Waterways
SACRAMENTO RIVER WATERSHED PROGRAM

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The Pelagic Organism Decline (POD) in the Upper San Francisco Estuary

and Implications for the Sacramento River Watershed

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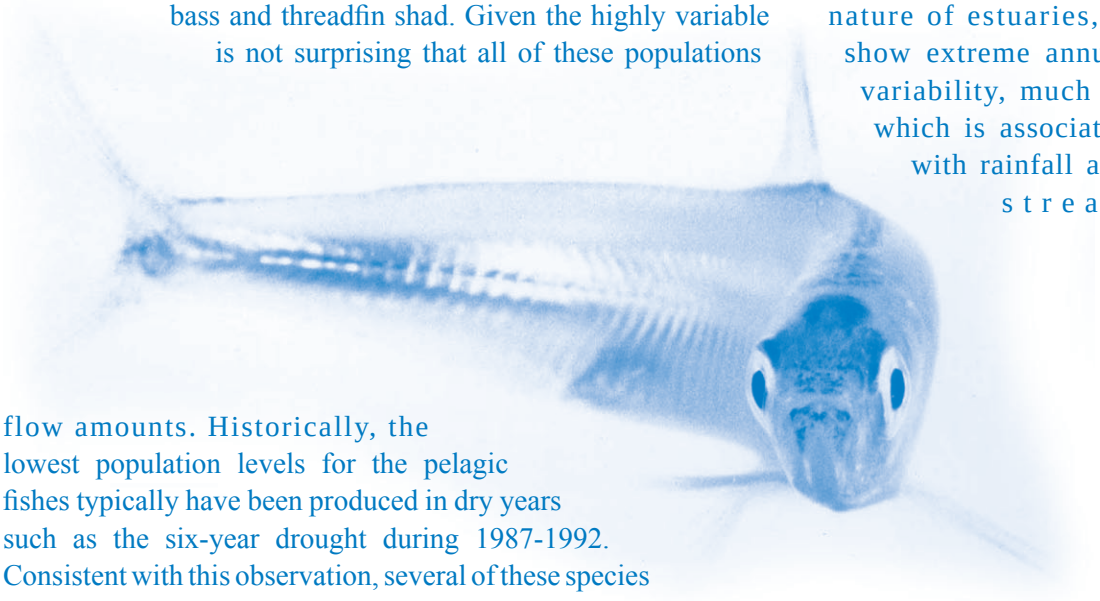
Introduction

The Interagency Ecological Program (IEP), a consortium of nine state and federal agencies, has been monitoring fish populations in the San Francisco estuary for decades, and has developed one of the longest and most comprehensive data records on estuarine fishes in the world. One of the most widely used IEP databases is of catch from the fall midwater trawl, a survey which has been regularly conducted by the California Department of Fish and Game since 1967. This survey samples the pelagic fish community in the estuary, with most sampling occurring in the tidal freshwater and brackish portion of the system. The major resident pelagic fishes captured are two native species, delta smelt and longfin smelt, and two introduced species, striped bass and threadfin shad. Given the highly variable nature of estuaries, it is not surprising that all of these populations show extreme annual variability, much of which is associated with rainfall and stream flow amounts. Historically, the lowest population levels for the pelagic fishes typically have been produced in dry years such as the six-year drought during 1987-1992. Consistent with this observation, several of these species show strong statistical associations with flow (Stevens and Miller 1983; Jassby 1995; Kimmerer 2002).



The decline to record low, or near-record lows, of fall midwater trawl abundance indices for all four pelagic fishes in 2000 raised concern with lead agency scientists in the IEP. Moreover, these low abundance levels were surprising in that winter-spring river flows into the San Francisco estuary were moderate during this period. The situation further deteriorated over the next several years, when abundance indices for 2002-2004 included record lows for delta smelt and age-0 striped bass, and near-record lows for longfin smelt and threadfin shad. By 2004, these declines became widely recognized and discussed as a serious issue, and collectively became known as the Pelagic Organism Decline (POD).

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SACRAMENTO RIVER watershed PROGRAM

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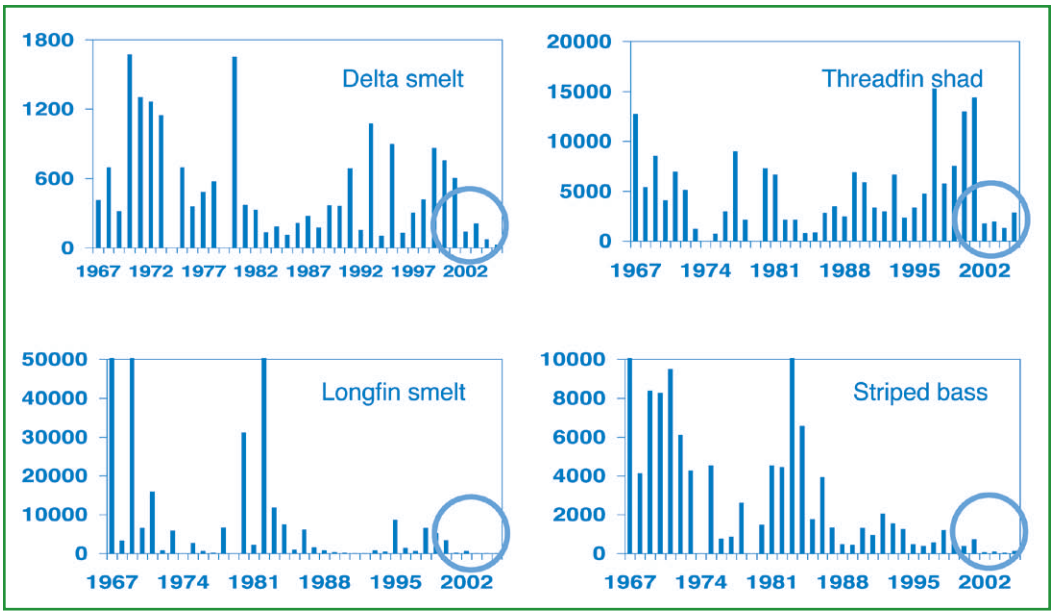
Management Implications of the POD

