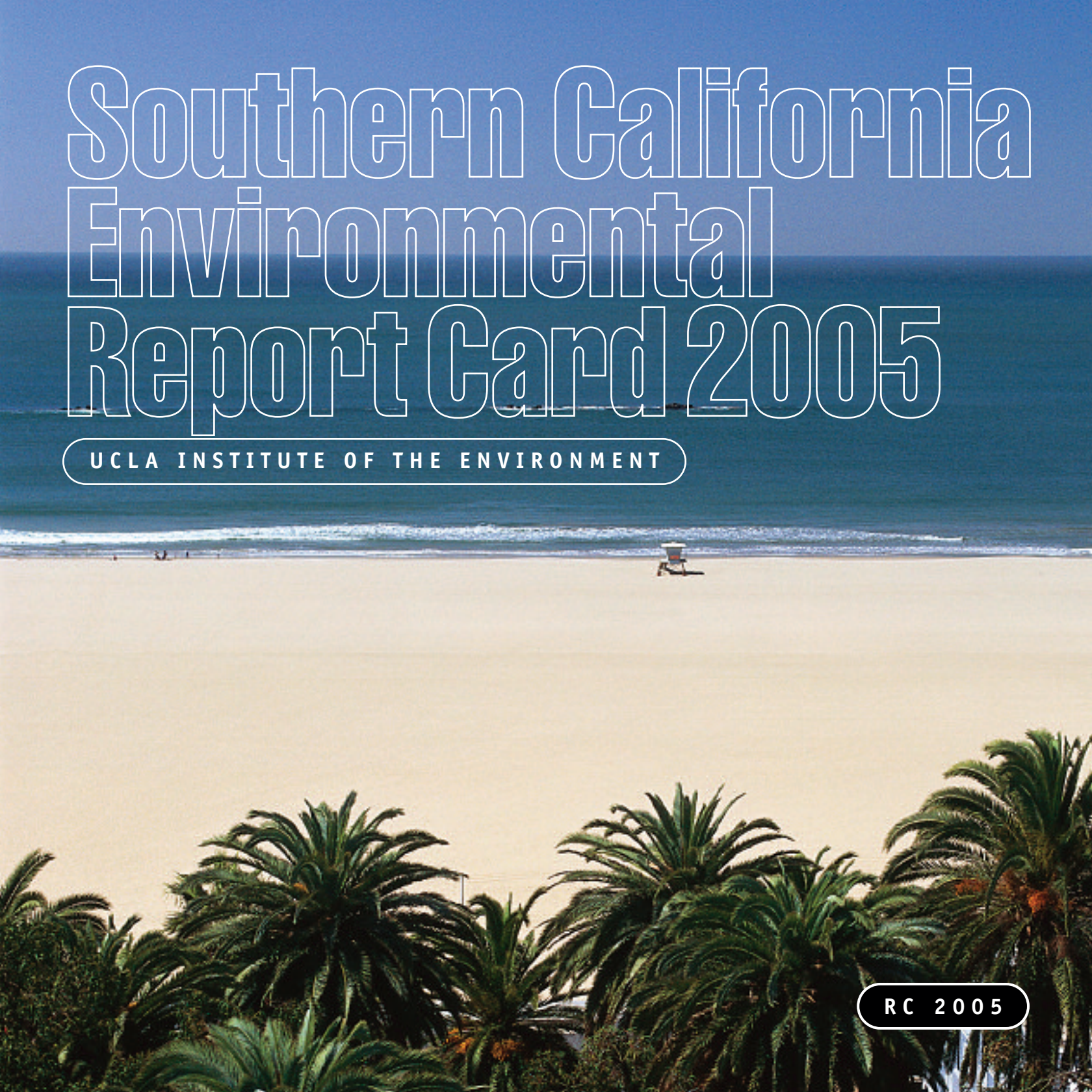

Southern California Environmental Report Card 2005

UCLA INSTITUTE OF THE ENVIRONMENT

RC 2005

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RC 2005

From the Director

Mary D. Nichols, J.D.
Director
UCLA Institute of the Environment

If this is your first glance at a Southern California Environmental Report Card, be prepared for a much more searching evaluation than is usual under most grading systems. The authors of the four essays that make up the 2005 Report Card have taken great care to summarize the key factors contributing to four of our region's most pressing environmental concerns—drought, impaired water quality, releases of toxic and hazardous wastes, and the loss of marine resources from our coast. They provide scientific data and objective analysis. The final grades may provide useful feedback to the government agencies responsible for enforcing the laws that have been put in place to address these concerns, but their primary purpose is to give the people of Southern California a sense of what a select group of UCLA environmental researchers think is working well—and what is not.

