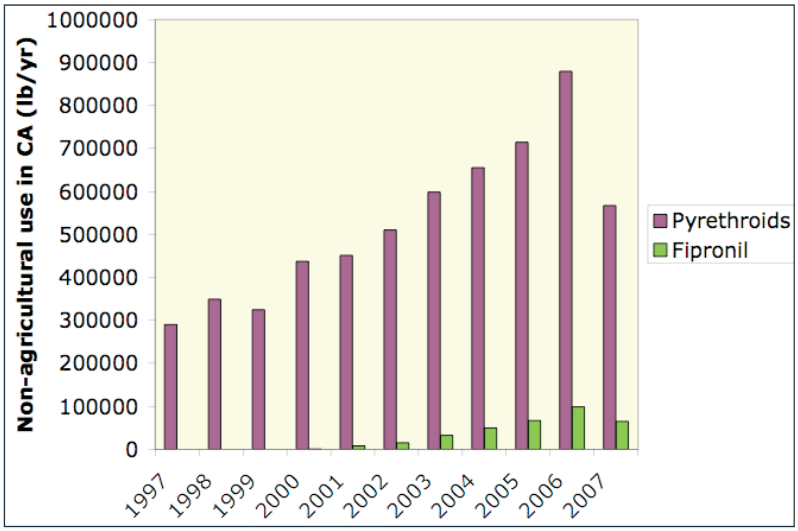
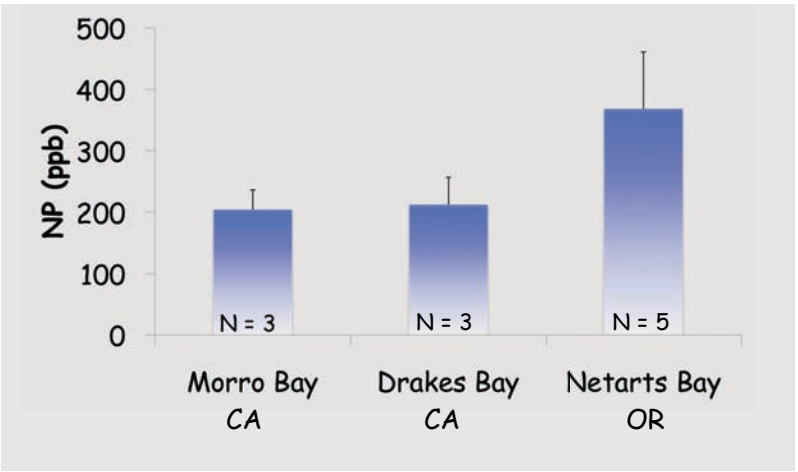
Changes in Pesticide Use



Nonagricultural use of pyrethroids has increased dramatically since the 1990s.

Nonylphenol in Oysters Along the West Coast



Drake's Bay oysters have nonylphenol levels similar to Morro Bay.

and a reproductive hazard for aquatic life. "We can't say 100 percent where these chemicals are coming from," she said. "But they're present in house dust, and we know they're in indoor air and laundry water. Effluent discharge and stormwater runoff are major pathways for similar products." The good news is that the new generation of flame retardants shows up at lower levels than PBDEs, if at all, in local seal blubber, and cormorant eggs. However, chlorinated tris concentrations in Bay sediments were comparable to PBDEs.

Turning to pyrethroids, UC Berkeley's Donald Weston presented the results of recent research on their presence in wastewater treatment plant discharges, stormwater runoff, and agricultural drains (see "Pesticide Pass Through," ESTUARY NEWS, October 2009, available at www.sfestuary.org). He compared data from 1993, when the organophosphate pesticide diazinon was still widely used, with the present-day dominance of pyrethroids: "Are we better off than in 1993? We're not seeing 30 to 40 miles of the Sacramento River toxic any more. But pyrethroids have challenges that are not involved with organophosphates." Weston said they were minimally monitored and hard to detect with the methods used by most monitoring programs.

One problem, Weston said, is that most monitoring programs are still using the freshwater crustacean *Ceriodaphnia dubia*—"a fine species for yesterday's pesticides"—as a test organism: "If pyrethroids are a concern, *C. dubia* is not a good species to be using to find toxicity." Another crustacean species, *Hyalella azteca*, is much more sensitive to pyrethroids. Using *H. azteca*, Weston found toxic pyrethroid concentrations in Ulatis and Alamo Creeks as they exited Vacaville: "The character of the creek water totally changed as it passed through the city." Urban runoff sampled in eight Bay Area and Central Valley communities contained levels of pyrethroids well above the toxicity threshold of 3 parts per thousand. Weston also documented unexpected pyrethroid toxicity in the American River after winter rains during a low-flow period. These levels are attributable to non-agricultural uses, including structural pesticide applications, which have outpaced agricultural use, said Weston. In contrast, only 10% of agricultural runoff samples showed pyrethroid toxicity. As if the pyrethroid challenge wasn't enough, new contaminants are waiting in the wings. "Fipronil may be the one we're talking about five years from now when pyrethroids are under control," he said.

