CALFED CONFERENCE HIGHLIGHT

THINKING GLOBALLY AND LOCALLY

CALFED's October science conference kicked off with a plenary session encouraging scientists and decision-makers to think globally, regionally, and locally. CALFED Director Joe Grindstaff reminded the audience of 1,150 people that everyone must "commit to a healthy Delta," and make decisions based on facts. Since the last science conference, said Grindstaff, the pressure to solve the Delta's problems has increased, and we are nearing the point of making key decisions. The Delta Vision Task Force has released its strategic plan and the Delta Vision Committee will send its recommendations to the Governor by the end of the year. An EIR/EIS for the Bay Delta Conservation Plan—for ecosystem restoration and conveyance—is underway (see "Delta Fix," page 4), and "may be the most controversial project in the history of the state," Grindstaff proclaimed. "But we have an incredible opportunity if we can do it right. Science is fundamental to those decisions. If we didn't have good science, I question whether we would have the ability to move forward and ground our decisions in reality. It's important to find ways to communicate effectively with policymakers so that science can be used to make decisions." Grindstaff was followed by Michael Healy, former CALFED lead scientist, who introduced the Brown-Nichols Award and presented it to Sam Luoma (see page 7).

Next up was new lead scientist Cliff Dahm (see "People," August 2008 ESTUARY), who shared his experience working in other parts of the country—and world—on complicated water issues similar to those facing California and the Delta. In Florida, the largest river restoration in the world is taking place, returning the meanders to the Kissimmee River after it had been channelized by the U.S. Army Corps of Engineeers decades ago and had most of its wetlands destroyed. The initial construction phase of the project, predicted to cost $30 million, came in at only $18 million, said Dahm, because a drought made it possible to get construction equipment in and out of the site more easily. As part of the restoration, an evaluation program was set up to monitor 60 goals, one of which was to increase dissolved oxygen levels in the river.

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INSIDE

YOUR SOURCE FOR BAY-DELTA NEWS & VIEWS

ESTUARY

SPILL SPURS BILLS

November marked a grim anniversary for the Bay: one year since the 900-foot-long container ship Cosco Busan collided with the Bay Bridge, spilling over 53,000 gallons of fuel oil into the Bay and killing almost 3,000 birds.

The accident and its grim aftermath—including an official response and cleanup effort that many participants and observers believe was highly inadequate—galvanized the public and spurred investigations, hearings, and a raft of new legislation. In October, Governor Schwarzenegger signed seven bills aimed at preventing another oil spill, as well as improving response and cleanup should one occur. He also vetoed three other related bills; two more failed in the state legislature.

Environmentalists and others who have been keeping tabs on developments since the catastrophe say the new laws are a step in the right direction but that more still needs to be done to protect the Estuary from the devastating effects of another spill.

"Prevention is critical," says Save the Bay's David Lewis. "We know that no matter what, in this kind of spill, a large percentage of the oil is not going to be contained. These accidents are preventable, but we have not been doing everything we can to prevent them." Lewis hopes that SB 1627 will help to change that. The bill moves the Board of Pilot Commissioners, the agency that regulates the pilots who navigate ships on the Bay, under the oversight of the state Business, Transportation and Housing Agency and requires a comprehensive performance audit of the Board by October 1, 2009. The Board's oversight came into question when information surfaced after the Cosco Busan spill that the ship's pilot had been using prescription medication. "The Board of Pilot Commissioners is kind of an old boys' network with substandard oversight," says Lewis. "This bill might seem like a minor bureaucratic change, but it is important because it will bring sunshine to an important aspect of how navigation happens on the Bay. SB 1627 doesn't guarantee that people with drinking problems or drug issues won't be piloting ships on the Bay, but it does at least help."

Lewis adds that another bill, currently stalled in the state Senate, would go a long way toward preventing future spills. SB 2699 would require that cargo ships have double hull protection around their fuel tanks (double hulls are already required for oil tankers). "If the Cosco Busan had had a double hull, the spill might have been prevented in spite of the collision."

Photo by Ron Sullivan

Many of those who participated in the cleanup and wildlife rescue efforts in the aftermath of the Cosco Busan believe that much of the devastation could have been avoided if there had been better communication and coordination between Cal Fish and Game's Oil Spill Prevention and Response (OSPR) program and local agencies, and if local agencies and volunteers had been better prepared. "Local agencies were unequipped to protect their own shorelines," says BayKeeper's Sejal Choksi.

Several of the new laws address these concerns. "One of the first problems with the Cosco Busan spill was that local agencies were not put in the loop," says Lawrence Lingbloom, a consultant for the Assembly's Natural Resources Committee, who worked on much of the new legislation. "AB 2031 improves the capacity of local agencies to work on spill response." This bill requires notification of local agencies when there is a spill, and

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THINKING, CONTINUED

After the restoration, oxygen levels increased as decades of "organic muck" got pushed out, explained Dahm. Dissolved oxygen levels have remained above 4 mg/L ever since. State statute in Florida also requires setting river flows and levels that do no significant harm to aquatic ecosystems, evaluated by breaking the hydrograph into building blocks where different flow conditions exist, explained Dahm. Flow is then translated into habitat area and aquatic species requirements using hydrologic and ecologic models. A decrease in habitat by more than 15% is judged harmful. Even during high flows, only a certain percentage may be diverted because "we still want the ecological effects of flood flows," said Dahm.