The UCLA Institute of the Environment publishes a Report Card annually, in what is now an eight year conversation with policy makers and interested members of the community. I use the term "conversation" advisedly, because some of the data that are reported here can actually be traced back to recommendations in previous Report Cards. Proposition O, a $500 million bond approved by the City of Los Angeles voters in November 2004 with a convincing margin of 74.9%, is a terrific example of the Report Card's influence. The resounding victory demonstrates a strong consensus that we need to get serious about fixing the polluted storm water runoff that has degraded our local groundwater, frequently closing our beaches and backing up onto streets when it rains.

Government officials, environmental advocates, business leaders and the news media all played critical roles in developing the ideas and building the political will to pass this much-needed measure. But it was the science and policy analysis that made the case. Years (actually, decades) of work by UCLA researchers and others have built the case for action and demonstrated the technologies that can reverse the damage caused by past failures of policy and planning. So when the City Council decided to put Prop. O before the electorate, the facts were widely known and the public was well aware that our water quality problems are real. Voters felt confident they were supporting a well-crafted set of policies and projects with a high likelihood of success.

I served as co-chair of Yes on Proposition O. It was a remarkable campaign: at a time when the nation was being divided into red states and blue states, we had no active opposition. So instead of the typical negative television ads, we could focus on the benefits of

The IOE's Report Card is now part of an eight year conversation with policy makers and interested members of the community.

re-engineering the city to capture rain water and allow it to permeate the soil, greening neighborhoods and keeping trash and toxics out of the ocean. At every step we had the backing of studies documenting the sources of pollution, the effects on human and ecosystem health, and the cost-effective solutions. For once, science and social science really did inform the debate.

I'm proud to report that research and analysis by two of this year's Report Card authors, biologist Richard Ambrose and engineer Michael Stenstrom, played a critical role in developing the scientific consensus that paved the way for a public policy victory that seems all too rare these days. Their articles address the progress we've made in improving water quality and marine resources and the problems that remain. But I also want to push the point a bit farther because without sustained funding for research on important environmental issues, future victories will be less likely. Public skepticism, fueled by press reports of "scientists say this" or "a new study reveals that," has contributed to severe cutbacks in the funds given to federal and state agencies for the kind of policy-relevant research needed to make further environmental progress. One of my not-so-secret hopes for the Report Card is that by communicating the results of academic research in a non-academic format, we can demonstrate the value of long-term public support for environmental studies at nonpartisan research institutions like UCLA.

Toxic and hazardous waste—addressed in the RC by two public policy experts, J.R. DeShazo and Bowman Cutter—continues to stay buried in urban areas and buried in the public consciousness until a truck overturns on the freeway or a leaking underground tank threatens local drinking water supplies. Professors DeShazo and Cutter have examined the data and come to a couple of important conclusions. One is that cities are doing a pretty good job of carrying out the inspections required by law but that counties need to do more. The other, more disturbing, finding is that the data are simply not being collected that would enable the legislature or the public to assess how well or poorly individual companies are managing their wastes. Clearly a program that inspects but then doesn't act on the information revealed by inspections is only a partial solution to the release of toxic chemicals into the environment.

While most Southern Californians are aware that they are dependent on water imported from Northern California to meet their basic needs, and the decline of the San Francisco-Sacramento Bay-Delta is the focus of a massive federal and state recovery effort, a much larger threat to Southern California's water supply and environment is the looming loss of Colorado River water. Glen McDonald's lead article succinctly lays out the impacts of the changing weather patterns and long-term drought, as well as the institutional and legal constraints that are coming together to force massive changes in the way we import and use water. This article should help re-focus our attention on the fastest-growing area of Southern California, the Inland Empire, and the effects this growth will have on the region as a whole.

continued on page 40

GRADES B+ to D

Water Supply

by Glen MacDonald, Ph.D.

Professor of Geography

Drought is not the first word that comes to mind at the end of a record-breaking rainfall season in Southern California. Nonetheless, the state remains on the verge of a potential water crisis and faces severe uncertainties in long-term planning to meet Southern California water demands. The Colorado River system—a principal source of supply—is experiencing both severe drought and increasing water demands from other states and Mexico. In this article we examine water demands in Southern California and consider the capacity of the Colorado system to meet those demands. We also consider evidence the Colorado system could experience severe and sustained droughts that make the current situation, or any drought experienced over the past 200 years, pale in comparison. Finally, we outline current actions California is taking to plan for the sustainable use of Colorado River water.

