



Photo by Verne Nelson.

# ESTUARY NEWS

Bay-Delta News and Views from the San Francisco Estuary Partnership | Volume 20, No. 4 | AUGUST 2011

## STATE OF THE ESTUARY

Come hear the latest scientific findings about the health of San Francisco Bay at the 10th Biennial State of the Estuary Conference on Tuesday and Wednesday, September 20-21, 2011, at the downtown Oakland Marriott (City Center BART Station).

The *State of San Francisco Bay 2011* report will be released at the conference, with a summary presentation given on the first day by lead author Andy Gunther from the Center for Ecosystem Management and Restoration. Topics range from salt pond restoration to pollution solutions to watershed health, green streets, and sustainable communities.

Other featured speakers include:

- Phil Isenberg, Delta Stewardship Council
- Fran Spivy-Weber, State Water Resources Control Board
- Jerry Meral, California Natural Resources Agency
- Peter Gleick, Pacific Institute

To see the full program and register, go to <http://sfestuary.org/soe2011/>

A gala precedes the conference the evening of September 19 at the Aquarium of the Bay in San Francisco and is included with registration.

**Early bird deadline for registration:**  
August 26, 2011

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## RETURN OF THE NATIVES

As shorebirds and waterfowl have begun using newly modified salt ponds in the South Bay, so have fish. The first year of monitoring by the UC Davis Fisheries Research Team led by Jim Hobbs detected a high diversity of fish species in the ponds, with a strong preponderance of natives.

Hobbs' team monitored fish populations in the Eden Landing, Alviso, Ravenswood, and Bair Island areas, including restoration ponds like Ravenswood's SF2 and flooded "island ponds" like Alviso's A19, A20, and A21, from July through December 2010. Shallow sloughs and intertidal creeklets were also surveyed. Sampling diverse habitats requires using a variety of trawls and traps, as well as hook-and-line angling at pond outlets.

An impressive 98% of all fish caught by trawling the sloughs were native species. Of 30 species, three-spined sticklebacks accounted for more than half (1,678 of over 3,300) of the captures, followed in abundance by northern anchovy (549), top-smelt (392), staghorn sculpin (253), arrow goby (142), and longfin smelt (61). "That's comparable to the open Bay," Hobbs explains. "Environmental conditions in the South Bay are a little saltier. Most invasive fish species are more freshwater tolerant, and are more common in the North Bay." The presence of small fish like sticklebacks and anchovies is good news for cormorants and other fish-eating birds.

The assemblage varied seasonally, with more sticklebacks, anchovies, sculpins, and gobies in summer and more smelt, herring, shad, and silversides in winter. "The anchovies came in late summer and fall and spawned," says Hobbs. The Pacific herring followed: "We're now seeing young herring all over the South Bay." He credits "good freshwater outflow and ocean productivity conditions" for the herring's success.

Hobbs also found that larger predators, notably leopard sharks and bat rays, are foraging at the outlets of the "island" ponds like A19. Like human anglers, the sharks wait for smaller fish exiting the ponds as the tide recedes. "We caught at least half a dozen sharks and rays per hour," he recalls.

One result that caught his attention was the relative abundance of longfin smelt (*Spirinchus thaleichthys*), a species involved in the Pelagic Organism Decline ("POD") phenomenon: "Longfin smelt abundance has collapsed in the pelagic ecosystem of the North Bay and Delta. They had been intermittently collected in the South Bay during various surveys, but there hadn't been enough studies using appropriate gear this far up into the sloughs. We caught quite a few up



Leopard shark by Matthew Field, taken at Monterey Bay Aquarium.

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## CONAWAY'S COLONY



Tricolored blackbird. Photo by Bob Lewis.

One of several sensitive species inhabiting the Conaway Ranch is the tricolored blackbird (*Agelaius tricolor*), a California near-endemic (there are small populations in Baja California, Oregon, and Washington State, and a single colony in Nevada). This bird, a close relative of the widespread red-winged blackbird, was once incredibly abundant. Johnson Neff, writing in the 1930s, estimated the statewide population as two to three million.

Tricolors, named from the male's black, white, and crimson plumage, once nested in huge colonies in freshwater wetlands throughout the Central Valley and coastal central and southern California. Many are itinerant breeders, raising one brood at a San Joaquin Valley location, then moving north en masse for second and possibly third attempts in the Sacramento Valley.

That was before the development of rural California. More recent estimates have ranged from 150-260,000 from 2000-2005 to 400,000 in 2008 to 259,000 this year. Biologists who study the tricolor, like Robert Meese of UC Davis, believe numbers are continuing to fall. The Department of Fish and Game has designated the tricolor a Species of Special Concern. Petitions for federal and state endangered listing were declined in 2005 and 2006.

Meese points to the usual suspects: the loss of wetlands to agriculture and urbanization, exacerbated by water diversions. The replacement of crops like alfalfa and sunflower with vineyards and orchards has eliminated additional suitable foraging habitat. Until 1985, it was legal to shoot tricolored blackbirds as agricultural pests. Some Sacramento

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## Conservation

## LINCHPIN LAND IN LIMBO

Yolo County is archetypal farm country. "The farmers and ranchers as stewards have done a remarkable job in leaving lots of biodiversity," says Maria Wong, who has been formulating the county's Habitat Conservation Plan/Natural Community Conservation Plan. "The landscape is stable. We're not growing houses."

The 17,000-acre Conaway Ranch, Yolo's largest contiguous farm operation, lies between the cities of Davis and Woodland and the Sacramento River, in the river's floodplain. About two-thirds of the ranch lies within the Yolo Bypass, a system that protects Sacramento and other areas from flooding by allowing the river's high flows to overflow into fields and seasonal wetlands, through a system of weirs.

About half of the ranch is planted in rice. Four thousand acres produce 16 row crops, from alfalfa to wheat. The ranch's wetlands attract waterfowl, and its working fields are habitat for such sensitive species as the tricolored blackbird (see sidebar), Swainson's hawk, and giant garter snake. It's in the spotlight now as potentially a key piece of the Bay-Delta Conservation Plan (BDCP), its future contested by developers, county officials, and environmentalists.