The management implications of the POD are most serious for delta smelt, which has been listed since 1993 under the Federal Endangered Species Act (FESA) as a threatened species (Bennett 2005). The range of delta smelt overlaps with the center of the State Water Project and the Central Valley Project – large water diversions that supply water to over 22 million people in the state. As a consequence, for many years delta smelt have been the focus of a wide range of protective management actions. Each year, millions of dollars in decisions about water use are affected by the status of delta smelt. Much of the effort to improve the status of delta smelt has been led by the California Bay Delta Authority, an interagency group that invested $335 million in over 300 habitat restoration projects through 2002, and developed a large allocation of water for use by fisheries agencies, the Environmental Water Account (CBDA 2003).

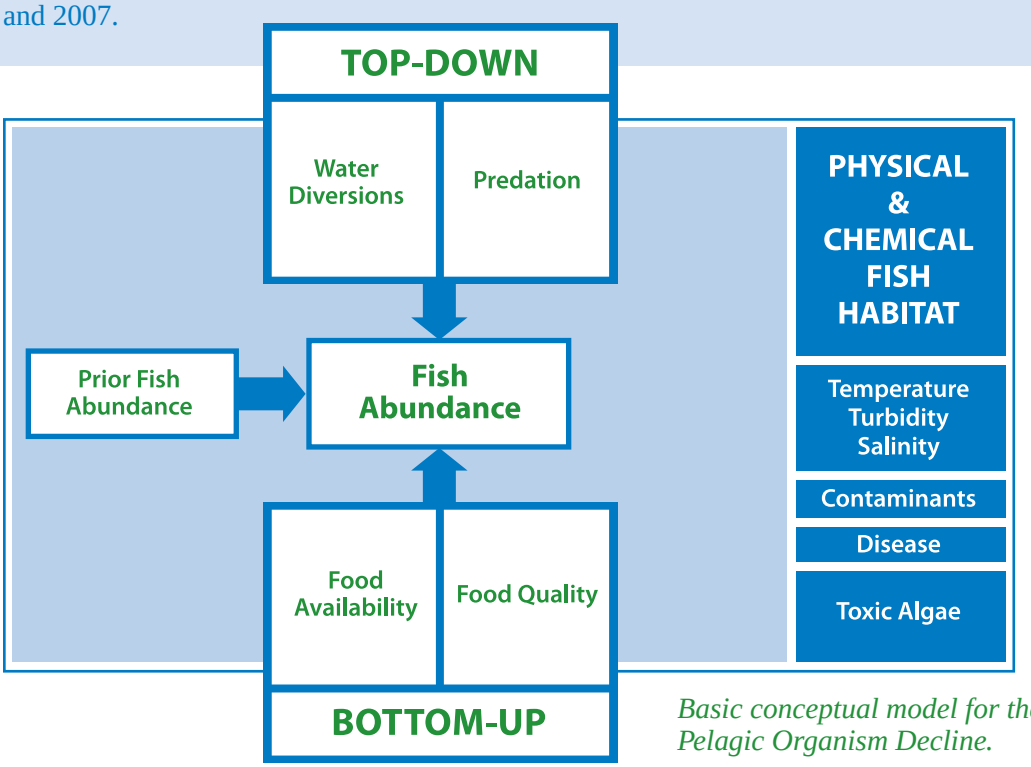
The recent decline of delta smelt had numerous consequences including a March 2006 petition by a consortium of environmental groups to change the federal listing status of the delta smelt from threatened to endangered. The collapse of the delta smelt population also resulted in a FESA reconsultation (Section 7) for the operation of the state and federal water projects ("OCAP"), lawsuits, and hearings by Congress and the state Legislature.



Trends in four pelagic fishes based on the fall midwater trawl, a DFG survey that samples the upper San Francisco estuary. The vertical-axis shows abundance indices for each species during 1967-2005.

The POD Investigation

In response to the POD, the IEP formed a work team in 2005 to evaluate the potential causes of the decline (IEP 2005a,b). The team quickly organized an interdisciplinary, multi-agency effort including staff from nine separate agencies and organizations. Project components were selected based on their ability to evaluate the likely mechanisms for the POD, and their feasibility in terms of methods, staffing, costs, timing and data availability. The study budget was $2.4 million in 2005, and has increased to $3.7 million for 2006 and 2007.



Basic conceptual model for the Pelagic Organism Decline.

Implications for the Sacramento River Watershed

Bottom up effects such as food chain limitation and contaminants may be directly related to changes in land use practices and management actions in the Sacramento and San Joaquin River Watersheds. For example, the rapid shift in the last decade from Organophosphate pesticides to Pyrethroids has occurred faster than the ability to assess transport and fates in the estuary. The hydrophobic nature of pyrethroid pesticides makes direct sampling and analyses of their presence challenging.

To date, POD work in acute toxicity for fish and smaller aquatic organisms has not found much evidence for a direct link between the fish declines and contaminants. Other work in assessing fish health through biomarkers may uncover sub-lethal contaminant effects. Regardless, the rapid urbanization of the Sacramento watershed will continue to create shifts in pesticide use and contaminant loading that will need to be monitored.

Work is also being conducted on long term trends in contributions of nutrients, organic carbon, and aquatic organisms from the Sacramento River to the estuary. Changes in agricultural water management practices, ecosystem water needs, and shifts from agricultural to urban water use has changed the hydrodynamics and loading of these constituents to the Delta. Sediment transport has continued to decline, resulting in a less turbid Delta. This has implications for the increase in submerged aquatic vegetation and suitability for juvenile fish survival.