SOUTHERN CALIFORNIA WATER USAGE AND SUPPLIES

The big player in southland water distribution for urban and suburban areas is the Metropolitan Water District of Southern California (MWD). This consortium of 26 cities and smaller water districts serves almost 18 million people over a 5200 square mile area that extends from San Diego County to Ventura County. For the City of Los Angeles, the Department of Water and Power relies heavily on the eastern Sierra Nevada, but draws more upon the other MWD sources in times of shortage. To meet water demands, the MWD delivers 1.7 billion gallons of water each day, almost 100 gallons per day for every person in its service area. This is the water for drinking, bathing, industrial uses, parks and recreation and other demands required to support the Southern California population and lifestyle. Water allocations of this scale are measured by the acre-foot, the amount of water required to cover one acre to a depth of one foot, 326,000 gallons. Today the MWD requires about 1.8 million acre-feet of water per-year to keep the major urban and suburban areas of Southern California functioning.

Although the billions of gallons of water distributed by the MWD is an appreciable amount, Southern California agriculture uses an even larger proportion of water. For example, the Imperial Irrigation District (IID) distributes over 3 million acre-feet of water per-year, yet the entire population of Imperial County is only about 150,000 people. In some cases, the agricultural users have priority over urban and suburban users.

Southern California is an arid to semi-arid environment with low annual precipitation. Even in years of record precipitation such as 2004-05, Southern California retains less precipitation than it needs to meet its water requirements. The average annual precipitation in the Los Angeles Basin is about 15 inches per year. Over the area of the MWD this would provide a total of around 4 million acre-feet of water. However, about 60% of this moisture evaporates, is used by vegetation, or enters the soil. Much of the rest runs directly into the ocean as surface flow where it often serves vital ecological functions in systems such as coastal estuaries. Only a small proportion is captured in reservoirs. For more than 100 years Southern California has had to import water to support its large population. At present less than half the water we use

The Upper and Lower Basins of the Colorado River with the locations of major reservoirs and aqueducts, as well as the areas serviced by the large southern California water districts that draw from the river.

comes from local surface or groundwater sources. The rest is imported from outside of Southern California.

Some of our imported water comes from the Sierra Nevada Mountains and northern portions of the state. However, a large proportion is derived from the Colorado River. The Colorado River water is perhaps the most critical and uncertain element of water resource planning in Southern California and for the MWD.

COLORADO RIVER WATER AND SOUTHERN CALIFORNIA

So important is the Colorado River that MWD spokesman Bob Muir has called it "the backbone of water supply in Southern California." Today Colorado River water contributes about 65% of the water distributed in Southern California. Water in the Colorado arises mainly from the upper portions of its drainage basin,

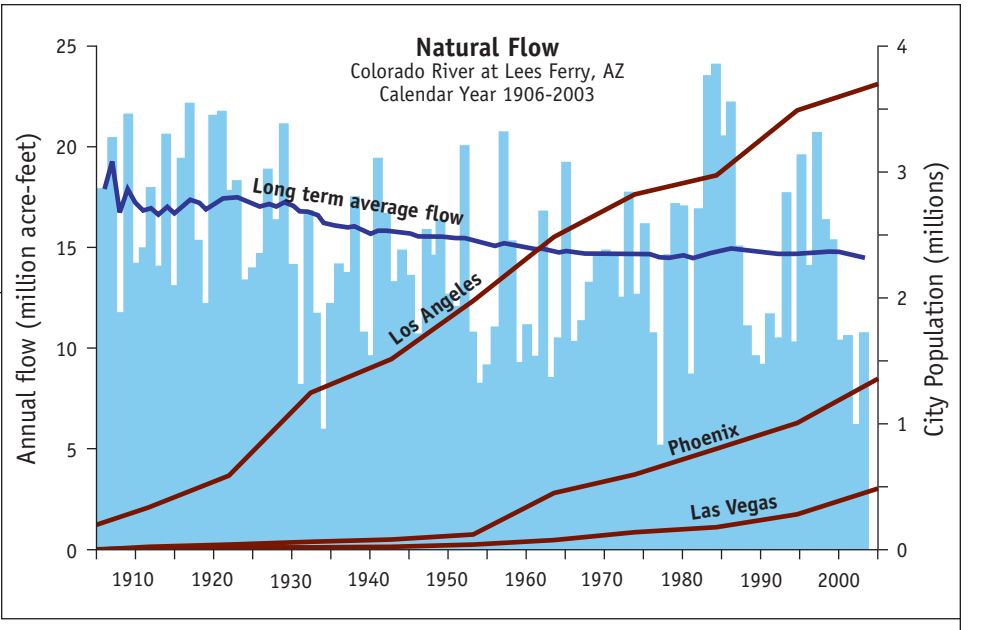
The Colorado River system—a principal source of supply—is experiencing both severe drought and increasing water demands from other states and Mexico.