Benjamin Franklin Conaway, who made his fortune in Southern California oil, bought the ranch from a Yolo County dairyman in 1915. The property has passed through multiple hands. At the turn of the century, it was owned by National Energy and Gas Transmission. When a group of out-of-county developers—the Conaway Preservation Group (CPG)—showed interest in 2004, the county made a counterbid for it, but the owner refused to sell to a public entity. "The developers bought it, and the county went to court to try to obtain the

property," explains county attorney Phil Pogledich. The eminent domain suit was settled in 2006, and CPG kept the land.

In October 2010, in a move that would have implications for future owners of the ranch, Yolo County adopted a moratorium on habitat projects intended to mitigate for out-of-county environmental impacts. "We had seen an increase in the number of mitigation and conservation banks established in the county, mitigating for habitat impacts outside the county," says Pogledich.

Last year, politically-powerful Sacramento-based developer Angelo Tsakopoulos, who was fined by the US EPA for a Clean Water Act violation and is seen by enviros as a promoter of urban sprawl, bought a majority interest in the property and reopened negotiations with the county on water sales and other issues. As part of the agreement, the county created a loophole in its moratorium on mitigation banks, exempting three proposed conservation easements on the Conaway property. The largest piece was a 4,000-acre section of the ranch proposed for sale to the state to be restored as seasonal floodplain habitat in the Yolo Bypass in connection with the BDCP. Two other parcels of a thousand acres each were proposed as conservation easements for the Swainson's hawk and giant garter snake. The apparent presumption was that all three parcels would be used to mitigate for out-of-county impacts, although the agreement did not spell this



Adult gartersnake, Yolo County. © Gary Nafis.



Photo by Randy Smith. Courtesy of Friends of the Swainson's Hawk.

out. The supervisors approved the new agreement in February by a 3-2 vote.

Supervisor Jim Provenza, who voted against the agreement, has other worries about the ranch's future. "The significance of Conaway Ranch is that it's exactly where the water would go in lowering the Fremont Weir to inundate the Yolo Bypass. It appears that part is really the linchpin of the BDCP going forward. You wouldn't be able to do the BDCP without it. We want a solution that minimizes the impact on agriculture, flooding, and the Yolo Wildlife Area. The most recent iteration of BDCP has a lot more water than we can handle and still preserve rice growing. If lowering the Fremont Weir put too much water in the Bypass too late in the year, it would be catastrophic to our interests."

The Fremont Weir, a linear concrete structure, has been the repeated scene of salmon and sturgeon strandings. In addition to BDCP, notching the weir was recommended in the NOAA Fisheries biological opinion on California water operations and its recovery plan for salmon. The Yolo Basin Foundation is pushing a Westside Option alternative to the Fremont modification that would use managed flows across private lands to move juvenile Chinook salmon from the Sacramento River into the Bypass. The foundation's preliminary study was funded by Southern California's Metropolitan Water District. Provenza thinks the Westside Option might be acceptable, perhaps as part of a hybrid plan.

In the meantime, some enviros are fretting over the county's agreement with Tsakopoulos. "We don't think it's a good deal at all," says Pam Nieberg with the

Citizens' Alliance for Regional Economic Stability, a newly organized group. "We were surprised that the county entered into an agreement which was so one-sided in favor of Conaway Ranch. Rice farming is a multi-million-dollar business in Yolo County and provides substantial fiscal benefits to the county. The fiscal benefits from this agreement are minimal compared with what the county stands to lose." She says Farm Bureau and Yolo Landowners' Association members share CARES' concerns about the impact on rice farming,

but they have taken no public position on the agreement. Neither have local Audubon and Sierra Club chapters, although individual members have lined up on both sides. Bob Schneider, senior policy director of the Tuleyome conservancy, and Chad Roberts, Yolo Audubon conservation chair, publicly supported the agreement last December, praising "commitments from the Conaway Ranch landowners about farming and habitat restoration or enhancement that can serve as a beginning to resolving questions about the conservation use of the Yolo Bypass."

Provenza says a shift in the political terrain may ultimately favor a positive resolution. "The county is in the process of negotiating a Memorandum of Understanding with the state," he says. "I'm much more optimistic now than when I voted on Conaway that an agreement can be reached on the BDCP that balances all the interests and protects Yolo County as a result of commitments made by the Brown administration."

Beyond what was specified in the agreement with the county, Tsakopoulos' long-term plans for the property are unclear. There have been no rumors of plans for residential or commercial development or conversion from other agricultural uses to vineyards. Nieberg speculates that the hawk and snake easements will be used for mitigation banking. Maria Wong says a Conaway easement might satisfy some of the HCP's obligations, but would not be an urgent priority unless threatened by development or crop pattern changes. Bob Thomas, who manages the Conaway Preservation Group, did not respond to an interview request. **JE**

Valley rice growers still do so; enforcement is spotty.

Tricolors are also falling victim to a kind of attractive nuisance. They've been adaptable enough to switch from cattails and bulrushes to other nesting substrates, including introduced species such as Himalayan blackberries, mustard, milk thistles, giant reeds, and—unfortunately for them—the triticale that's grown to feed cattle. Growers have been harvesting the triticale before the birds complete their nesting cycle, killing thousands of eggs and nestlings. The federal program that provided financial compensation to delay the harvest has been defunded although Meese says that source has been replaced by others.

The latest threat, at least for the San Joaquin Valley population, is predation by cattle egrets. "Prior to 2006, cattle egrets were not known to prey on tricolored blackbird eggs or nestlings, but in that year they went into a colony in Tulare County and basically wiped it out," says Meese. "Three colonies were lost last year, and another this year. No young were produced by any of these colonies."

Tricolors have been doing well at the Conaway Ranch, though. Meese has tracked a colony there since 2005. Two years ago, it produced 28,500 young, the highest number known from any colony in the state. The colony was smaller but still productive in 2010. Conaway, Meese has written, "may serve as a model for tricolored blackbird conservation on private, productive farmland."

The birds' tendency to form a new colony the year after a fire or similar disturbance event suggests an effective management strategy. "Mike Hall, the wildlife manager at Conaway, burned about a third of the cattails last fall at my suggestion, and they came back thick and lush this spring," Meese says.