Next he discussed the efforts in Southeast Queensland, Australia to conserve water and improve water quality in its watersheds, after a 7-year drought brought reservoirs down to 15% capacity. Water restrictions reduced use from 400 liters per person to 140 in Brisbane ("one-tenth of what the people in Sacramento use"), said Dahm, and outdoor water, including for swimming pools, was severely curtailed. "They did it with a nice mix of incentives and enforcement actions," he added.

The primary goal established by 19 local governments, state and federal government, university researchers, and the public was that "by 2020, there will be healthy living ecosystems supporting livelihoods and lifestyles," said Dahm. An annual report card of the area's waterways is linked to aggressive adaptive management, and targeted management efforts include upgrading sewage treatment, rehabilitating riparian areas, and dealing with stormwater better. Each year an annual riverfest—with fireworks, art, culture, and science—takes place, with the theme of "Healthy Waterways/Healthy Catchments." Dahm also described his work on the middle Rio Grande near Albuquerque, where high levels of ammonium, nitrate, and phosphate were found to increase algal blooms and create toxic conditions for fish downstream of a large wastewater treatment plant. "Some of our point sources here in the Delta have similar loadings," he said. (See page 5 for some highlights of the Low Dissolved Oxygen session.)

Following Dahm, UC Riverside's Daniel Schlenk also took a global perspective to the problem of fish feminization (see page 3). The USGS's Jim Cloern described how

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POD Puzzle

The Pelagic Organism Decline (POD)—affecting Delta smelt, longfin smelt, striped bass, and threadfin shad—had a day-long session all to itself at this year's conference. Some speakers focused on individual POD species. Others described new tools for modeling Delta processes and population dynamics. One presentation addressed a top-down stressor, entrainment of fish by pumping operations. Several dealt with bottom-up factors: habitat constraints, contaminants, and changes in the estuarine food web.

William Bennett of UC Davis described the POD as a "train wreck" involving the interaction of climate change and selective mortality.

Department of Water Resources biologist Ted Sommer offered new information on the striped bass, a non-native species that is a popular sport fish. "What's been driving us nuts," Sommer said, "is how can you have so many adults and so few juveniles." During the POD years, juvenile numbers fell even when flows increased. The smaller average size of older bass, which would affect egg supply, might offer a clue. Another trend: sex ratios have shifted from 50-50 in the 1920s to only 10% female today, a signal that "something really big has changed out there." This may reflect selective harvesting of females by anglers, distributional shifts, or other factors.

William Bennett of UC Davis described the POD as a "train wreck" involving the interaction of climate change and selective mortality. Ocean influences are critical, he said: Delta smelt do poorly when the Pacific Decadal Oscillation is in a warm phase, while adult striped bass thrive in warmer seas. In the case of the smelt, Bennett also sees artificial selection through early-season entrainment at the pumps overriding natural selection: "We're messing up how the population evolves." With water temperatures rising, Delta smelt are in an evolutionary bind; they must either adapt to higher temperatures or "go back where they came from," to higher-salinity waters.

Reporting on "the other whitebait," Randy Baxter of the Department of Fish and Game discussed the longfin smelt, a recent candidate for endangered status. "No smoking gun has been identified so far," Baxter said. The population appears healthy, and there's no evidence that it's limited by predation. "Winter outflow is the strongest factor," he concluded. "Increased winter exports result in entrainment of larval smelt" during negative Old and Middle River flows. The young smelt aren't large enough to show up in salvage counts until April.

Striped bass dynamics may be different. Computer modeling suggests that "the pumps don't play a real significant role in population numbers" for this species, according to UC Davis's Frank Loge. Other modelers included Ken Newman of the US Fish and Wildlife Service and the National Center for Ecological Analysis and Synthesis, whose working group tried to identify change points, trends, and significant covariates for the POD species, and environmental consultant Edward Gross, with a three-dimensional particle-tracking model for the Bay-Delta system. In another talk, Newman presented a new approach to estimating pre-adult and adult Delta smelt abundances based on fall midwater trawl samples.

DWR's Lenny Grimaldo summarized field work on how the behavior of larval fish influences their risk of entrainment. He said larval striped bass feed higher in the water column at night and are vulnerable when night-time pumping is high. On the other hand, Grimaldo's study found higher Delta smelt densities during the daytime, with no evidence of vertical migration.

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Estrogenic Epidemic

Less publicized than other environmental threats, feminization of male fish is an emerging global concern. "We've got a world-wide epidemic of feminizing activity," said Daniel Schlenk of UC Riverside in his plenary session talk. The consequences for fish populations could be devastating.

