San Francisco Estuary Partnership

Salinity Influences
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Mercury in the Fog

Beyond the Bird Goo

Canvasbacks Retake Cullinan

The Search for Delta Master Variables

Rethinking our Grandest Plan for the Estuary
The Silver Dagger in Fog

The tinkle of Pacific fog on skin feels fresh and healthy. But recent studies suggest those microscopic droplets contain significant concentrations of mercury, making coastal fog a major source of this neurotoxin in the terrestrial ecosystems of Central California.

The tale begins in 2010, when researchers from UC Santa Cruz discovered dimethyl mercury, a volatile form of the element, in upwelled seawater. Ocean conditions appear to help convert dimethyl mercury into an even more biologically mobile form, monomethyl mercury. The scientists wondered if this upwelled mercury was being incorporated into rain, but found nothing out of the ordinary in rain samples.

Then Peter Weiss-Penzias, a researcher in the school’s department of microbiology and environmental toxicology, decided to look for the mobile mercury in one more place—fog. “During upwelling, we have this fog bank over the water. Because upwelled mercury is very reactive, it could be oxidized and get incorporated into the cloud droplets, and deposited on the land as fog drip,” Weiss-Penzias says.

In 2011, Weiss-Penzias and colleagues collected fog water from two sites around Monterey Bay. They found monomethyl mercury, which is able to accumulate in living tissues, at concentrations up to 100 times higher than in rain.

Their data suggested that the fog samples with the most mercury had been collected immediately after the strong winds that drive ocean upwelling had slackened. “The winds pump mercury to the surface, evaporation is enhanced to the fog bank above, and the fog transports it to land,” Weiss-Penzias says.

Now scientists are discovering that fog could be a major source of mercury in upland ecosystems. Coast redwoods rely on fog for moisture in summer. Jim Ryftuba of the US Geological Survey in Menlo Park compared the mercury content in redwood needles along the coast to an area exquisitely inland as far as Red Bluff. Ryftuba reported at the American Geophysical Union meeting this past December that monomethyl mercury concentrations in coastal redwoods were roughly 10 times higher than in their inland counterparts, making fog the dominant source of methyl mercury in coastal uplands.

To make matters worse, methyl mercury levels have been reported to be rising among yellowfin tuna and in ocean basins over the past 15 years, likely due to industrial activity. “The more mercury we put into the atmosphere with pollution, the more cycling of mercury between the ocean, atmosphere, and land will occur,” Weiss-Penzias says.

This is particularly worrisome because monomethyl mercury tends to accumulate in living organisms, especially in species at the top of the food web like pumas and people. For this reason, Weiss-Penzias has begun collaborating with UCSC biologist Chris Wilmer to study mercury levels in mountain lion whiskers.

Weiss-Penzias continues to collect coastal fog samples from Big Sur north to Eureka in search of patterns pointing to mercury production. “We’re looking for that smoking gun—where is the environment producing methyl mercury and the mechanism for it getting into fog,” he says. KW

Photo: Francis Parchaso

CONTAMINANTS

Sticky Mystery Spills Stump Spill Responders

The exact identity of the invisible, rubbery, odorless goo that glommed onto some 500 birds on the East Bay shoreline from Alameda to Hayward in January continues to thwart investigators at the California Office of Spill Prevention and Response. Polyisobutylene, a non-biodegradable fuel additive used to keep ship engines clean that has been implicated in the deaths of thousands of seabirds around the world, was the original prime suspect. But state officials quickly ruled it out. Their most recent guess is some type of “synthetic or natural oil or fat” that was deliberately dumped or accidentally spilled into the Bay.

Mike Connor, from the East Bay Dischargers Authority, says his members know the substance didn’t come from their facilities. “Everyone was evaluating their effluent up the wazoo to see if we found anything funny or out of the usual. But we didn’t. And if it was the consistency of a rubber cement type product, it would have clogged all of our filters. We looked intensively at our system and there were no issues, zero toxicity. I’m 98% convinced it was a ship-based source.”