Another chemical that's barely on the regulatory radar screen has been working its way into coastal food webs. Lars Tomanek of California Polytechnic State University said Morro Bay "had been considered a pristine estuary," but his team found troubling concentrations of the endocrine disrupter nonylphenol in arrow gobies, sand dabs, oysters, and mussels. It's a ubiquitous chemical, used in paper and textile production, pesticides and herbicides, paints, detergents, and contraceptive creams. Nonylphenol can be persistent in sediment. "It may not degrade at all under anaerobic conditions," Tomasek said. Likely sources near Morro Bay include a prison, a college, and residential areas where extremely high levels were found in septic systems. This isn't just a local phenomenon: preliminary data from Marin County shows comparable nonylphenol concentrations in Drake's Bay oysters, and higher levels in Tomales Bay gobies.

Baylor University's Bryan Brooks covered pharmaceutical and personal care products (PPCPs), a class of chemicals whose effects in estuarine systems are still little known. They enter the environment through wastewater treatment plant discharges; runoff from biosolid byproducts applied on agricultural land may be another pathway. "PPCPs challenge existing ecorisk paradigms," said Brooks. His talk focused on issues of methodology, including which organisms to use for bioassays and how to make the best use of existing pharmaceutical information. JE

Models exist for better protection for the Bay, say Keever and Seattle-based oil spill consultant Fred Felleman—even in inclement weather, including fog. (The *Dubai Star* spill occurred in "typically ideal conditions," according to the Coast Guard.) In both Puget Sound and Prince William Sound, ships are required to have booms in place before they begin transferring fuel or to have pre-approved "equivalent protection measures"—such as extra sets of eyes on the transfer operations or extra response equipment ready to be deployed immediately. In Puget Sound, pre-booming is required in all cases except where it is not safe or effective, says Byers, and applies to all ships transferring fuel at 500 gallons per minute or faster.

OSPR's Alecia Retallack says pre-booming in San Francisco Bay can be difficult because of strong tides and currents. Responds Felleman, "Yes, and it's difficult to safely transfer toxic fluids across floating vessels in the bay as well. If they are going to be permitted to do one [activity], they should be required to do the other. There will always be considerations for safety as we have in Washington."

"Eighty or ninety percent containment is better than nothing."—Dave Byers, Washington Department of Ecology

Byers agrees that "boom in a current is less effective for spills, but it is not ineffective. We expect booming to be done regardless of the current, when it is safe to do so. Current by itself is not sufficient reason to not boom, but when waves, wind or other factors make it unsafe, then alternative protective measures are appropriate." Byers said industry reps initially pushed back against the idea of pre-booming, arguing that it was ineffective. "We didn't accept that," he says. "Just because some oil might become entrained [and escape]…eighty or ninety percent containment is better than nothing." He adds, "We didn't want to regulate for every boat in every marina, but we did want to catch the oil in places where there is such high risk that when little accidents happen they result in a big spill," he says. Probably most importantly, the regs are strictly enforced: in 2008, 80% of the oil transfers requiring pre-booming in Washington were boomed. The remaining 20% used equivalent protection measures, says Byers.

A pre-boomed ship in Puget Sound. Most of the oil spilled here was contained near the ship. Photo courtesy of the Washington State Department of Ecology.

Washington's law, implemented in 2007 (after numerous bunker fuel spills in Puget Sound), has "worked great," says Byers. "Some companies implemented it voluntarily, and we know from the volume of oil being contained, it's a success. From the spiller's point of view, it's a much less expensive way of responding." On the heels of the *Dubai Star* spill, a $10 million lawsuit was filed by crab fisherman Mark Russo, herring fisherman Ron Alioti, and Next Seafood Company owner Russell Robinette against South Harmony Shipping, Inc. of Panama, seeking compensation for lost business due to the public's fear of buying seafood after the spill.

"Keep the oil in the hull first; but second, keeping it around the ship is far better than chasing it around the Bay."—Fred Felleman

The protective measures in place at Puget Sound include identifying and reporting all spots where fueling occurs and having response equipment stockpiled at those locations. That has had far-reaching benefits, says Felleman. "You know where fueling occurs; you get the spill contractors out and exercising their equipment. It's a good way to improve response capacity while at the same time doing something preventive." The bottom line, says Felleman, is containing the spill quickly. "Keep the oil in the hull first; but second, keeping it around the ship is far better than chasing it around the Bay."