The new ranch ownership, says Meese, "is planning to make enhancements to the existing pond and to manage a much larger area with tricolors as the focal species." He has recommended working with nearby farmers to enhance foraging opportunities by planting unsprayed alfalfa, which attracts the insects the blackbirds feed on and is also good foraging habitat for Swainson's hawks. **JE**

## STRAW ROOTS FLOURISH

Students and Teachers Restoring a Watershed—STRAW—is a major presence on the Bay Area restoration scene, with projects in four North Bay counties that enlist 3,000 volunteers every year. As STRAW's director Laurette Rogers recalls, it all started with an obscure but imperiled species, the California freshwater shrimp (*Syncares pacifica*). "In 1992, my fourth grade class at Brookside School wanted to do something for an endangered species," she says. "We chose the federal- and state-listed shrimp in the Stemple Creek watershed near the Marin-Sonoma county line." The shrimp, one of the few invertebrates protected by the California Endangered Species Act, is found only in a handful of Marin, Sonoma, and Napa coastal lowland streams, where it clings to submerged willow and alder roots and feeds on floating detritus. It has suffered from predation by introduced fish, contaminated agricultural runoff, and erosion from overgrazing. When ranchers granted access to private land, Rogers' students pitched in to clean up the creek and plant new willows.

STRAW stayed small for a while. "For six years we did one or two projects a year with a couple of classes," Rogers continues. "It was the ranchers who asked us for more. We went from that to 30 or 35 projects a year, not just in rangeland but in urban areas." The group also expanded from riparian habitat projects to tideland transition zones, and developed partnerships with resource conservation districts and other public agencies. Prunuske Chatham Inc., an environmental consulting firm, has been involved since the beginning. "It's our collaborations, our many partners, that make it work," Rogers adds.

STRAW's restoration director John Parodi describes their new role in bayland restoration: "We've worked with the San Pablo Bay National Wildlife Refuge, planting upland transition zone vegetation for six years. STRAW and refuge staff propagate the plants from seed sources on or near the refuge. The work is essential because historically the slow elevation

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## Restoration

### SALT PONDS TO SHOREBIRD HEAVEN

The most ambitious restoration effort in California history, the conversion of the South Bay's salt ponds into tidal marsh, is about to move into a new phase. "We're getting ready to wrap up Phase 1," says project manager John Bourgeois. "After a series of stakeholder meetings to solicit input, we recently decided what the Phase 2 projects are going to be." The project, he explains, is moving carefully to ensure that habitat restoration doesn't conflict with flood control priorities in a part of the Bay that is particularly vulnerable to the effects of rising sea levels.

Bourgeois has been involved in the South Bay project since the beginning, originally with a consulting biology firm. He succeeded Steve Ritchie as project manager in 2009. The restoration area includes the Department of Fish and Game reserve at Eden Landing and the Alviso and Ravenswood sections of the Don Edwards National Wildlife Refuge. Bourgeois also collaborates with the US Army Corps of Engineers, the San Francisco Bay Regional Water Quality Control Board, and local agencies like the Santa Clara Valley Water District and the Alameda County Flood Control District.

"We established bookends of what the project could look like," he explains. One scenario calls for 90% of the area to be restored to tidal marsh, with 10% remaining as managed ponds. The alternative is a fifty-fifty split. "In Phase 2 we're still trying to get up

to 50%," Bourgeois adds. "We need results from the adaptive management program to refine that decision. We're not moving past fifty-fifty until we have the science to allow us to. Some want us to move really fast and some think we're moving too fast."

Adaptive management involves, among other things, coping with the 45,000 California gulls that nest on islands and levees among the ponds. Last December pond A6, one of the Alviso ponds, was breached, flooding a former gull nesting colony. The concern is that displaced gulls will add to the predation pressure on shorebirds like American avocets, black-necked stilts, and endangered western snowy plovers. "We banded about a thousand gulls there," says Bourgeois. "Some are going to other existing colonies at Mowry and Newark." "It's the best-case scenario," says Cheryl Strong of the US Fish and Wildlife Service. "They didn't colonize new areas." "We're targeting areas like SF2, A22, and Eden Landing where we don't want them to show up," Bourgeois adds. "The Refuge has a proactive management plan and is prepared to do harassment to keep them out."

Other issues being addressed through adaptive management include methylmercury generation and dissolved oxygen levels in the ponds. "We're working closely with the Water Board on mercury," Bourgeois notes. Pond A8, which was opened to the tides in June, will be a key test site. "As for dissolved oxygen, we've tried to maximize the amount of turnover we get in these ponds, also work-



American avocets courting at the Palo Alto Baylands by Donald Dvorak.



**Black-necked stilt with hatchlings by Donald Dvorak.**

ing with baffles and aeration. The problem is a lot better. The US Geological Survey is studying larger and deeper ponds like A3W, where getting enough water turnover in all the little nooks and crannies is difficult."

Ravenswood pond SF2 near the west end of the Dumbarton Bridge is an ongoing experiment in habitat enhancement: "The ponds were engineered to make salt, not as wildlife habitat. We wanted to take a smaller footprint and modify it specifically for wildlife species, trying to create as much nesting and foraging habitat for shorebirds as we can. Based on similar work in the Central Valley, we built 30 islands in two different shapes, half round and half linear. The whole back third of the pond is dry seasonal salt panne for the plovers. Volunteers have spread oyster shells to create camouflage for plover nest sites, and we built moats to exclude mammalian predators."

Project staff thought it would take a couple of years for the birds to discover SF2. "Last year it was a moonscape," Bourgeois says. "We had hundreds of waterbirds within two or three weeks of opening it up. This spring we had a pair of snowy plovers nesting on each of four islands." A hundred pairs of American avocets and a few pairs of black-necked stilts also nested. Strong says the pond, with areas of varying depth, attracted large numbers of both dabbling ducks (shoveler and pintail) and diving ducks (scaup, common goldeneye, and ruddy duck)

during its first winter; the ducks forage by day and use the islands as night roosts. Migratory shorebirds, including least sandpipers, marbled godwits, willets, and semipalmated plovers, foraged along its edges. Biologists will continue to monitor shorebird and waterbird use to inform pond management and future managed pond projects.

Looking back at Phase 1, Bourgeois says the biggest and best surprise is the rapid rate of sedimentation in restored ponds: "The rate has been much faster than projected, with lots of marsh development. The South Bay is very sediment-rich. In light of sea level rise projections, we find we need to capitalize on that as soon as we can."

For the future, he sees "a lot of uncertainties. Flood protection is one of our biggest challenges. Pretty soon we'll hit a point where we can't do any more restoration until we have real flood protection in place." Bourgeois says project managers are working with the Corps and local flood control agencies to make sure these elements come together. He is also looking forward to seeing more results from the project's monitoring program in the coming years to better understand how the system is responding to these large-scale changes.