Whatever the mystery goo turns out to be—a wildlife rescuer, bird advocate, and politicians say the response to this incident is best they could but they could have saved more birds had there been more trained responders. At the peak of the response, only 12 trained volunteers to wildlife responders were working 36 miles of shoreline. “We need at least 1 person for every 2 miles of shoreline. This is yet another wakeup call.”

Richardson Bay Audubon Center and Sanctuary’s Jordan Wellwood says her organization is working with State Senator Mark Leno to improve the response process. Leno has introduced a bill that will be refined with help from partners like the Audubon Center and BayKeeper. Over 170 dead birds were collected in the field; 131 birds perished on their way to the rehab center or while under care. At press time, IBR had released 152 birds but still had 41 birds at its hospital. With no state funding to respond to this incident, IBR is spending up to $9,500 per day to care for the birds.

“We’re making sure their blood values and temperatures are good, that nothing is left on them that could impair their ability to survive before we release them,” says IBR’s Russ Curtis. LOV

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Copper Effects on Salmon Influenced by Salinity

Nietzsche was wrong: what doesn’t kill you doesn’t necessarily make you stronger. Sublethal doses of toxic copper can reduce a salmon’s chances of survival, but new research suggests impacts may be different in saltier water.

A decade of research by David Baldwin of NOAA’s North-west Fisheries Science Center and other biologists has shown that in some situations, very low levels of dissolved copper interfere with a salmon’s ability to detect smells. This can be a matter of life or death: salmon rely on their olfactory senses to avoid predators, locate prey, and home in on their natal streams when they return from the ocean to spawn. Earlier studies involved juvenile fish in freshwater settings. Baldwin’s latest project, funded by the Regional Monitoring Program for Water Quality in San Francisco Bay and the Copper Development Association, suggests things are different in brackish and salt water. At salinities that a young salmon is likely to encounter in San Francisco Bay, even copper concentrations well above the current water quality objective had no effect on test subjects’ olfactory function.

“As freshwater fish move into the estuary they become, in effect, polluted from day one,” says Baldwin.

Copper enters the watershed via wastewater discharges, as well as urban and agricultural runoff (some pesticides contain copper) and automobile brake pads. The use of copper in brake pads is now being regulated because it matches the salinity of the fish’s internal fluids and tissues, but it’s within the estuarine spectrum.

Recent RMP measurements indicate that dissolved copper levels in the Bay are under 4 µg/L, close to what studies in the 1970s found. However, concentrations as low as 3 µg/L have been implicated in behavioral impairment in juvenile salmon in freshwater. They can’t detect the chemicals released when another fish is attacked by a predator, and don’t take evasive action.

To tease out effects on fish, Baldwin has worked with juveniles — smolts — of both Chinook salmon, a species that travels through the Bay and Delta, and coho, a coastal-stream spawner. Smolting is a complex process, changing the young fish’s appearance and physiology from a freshwater phase to a seawater phase to adapt for life at sea. Baldwin used electrodes to measure how a smolt’s olfactory system responded to a mix of amino acids after exposure to a strong solution of dissolved copper, 50 µg/L, at a salinity of 10 parts per thousand (ppt). That salinity was chosen because it matches the salinity of the fish’s internal fluids and tissues, but it’s within the estuarine spectrum.

A seabound Chinook would encounter salinities of 2 ppt where the Sacramento River passes Rio Vista, 7 ppt in San Pablo Bay, and 30 ppt at the Golden Gate.

In Baldwin’s lab, while pre-smolted salmon tested in freshwater show a reduced olfactory response due to copper exposure, when tested in 10 ppt there’s no reduction. Likewise, in their seawater phase, copper exposures in 10 ppt appear to have no impact.

Previous freshwater work demonstrated copper olfactory toxicity in a salmon relative, the steelhead, the anadromous form of the rainbow trout. “I don’t see why the results of the estuarine/seawater work in coho and Chinook couldn’t be generalized to steelhead,” Baldwin adds. “It’s unlikely that the steelhead olfactory system is radically different.”

What’s not clear is whether salinity levels below 10 ppt would still be protective. And what about the returning adult salmon, seeking out water that smells like home? That research has yet to be done. But adults have less prolonged exposure to estuarine contaminants than smolts. “Smolts use the estuary as an arena to feed and rear, trying to decide ‘Am I really ready to go out in the ocean?’” Baldwin explains. Adults, however, don’t dither around on their way to the spawning grounds.