With the historic loss of tidal wetlands in the Delta, the interest continues to grow in preserving and enhancing remaining areas, such as the Yolo Bypass and the northwest corner of the Delta in the Cache Slough/Lindsey Slough area. Seasonal wetlands linked to the river can provide habitat and food for juvenile fish. Studies are under way to investigate providing fish passage through the Yolo Bypass to the Sacramento River, and to provide more seasonal flooding for fish habitat.

No one expects that results of the POD investigation will provide a single cause for the decline. No matter what contributing factors have created the decline, and whether the Sacramento River and its watershed plays a large or small role, the continued change in the land use and management of the watershed and river will require ongoing studies to understand future implications and impacts to the estuary.

The study is organized around a relatively simple conceptual model to describe possible mechanisms by which a combination of long-term and recent changes in the ecosystem could produce the observed declines in catch of pelagic fish species. This conceptual model based upon the classical food web and these four major assumptions: 1) prior fish abundance—continued low abundance of adults leads to reduced juvenile production; 2) habitat—estuarine water quality variables, disease and toxic algal blooms affect estuarine species; 3) top-down effects—predation and water project entrainment affect mortality rates; and 4) bottom-up effects—food web interactions in Suisun Bay and the West Delta have affected fish abundance.

A suite of 47 studies have been developed for 2006-2007 to cover each component of the conceptual model. The study program also contains a substantial synthesis effort including the development of life cycle models, as well as a contract with the University of California-based National Center for Ecological Analysis and Synthesis to provide assistance. Because of the high-profile nature of the study, the team has committed to an unusually high level of outreach including monthly Agency Director briefings, presentations at the IEP Annual Meeting (February 2007) and a proposed symposium at the American Fisheries Society National Meeting (September 2007). A synthesis report integrating the results of the first two years of the study will be developed by late 2007.

References Cited

Bennett, W .A. 2005. Critical assessment of the delta smelt population in the San Francisco estuary, California. San Francisco Estuary and Watershed Science. Vol. 3, Issue 2 (September 2005), Article 1.

California Bay-Delta Authority 2003. Ecosystem Restoration Program Phase 2 Report.

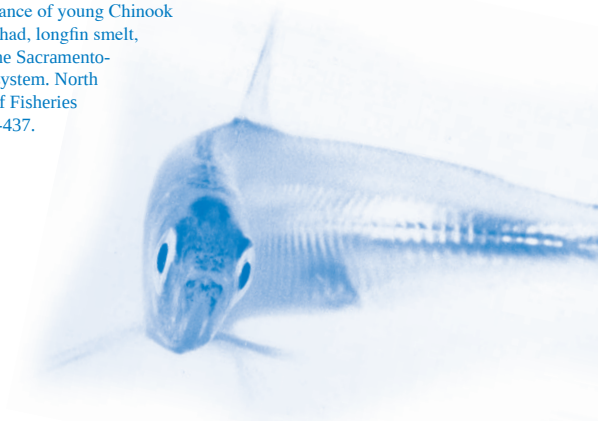
IEP (Interagency Ecological Program for the San Francisco Estuary). 2005a. IEP 2005 Workplan to Evaluate the Decline of Pelagic Species in the Upper San Francisco Estuary.

IEP (Interagency Ecological Program for the San Francisco Estuary). 2005b. IEP Synthesis of 2005 Work to Evaluate the Pelagic Organism Decline (POD) in the Upper San Francisco Estuary.

Jassby, A. D., W. J. Kimmerer, S. G. Monismith, C. Armor, J. E. Cloern, T. M. Powell, J. R. Schubel, and T. J. Vendlinski. 1995. Isohaline position as a habitat indicator for estuarine populations. Ecological Applications 5: 272-289.

Kimmerer, W.J. 2002. Effects of freshwater flow on abundance of estuarine organisms: physical effects or trophic linkages. MEPS 243: 39-55.

Stevens, D. E., and L. W. Miller. 1983. Effects of river flow on abundance of young Chinook salmon, American shad, longfin smelt, and delta smelt in the Sacramento-San Joaquin River system. North American Journal of Fisheries Management 3:425-437.



SRWP Kicks off Two New Projects

The Sacramento River Watershed Program (SRWP) was recently awarded a grant from the California Department of Water Resources for the development and implementation of the Sacramento River Watershed Information Model (SWIM). Funding from this grant is provided by the CALFED Watershed Program. SRWP also received a planning grant from the State Water Resources Control Board for the development of the "Sacramento River Watershed Roadmap." This project is funded through the Proposition 40 Integrated Watershed Management Program. Stay tuned for more information as these two exciting projects progress and as SRWP seeks input and participation from the Sacramento River Watershed community.

SWIM

For years SRWP has been working towards providing a watershed resource library to address the information needs of its stakeholders. Early on it was determined that this would best be accomplished by providing a virtual resource center through the SRWP web site, www.sacriver.org. In early 2007 SRWP will be taking a significant step towards that goal through the launch of the Sacramento Watershed Information Module (SWIM).

The SWIM Project started in 2006 with seed funding from SRWP's U.S. Environmental Protection Agency grant. In 2007 and 2008 SWIM will be massively expanded through a CALFED Watershed Program grant. SWIM will take the very successful Watershed Information Model developed by the Western Shasta Resource Conservation District and expand it to the entire Sacramento River Watershed. SWIM will become a key feature of SRWP's web site by providing an online database of maps, GIS coverages, documents, photos and other resources that will be searchable through an online map interface.