On November 5, a U.S. Navy aircraft carrier spilled 500 gallons of jet fuel into Puget Sound. The vessel was pre-boomed

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and 100% of the fuel contained. "The Navy's successful response to the 500 gallon spill—as darkness fell and a storm approached—demonstrates that the difficulty is well worth the effort," says Felleman.

OSPR's Rick Colliers said there had been a total of 1,881 fuel transfer operations in the Bay between January 1 and September 30, 2009.

Currently, ships in San Francisco Bay re-fuel all around the Bay, says Dragon, including at Anchorage 9, where the *Dubai Star* spill occurred. Roger Crawford, a San Francisco State University professor (now retired) who specialized in Bay issues, suggests that one solution might be to have just one central fueling station in the Bay, where spill response teams and equipment are at the ready at all times. Crawford also points out that the *Dubai Star* probably violated international maritime law, which requires ships to have someone "on watch" at all times, including during refueling operations.

At a November 12 meeting of the Harbor Safety Committee of the San Francisco Bay Region, OSPR's Rick Colliers said there had been a total of 1,881 fuel transfer operations in the Bay between January 1 and September 30, 2009. Only 381 of those took place at anchorages.

In Prince William Sound, says Felleman, "people were really motivated never to let a spill happen again. I would hope California legislators would see this opportunity to learn from Washington and Alaska. California could adopt what we've gone through. Transfers are notoriously the most risky things—and if you don't even know where they occur, you don't know how to stockpile equipment."

In addition to better state legislation, efforts at the federal and international levels could help prevent future spills in the Bay. A federal bill (SB 1194) introduced by Senator Maria Cantwell (D-Washington) reauthorizing the Coast Guard has a provision that would require pre-booming, according to Felleman. Another federal bill (HB 3619) introduced by Congressman Jay Inslee (D-Washington) also reauthorizing the Coast Guard has a provision requiring tug escorts for oil-laden tankers. Keever is also hopeful that an international protective zone will be approved next year by the International Maritime Organization (an arm of the UN set up to regulate shipping worldwide) requiring cleaner fuel in all U.S. and Canadian waters out to 200 nautical miles. "It still doesn't get rid of bunker fuel, and lots of other waters wouldn't be protected," says Keever. "But it's a start to seeing the phaseout of nasty, dirty bunker oil." Current regulations in California require ships to use cleaner, lower-sulfur fuel (marine distillate) once they get within 24 nautical miles of the state. "But beyond that they switch back to dirtier fuel because they can; it's cheaper because it doesn't need to be refined very much," says Keever. Ships have multiple fuel tanks, and while the *Dubai Star* may not have been running on bunker fuel in the Bay, it was filling one of its tanks with bunker fuel, says Dragon.

At the November 12 Harbor Safety Committee meeting, Coast Guard Captain Paul Gugg said he could not answer questions about the *Dubai Star* spill response time or volume because the case is still under investigation. When asked by a committee member when the investigation would be completed, he responded "some time in 2010." When Dragon tried to address the committee about the issue of pre-booming ships, the chair of the committee responded that the committee deals only with ship collisions in the Bay, not with oil spills or booming. Yet, according to the 1991 Lempert-Keene-Seastrand Oil Spill Prevention And Response Act, the Harbor Safety Committee is charged with "planning for the safe navigation and operation of tank ships, tank barges, and other vessels within each harbor."

Perhaps the greatest risk for San Francisco Bay, says Felleman, is complacency. San Francisco Bay has had two recent wake-up calls, in the *Cosco Busan* and *Dubai Star* spills, both of which were bad enough but could have been much worse. "The only time we get oil spill legislation is on the heels of a spill," says Felleman. "And typically we try to fix the widget that broke rather than the broken system. But in this case, the broken widget is the failure to acknowledge that this high-risk activity needs additional protections already vetted in Puget Sound and Alaska. There's no reason why this is not done everywhere. I would fix that widget now."

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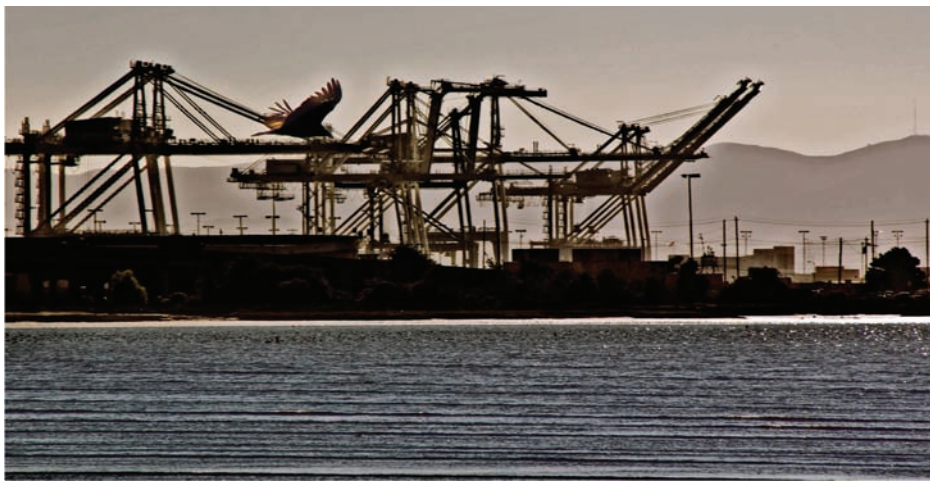

"Bird of Man, Bird of Nature" by Ken Osborn, 3rd place winner, 2009 San Francisco Estuary Partnership art contest.