Cullinan Finally in the Fold

Real estate developers often name their projects for what they’ve displaced: Quail Acres, Live Oak Estates. Egtet Bay would have been another such neronym. The 4,500-home development proposal for the former Cullinan Ranch on San Pablo Bay in 1983 would have been home for egrets, or other birds. A citizen’s group, Valleyjoans for Cost Efficient Growth, supported by Congresswoman Barbara Boxer, the land became part of the San Pablo Bay National Wildlife Refuge. Refugio Bay came the process of re-storing the badly subsided 1,500 acres to tidal wetland. On January 6, the dike between Cullinan and Dutchman Slough, a tidal arm of the Napa River and San Pablo Bay, was breached in three places, reconnecting the parcel to the Bay for the first time since it was drained and planted in oat hay in 1880s. The watery wasteland, followed by thousands of canvassback ducks—one of the intended beneficiaries of the refuge—and other waterfowl. “They’re taking advantage of the fact that here, all of a sudden, is a food source,” a Refuge Manager, Don Brubaker. “You have all you do add water. It’s like making oatmeal.”

Early plans for Egtet Bay, tutored by environmentalist William Boxer, were rescinded. He’s interested in using sensors and algorithms to improve the relationship between natural systems and the built environment.

By combining historical data and predictive modeling about a specific watershed, Cullinan thinks infrastructure built to control water flows—dams, levees, and the like—can become more adaptable and provide better ecological value.

Before joining the Harvard faculty, Cullinan taught at Louisiana State University where he and his students developed a theoretical way of modeling the Gulf Coast’s estuary. The region suffers from a rapidly declining salt marsh—some estimates have it that Louisiana loses a football-sized chunk of marsh yearly.

One reason for the salt marsh decline is that the sediment funneled through the Mississippi River is not getting to the Gulf in sufficient quantities. A half-century worth of aggressive floodland along three miles of Highway 37 required ‘delicate negotiations’ with CalTrans, and protecting the roadway was complicated by projections of sea level rise.

“The waterfowl response to the breach was almost instantaneous,”

Tunable Infrastructure

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To reestablish the natural function of the river basin, Cantrell came up with a device called a ‘PodMod’ that captures upriver sediment in mesh tubes and deposits it downstream, once clear of intervening infrastructure. A filled tube activates a float, which travels until it meets brackish water. The increased salinity activates electrochemical corrosion, which in turn opens a clamp, letting the load of sediment be dragged, tagged, tracked, and timed to match seasonal flows and other river output—or even to miss times of heavy boat traffic.

Cantrell proposed a trial of the system on the Alatchala River, a tributary of the Mississippi. The system, however, is not part of the current $50 billion Coastal Master Plan that guides federal environmental efforts.

While the PodMod idea might not be a good fit for the hydrology of the San Francisco Bay estuary, which also suffers from poor natural sediment recharge, Cantrell’s larger concepts about using technology to make infrastructure better mimic natural systems might still be locally applicable. In fact, some of Cantrell’s Harvard design students are modeling West Dakota projects to see if design systems can be used to create air pollution CULLINAN FINALLY IN THE FOLD

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Good Old Days for Smelt

The ongoing drought may have pushed the Delta smelt to the brink of extinction, with the species plummeting to its lowest levels, according to UC Davis biologist Peter Moyle in a recent interview on Capitol Public Radio. Yet a new report released by the Interagency Ecological Program finds that just a few years ago, in 2011, the slim silver fish had a banner year, which showed that the smelt has the ability to rebound, if conditions are just right.

According to the report’s co-authors, that year’s tempest in 2011 showed that, at that time, the system had not reached such an altered state that it could not be restored by the smelt species. It also showed that smelt can thrive when conditions are good for spawning, growth and survival.