Once completed, SWIM will become an important resource for many of the watershed organizations within the Sacramento River Watershed. SRWP is purchasing and installing the high-end software on our Internet server so web users can enjoy many of the resource searching and mapping capabilities through their own web browsers and will not have to purchase additional software. Through web links, watershed organizations will be able to have customized map interfaces on their own web sites that will be based upon a map (and associated GIS coverages) of their watersheds. Additionally, SWIM will provide much greater map production capabilities to web users than has been available to them before. Thus, SWIM will enable web users to design and print high quality custom maps; a great benefit to many watershed organizations that have limited map production capabilities. If you are interested in getting on the e-mail list to keep informed of the SWIM project, please go to www.sacriver.org to join.

ROADMAP

The Sacramento River and its many tributaries has in recent years been the focus of multiple reports, projects, assessments and management plans. This activity has provided a wealth of information about the history and current state of our watershed; yet, much of the information collected remains off the radar screen of agency leaders, elected officials, special interest groups, and the watershed community as a whole. The purpose of this project is to consolidate and link the great work that has been conducted by locally directed watershed management programs into a comprehensive report – or "Roadmap" for the Sacramento River Watershed. The Roadmap will highlight key information about our watersheds in layman terms and provide a comprehensive look at the entire watershed. The outcome will be a document that will provide an overall picture of the condition of the watershed, identify priorities for improving the health of the watershed, and describe a strategy for implementing those priorities. Included in the Roadmap will be a watershed health tracking program to monitor and track long-term trends in watershed conditions. Development of the Roadmap will be guided by a steering committee comprised of watershed practitioners throughout the basin and other experienced representatives. Frequent updates and a number of watershed workshops will be conducted before the project is completed in September 2008. If you are interested in getting on the e-mail list to keep informed of the Roadmap project, please go to www.sacriver.org to join.

SRWP Studies on Pyrethroid Insecticides and Their Effects in the Sacramento River Watershed

Technical Corner

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In 2005, the SRWP was awarded a grant from the Pesticide Research and Identification of Source and Migration (PRISM) program of the State Water Resources Control Board for a study focusing on pyrethroid insecticides. Regulatory agencies and other stakeholders were aware of emerging pyrethroid use and the potential for environmental impacts, but lacked data by which to assess these risks. This study was intended to provide such data and help address uncertainties surrounding pyrethroids and identify management methods to reduce environmental impacts. The work was led by UC Berkeley, and included collaboration with Southern Illinois University, Pacific EcoRisk, UC Davis, and the California Department of Fish and Game.

When the SRWP pyrethroid study began, there was remarkably little data on the environmental fate or effects of pyrethroids on aquatic systems despite their widespread and rapidly growing use. In particular, there was no data at all on their presence in urban creeks, though pyrethroids have become the dominant insecticide used in urban settings. The SRWP study, focused on three main topics: 1) pyrethroids in urban creeks; 2) their persistence in farm soils: and 3) determining thresholds for toxicity.

Urban Creek Studies

At the outset of the study, available pyrethroid monitoring data was limited to agricultural water bodies; thus the impact on the environment was often perceived as an agricultural problem. However this perception ignores the fact that agricultural use of pyrethorids pales in comparison to urban use. It is used in the urban environment that is growing rapidly as pyrethroid-containing products replace those with diazinon and chlorpyrifos, compounds that can no longer be sold for use in urban environments.

The SRWP-supported study examined seven creeks in Sacramento. Toxicity in the water of many of these creeks had been previously reported, and found to be toxic due to diazinon or chlorpyrifos insecticides. However, pyrethroids are different in that they bind quickly to sediments; therefore, it is bottom-dwelling animals, rather than those in the water column, that are at the greatest risk. Our sampling of sediment in the Sacramento creeks showed pyrethroids to be present in all of them; every one of 28 samples had measurable concentrations of the compounds. Of greater concern was the fact that at least some portions of six of the seven creeks contained concentrations high enough to be toxic to sensitive aquatic life. Using a crustacean nationally used for sediment toxicity testing, two-thirds of the sediment samples were found to be toxic to the animal. Subsequent work in several other communities has shown these findings are not unique to Sacramento.

The one pyrethroid that contributed about two-thirds of the toxicity was bifenthrin. This compound is used around the exterior of homes by professional pest control applicators, and is also available for retail purchase by consumers, often as an insecticide for lawns and sometimes mixed with fertilizer. Whether it is professional or homeowner use of bifenthrin that is leading to appearance of the compound in creek sediments remains an open question, but the answer is likely to emerge from studies done over the next couple years.

In an interesting follow-up study, it has been shown that the pyrethroids in Sacramento creeks even played a role in increasing the aquatic impacts of the aerial spraying for mosquitoes over the City. A substance in the product applied, known as PBO, was intended to enhance the toxicity of the insecticides being sprayed, but appearance of the compound in Sacramento creeks after the spraying may also have slightly increased the toxicity of the pyrethroids already present in the sediments.

Persistence in Farm Soils

Though there is some dormant season application of pyrethroids in orchards, the majority are applied to crops during the growing season. The key to minimizing pyrethroid movement off the fields and into nearby creeks is to minimize erosion of soil particles and the insecticides they carry. While minimizing erosion is clearly in the interest of growers for reasons even beyond pesticide concerns, the strategies for accomplishing it will depend on whether control of dry season irrigation runoff or wet season stormwater runoff is the objective. For pyrethroids applied to crops in the summer, transport by irrigation runoff is of concern, but it is more readily managed by irrigation management practices than is control of runoff from winter storms. A key question that exists is how long pyrethroids remain in soils in a toxic form, and whether they would persist from summer application until winter rains.