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*Photos by Donald Dvorak, one of the winning photographers in the Estuary Partnership's 2011 Birds of San Francisco Bay calendar contest.*

climb from mudflats to uplands provided critical habitat for a lot of species, including the endangered California clapper rail and salt marsh harvest mouse, during high tide events. That transition zone has often been reduced to just the sides of levees, covered with invasive plants. By rebuilding the transition zone habitat, we're getting the refugia back for those species. It is critical to have this habitat in place as sea level rises."

Formerly sponsored by The Bay Institute, STRAW recently became a project of PRBO Conservation Science. "They're such leaders in monitoring restoration progress, climate change, and sea level rise," says Parodi. "This will increase our potential for prioritizing how to work, where to work, and how to assess data effectively. We'll be looking at our designs more in terms of climate change to make our projects, and the wildlife that depend on them, more resilient against the uncertainty ahead."

Environmental education remains a core principle. Most of STRAW's volunteers (2,500 to 2,800 each year) are K-12 students, augmented by adult summer volunteer programs. STRAW provides a free three-day summer workshop for teachers. There's also outreach to local communities. "Getting the community involved is an effective way to make projects sustainable," Parodi explains. "Projects in high-traffic public areas can often be challenged by vandalism. These projects need time to get established, and setbacks caused by vandalism can compromise results. When local stakeholders play an active role in the project, we experience a dramatic decrease in vandalism, which ultimately leads to a successful project."

They're in it for the long haul. "Our projects are starting to link up in the greater Stemple Creek watershed," says Rogers. "I'm proud of the fact that we've worked on that stream every year for 18 years." She says it's difficult to tell whether the freshwater shrimp population has increased, but their range has clearly expanded: "They've moved downstream, holding onto the roots of willows that the kids have planted." **JE**

## PBDE CANARIES?

The ubiquitous fire retardants called polybrominated diphenyl ethers (PBDEs) have long been suspected of affecting the health of humans and wildlife. Like PCBs, PBDEs accumulate in body fat. They've been detected in the tissues of polar bears, whales, and peregrine falcons, and in human breast milk. Concentrations in both people and wildlife in the Bay Area are among the world's highest (see "New Worries," ESTUARY NEWS, December 2009.)

Now scientists from Baylor University have weighed in with evidence that early exposure to PBDEs can cause developmental malformations, behavioral changes, and death in zebra fish, the lab rats of the fish world. Their report recently appeared in the journal *Environmental Toxicology and Chemistry*.

The Baylor team tested six PBDE mixtures, chosen for their environmental relevance, on zebra fish embryos. Those with the fewest bromine atoms were found to be the most toxic to the fish. The two with the lowest bromination resulted in a curved body axis and eventual death. Four of the six caused developmental anomalies, including pulmonary edema. Five produced alterations in behavior, such as decreased swimming rates and hyperactivity.

"Alterations in early behavior may potentially be due to disruption of thyroid hormones," says Baylor's Erica Bruce. "Thyroid hormones play a vital role in the development of the cholinergic system and this study gives insight into biological interaction within a few hours of exposure. The observed hyperactivity may be due to overstimulation of the cholinergic system." Hyperactivity has also been reported in PBDE-exposed mice, along with effects on learning and memory.

Bruce sees the study as enabling more sophisticated regulation of PBDEs: "While most PBDEs have either been banned or phased out throughout the world, it may be more beneficial to identify congeners of concern rather than replacing these compounds with chemicals of unknown biological interactions."

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## Legislation

## LEAVING THE LITTLE FISH

Although maybe not as obvious or well-known, the smaller animals (and plants) lower in the food web are what help the bigger, more charismatic fish, seabirds, and mammals, many of which bring lots of tourist dollars into the state, to thrive. A new bill introduced by Assemblymember Jared Huffman (D-Marin) and making its way through the state legislature highlights the importance of these "forage species" by requiring the Department of Fish and Game to take species like sardines, herring, mackerel, squid, and anchovies (to name just a few) into account when developing new fishery management plans. Geoff Shester, of the international marine conservation organization Oceana, AB 1299's sponsor, says the goal is to move ecosystem-based—rather than single-species—management forward. Says Shester, "In many cases, the needs of the large fish or the seabirds and mammals that prey on forage species are not taken into explicit account—there's no accounting system for predators when deciding on how much of the forage species we harvest."

Right now the state regulates its fisheries through the Marine Life Management Act, which does not call out forage species explicitly enough, says Shester. "We've seen the problems with the vagueness of the MLMA and how it's been interpreted so far. So let's clarify what forage species are, establish ecosystem-based management, and require management actions to show how the role of the forage species is accounted for," says Shester.

One such fishery—herring—is well-known in San Francisco Bay. "You have a world-class system, yet that fishery collapsed a few years ago, probably due to multiple causes," says Shester. "We're hoping to work collaboratively with the herring industry. Right now when deciding how much herring to catch it's all about how many are out there. What about looking at what the ocean conditions are doing? What are the main predators and how are they doing? Why aren't those things part of the equation that determines how much to catch? We can do that in a way that maintains the industries."

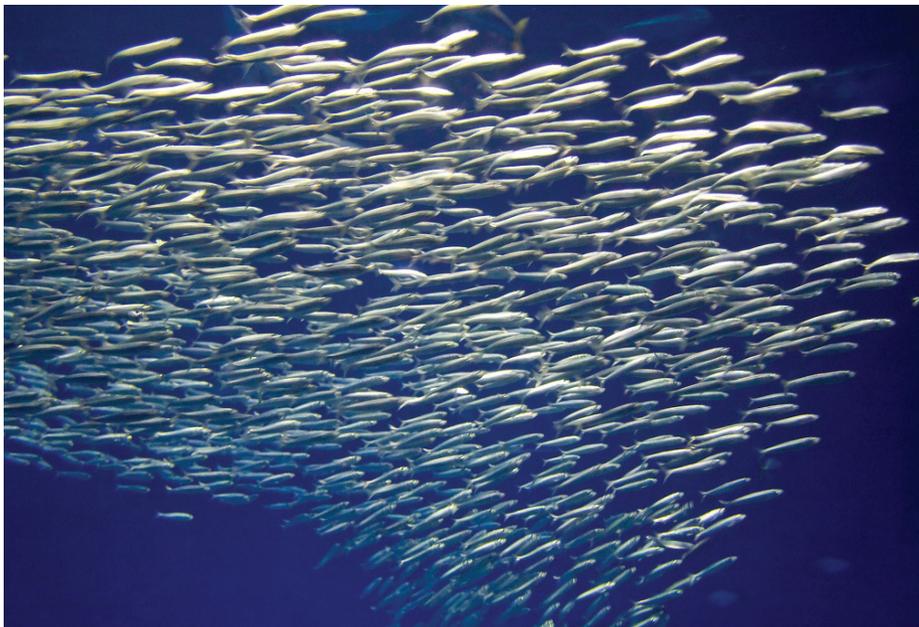
Shester says the original bill has been improved upon with input from various sport-fishing clubs, industry, and fish markets (not to mention an extensive list of environmental groups). He says most of the opposition to