A general life cycle conceptual model for the four Delta smelt life stages of adult, eggs, larva, and juvenile, and sub-adult—as well as life stage transition—encompasses 16 hypotheses about factors that may have contributed to the 2011 increase. The authors then evaluated these hypotheses by comparing habitat conditions and Delta smelt responses in the wet years, 2005-2006, to those in the drought years of 2006 and in the drier years 2005 and 2010. Although larval recruitment was high in both wet years and lower in the drier years, juvenile and adult abundance increased only in 2011. The lack of juvenile and adult abundance in 2006 might have been due to poor survival of larvae in 2005-2006.

Other factors helping make 2011 a good year were prolonged wetter temperature and high 2011 winter and spring outflows—which reduced entrapment and increased food availability in both warm and cold water temperatures in late spring and early summer as well as improved food availability and low salinity conditions. Sub-adults benefited from improved food availability and favorable habitat conditions in the river, low salinity, which was located more toward Suisun Bay in 2005-2006 and 2010. The authors conclude that while good larval recruitment is essential for a healthy smelt population, growth and survival in subsequent life stages are essential to support healthy smelt populations.

The authors point out that the report benefited from years of monitoring data, although some data gaps still exist. While they did not reject any of their hypotheses entirely, certain aspects of other habitat attributes either produced inconclusive results or were limited by a lack of suitable data.

DWR’s Ted Sommer, one of the authors, says the report breaks new ground because the model it presents is the “most refined version” of all the conceptual models used to date. "It reflects the progress we’ve made in the past decade figuring out what the contributors important to Delta smelt, organized all in one place," and the report isn’t sitting on a shelf but is already being applied to “real time” ecosystem management. "We’re using the model to help us identify what things to measure and which questions to ask.”

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**Master Variables Questioned**

It isn’t your grandfather’s Estuary—or even your father’s. Changes have rippled through the food web from seasonal shifts in the growth of microscopic diatoms to a sharp decline in pelagic fish. It’s a hyper-disturbed ecosystem, says US Geological Survey aquatic ecologist James Cloern.

As the changes have grown more alarming, everyone has been searching for a single culprit. Some have been pointing the finger at ammonia from a regional sewage treatment plant and others at everything from the loss of river flows to too many hungry alien clams or bass. But in such a disturbed system things are rarely simple. “We can’t attribute the restructuring of the biological community to a single factor,” says Cloern. “There’s a broad scientific consensus that landscape transformation, water diversions, toxics, introduced species, and nutrient loads are all involved.” Consensus or not, in the delta there always seems to be a devil in disguise, especially when it comes to how nutrients like nitrogen affect the ecosystem.

Nitrogen is vital to phytoplankton, the single-celled photosynthesizers, including diatoms, responsible for primary production in aquatic ecosystems that fuels the food web. But the value of nitrogen depends on its chemical form. Ammonium, one kind of nitrogen compound, can interfere with the ability of phytoplankton to use nitrate, another compound, to produce food for fish. Nitrogen enters the estuary system from wastewater treatment plants and agricultural runoff.

Recent paradigms explaining change in the Estuary identify nutrient loads, mainly from the Sacramento Regional Sewage Treatment Plant, as a “greater variable.” That view, represented by Patricia Gilber of the University of Maryland Center for Environmental Science and Richard Dugdale of San Francisco State University’s Romberg Tiburon Center, has been one of the foundations of proposals for substantial technological changes at the wastewater treatment plant.

An article by Cloern and six co-authors in the current Interagency Ecological Program Newsletter, however, argues that it’s highly uncertain that such measures will be enough to recover the Estuary. Reanalyzing data on Suisun Bay, they question in particular Gilber’s linkage of nutrient inputs to food web changes and her prescribed technological fix.

Gilbert contends that reducing ammonium inputs “is essential to reductions in phytoplankton concentrations” in a 2010 article in Reviews in Fisheries Science analyzing data from the Inter-agency Ecological Program’s (IAP) sewage treatment plants and other nitrogen sources. If that isn’t done, she says, “other measures, including regulation of water diversions or more efficient nitrogen use, as has been the current strategy, will likely show little beneficial effect.

In addition to ammonium, Gilbert points to increased ratios of nitrogen to phosphorus that select against diatoms, high-quality food for other organisms, and fungi and actinobacteria as lower-quality foods, leading through multiple trophic steps to the collapse of the pelagic food web. Freshwater flows to, Gilbert, are a secondary factor. (At press time, Gilbert was traveling in China and unavailable for an interview.)