The SRWP studies examined three farms: a pear orchard that applied the pyrethroid esfenvalerate, a tomato farm that applied lambda-cyhalothrin, and a rice farm that applied

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2006 Year In Review

January

- Held retreat for SRWP Board of Trustees at the McConnell Foundation focused on refining the vision for the SRWP

February

- Initiated Phase I of the Sacramento Watershed Information Module (SWIM) project to develop an online database of watershed documents and resources
- Began investigation of opportunities to address the low density development that is occurring throughout the watershed

March

- Completed 2006-07 Strategic Work Plans for Public Outreach and Education Program and Support for Local Watershed Stewardship services

April

- Co-sponsored "Watershed Day at the Capitol" event to encourage and provide opportunities for local watershed partnerships to meet with their elected officials
- Reinitiated mainstem river monitoring under Proposition 50 CALFED Watershed Program Grant

May

- Celebrated California's second annual May Watershed Awareness Month
- Sponsored Folsom High School Film Contest focused on issue of "dry year planning "

June

- Submitted planning grant proposal to the State Water Resources Control Board for Proposition 40 Integrated Watershed Management Program

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lambda-cyhalothrin. Environmental persistence of chemicals is measured using the concept of half-life; the length of time it takes half of any given amount of the compound to degrade. For the pyrethroids in the farm soils, the half-lives were relatively short, averaging 40 days for esfenvalerate in the orchard soil, and 23 and 54 days for lambda-cyhalothrin at the tomato farm and rice farm, respectively. The message from these results is control of sediment loss via irrigation runoff is critical for controlling off-farm movement of pyrethroids, but winter storms are likely to be of less significance because much of the compound will have degraded by that time.

Toxicity Thresholds

Most currently used pyrethroids were registered with the Environmental Protection Agency (EPA) 20-30 years ago with little or no testing of the compounds on species living in the sediment. Regulatory emphasis was placed on toxicity to water column animals, despite the fact that pyrethroids quickly adhere to sediments and thus do not stay in the water column. Despite decades of use, the amount of pyrethroids toxic to the organisms that are widely used for sediment testing remained unknown.

The SRWP study determined the levels of pyrethroids needed to cause toxicity to Hyalella azteca, a small, shrimp-like crustacean that is used in virtually all sediment toxicity testing in California. The results showed that toxicity varied 20-fold depending on the particular pyrethroid, and the most used pyrethroid (permethrin) was also the least toxic. However, several other pyrethroids were toxic at about 3 parts per billion; roughly equal to the weight of a few grains of dry rice in a dump truck load of soil.

Data on the amount of pyrethroid needed to cause toxicity has been critical in developing monitoring programs for the substances. Before the SRWP work, much of the State's monitoring was done with a detection limit of 10 parts per billion. Thus, concentrations could be three times lethal levels and would still be chemically undetectable. The data provided by this study has been critical in encouraging laboratories to improve their analytical capabilities for the compounds.

A great deal has been learned in the past few years about pyrethroids in the environment through the research done under this SRWP-supported PRISM project. Further details on studies described above can be found at www.sacriver.org. The urban work in particular, has provided important lessons on how lawn care or structural pest control practices in residential areas can have adverse consequences in nearby creeks that homeowners rarely consider when they make choices for pest control. The results have had considerable impact in designing monitoring programs, in State pesticide regulatory efforts (see sidebar), and in ongoing federal re-registration of pyrethroid compounds. Pyrethroids offer a number of advantages to the organophosphate insecticides they have replaced for some uses, though the challenge remains to keep residues from moving from the site of application and affecting non-target animals. Efforts are underway to provide more precise identification of sources and develop measures to minimize these unintended effects.

July

- Developed map and directory of Sacramento River Watershed Partnerships
- Awarded a Proposition 50 CALFED Watershed grant to implement Phase II of SWIM project
- Published 21st issue of the Waterways newsletter

August

- Launched Northern California television campaign with a spot regarding the importance of watershed stewardship. The spot was filmed on SRWP Board member, James Rickert's family ranch.

September

- Partnered with Western Shasta Resource Conservation District (RCD), Butte County RCD, and Cache Creek Conservancy to purchase new environmental education equipment for their lending libraries

October

- Hosted "Watershed Moment" fundraising dinner event with Christopher Cabaldon, Mayor of West Sacramento and Central Valley Regional Water Quality Control Board Member, and Assembly Member Lois Wolk serving as keynote speakers
- Hosted Environmental Compliance and Permitting Workshop as part of the 8th Annual Weed Management Area Statewide Meeting
- Partcipated in Salmon Festivals

November

- Hosted annual stakeholder meeting at Deseret Farms in Chico
- Welcomed two new Board members: Irenia Quitiquit, Robinson Rancheria, and Gregg Roy, Jones & Stokes

December

- Awarded Proposition 40 Integrated Watershed Management Program to develop the "Sacramento River Watershed Roadmap"
- Completed Water Quality Summary Monitoring Report
- Completed our sixth year of partnering with News10 on the educational television campaign

The California Department of Pesticide Regulation's Re-evaluation of Pyrethroid Insecticides

Monitoring by the California Department of Pesticide Regulation (CDPR), the SRWP-supported work, and other studies throughout California have documented the presence of pyrethroid insecticide residues in both agricultural and urban-affected waterbodies, and concentrations sufficiently high to represent a threat to sensitive aquatic life. These findings have sparked the recent entry of pyrethroids into a formal process known as "re-evaluation." It is by far the largest re-evaluation effort CDPR has ever pursued and unusual in that it has been prompted by environmental, rather than human health concerns.

It is probably surprising to most Californians to learn over 1,200 pyrethroid-containing products are registered with CDPR for use in the State. About half of these products are used indoors, are in containerized baits, or for other reasons would be unlikely to contribute to the residues found in surface waters, and are therefore excluded from re-evaluation. However, the re-evaluation does encompass slightly over 600 products from over 120 companies that have registered pyrethroids with CDPR. The purpose of the re-evaluation is to obtain data from these manufacturers on the toxicity, environmental fate, sources, and potential mitigation practices for their products. This information will be provided over the next few months to next couple years, depending on the effort necessary to obtain specific data.