the bill consists primarily of worries that the "wet fish" industry (meaning from ocean to can) will be shut down and that administrative costs to Fish and Game will increase, both claims he disagrees with. According to Fish and Game's Dale Sweetnam, the agency is analyzing the bill for the state and cannot comment on it. He did say that the agency is "satisfied with the intent of the Marine Life Management Act."

Despite support for the bill from enviros, fishing clubs, and even several fish markets, the California Wetfish Producers Association and many others, including the California Association of Harbor Masters and Port Captains, the San Francisco Bay Herring Research Association, city of Monterey, and the Pacific Coast Federation of Fishermen's Associations, to name a few, strongly oppose it. Says the Wetfish Producers Association's Diane Pleschner-Steele, "Our concern is that they are looking to shut us down, if not today, then tomorrow. The Marine Life Management Act already uses an ecosystem-based approach, and we are already one of the most precautionarily managed fishery groups in the world. If you eliminate this fishery, you've eliminated the heart and soul of California's fishing economy." Pleschner-Steele says the bill does not truly protect forage species because most of them range far beyond California waters. She says her industry's other concerns are that the bill is "not based on objective science," that the Department of Fish and Game cannot afford to undertake any additional "impossible analyses," and that the focus on a "narrow group of forage species comes at the expense of everything else in the ecosystem. When you look at what's in the forage pool—it's an enormous pool—a lot of what other organisms eat are not measured." She adds, "This bill is not fair to the fishermen, especially if the ecosystem is also supposed to support people."

Steve Scheiblauber, the harbormaster in Monterey Bay, says his harbor is already down to three resident vessels instead of the 17 purse seine vessels it used to have. He points to the 100 jobs the wharf itself supports, 400 jobs in processing, and many hundreds of fish-related jobs, including restaurant workers and tourism-related jobs in the area. He and Pleschner-Steele are especially worried about additional regulation of squid. "Monterey is synonymous with sardines but it really should also be synony-

## LOOKING BACK TO MOVE FORWARD



Pacific sardines. Courtesy Monterey Bay Aquarium.

mous with calamari/squid," he says. Those delicious ten-appendaged critters support lots of restaurants in the area, but Scheiblaue and Pleschner-Steele say their biomass is extremely difficult to quantify because the creature is so enigmatic. "The squid population is the poster child for the unknowable," says Scheiblaue. "Each can carry up to 4,000 eggs. There are billions of these creatures along the coast—how would you ever do a population count or a biomass estimate? It's almost impossible for that particular animal." Scheiblaue reinforces Pleschner-Steele's belief that existing regulations are adequate to protect market squid, citing weekend fishery closures, marine protected areas, and caps on catch. "We've fished 112,000 metric tons of squid of before—that's the cap. So that amount has been fished in the past without harming the squid population," he says. Scheiblaue and Pleschner-Steele also point out that NOAA Fisheries is working on a multi-year science-based process to create an ecosystem-based fishery management plan for the California current, including for forage species, making state legislation unnecessary. All of his objections aside, Scheiblaue says he believes the industry "would welcome working constructively with Oceana and Huffman to fine-tune California's policies on a scientific basis while partnering with the federal government."

Huffman disagrees that the bill lacks science. "That's a hard claim for them to support

when we have so many scientists working with us on this bill—every leading marine think tank and scientists at the Monterey Bay Aquarium think it's a good idea. That's like saying there's no science behind global climate change. There is also really strong science behind the problem statement that these fisheries are critically important and vulnerable. The solution is the forward-thinking framework in the bill." Huffman says AB 1299 has been amended to address any possible additional costs to Fish and Game. A July 12, 2011 open letter from 29 pre-eminent scientists (from UC Berkeley, Davis, Santa Cruz, and Santa Barbara, Stanford, PRBO Conservation Science, Scripps Institute, and many others) links the loss of Sacramento River fall-run Chinook salmon to lack of ocean food supply and suggests that "management should recognize the critical role forage species play and provide guidance on how to account explicitly for the needs of predators when setting catch limits so that adequate prey are available for fish, birds, and mammals." The Monterey Bay Aquarium's Aimee David says the Aquarium "supports conservation of forage species low on the marine food chain" but has not taken a position on AB 1299.

The bill heads for the senate appropriations committee August 15 and then the senate floor; if approved, it could be on Governor Brown's desk by early September.

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With a lean and not very "mean" staff of four, the San Francisco Bay Joint Venture, which turns 15 this year, has managed to acquire, enhance, and restore nearly 70,000 acres of seasonal and tidal wetlands and riparian habitat throughout San Francisco Bay and its watersheds, and along the San Mateo, Marin, and Sonoma county coasts.

The Joint Venture, one of 18 established under the North American Wetlands Conservation Act with base operating funding from the annual Interior Appropriations Act, coordinates nearly 100 public and private agencies, conservation groups, and business interests to accomplish this work. Although proud of its on-the-ground projects, coordinator Beth Huning says, "Our biggest success is really our ability to coordinate and work collaboratively toward our collective goals of protection, restoration, and enhancement." The Joint Venture partnership is currently developing an ambitious monitoring program by which it will evaluate its projects.

"I think that now we're kind of at a transition and crossroads. We need to make certain that the projects are functioning the way they were designed and that the habitat is benefitting the species it was supposed to. We want to evaluate how well they integrate with other projects in the region, how well they provide connectivity," says Huning. She is particularly concerned about ensuring that wetlands connect with adjacent subtidal habitat and uplands. "The uplands will allow some of these marshes to migrate landward as the climate changes and also provide refugia—habitat that is not hard-edged and provides a zone in which species can move."