Dugdale, who calls himself “a stranded oceanographer,” emphasizes the Ammonium Paradox: “Phytoplankton are nitrogen hungry diatoms, are so for growing in nutrient-laden waters, in using nitrate, gobbling it up incredibly fast. But their nitrate uptake is inhibited by low concentrations of ammonium loads.

Dugdale also underscores the interaction between freshwater flow and ammonium. “You need a certain level of flow in order to dilute the Ammonium concentration being put out by the treatment plant,” says Dugdale, who and there’s not enough dilution to allow phytoplankton to exploit the nitrate; too much and the phytoplankton cannot get washed out of the system. When ammonium declines to non-inhibiting levels, you start to get nitrate uptake at the surface, and algae fail in enclosure experiments and in the field. “Dugdale and others argue that “changes in water treatment practices and water allocation” could reduce ammonium inputs in a 2007 article in Estuaries and Coasts.

If nutrients have driven the downfall in phytoplankton, argue Cloern and his co-authors in their recent article, you’d expect to see declining nitrate and higher phyh-a concentrations, an indicator of phytoplankton biomass, to mirror the curve for increasing nutrient loads. But it doesn’t. Instead, there’s a step change in...
Oakland Coliseum Area Looks Vulnerable

FLOODING

in IEP data from Suisun: a precipitous drop to lower — and stable — levels in 1987. (Dugdale sees evidence of a decrease prior to that; Cloern’s group found no statistically significant evidence.)

The drop coincides with the advent of the invasive overbite clam (Potamocorbula amurensis), a voracious filter-feeder that vacuums diatoms out of the system. Cloern’s group also found no support for reports of a shift from “good” phytoplankton to “bad” phytoplankton. The earlier IEP samples, Cloern says, are not of high reliability criteria, while more recent and more robust data show a continuing preponderance of diatoms in a reduced phytoplankton biomass. “There’s no evidence that phytoplankton now has poorer food quality,” he says, “but it’s not clear that the problem is not quality but quantity.”

Dugdale acknowledges complications: his model doesn’t completely fit what’s happening in places like Suisun Bay, where his research group has suggested that “some unknown factor” appears to selectively depress nitrate uptake in experimental enclosures. Possible culprits could be trace metal leakage from the ‘mothball’ port for reports of a shift from “good” to “bad” phytoplankton.

The Central Valley Regional Water Quality Control Board’s Delta Strategic Workplan includes a Delta Nutrient Management Strategy which calls for research to determine the role of nutrients in problems such as increased abundance of aquatic weeds, low dissolved oxygen in back sloughs, and cyanobacteria blooms, as well as changes in phytoplankton community composition. As part of the research plan, the Board is convening a Science Work Group to investigate first the Ammonium Paradox, then Gilbert’s model, with a report due in 2018. Dugdale, Gilbert, and Cloern’s co-author David Senn are on preliminary lists of work group members.

“The most important decision about ammonium reduction has already been made,” says Dugdale. The Sacramento regional plant has a new permit for advanced secondary treatment that requires most ammonium to be converted to nitrate and will also reduce the total nitrogen output. Pilots are running, and the new system should be on line in 7 or 8 years. “It will be a grand experiment at that point.”

Cloern agrees that the new treatment will have environmental benefits: “My question is this: what will be the expectation that this single action will lead to recovery of the ecosystem?”

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A New Comprehensive Plan for the Estuary

Changing estuarine conditions and new pressures from ongoing urbanization and development, as well as from climate change, inspired estuary planners to undertake a revision to the Comprehensive Conservation Management Plan (CCMP) in 2014. The CCMP, first published in 1995 and most recently updated in 2007, was the first master plan for improving the health of the estuary encompassing San Francisco Bay and the Sacramento-San Joaquin River Delta. The intent of the current update — a project still led and managed by the San Francisco Estuary Partnership (SFEP) — is to streamline the current plan, which contains more than 200 actions and refocus on contemporary concerns.