In one field study, University of New Brunswick biologist Karen Kidd dosed a Canadian lake with the steroid ethinyl estradiol to a concentration that Schlenk described as "a drop in an Olympic swimming pool." The lake's population of fathead minnows collapsed within two years. "The results from this whole-lake experiment demonstrate that continued inputs of natural and synthetic estrogens and estrogen mimics to the aquatic environment in municipal wastewaters could decrease the reproductive success and sustainability of fish populations," reported Kidd and her colleagues in a Proceedings of the National Academy of Sciences.

"We've got a world-wide epidemic of feminizing activity."

On every continent and in open-sea and deep-ocean fishes, scientists have been finding a telltale marker, the egg-yolk protein vitellogenin, in male fish, as well as abnormalities in reproductive organs and reduced sperm counts. The data began to accumulate 15 years ago, when John Sumpter reported increased vitellogenin production in male fish downstream from British wastewater treatment plants.

Early studies fingered steroids like ethinyl estradiol as the culprits. The mechanism is clear: steroids like estradiol bind to the estrogen receptors of cells. Most lab studies have involved in vitro yeast estrogen screens (YES), using genetically modified yeast cells that change color when the receptor is activated. Steroid concentrations similar to those found in the environment were shown to trigger feminization in whole-organism tests with several fish species.

Such results led Sumpter to conclude that "essentially all the evidence to date suggests that it is the potent steroidal estrogens that are the primary causative agents leading to the feminization of fish." Schlenk isn't so sure the case is closed. Some wastewater effluent studies found feminization in the absence of estrogens. "There's a lot of things that control estrogen, and estrogen controls a lot of things," he continued. "Behavior, the central nervous system, and stress all play a role in estrogen biosynthesis."

In a later interview, Schlenk described other biochemical pathways that could induce feminization. Nonylphenol, a breakdown product of detergents, can stimulate the release of gonadotropin and cause more estradiol to be synthesized. Some forms of DDT bind the androgen receptor, changing the effective hormonal balance. Still other compounds impact estrogen biosynthesis by interacting with thyroid hormones, or inhibit the metabolism of estradiol so that it remains in the fish's body longer.

Pyrethroids—the insecticides that replaced organophosphates—may also be in the mix. Schlenk's group has seen estrogenic activity with bifenthrin, cypermethrin, and permethrin. To complicate matters, Schlenk and his doctoral student May Grace Nillos have found that different molecular forms of permethrin have different effects.

Schlenk said cellular assays like YES, although faster and easier than the more labor-intensive whole-animal approach, have limited ability to detect the effects of nonsteroidal compounds. He summarized recent research where wastewater has been subjected to both in vitro and in vivo analysis, using the medaka fish. Residential wastewater systems do show clear steroid effects, but the picture is more complex when multiple agricultural and urban sources are factored in. In a Long Island study of three wastewater treatment plants, "fish were more sensitive [to wastewater] with a higher magnitude of response, and we saw activity in fish that wasn't seen with YES." Another project involved sediments near wastewater outfalls on the Southern California coast, where feminization of flatfish has been documented. In a toxicity identification evaluation (TIE), the fractions of the sample with the highest estrogenic activity in fish didn't match the fractions with the highest steroidal estrogen concentrations. Something else had to be involved.

Closer to home, Schlenk collaborated in a CALFED study, described at the conference by Jorge Loyo-Rosales of UC Berkeley, that examined the potential for salmonid feminization at 16 sites in the Sacramento and San Joaquin watersheds. Steroids and other known estrogenic compounds were present, but at very low concentrations. Samples from the Napa and Sacramento Rivers showed high estrogenic activity that did not correspond to the chemical analyses. "In the Delta, we had activity similar to estradiol," Schlenk said. "In the Napa River, a completely different set of [unknown] compounds was likely."

Identifying the non-steroidal agents is proving to be a long and frustrating task. "You have to know what you're going after," Schlenk explained.

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THINKING, CONTINUED

localized environmental impacts can often be explained by global phenomena: the 1992 smothering of a coral reef by an algal bloom in the Red Sea was linked to the eruption of Mount Pinatubo in June 1991 and its injection of aerosols into the atmosphere. "We need to take a global perspective when thinking about ecosystems from the local perspective," said Cloern. "Global processes cascade down to Bay-Delta ecosystems; the Bay-Delta is influenced both by its connection to the ocean as well as its watersheds. We tend to forget that estuaries are connected to oceans." Estuarine ecosystems are even more complex than ocean ecosystems, said Cloern. One method of modeling these impacts is the CASCaDE system of linked sub-models, which takes global climate and sea level rise models and "downscales" them to regional and watershed-scale models, and then to more specific models for sediment supply, phytoplankton and primary production, invasive species, and others (see "Science," August 2008 ESTUARY). But local-scale processes—like changes in pumping in the Delta or new conveyance and storage measures—can "propagate up" as well, and have regional impacts, said Cloern.