Implementing more projects is still a priority, says Huning. But the monitoring and evaluation plan will be a key tool moving forward. "We want to ensure that we can track net landscape change and to develop or use existing protocols to monitor how species are doing under the changes that have taken place—areas that were diked off where more water has been brought in, riparian areas that have been planted, areas that had been totally dry for 100 years that now see tidal action again."

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## CLAMDESTINY



Photo courtesy Noel Burkhead, USGS.

Nature, to paraphrase the eccentric but brilliant biologist J.B.S. Haldane, is not only stranger than we suppose. It's stranger than we can suppose.

Consider the Asian clam *Corbicula fluminea*. Native to Asia, Africa, and Australia, this freshwater bivalve is one of the most successful invasive species in North America. It was initially reported from the mouth of the Columbia River in 1938 and had spread to the Delta, where it is now the dominant mollusk, by 1945 and the Imperial Valley by 1952. It's abundant in the San Joaquin River and even Lake Tahoe. In the Delta, concentrations of 2,000 young clams per square meter are common.

*C. fluminea* is prolific (with the highest biomass production of any freshwater bivalve) and hardy (a living specimen was mailed in an envelope from Pennsylvania to Washington State and back, with no apparent ill effects.) And it's a pest, clogging pipes, limiting pelagic food sources, and outcompeting native clams.

*C. fluminea* has a trick up its shell that may explain its success as a colonizer: a reproductive strategy called androgenesis, otherwise known only in a few related clam species, the Saharan cypress, and the little fire ant. The clam, like many mollusks, is hermaphroditic; each individual has both male and female sex organs. In a typical clam, sperm and eggs are broadcast, meet and go through the usual recombinant dance, shuffling the genetic deck with each generation. In *fluminea*, though, the maternal nuclear chromosomes are discarded. The young are all clones of the male parent, although they inherit the female parent's mitochondrial DNA. Parthenogenetic (all-female) species—rotifers, whiptail lizards, Amazon mollies, dandelions—have evolved fairly often. Androgenetic species can be counted on the fingers of one hand.

In theory, a self-cloning species would have a marked advantage over a relative that reproduced the old-fashioned way. The catch is the loss of genetic variation,

*continued on side page 9*

## Planning

## FISH TO GET ASSIST?

Anyone with even a passing interest in field ecology has likely heard of Stanford University's Jasper Ridge Biological Preserve. In this 1,189-acre slice of Peninsula hills near the campus, Paul Ehrlich carried out his long-term studies of the Bay checkerspot butterfly; Deborah Gordon mapped the invasion of the Argentine ant and its consequences; and a whole team of researchers are tracking ecosystem responses to climate change.

Jasper Ridge seems an unlikely arena for environmental controversy. But one has arisen over the future of Searsville Lake.

Formed in the 1890s when the Spring Valley Water Company built a dam below the confluence of several tributaries within the San Francisquito Creek watershed, the reservoir was subsequently acquired by Stanford and leased for recreational use until 1975, when it became part of the preserve. Some contend that the reservoir has value as habitat for birds, bats, and other species. Others, like Matt Stoecker, founder of Beyond Searsville Dam, want the dam removed so steelhead trout can resume their historic migratory journeys.

Stoecker's involvement dates to the mid-1990s. "I was at the base of the dam in spring and saw 30-inch steelhead jumping at it, banging their heads against the concrete wall and falling back into the pool at its foot," he recalls. "There was no way for them to get back upstream." After majoring in biology at UC Santa Barbara, he moved back to the Stanford area and became active in the San Francisquito Creek Watershed Council and its Steelhead Task Force, which identified Searsville Dam as the major obstacle to steelhead passage. Stoecker and his fellow creek advocates took on more than a dozen restoration projects in the watershed, but the dam remained off limits. "It was always frustrating that Stanford would participate in other projects but always say they weren't going to address the dam," he says. "In 2007 we got tired of their foot-dragging and started Beyond Searsville Dam."

That was the year that Stanford's Jasper Ridge Advisory Committee released a position statement on the lake. The committee concluded that Searsville Lake "provides a number of important benefits to the preserve" and that "none of the alternative

options we have considered presents a comparable balance of environmental benefits, costs, and risks, based on the preserve's mission." Removing the dam, they warned, "would result in significant disruption to the Jasper Ridge mission" and reduce or eliminate bird and bat habitat at the reservoir's south end, without guaranteeing the restoration of steelhead.

The lake today is inhabited by non-native bullfrogs and sport fish, including bass, crappie, bluegill sunfish, and catfish. "One of the Jasper Ridge people says it's a perfect example of a piece of Arkansas," says Stoecker. He's concerned that species are dispersing from the lake into the San Francisquito watershed, threatening the endangered California red-legged frog. Chris Field, the preserve's faculty director, notes that the reservoir is good habitat for aquatic birds, with one of the Peninsula's highest concentrations. He was not aware of any special-status species that used the lake.

Stoecker says that in 2001 his group arranged for a free dam removal feasibility study by the California Department of Water Resources, and that the university rejected the offer. Field was unable to confirm this, and other Stanford sources have not responded. Stoecker contends that Stanford has never actually studied the removal option.

The latest round in the dispute involves Stanford's proposed Habitat Conservation Plan and incidental take permit application, covering Jasper Ridge as well as other university land. This January, the university notified the US Fish and Wildlife Service and NOAA Fisheries, the reviewing agencies for the HCP, that they were removing all "Searsville activities" from the plan. "Stanford believes that removing these activities from the HCP, and addressing them through an independent Searsville-focused process, will provide NOAA Fisheries with the additional time and data that it needs to assess the potential take of steelhead from Searsville-related activities," wrote the university's Catherine Palter.

"They're trying to get coverage for their 'Lake Water' system, which includes the Searsville dam and reservoir, without addressing the impacts of Searsville," Stoecker explains. "They've claimed the Searsville diversion activities are separable from the dam. We don't fully understand their logic, or how

they think this meets the requirements of the Endangered Species Act.” In a letter to NOAA Fisheries and Fish and Wildlife, Beyond Searsville Dam and American Rivers argued that “Searsville Dam and Reservoir and their activities are inseparable from and therefore must be considered a part of Stanford’s non-potable ‘Lake Water’ system.”

According to Jim Milbury of NOAA Fisheries, the change to the HCP would not require federal concurrence: “It’s up to them to decide what to submit with their permit request. They tell us what they want included in it. If they don’t want to put the lake into the permit, they don’t have to.” But the university would not receive Endangered Species Act permission for any take of steelhead and other protected species in the excluded area.