“We’re seeing the forecasts for faster rates of sea level rise and lengthier periods of drought come true. We’re having to revise our plans in anticipation of a much more tumultuous future for the estuary and Bay Area residents,” says Marc Holmes of The Bay Institute, one of the early and current framers of the CCMP.

“So much has changed since 2007 that there has a direct impact on the Bay and Estuary,” says Carol Mahoney of Zone 7 Water Agency, who is also working on the CCMP revision. “From legislative actions (like SB x 720% water conservation by 2030) to me in the Estuary.”

Within the CCMP process, stakeholders gained a greater understanding of the significance of environmental and economic issues in the estuary. As mentioned in the December article, the revised CCMP will look forward to 2050 while crafting a small set of strategic actions that can result in measured progress over the first five years of implementation.

“An important step is to harness the big picture spirit and strong partnerships of the first CCMP in this new revision,” says Partnership director Judy Kelly.

SHORTHISTORY OF THE CCMP

The San Francisco Estuary Project had its origins in the Clean Water Act, and its purview is one of the America’s 28 “estuaries of national significance.” In 1987, the Project began assembling a series of ground-breaking status and trends reports on key environmental and management issues troubling San Francisco Bay and the Delta — linking them into one estuary for the first time. Building on this foundation, it developed the strong vision for addressing these issues now known as the CCMP.

“The first time we took a serious look at the estuary in a comprehensive way was the CCMP. All successive efforts have built on that foundation,” says western water consultant Barry Nelson. Nelson was one of more than a hundred stakeholders from diverse interests, ranging from business and environmental groups to government agencies, invited to pull up a chair at the negotiating table. The resulting 300-page CCMP aimed to restore the ecological functions of an estuary that drains almost forty percent of the state, while at the same time sustaining its use by humans and wildlife.

Ultra-marine at Cullinan Ranch in the North Bay. Toxins to the tenacity of a variety of entrenched and wildlife and wildlife interests working to bring a complicated, expansive, time-consuming restoration project to fruition (see p. 5).

Photo: Marc Holmes

NEW CHALLENGES & ACTIONS

Asked about how the proposed new CCMP will be different from the last one, Kelly had this response: “Clearly regional climate change adaptation is going to be a major theme as we plan for the next 35 years. In addition, new water quality issues such as contaminants of emerging concern are taking their place as areas of possible focus alongside long-standing concerns about legacy PCBs and mercury.”

According to Sweeney, some of the more immediate priority actions CCMP revision teams are considering in their new plans include:

• Leveraging natural processes through “green” infrastructure to provide multiple benefits such as flood protection, aquatic habitat, and water quality.

• Developing freshwater inflow standards to protect all beneficial uses in the Estuary.

• Addressing emerging contaminants.

• Planning for extended droughts.

• Protecting and increasing fish and wildlife populations.

• Restoring and sustaining ecosystems, and increasing the adaptive capacity of our shorelines, in the face of climate change.

• Developing and sustaining reliable funding sources and collective leadership to meet our future goals.

“We are already working with our partners and others in small group settings to explain the process and get feedback and ideas for the new plan,” says Kelly.

continued to back page

WHAT’S YOUR TAKE?

The San Francisco Estuary Partnership welcomes your input!

> CHALLENGES ?

What are the 3 biggest challenges now facing the San Francisco Estuary?

> ACTIONS ?

What are the 3 most important actions we can take for a healthier estuary over the next five years?

> CONTACT ?

How can we get in touch with you?

YOU CAN EITHER:

1. Go online and answer these questions at www.sfestuary.org/ccmp revision/

2. Type up your responses and mail them to Caitlin Sweeney, SFEP, 1515 Clay Street, Suite 1400, Oakland, CA 94612

Or, Caitlin.Sweeney@waterboards.ca.gov

What makes the San Francisco Estuary one of the world’s great estuarine areas: habitats, living resources, and water quality and quantity. Next steps will involve soliciting feedback from the larger Bay Area community, and review of the draft actions by the steering committee working under SFEP’s Implementation Committee.