Google.org's Amy Luers spoke about her work on a wide range of emerging environmental and health threats related to climate change. Luers described the "top down" approach to climate change being taken by industrialized nations vs. the "bottom up" approach most developing nations are using. The bottom-up approach focuses on building resiliency starting with local ecosystems, said Luers, while the top-down approach starts with evaluating global climate change models and scenarios and scaling them down to a regional effort to look at socioeconomic and adaptation options. "We need to integrate these approaches in both worlds," says Luers. "Even if we follow projections for the lowest levels of increases of greenhouse gas emissions, we can expect to see significant warming over the next century." And filmmaker Randy Olson wrapped up the session with his opinion that communication to the public about global warming in this country has been a "disaster." Olson said that to be more effective, scientists must first "arouse" their audience, and then "fulfill" their desires. LOV

Illustration by Lisa Krieshok

BURNINGISSUE

DELTA FIX

Last spring, in the aftermath of the disastrous decline in pelagic organisms in the Delta and during development of the Delta Vision Strategic Plan, the California Department of Water Resources announced preparation of an EIR/EIS for the "Bay Delta Conservation Plan," an unassuming title for a large-scale planning effort designed to fix the Delta, by hook, crook, and canal. But pipes and canals are only one part of this planning effort, stresses CALFED's Keith Coolidge. "An important part of the plan is to identify and implement conservation strategies that improve the overall ecological health of the Delta by addressing toxic pollutants, invasive species, and impairments to water quality." The goal, says Coolidge, is to formulate a final habitat conservation plan under the federal Endangered Species Act and a natural community conservation plan under California's Natural Community Conservation Planning Act. Still, while a major aspect of the BDCP will involve working with interested Delta landowners and other stakeholders to restore marshes, channels, floodplains, and the overall Delta ecosystem, much of the focus of the EIR/EIS is on analyzing "alternative conveyance systems," (with the goal of decreasing impacts on Delta fish). Says Coolidge, "It's important that people realize that the reason we're doing conveyance isn't because we just want to build a canal. [Alternative conveyance] would have pretty strong benefits to the Delta ecosystem."

So far, five main conveyance options are under consideration, says DWR's Rich Sanchez, although he stresses that they are all very "conceptual and preliminary at this point." The first is an "eastern alignment," 42 miles of canal that would divert water around the Delta starting either at Hood or Clarksburg, and follow the path of the formerly proposed peripheral canal. A 49-mile-long "western alignment" would have its intake on the Sacramento River north of Clarksburg, and would follow the existing deep water channel alignment and use some tunnels in addition to a canal, says Sanchez. A "through-Delta" option would use existing but upgraded levees and involve several miles of new channel with an intake on the Sacramento River; a fourth option proposed by the South Delta Water Agency would strengthen some levees and involve the use of siphons and barriers. Both of the new canal options

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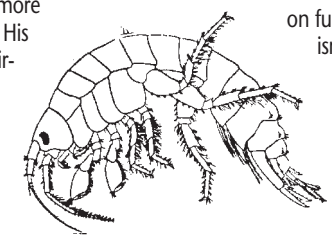
Problem Pesticides

Once again, pyrethroids—synthetic insecticides modeled on natural compounds in plants, introduced as safer alternatives to organophosphates—were in the spotlight during the pesticides session. Widely used in both residential and agricultural settings, they're toxic to some aquatic organisms as well as their target insect pests. Scientists are mapping the extent of pyrethroid contamination, quantifying residential sources, and tracing their environmental effects. But pyrethroids aren't the only game in town: organophosphates are still around, use of the newer insecticide fipronil is rising, and there's a whole category of chemicals—the fungicides—whose impacts are little known.

> **"We need a change in use practices."**
>
> **—Donald Weston**

Robert Holmes of the California Department of Fish and Game reported on a statewide survey of pyrethroids in the sediment of urban creeks. Every sample contained pyrethroids, and all were toxic to the pyrethroid-sensitive amphipod crustacean *Hyalella azteca*, with the highest magnitude of toxicity in the Los Angeles and Central Valley regions. Sediment from Richmond's Rheem Creek had low pyrethroid levels but was still toxic. UC Berkeley's Donald Weston examined pyrethroids coming out of urban drains in the Sacramento Valley, also using *Hyalella* for toxicity testing. "There's good evidence that pyrethroids are responsible for toxicity in the vast majority of cases," he said. Bifenthrin was the most commonly identified pyrethroid, far more common in urban runoff than in agricultural samples. Weston said increasing retention time of runoff could help reduce pyrethroid concentrations: "That's not a fix, though. We need a change in use practices."

UC Cooperative Extension's Darren Haver took a broader approach to residential runoff from Sacramento and Orange County sites, finding the organophosphates diazinon and chlorpyrifos and the broad-spectrum insecticide fipronil (known to be toxic to mysid shrimp, among other species) as well as the pyrethroids bifenthrin and permethrin. "There's considerably more pesticide use in Orange County, most likely due to a more severe ant problem," Haver noted. His recommendations included better irrigation control, better choice of plant material, and integrated pest management.



Several speakers addressed the effects of pyrethroids on test organisms. According to Susanne Brander of UC Davis, the toxic effects of cyfluthrin and permethrin are almost additive, cyfluthrin being far more toxic to *Hyalella* than permethrin. Daniel Schlenk of UC Riverside said some pyrethroids and their metabolic products show estrogenic activity, with different mirror-image forms of permethrin having different effects. Richard Connon, also from UC Davis, discussed the development of molecular biomarkers for contaminant effects on Delta smelt, focusing on the sublethal effects of the pyrethroid esfenvalerate, and copper. He reported that both chemicals altered the expression of numerous genes involved in neurological and immunological function.