Stoecker sees Stanford’s recent formation of a Searsville Committee as a more hopeful development, an opportunity for a fresh perspective. The members, including Chris Field, are a mix of Stanford faculty (with expertise in water law, environmental history, and related areas), and administrators. Field says studies by faculty and consultants are planned. “We’re looking at a couple of years to assess all the alternatives,” he adds. “All the options are

on the table. Having a bunch of academics involved ensures that the issues get examined from lots of perspectives. I’m encouraged and convinced that the university is trying to figure out what’s the best solution, not the quickest or the most convenient.”

Whatever the outcome, Stoecker and his supporters, who include former US Representative Pete McCloskey and Patagonia Inc. founder Yvon Chouinard, see broader issues at stake in the dispute. “The dam’s impacts and its future have major implications for the health of the entire San Francisco Bay ecoregion,” he says. “The past and future of Searsville Dam are intimately tied to the health and survival of Bay wetlands and restoration efforts as the dam prevents sediment from building up wetlands in the face of sea level rise. The dam also limits the productivity of one of the Bay’s last wild steelhead populations, which could be a key source population to help naturally recolonize other Bay streams as they are restored. San Francisquito Creek has the potential to become a model for others around the Bay to build from.”

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the raw material of evolution. No new information comes in, and harmful mutations accumulate. In the models created by Carleton College biologists Mark McKone and Stacey Halpern, androgenesis could become the only form of reproducing in a population within 50 to 100 generations. “If androgenetic individuals produce very few or no eggs, this could lead to extinction within that time frame,” says University of Texas–Austin biologist Shannon Hedtk.

Does this mean that all those invasive populations of *C. fluminea* are doomed? No such luck. “Unfortunately, I don’t think that *Corbicula* is likely to go extinct in California any time soon,” Hedtk. continues. In its native Asian range, *fluminea* was able to beat the odds by occasionally capturing female genetic material from related *Corbicula* species, a process Hedtk. has reconstructed by analyzing mitochondrial DNA. That appears to be happening in North America as well. Although considered a single species by some taxonomists, varieties called Form A and Form B may in fact be distinct species—and they co-occur in some areas, notably Texas.

According to USGS’s Jan Thompson, only Form A has been identified in California so far. “It’s getting more complicated instead of less as the geneticists are doing more work,” she adds. Says Hedtk, “I wouldn’t be surprised if Form B eventually ended up also being established in California. Indications in Texas are that their range is expanding. I’ve found them recently in places where 30 years ago there was only Form A reported.”

*Corbicula* clams are subject to boom-and-bust cycles, says Hedtk. “Right after really heavy rain and flooding, I’ve had sites where I couldn’t find them anymore. But these local areas very quickly become reestablished by dispersal. After all, it only takes one clam to found a population, since they are capable of self-fertilizing their own eggs. The average number of offspring produced per breeding season has been estimated as 35,000. While most don’t make it to reproductive maturity, that’s still a lot of clams.”

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American Rivers’ Steve Rothert surveys Searsville Dam. Photo courtesy Matt Stoecker.

**DECONSTRUCTING THE DROUGHT**

Who were the winners and losers in California's recent three-year drought? *Impacts of the California Drought from 2007-2009*, a new report from the Pacific Institute, provides some counterintuitive answers.

"The data show actual impacts that were significantly different from expectations," says Pacific Institute's Peter Gleick, who co-authored the report. "The total value of California's agricultural products actually broke records in all three years of the drought. Overall, California farmers proved themselves to be flexible and resilient."

Despite complaints that the agricultural sector was water-starved during the drought, California's farmers and ranchers adapted by increasing groundwater use, arranging for temporary water transfers, fallowing, and changing cropping patterns and types. The sector grossed \$38.4 billion in 2008, an all-time high, and \$34.8 billion in 2009, the third highest year on record. Trends toward reductions in farmed acreage slowed during the drought years, and yields remained high.

Based on census and employment data, the Pacific Institute report found no disproportionate loss in agricultural jobs in areas where water supplies were restricted. Actual job losses in the three-year period were worse in sales and construction. Agriculture-related jobs in the Central Valley rose by 2% from 2003 to 2009; construction jobs fell by 44%. "These data show that unemployment in the San Joaquin Valley is a long-term problem, not simply the result of the recent drought," says lead author Juliet Christian-Smith. "Hunger, homelessness, and other signs of poverty are real and happening, and they are happening in wet years and dry ones."

The environment took a major hit. Even if other factors may have been implicated, the report makes the case that the 2008 and 2009 salmon fishery closures, which cost 1,800 jobs and \$118.4 million in income, were drought-related. Decreased river flows led to the highest Bay-Delta salinity records since 1992. The San Joaquin Valley's average groundwater depletion rate doubled between 2006 and

**Re-Use**

**RARE IN RICHMOND**

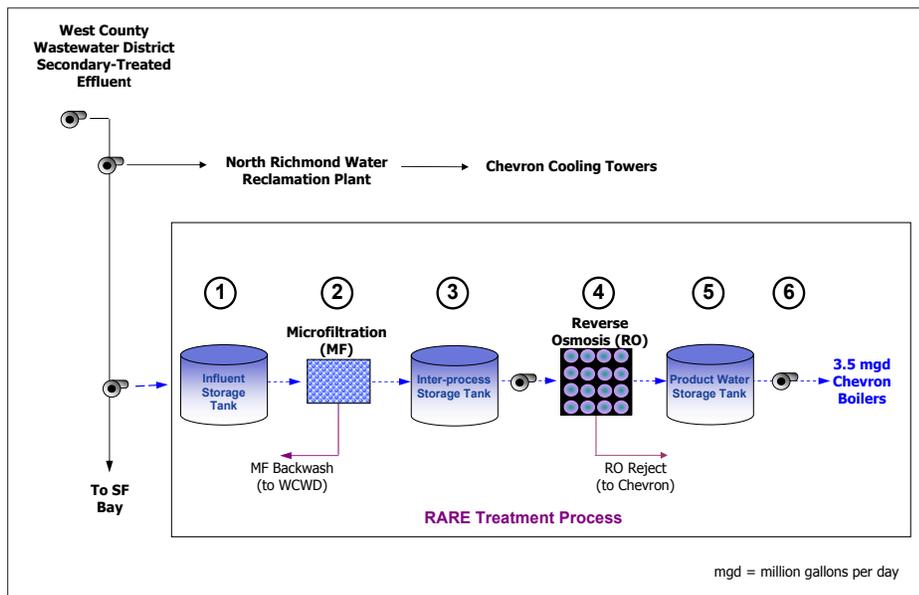
In what will hopefully not be a rare event, an innovative new recycled water project is now on-line in Richmond. Planned since 2004 as a partnership among EBMUD, Chevron, and the West County Wastewater District (WCWD), project "RARE"—the Richmond Advanced Recycled Expansion Water Project—became fully operational last summer, taking treated wastewater from WCWD, putting it through a high-purity treatment process, and producing 3.5 million gallons per day of water for use in the giant refinery's boilers.