“The teams have really rolled up their sleeves and proposed a robust set of possible actions,” says Clifton Sweeney, a senior planner for the Partnership. Sweeney is now working with the teams to cross reference and refine proposed actions across program areas. “Everyone is more aware of the many days of how every action affects others,” she says.

As mentioned in the December article, the revised CCMP will look forward to 2050 while crafting a small set of strategic actions that can result in measured progress over the first five years of implementation.

“We continue to harness the big picture spirit and strong partnerships of the first CCMP in this new revision,” says Partnership director Judy Kelly.

SHORT HISTORY OF THE CCMP

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Within the CCMP process, stakeholders considered their ideas down to 145 specific actions tackling pollution, dredging, land use, water use, wetlands, fish and wildlife issues, among others. “The CCMP provided a structure for allowing people to do what they care about—kind of church of the estuary,” says Will Truax, former director of the San Francisco Bay Conservation and Development Commission (BCDC).

On the 20th anniversary of the CCMP, the Partnership published a special 24-page issue of ESTUARY NEWS magazine. The issue commemorates twenty years of progress, including everything from planting native coastal plantings, reforestation efforts, thousands of volunteers involved in hands-on stewardship, and whole rivers returned to their floodplains. Much of the progress comes thanks to the investment of taxpayers in state water bonds.

Moffett Field near Sunnyvale, just one property on the long shoreline between San Francisco and San Jose which is threatened by continued urbanization and vulnerable to sea level rise. Photo by Marc Holmes.

Nominations must be received by mail or e-mail to the Friends of the San Francisco Estuary at friendsofsfestival@gmail.com or P.O. Box 791, Oakland, CA 94604. Deadline is Tuesday, June 30, 2015. For details: www.sfestuary.org/oeo
CULLINAN, continued from page 5

recalls Brubaker: up to 4,000 ducks showed up. Ducks Unlimited biologist Craig Garner estimates around 2,000 canvasbacks. During high tides, stilts, avocets, and other shorebirds are using the 16 oblong marsh mounds engineered into the project. Egrets, grebes, and cormorants have also been observed foraging for aquatic prey.

San Francisco Bay is the most important wintering location on the Pacific Flyway for canvasbacks, and most concentrate in San Pablo Bay. Thirty years ago, biologist Warren Reinecker estimated that 80 percent of the flyway’s canvasbacks used San Pablo Bay. Numbers have fluctuated, but there are still lots of these handsome white-backed diving ducks. Brubaker notes that canvasbacks, while recovering from earlier lows, “are still not doing as well as we’d like.” Locally-wintering birds may have nested anywhere from Alaska to Alberta, experiencing the effects of climate change, resource extraction, and agricultural expansion.

As sediment accretes, Cullinan will also become habitat for the endangered Ridgway’s rail (formerly called the California clapper rail) and salt marsh harvest mouse. Refuge managers hope to jumpstart that process on 290 acres with dredged material from the Mare Island dry docks. “BCDC came to us over a year ago about beneficial reuse,” says Spenst. Brubaker says all the permits are in place and pumping could start any day now, hastening the day when the refuge can start farming mice and rails.

On the day of the breach, Demgen looked back: “Today we are witnessing how wildly successful a handful of committed folks supported by a large group of believers can be!” If Egret Bay had gone through, she says, “the North Bay would have gone down like dominoes.” What could have become Foster City North, an entering wedge for the development of the San Pablo Bay shoreline, is now a key piece of a mosaic of protected tidelands.

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Later this spring, the Partnership will start a wider outreach effort. By the next State of the Estuary Conference, set for September 17th and 18th at the Oakland Marriott, the Partnership hopes to have a complete first draft of the 2016 CCMP ready for review and comment.

“One of the issues commonly cited as a big challenge in restoring the ecological functions of the estuary is that there are so many different agencies and jurisdictions involved,” says Letitia Grenier, lead scientist for the 2015 Baylands Ecosystem Habitat Goals Update, which includes new science and recommendations to be considered in fleshing out the new CCMP. “The CCMP is one of very few regional plans that treats the full estuary as a single system, recognizing that actions and changes in one part of the system will affect the other parts, and championing strong integration across different planning efforts.”

For updates on CCMP development: www.sfestuary.org/ccmp-revision

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