The re-evaluation is likely to result in modification of permissible application practices or allowable uses of specific products. While CDPR is certainly aware of the recent environmental findings regarding pyrethroids, they also view the compounds as preferable to many of the alternatives. Thus, it is unlikely that the re-evaluation will result in the withdrawal of a large number of pyrethroid products. Rather, it is hoped that the data provided will identify a narrow subset of products or practices that are contributing to the surface water impacts being observed and that these conditions can be corrected by specific and well-targeted regulatory actions.

Local Watershed Group

Lower Clear Creek Restoration Team Receives State's Top Environmental Leadership Award

The Restoration Team for the Lower Clear Creek Floodway Rehabilitation Project, led by the Western Shasta Resource Conservation District (RCD), received the 2006 Governor's Environmental and Economic Leadership Award Program – the State's highest and most prestigious environmental honor, on December 5, 2006. The program recognized individuals, organizations and businesses operating in California that have demonstrated outstanding environmental leadership. The Team's award was in the category of Ecosystem and Watershed Restoration.

The Restoration Team guided the recovery and maintenance of resilient, naturally reproducing salmon and steelhead populations and restored riparian plant and animal communities on the floodplain by revitalizing critical hydrologic, geomorphic, and ecological processes. The project increased the return of fall-run Chinook salmon from a 1967-1991 average of 1,689 to over 16,000 in 2003, recreated 60 acres of floodplain, reduced juvenile fish stranding by filling old gravel extraction pits, removed a dam that opened 10 miles of creek for spawning and rearing habitat, and injected 95,000 tons of spawning gravel. Congratulations to all those involved with this exciting project!

Project Background

Lower Clear Creek is a major westside tributary of the Sacramento River southwest of Redding in Shasta County. The decline of the Lower Clear Creek Watershed began over 150 years ago with the discovery of gold at Reading Bar, which led to a 100-year legacy of alteration and degradation. Floodplains and terraces were "turned upside down," removing all riparian and upland vegetation, leaving piles of cobbles unsuitable for revegetation. Commercial instream aggregate mining began in the 1950s and continued destroying the natural channel and floodplain morphology. Further ecological degradation occurred in 1963 with the construction of the Whiskeytown Dam, which decreased the amount of water flowing into Lower Clear Creek by 60 percent. Additionally, all of the alluvial materials—cobbles, gravel and sand—that normally wash down from the upper watershed during high water and flood events are now trapped by the reservoir.

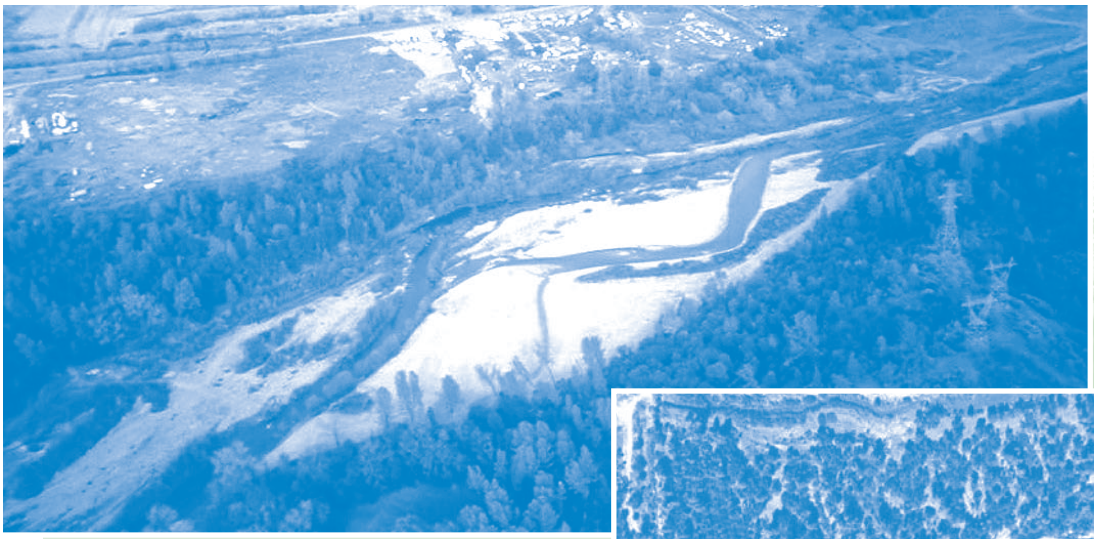
To address these impacts, the Western Shasta RCD initiated the Lower Clear Creek Coordinated Resources Management and Planning (CRMP) group in 1996, which provided a consensus-based forum for all stakeholders—private landowners, recreation groups, industry representatives, agencies, and other community members—to provide input on an equal basis concerning issues in the watershed. By 1998, the group had completed a management plan, providing the vision for the future restoration and management of the watershed. "The Lower Clear Creek Management Plan" laid the foundation for many of the projects currently underway in the watershed—projects designed to reverse the impacts of over 100 years of degradation.