"It's the lowest of all low-hanging fruit when you can have one customer use a huge amount of recycled water on a 24/7 basis while minimizing construction impacts to the surrounding community," says EBMUD's Lori Steere.

The project was built on site at the Richmond refinery, and puts secondary-treated effluent from the WCWD's North Richmond treatment plant through microfiltration and

reverse osmosis before sending it to the boilers to supplement the potable water the refinery uses. A microfiltration process filters out suspended solids while reverse osmosis tackles dissolved solids. Because boilers are "temperamental things" and require highly pure water, says Steere, the potable water used in high-pressure boilers also goes through reverse osmosis first. Steere says Chevron has been using recycled water in its cooling towers since the mid-1990s.

As far as future recycling projects, Steere explains that EBMUD's potable water service area covers 331 square miles while its wastewater service area only encompasses 88 square miles. "That means we have to find other sanitation agencies to partner with to do recycled water projects outside of EBMUD's wastewater service area." Because Chevron is able to re-use the treatment plant's water, she adds, "There will be times when the WCWD is discharging zero treated wastewater into the Bay."



**RARE Water Project Process Schematic, courtesy EBMUD.**

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2010. Groundwater pumping by the Westlands Water District alone increased nineteen-fold from 2006 to 2009.

"A key conclusion," says Gleick, "is that we need to put in place strategies capable of addressing the risks of inevitable longer and more severe water shortfalls."

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## SWALES FOR STEELHEAD

Over the past seven years, a half-mile stretch of Codornices Creek, which forms the boundary between Berkeley and Albany and has a thriving population of steelhead trout, has been transformed from a

straightened ditch to a sinuous, meandering stream with a floodplain and lush riparian vegetation. More restoration projects will take place over the next few years.

With polluted urban runoff a threat to the fish, Dan Dole, a blacksmith and private property owner who lives and works next to the creek, decided to do his part to catch pollution from his rooftops and a large parking lot by slowing and filtering runoff before it reaches the creek. Dole, a member of the Codornices Creek Watershed Council, hired a contractor to dig up 350 square feet of asphalt. With a grant from the Alameda Countywide Clean Water Program, the Estuary Partnership hired Four Dimensions Landscaping to design and plant a bioswale with native sedges, rushes, shrubs, and trees this past winter. Over 90% of the plants have survived. The Partnership also installed an interpretive sign explaining the project's benefits to the creek.

Says Dole, "I'm delighted to be capturing runoff from over 12,000 square feet of hard surface on my property." The San Francisco Bay Regional Water Board's Dale Hopkins, who is also a member of the watershed council, says the group was "particularly happy to be able to put this swale in an area near several creek restoration sites where it is also an educational resource for University Village (UC Berkeley's student housing), youth soccer and baseball teams, and other visitors." **LOV**



Codornices Forge bioswale, before (above left) and after, with the Codornices Creek Watershed Council's Dan Dole. Photos by Lisa Owens Viani. Illustrations by Lisa Krieshek.

## NEW VIDEO PODCASTS: [WWW.SFESTUARY.ORG/PODCAST](http://WWW.SFESTUARY.ORG/PODCAST)

### MARSH MAGIC

The Estuary Partnership and Marin Audubon Society are working to enhance seasonal and tidal wetlands at Bahia Marsh in Marin County, over a three-year period, by growing and planting 40,920 native plants to help establish upland transition zones adjacent to the existing tidal wetlands. These plants will help create a more ecologically complete and resilient wetland habitat attractive to the federally-listed, endangered California clapper rail and salt marsh harvest mouse, and other wildlife. The seasonal and tidal wetlands, uplands, and transition zones will form an integrated network of habitats.



Bahia Marsh. Photo by Chris Kay.

### PICKING OFF PERIWINKLES

*Littorina littorea* is an exotic snail that has been introduced into San Francisco Bay. It is a small creature, so what harm can it do? Turns out it can have big impacts on native species.

### TAMING MERCURY

Mercury has been called San Francisco Bay's public enemy number one. It is the main pollutant driving concerns about eating fish from the Bay, and it is a prime suspect in harming the health of birds and wildlife in the Bay. Its most toxic form is methylmercury because that form "bioaccumulates" in critters in higher and higher concentrations as it moves up the food chain. Learn about what scientists and resource managers are doing to control it.



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## RETURN OF THE NATIVES

(CONTINUED FROM PAGE 1)

Coyote Creek and in the island ponds. During late fall, they're coming back from the nearshore ocean and either turning right and going into the South Bay or left into the North Bay and Delta. I've looked at some of the data before and during the POD, and there's a correlation between their decline in the North Bay and increase in the South Bay. If they hang out until January and February in the South Bay, they're not likely moving into the North Bay to spawn."

Hobbs was also looking for a small unprepossessing goby called the longjaw

mudsucker (*Gillichthys mirabilis*.) Although it currently has no conservation status, it's a sentinel species for the Bay's much-reduced pickleweed marsh habitat. "It's the only fish species that lives intertidally in these marshes," he says. "It's an important prey species. It used to be used heavily as bait, but stopped showing up in bait shops in the 1980s. We're trying to get an assessment of what its distribution formerly was like." In much of its intertidal habitat in the Bay, the mudsucker has been displaced by the non-native yellowfin goby.

Monitoring will continue on a monthly basis for the next four years. New approaches will include a mark/recapture study of mudsuckers to determine population size and mortality and an analysis of fish otoliths (ear bones) for heavy metal contaminants like mercury and copper. The researchers will also look at the distribution and abundance of zooplankton and benthic fauna like the overbite clam (*Corbula amurensis*).

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