which includes portions of Wyoming, Utah, Colorado, New Mexico and Arizona.

Water from the Colorado is used for drinking, irrigation and other purposes by California, the other states of the basin and Mexico. In 1922 the seven states of the upper and Lower Colorado Basins implemented the first stages of the Colorado River Compact, which apportioned 7.5 million acre-feet per-year to Colorado, New Mexico, Utah, Wyoming, Arizona, Nevada and California. In 1944, Mexico was apportioned 1.5 million acre-feet. This total allocation—16.5 million acre-feet—was based on the premise that the average annual river flow at Lees Ferry, just below present Lake Powell, is 17 million acre-feet.

Under the Boulder Canyon Project Act of 1928, California was apportioned 4.4 million acre-feet of water per year under normal conditions. In total this amount is less than the current or anticipated future total water needs for the MWD and the IID, not to mention other users such as the Cochella Valley Water District (CVWD). California has enjoyed a cushion in that the Compact allowed us to draw upon the 'surplus' water not used

Today Colorado River water contributes about 65% of the water distributed in Southern California.



Annual and long-term Colorado River water variability flow compared to population growth of the cities of Los Angeles, Las Vegas and Phoenix. City populations include only residents living within city jurisdictions.[1]

by other states. So long as populations in Nevada and Arizona remained small, California had access to additional water from the Colorado. California's recent consumptive use of Colorado River water has been approximately 5.2 million acre-feet per year, well above the base level of 4.4 million apportioned under the Compact. Much of this 'surplus' water has in the past been used by the MWD.

A massive system of dams stores water to mitigate seasonal and annual variability in Colorado River flow and generate electricity. Hoover Dam, which produced Lake Mead, was completed in 1935 and there are now a number of major reservoirs throughout the Upper and Lower Basins. The reservoir system, which can hold 60 million acre-feet of water, is supposed to provide a four to five year buffer supply of water in case of severe drought.

THE LOOMING CRISES

Two crises confront Southern California in terms of water management and the Colorado River. The first concerns the Colorado Compact and the annual allocations of water, where we face two challenges—decreased supply and increased demand.

Water allocations under the Colorado River Compact assume the average flow of water from the Upper to Lower Basin at Lees Ferry is 17 million acre-feet per year. This assumption was based upon the short record of observed river flow available in 1922. In subsequent years, annual measurements of Colorado River flow have highlighted two problems. First, the average flow during the period 1905 to 1922 was anomalously high compared to most of the 20th century. Long-term average flow on the Colorado is more likely to lie between 13 million to 15 million acre-feet per-year. The result is that more water may have been allocated than the river can be expected to provide in a sustained fashion. In addition, flow over the 20th century has been much more variable that could have been anticipated when the Compact apportions were granted. For example, during the Dust Bowl years of 1930 to1937 the annual flow at Lees Ferry averaged only about 10 million acre-feet. The most recent drought, which commenced in 1999, has led to some even lower flows. The average flow between 2001 and 2003 at Lees Ferry reached a low of only 5.4 million acre-feet. This is 11 million acre-feet below the total current water allocations

A white rim along the rocky shores of Lake Mead provides evidence of the former water height in the reservoir and the drawdown in storage reserves caused by recent prolonged drought.

A continued drought could soon overwhelm the buffering capacity of the reservoirs.