Other talks covered vegetated agricultural drainage ditches as pesticide filters for both organophosphates and pyrethroids. Mat Rogers, a doctoral candidate at UC Berkeley, reported that cattails and gray rushes capture more chlorpyrifos than alfalfa, ryegrass, or wheat. The U.S. EPA's Debra Denton found a 61% reduction in permethrin concentration in runoff from a tomato field that passed through a vegetated ditch with a V-shaped profile. Inge Werner, who heads the Aquatic Toxicity Lab at UC Davis, agreed that pesticide concentrations were reduced but found no reduction in toxicity to *Hyalella*. "I'm glad these ditches don't lead directly into surface waters," Werner added.

USGS's Kelly Smalling provided an eye-opening introduction to fungicides, which are heavily used—32 compounds in the Bay Area alone—but not well studied or rigorously monitored. They're applied differently from insecticides, with more frequent treatments and more of a mix of compounds during the growing season. Smalling's study found higher concentrations in agricultural watersheds like the Salinas River Valley than in urban streams like Sacramento's Arcade Creek. Myclobutanil and two other fungicides were detected even in the Golden Gate National Recreation Area. She said data on fungicide toxicity to aquatic organisms is limited. As with pyrethroids, much remains to be learned. JE

Little Oxygen, Lots of Nutrients

What to do about the ongoing problem of low dissolved oxygen and excess nutrients in the Stockton Deep Water Ship Channel and the lower San Joaquin River was addressed by several speakers on the first day of the conference. The Central Valley Water Board's Christine Joab said that the problem of fish kills in the lower San Joaquin River within the channel—from Disappointment Slough to Stockton—first became evident in the 1960s. Low dissolved oxygen conditions violated the water quality objective — 5.0 mg/L in the Delta year-round and 6.0 mg/L September 1-November 30 (Turner Cut to Stockton), which led to adding the channel to the state's 303(d) list in 1994. In 1999, a steering committee of stakeholders was formed to assist in the development of a TMDL (total maximum daily load) for dissolved oxygen, in conjunction with several CALFED-funded studies, to determine the causes of the oxygen depletion. The TMDL, which was approved in 2005 by the Central Valley Water Board and in 2007 by the U.S. EPA, uses a phased approach; the first phase identified the contributing factors to the low dissolved oxygen problem: channel geometry, reduced flow, and oxygen-demanding substances, said Joab. The second phase will assign final load allocations. Upstream studies, which were completed in June 2008, addressed sources of excess nutrients and algae; downstream studies, which are set to begin in 2009, will attempt to characterize the impact of upstream algal loads on dissolved oxygen conditions in the channel.

One goal of the study is to develop a water quality model for the San Joaquin River estuary. In the meantime, said Joab, three aerators are at work in the channel: two operated by the Port of Stockton and a third, constructed in 2006 and operated by DWR, as a demonstration aeration facility. The demonstration aerator, which is undergoing a multi-year testing phase, was designed to deliver up to 10,000 pounds of oxygen per day into the channel any time the water quality objective for dissolved oxygen is not being met.

The University of the Pacific's William Stringfellow is aiming to find out what's going on upstream. Stringfellow investigated the San Joaquin River from Los Banos to Stockton, and collected data at 188 locations, measuring surface water inputs and ranking phosphate loadings. Concluded Stringfellow, "We have sufficient information to set load allocations for the estuary part of the river; we have a water quality model for the main stem and southern areas, and non-point source discharges have been thoroughly characterized." Stringfellow thinks low dissolved oxygen and salt TMDLs could provide guidance for restoration activities. One solution, he said, might be to "investigate an emissions trading program for the San Joaquin River basin." The results of his models indicate that nutrients will need to be reduced by more than 80% to limit algal growth in the river. "The decay of organic material from phytoplankton blooms upstream in the San Joaquin River is a cause of oxygen depletion in the Deep Water Ship Channel," said Systech Water Resources Inc.'s Joel Herr, describing the modeling and field experiments he conducted to see what would happen if phytoplankton could be removed. His key finding? "Reducing Mud Slough phytoplankton may be effective at reducing phytoplankton loads at Vernalis and Old River." Said Herr, "Response in the deep water ship channel depends on the flow past Old River, and is delayed and diffused over a longer time period."

> **"One solution might be to investigate an emissions trading program for the San Joaquin River basin."**
>
> **—William Stringfellow**

Ploesoma hudsoni, a rotifer found in the San Joaquin River

New methods using stable isotope data for tracing nitrate and particulate organic matter in the river—and their sources—were described by USGS's Carol Kendall and Megan Young, while Berkeley National Laboratories' Nigel Quinn described a two-dimensional hydrodynamic model that furthers scientists' understanding of algal dynamics between Vernalis and the deep water ship channel.