LION IN THE WATER

TOM GRAFF's word was gold. Every day he wrote a to-do list on a scrap of paper and kept it in his pocket. You could ask him about a ruling or decision or project that happened years ago and he would put his hand in one of the three-foot-high, dusty file stacks crowding his office and pull out a pertinent piece of paper. He remembered names, listened more than spoke, mentored the young, and advised the new. He had a way of entering discussions only when it really mattered, so people paid attention. When he died, at 65, on a Thursday morning in November, something shifted at the core of the California water world. A leader of unusual integrity, respected by friend and foe, had left the scene. And almost everyone who knew Graff agreed about one thing: this man, in this day and age, was irreplaceable.

"He was a gift to the environment," says Roberta Borganovo of the League of Women Voters. "He graduated top of his class, was educated in the best schools, and could have been a top-flight, top-earning lawyer. But he chose to follow his ideals."

Tom Graff came to California in 1970, after graduating from Harvard and the London School of Economics, and working for a federal judge and a New York mayor. He joined a San Francisco law firm, but a year later he left it to found the California office of the Environmental Defense Fund in a Berkeley attic. Instead of hiring tree-huggers and biologists, he hired economists and computer geeks. He then pioneered what has become EDF's trademark philosophy: bringing market forces to bear on resource conflicts. "If a resource is scarce, we ought to put a price on it that reflects its value, otherwise there's an incentive to over-consume it," he once said.

California has never seemed to have enough water to go around. When Graff arrived on the scene he quickly surmised that the old way of doing business wasn't working. "He envisioned a system not based on political arrangements and historic entitlements that no longer make sense, but driven by price, and the true valuation of the resource," says David Yardas, one of EDF's early number crunchers. Graff thought farmers would use water more efficiently if they could sell some of their supplies to thirsty cities at a profit. He thought freeing up water in this way, and conservation, could prevent dam building. He also thought the environment should be endowed with a right, or a budget, for some of the water.

Graff brought this concept to the negotiating table during his most well-known contribution to state water policy—passage of the Central Valley Project Improvement Act of 1992. The Act not only created a new accounting system for the water diverted and pumped by the Project, but also dedicated a specific amount of water to the environment itself.

Graff's brilliance and listening skills helped create the unprecedented alliance between environmentalists and urban water districts that shepherded the Act into law. "I take great pride in some of the breakthrough work Tom and I did to achieve mutual interests," says Carl Boronkay, retired General Manager of Los Angeles' powerful Metropolitan Water District. "He was a capable lawyer with a nice manner. He and I discussed water marketing for twenty years, and by the end I was a believer."

Graff had a gift for strategy, which helped him in everything from his successful battle to stop the East Bay Municipal Utility District from tapping the salmon-friendly American River to standing firm against each new incarnation of a peripheral canal and facilitating California's forward-thinking cap on greenhouse emissions.

"He had a very strategic sense of things, of looking way down the field, making some bank shots, knowing you can't always go in a straight line, knowing you need to adapt as you go, putting yourself in other people's shoes," says Yardas. "He taught me not to confuse the issues with the people."

Borganovo agrees. "He taught me not to take it personally, to know that the outcome may not be what you expect, but to always have a clear picture of your own bottom line."

Many people remember Graff for coaching them, giving them advice, encouraging others to take the initiative, the limelight, the credit. "He was a master puppeteer," says EDF's Spreck Rosekrans. "You never knew whether he was a giant and we were all standing on his shoulders or vice versa."

Graff worked hard but knew where to draw the line. He never missed his kids' soccer games or music recitals. When his fight with cancer forced him to give up his daily workout, he set himself to shooting baskets from 15 feet away, and kept track of the results of these free throws. "He was very proud that he could still shoot better than 80 percent from the free throw line," says Rosekrans. Long time colleague David Roe says Graff always steered unerringly toward a better future. "He was the happiest environmental advocate I've ever known." ARO

To read more about Tom Graff, see http://blogs.edf.org/waterfront/2009/11/12/in-memory-of-tom-graff/

Tom Graff with Marcia Brockbank at the 2007 State of the Estuary conference. Graff was presented with the Jean Auer award that year.

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