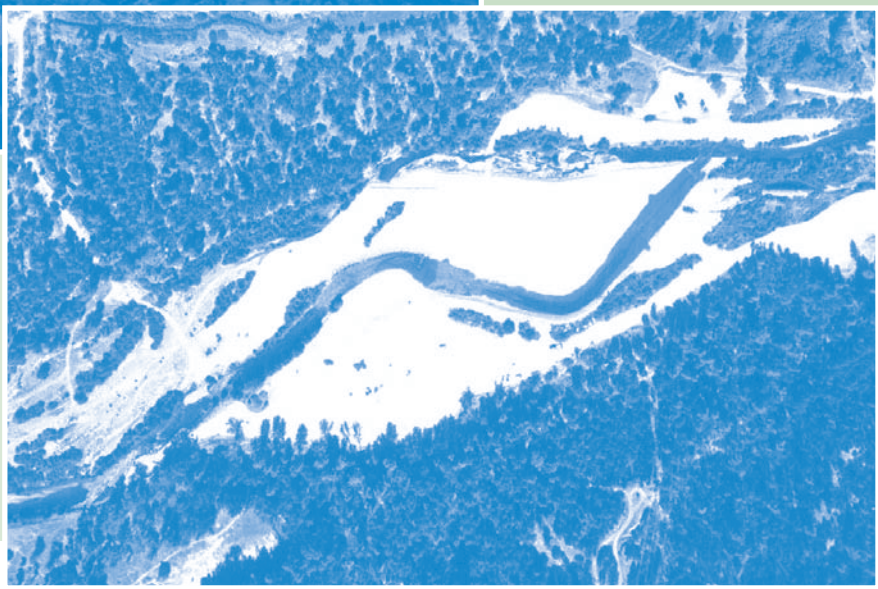
Mary Mitchell, Western Shasta Resource Conservation District; Mark Cibula, Shasta County Supervisor; and Francis Berg, Bureau of Land Management, shown with the 2006 Governer's Environmental and Economic Leadership Award on behalf of the Lower Clear Creek Restoration Team.

The Project: Reconstructing an Altered Floodway

The purpose of the Lower Clear Creek Floodway Rehabilitation Project is to promote the recovery and maintenance of resilient, naturally reproducing salmon and steelhead populations and to restore riparian plan and animal communities on the floodplain by revitalizing critical hydrologic, geomorphic, and ecological processes within the current flow and sediment conditions system of Lower Clear Creek. In 1999, the restoration team completed a conceptual design for the floodway rehabilitation site. The conceptual design called for major construction activities to recreate functional channel segments, increase salmon spawning habitat, repair the floodplain and improve riparian habitat and wetlands for the benefit of both wildlife and recreation. The project included three phases:

- **Phase 1: Reduction of salmon stranding**
- **Phase 2: Floodplain creation**
- **Phase 3: Instream channel work**





The above photo illustrates the Lower Clear Creek Floodway prior to Phase 3 of the project.

The below photo was taken after the braded bedrock channel was redirected into a single channel through fresh alluvial material to reduce stranding and provide much better spawning habitat.

Thanks to grants from several agencies and efforts by the U.S. Bureau of Land Management to purchase riparian land throughout the watershed, the Western Shasta RCD was able to complete Phase 1 during project design as an interim measure to prevent fish from getting into the most severe stranding locations. Using fill from an upstream borrow site, the elevation of a large salmon steelhead standing pit downstream was raised and re-graded to deter stranding.

From 1999-2001 Phase 2 was completed, which included filling the off-channel mining pits to eliminate the worst salmon and steelhead stranding areas and reconstructed over 60 acres of floodplain and replanted 36 acres. An additional seven acres of reconstruction and two acres of revegetation took place upstream at the 'borrow site.' The U.S.Bureau of Reclamation provided funding for gravel injections throughout the stream channel.

Phase 3A was completed during 2002-2005 thanks to a CALFED grant managed by U.S. Fish and Wildlife, which converted a barren bedrock channel back to a cobble-bedded stream with natural gravel bars, pools and riffles. The channel was relocated and reconstructed in the uppermost 1,500 feet. of the project site using large trees and root-wads to protect the new bank and provide shelter for juvenile fish.

Phase 3B will soon be underway thanks to a CALFED grant managed by the California Department of Fish and Game that is focused on recreating natural processes within the altered hydrologic and geomorphic conditions. During the implementation of these phases, the Lower Clear Creek Technical Team is:

- restoring a historical meander in the channel;
- reconstructing an appropriately confined channel to improve the transport, storage and routing of gravel;
- reconstructing floodplains to encourage natural processes of floodplain creation, deposition and inundation;
- encouraging natural channel migration and floodplain processes, and
- restoring the stream grade and reducing exposed clay hardpan by increasing gravel supply.

To read the full case study of this exciting project, please visit www.sacriver.org or contact Leslie Bryan, Western Shasta RCD, at 530.365.7332 or leslie@westernshastarcd.org.

Lending Libraries

Educational Watershed Materials on Loan

The Sacramento River Watershed Program supports the sharing of resources for schools and organizations to learn about the watershed. The Watershed Education Lending Library (WELL) and the Environmental Education Kit (EEK) Lending Library for Educators are two such programs.

The Shasta Conservation Fund's Watershed Education Lending Library (WELL) is a lending library for watershed education equipment and curriculum. Agencies, organizations and groups use the WELL as a virtual library database to identify what materials are available to share. Items in the WELL include GPS units, binoculars, Enviroscape Watershed Models, field insect nets, pH strips, water sampling vials, posters, field guides, books, videos, and much more. Borrowers can sign out materials for no charge and utilize these items for research, service learning project and field trips. Visit www.shastaconservationfund.org/Lendingwell.html to view the full list of what the WELL has to offer.

Cache Creek Conservancy offers the Environmental Education Kit (EEK) Lending Library for Educators. This program provides Owl Pellet Dissection Kits, Orienteering Kits, and Tracks and Scat Kits to area educators. The kits are filled with specimens, books, videos, software, lesson plans, consumables and scientific tools. Hands-on activities for students and educator lesion ideas are included in each kit.

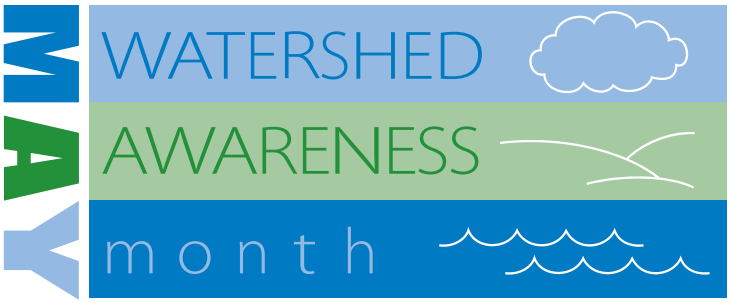
To borrow an EEK, teachers must attend the appropriate teacher workshop for the kit they wish to borrow. For information on upcoming workshops, contact the Cache Creek Conservancy Education Coordinator at ccnp@yolo.com or (530) 661-1070.