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DELTA FIX, CONTINUED

would consist of large—up to 24 feet deep and 340 feet wide with a maximum flow capacity of 15,000 cfs—canals as well as some large tunnels, says Sanchez.

The fifth alternative would be to use the existing Stockton deep water ship channel, says Sanchez. That alternative has received support from some members of the public who are urging the agency to try to utilize existing facilities and minimize environmental impacts and impacts to communities. But others have concerns about water quality in the channel (low dissolved oxygen and contaminants), as well as its capacity, says Sanchez. "Based on the initial work we're doing, the channel would have to be improved; we can't leave it in its existing condition and push water through it. We would have to make significant improvements." There is also—as always under CEQA—a "no project" alternative. But doing nothing isn't likely, says Sanchez. "I think everybody realizes we need to enhance the Delta."

No matter which conveyance option is chosen, says Sanchez, fish screens will be a big part of the picture. "We have a lot more information on the type of screens that work better as well as where they should be located. Before, we would draw the water into a channel and bring the fish with it—and that was not a good thing. We're looking at locating these intake structures in a manner that helps support the fish populations."

One thing won't change: the State Water Project and Central Valley Project pumps. "The plan is to make the changes where we draw the water," says Sanchez. "The eastern and western facilities are called 'isolated facilities' because we are isolating them from—and so not impacting—Delta waters." So far, says Sanchez, enviros haven't expressed a preference for one alternative over another. "We're trying to ensure that we're giving a fair evaluation of all potential options," says Sanchez.

The overall conservation strategy for the BDCP is scheduled to be available by the end of 2008, with a draft of the full plan by the middle of 2009. A draft EIR/EIS will be available for public review by the end of 2009, with a final conservation plan and EIR/EIS available at the end of 2010. Construction of the chosen "conveyance option" would be scheduled for completion by the end of 2015.

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SPILL SPURS BILLS CONTINUED

requires OSPR to offer grants to local governments with jurisdiction over marine waters to deploy oil spill response equipment. However, language that would have required local agency representation on the "Unified Command" for a spill—now consisting of the responsible party, the U.S. Guard and OSPR—did not make it through the legislature. This is unfortunate, says San Francisco BayKeeper's Sejal Choksi. "The local agencies are the local experts; if they are not in the loop, then the state and federal agencies don't get that expertise."

However, and perhaps most importantly, says Choksi, AB 2931 does create a process for delegating volunteer training to the local emergency responders. During the Cosco Busan spill, volunteers who wanted to help with the cleanup and rescue found that they had to get hazardous material training through Cal Fish & Game. "We saw thousands of people who wanted to help turned away because there we not enough trainers to train them," she says. "There were not enough trained volunteers, so lots of birds were left where they were."

Another bill, AB 2911, provides additional funding for training volunteers to the Oiled Wildlife Care Network, the agency responsible for carrying out wildlife search and rescue. The same bill gives OSPR authority over inland oil spills as well as those in marine waters—significant, says Choksi, because inland spills are common and result in nine times as much oil in the watershed every year as the Cosco Busan spill.

Advocates for the coast and Bay were disappointed by the governor's veto of AB 2547, which would have established California oil spill prevention and cleanup technology grants to encourage the development of new spill response technologies. "Current law requires that we have the 'best achievable protection,'" says Lingbloom. "But it is obvious that the absorbent boom is a fairly limited technology. This bill tried to get at that."

Even more significantly, the governor also vetoed AB 2032, which would have increased the maximum oil spill prevention and administration fee from 5 cents to 8 cents per barrel, increasing the funding available to OSPR by about $18 million per year. "OSPR is currently operating at a deficit," says Lingbloom. "They do have a reserve, but they are spending it. Their long-term financial picture is not very good."

Are we doing all we could to protect California's environment from another catastrophic spill? "These bills should improve the capability of volunteers, enhance communications, and lead to better oversight of Bay pilots," says Save the Bay's Lewis. "But they will not prevent all accidents, mandate faster response to them, or lead to better technologies for containing spills and preventing them from reaching the shore." CHT

ENVIRONMENT

STORMWATER ASSETS

In southern California, a Sun Valley neighborhood will soon be a model for coping with heavy stormwater flows—without any pipes. The Elmer Avenue neighborhood, built in the 1950s, currently has no stormwater infrastructure, and floods in heavy rains, says the Los Angeles & San Gabriel River Watershed Council's Edward Belden. The Council adopted the philosophy that they would "take a liability and turn it into an asset," according to the Council's Nancy L.C. Steele. "It's all part of a larger effort throughout the watershed to deal with flooding problems without installing more storm drains."

The Elmer Avenue project was chosen after the multiple-partner Water Augmentation Study monitored six stormwater infiltration sites and found no negative impacts to groundwater. With a $2.6 million budget funded by the California Department of Water Resources, the Bureau of Reclamation, and many local partners including the City of Los Angeles, Elmer Avenue involves capturing runoff for infiltration, by installing vegetated swales that act as biofilters along the curbs, and rain gardens in residents' yards, plus transforming a blighted paseo—or alley—into a walkable greenway with a dry streambed that runs its length. A gravel "infiltration gallery" is being built beneath the street itself to collect the filtered stormwater and allow it to flow to the groundwater aquifer, says Belden. During the first few years of the project, neighbors will help the native plants in the swales and yards become established, says Belden. "It will be a great test case to see what a neighborhood can do to reduce stormwater impacts."

Unlike northern California, much of southern California's drinking water is from groundwater, which ultimately comes from rainwater percolating into the aquifers. "We drink it," says Steele. "It depends on where you are, but in some parts of the San Gabriel Valley, up to 90% is used for drinking water."

To get neighborhood buy-in, the Council held six community meetings and went door to door prior to planning and implementing the project, explains Belden. Because the neighborhood is largely Spanish-speaking, outreach was done in Spanish with English translation, says Belden. "The design reflects the community's participation." In addition, 50% of residents were interested in installing a rain garden or removing existing impervious surface on their property, he says.

While the project was being designed, the Council found that 40 acres drained into the neighborhood and an additional 20 acres into the paseo. "We picked the right street for a demonstration project," says Belden. "It was sort of an accident of development that this one neighborhood had to deal with all of this stormwater."

Beyond handling flood flows and treating stormwater, Belden expects the project to have other benefits: "native habitat in the front yards and additional green space through the paseo." The Council will not only monitor stormwater performance, but also "residents' attitudes and habitat benefits," says Belden. But possibly most exciting is the new mindset toward stormwater. "We looked at stormwater as an asset, at the true costs and benefits—at the avoided cost of building stormwater infrastructure vs. the traditional approach of just looking at the cost of the BMP."

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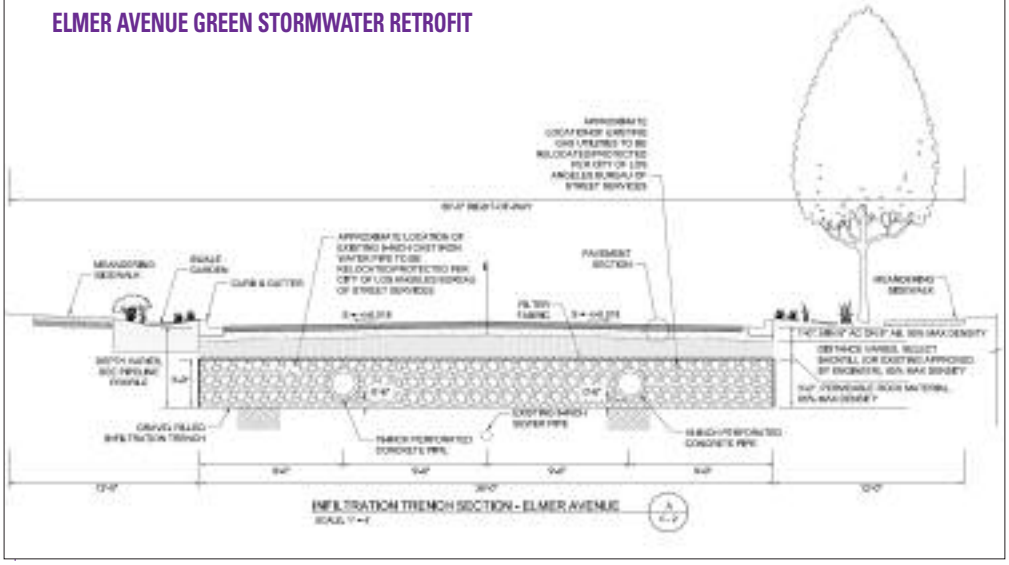
LOV

ELMER AVENUE GREEN STORMWATER RETROFIT



PEOPLE

LUOMA LAUDED

Sam Luoma was honored by his peers as the first recipient of the Brown-Nichols Science Award, presented at the 5th Biennial CALFED Science Conference on October 22. Luoma, who leads science policy coordination for the John Muir Institute of the Environment at UC Davis, accepted the award, named in honor of Randall Brown and Frederic Nichols, who were instrumental in putting together the first three CALFED science conferences. Brown served as the first Chief of the Department of Water Resources Environmental Services Office (now Division of Environmental Services), and Nichols is a retired U.S. Geological Survey oceanographer. In honoring the substantive contributions of both Brown and Nichols, the award recognizes the facilitation of good science and its communication to managers and policymakers in the San Francisco Estuary and watershed.

Luoma was recognized for his contributions to California as the first Lead Scientist of the CALFED Bay-Delta Program, a role he held for three years beginning in 2000. Additionally, he was hailed for his work in unraveling some difficult contamination issues in the Delta, particularly those related to mercury and selenium, and shedding light on their important implications for policymakers.

Luoma recently retired from the U.S. Geological Survey after 34 years as a research scientist. Currently, in addition to his work at UC Davis, Luoma is editor-in-chief of the on-line journal *San Francisco Estuary & Watershed Science*, supported by the CALFED science program. He is also a scientific associate with the National History Museum in London, UK.