For more information about a Lending Library in your area, contact Mary Lee Knecht at marylee@watershednetwork.org.

Map and Directory of Sacramento River Watershed Partnerships Available

Did you know that there are over 50 local watershed partnerships working to improve the health of the watersheds in the Sacramento River Basin? These partnerships include local Resource Conservation Districts, local watershed groups, and other community organizations. Visit www.sacriver.org to view and print out a copy of the map and directory, or contact Mary Lee Knecht at marylee@watershednetwork.org to request copies. The map and directory is updated on a quarterly basis.

May is Watershed Awareness Month...



Get to Know Your Watershed!

May 2007 is being celebrated as Watershed Awareness Month to encourage Californians to learn more about their local watersheds and participate in environmental activities to enhance their natural surroundings and communities. This celebration – in its third year – is sponsored by the Sacramento River Watershed Program and California Watershed Network, and is supported by Governor Arnold Schwarzenegger.

Throughout the month of May, watershed partnerships, educators, and other community groups are encouraged to promote the importance of watersheds and stewardship at the grassroots and community levels by organizing and participating in watershed awareness activities. To celebrate Watershed Awareness Month, participants can take part in watershed walks, project field tours, water quality monitoring, streamside cleanups, and other activities already taking place in their watersheds – or they can organize an event of their own.

Check out the event calendar on the Sacramento River Watershed Program's web site (www.sacriver.org) to find out what activities are planned in your community.

Watershed Day at the Capitol

Join the Sacramento River Watershed Program and other watershed partnerships at Watershed Day at the Capitol:

Wednesday, March 21, 2007

CalEPA Building
1001 I Street
Byron Sher Auditorium

Sacramento, California

This year's "Watershed Education Day for Legislators" is a great opportunity to learn about the political climate regarding the future of watershed management and restoration. It also provides an interactive forum for watershed practitioners to meet with elected officials and let them know that it pays to invest in community-based watershed stewardship. This year's event includes keynote speaker: Assemblymember John Laird, Chair of the Assembly Budget Committee; a panel discussion regarding funding opportunities from recently passed bonds and the Integrated Regional Water Management Program; and opportunities to meet with your legislators.

The Sacramento River Watershed Program would like to coordinate meetings between legislators and watershed partnerships in the Sacramento River Basin. If you or your organization are planning on participating please contact Mary Lee Knecht at marylee@watershednetwork.org or 916.549.4017. Registration and full agenda are available at www.watershednetwork.org.

Upcoming Watershed Workshops

Planning a trip to Sacramento on March 21st to attend "Watershed Day at the Capitol?" Come a day early and participate in a watershed workshop!

Permitting and Environmental Compliance "101" for Watershed Restoration Projects.

This workshop will provide an overview of environmental regulations and permitting requirements applicable to watershed restoration projects and strategies for streamlining the process. This informative, half-day workshop is being taught by Ken Bogdan, an environmental planner, attorney and environmental counsel with Jones & Stokes.

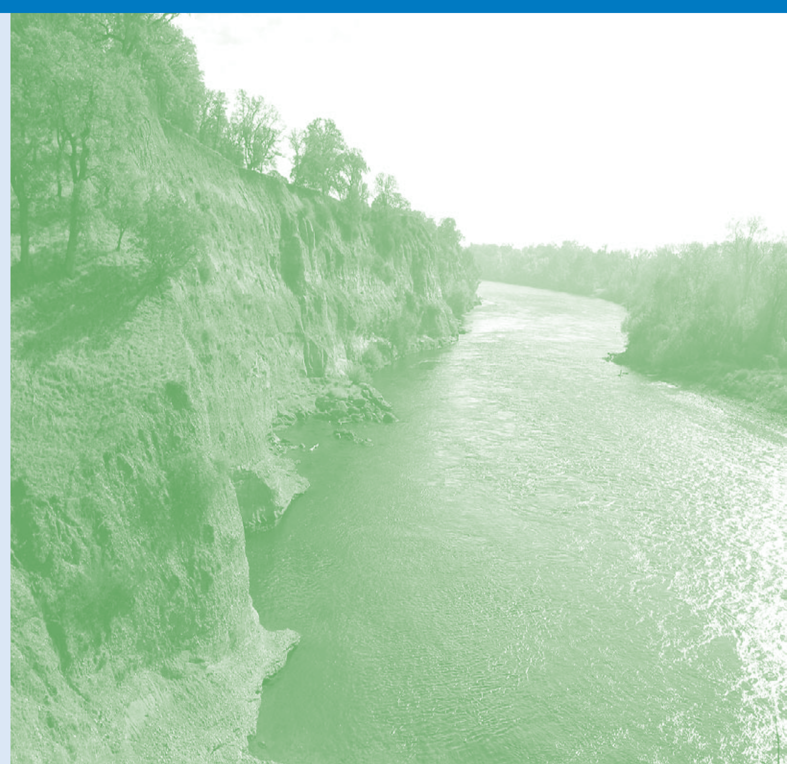
"Integrating" Watershed Management into the Integrated Regional Water Management Program.

Join other watershed practitioners in a workshop discussion on the Integrated Regional Water Management Program to find out what's working, what's not, and develop solutions to improve the process.

Visit www.watershednetwork.org to register for these exciting workshops!

Sacramento River Watershed Program
327 College Street, Suite 205
Woodland, CA 95695

If you would like to submit articles, have questions, or topics you would like researched and discussed in the SRWP "Waterways" newsletter, please contact Jennifer Tencati at (916) 567-6309.



Sacramento River Watershed Program Web Site:
www.sacriver.org