His specific research interests are in the bioavailability and effects of metals in aquatic environments, as well as coordination of water policy with science. Luoma has served as a scientific advisor on many issues at the interface of science and environmental management, including environmental monitoring design, science for water management, sediment quality criteria, and bioavailability of contaminants in soils and sediments.

More information about Luoma and the Brown-Nichols Science Award can be found at: http://www.science.calwater.ca.gov/events/conferences/bn_award.html —Jeanie Esajian

POD PUZZLE, CONTINUED

Other speakers covered environmental stressors that may be affecting POD fish. David Fullerton from Southern California's Metropolitan Water District pointed to correlations between high ammonium concentrations and Delta smelt and longfin smelt abundance. Delta smelt prefer turbid environments; Erin Hestir of UC Davis said invasive submerged aquatic vegetation may have contributed to turbidity declines. Another UC Davis researcher, Swee Teh, considered the adult Delta smelt in his recent samples to be "pretty healthy" but saw liver anomalies in juveniles.

Inge Werner, director of the Aquatic Toxicity Lab at UC Davis, mentioned hot spots for invertebrate toxicity and the presence and bioavailability of pyrethroids throughout the Delta. Werner also found Delta smelt three to ten times more sensitive to current-use insecticides, ammonia, and copper than the fathead minnow, a standard species for toxicity testing. DWR'S Dan Riordan exposed fathead minnows to Sacramento and San Joaquin river water and reported that histopathological results appeared to indicate a decrease in sperm production.

Then there's the question of whether the POD species are food-limited. DWR's Peggy Lehman examined the cyanobacterium *Microcystis aeruginosa*, source of a carcinogenic toxin, finding no significant effect on phytoplankton and zooplankton biomass but possibly influencing community composition. However, K. Ali Ger of UC Davis concluded that *Microcystis* provides poor nutrition and is toxic for the copepods *Pseudodiaptomus forbesi* and *Eurytemora affinis*, major players in the foodweb. Even low concentrations of *Microcystis* in their diets caused high mortality.

Four presentations came out of the CALFED Foodweb Project at San Francisco State University's Romberg Tiburon Center. Richard Dugdale explained how ammonium concentrations limited the productivity of phytoplankton by inhibiting nitrate uptake. Alexander Parker reported that bacteria play a significant role as producers in the low-salinity zone (LSZ), accounting for up to 75% of primary production. Lindsay Sullivan compared predation rates of larval Delta smelt and striped bass on three abundant copepods, *P. forbesi, E. affinis*, and the smaller *Limniothona tetraspina*. Pulling several strands together, Wim Kimmerer characterized the food web as more complex than had been assumed ("There's a trophic level we didn't know about") and its productivity as "extremely curtailed compared with any other temperate estuary we know of." According to Kimmerer, a Delta smelt is 5 or 6 trophic steps above the primary-production base of the foodweb—and "each of these steps reduces available energy." JE

ESTROGENIC EPIDEMIC, CONTINUED

"A compound may change after going through the human body or a water treatment plant." In the Southern California studies, his team identified some known compounds—notably the sunscreen ingredient oxybenzone, and some pharmaceuticals—but at concentrations too low to have any effect. There was a possible positive for the organochlorine pesticide chlordane, but further tests ruled it out. "If you think of the potential for the millions of metabolites that can be made from any particular compound," he said, "the chances to identify them are somewhat daunting."

"The most difficult part of the work is that we're not seeing anything that's known in these active fractions," Schlenk continued. "We know what they're not. If we could identify a couple of the unknowns it would be really good."

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San Francisco Estuary Project

LITTLE OXYGEN, LOTS OF NUTRIENTS CONTINUED

UC Davis's Randy Dahlgren described UC Davis-USGS studies on how groundwater affects surface water quality of the river. The UC Davis-USGS synoptic study of wells along the river found anoxic conditions and low nitrate concentrations in most of the wells; however, said Dahlgren, many also displayed high ammonium concentrations that could be oxidized to nitrate when they enter the river. "There may be some transfer of nitrate to ammonium going on in the riparian zone, or some ammonium being formed from mineralization in the bottom sediments," said Dahlgren. "Numerous mechanisms could be leading to loss of nitrate in the system—we need further investigation." Dahlgren also found that water quality in the wells was surprisingly similar to what it was 20 years ago, that seasonal and temporal variations in water quality variability are relatively low, and that spatial patterns in groundwater chemistry are large, both horizontally and vertically.

University of the Pacific's Mark Brunell shared the studies he did on zooplankton in the tidal reach of the San Joaquin River in the summers of 2005-2007. "It is very likely that their grazing significantly impacts the load of algae entering the ship channel," said Brunell. Populations of zooplankton flourish between the Deep Water Ship Channel and the head of Old River, says Brunell, about a 14-mile reach, in which they "slosh back and forth" with the tides and wait for algae. "These guys have moved upriver to the point where they can get the algae," said Brunell. A speaker from the audience asked about increasing zooplankton to control the algae. "Artificially increasing zooplankton would be difficult," said Brunell. "And their numbers would quickly drop down to carrying capacity levels according to food availability." LOV

Ideas, questions, feedback?
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