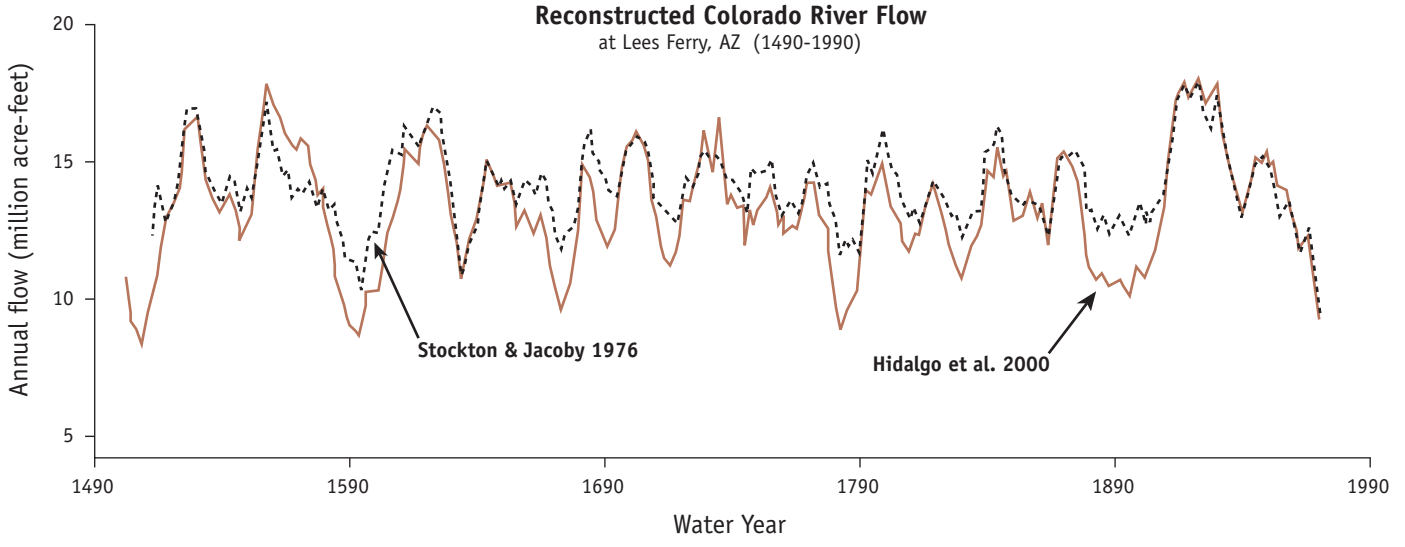
and is only slightly higher than California's recent consumptive use of Colorado River water of 5.2 million acre-feet.

The reservoir system in the Colorado Basin is supposed to allow the system to provide adequate water to users during times of drought. However, this current drought is straining the capacity of reservoirs to mitigate the low flows. Lake Mead has seen a drop in water levels of over 30 feet and reached its lowest level since 1965. Water levels have fallen by over 100 feet in Lake Powell and are at their lowest levels since initial filling of the reservoir. A continued drought could soon overwhelm the buffering capacity of the reservoirs.

It is clear the current flow rates of the Colorado River are insufficient to meet the water allocations from the system if all states and Mexico were to withdraw their full portions. It is also clear the high variability in flow and the occurrence of prolonged droughts such as occurred in the 1930s and today exacerbate this problem despite the extensive reservoir system.

The other challenge confronting us is increasing demand caused by growing populations in the Southwest. This problem is particularly acute in the Lower Basin states of California, Nevada and Arizona. The booming cities and metropolitan areas of Los Angeles, Phoenix, Tucson and Las Vegas are all supplied with water from the Colorado. Since the Colorado Compact was first devised in the early 1920s and 2000 the city of Los Angeles has grown six times, from about 577,000 people to over 3.7 million. Even more striking, since 1920 the population of Las Vegas has grown by 200 times and Phoenix by 47 times its 1920 population. Much of this growth has occurred in the past 50 years. This has generated a massive increase in water needs, including a 410% increase in domestic water use in the Southwest since 1950. All projections indicate robust population growth will continue throughout the Southwest. No longer can California count on the 'surplus' unallocated water from Arizona or Nevada to meets its needs.

The second looming crisis for Colorado River water allocations is the specter of severe and sustained drought beyond the magnitude of any drought experienced in the past 100 years. A severe drought that persisted for a decade or more could overwhelm the buffering capacity of the Colorado reservoir system and lead to a crisis in water supply for irrigation and domestic use in Southern California. How real are the



Long-term variations in Colorado River flow and large scale drought induced episodes of decreased flow reconstructed by two independent studies using tree-rings. [2]

chances of such a 'mega-drought' occurring on the Colorado system? Historical records of river flow only date back to the early 20th century, but the record of flow can be extended back hundreds of years using tree-rings. Many long-lived species of pines and other coniferous trees grow in the Colorado River region. In many instances the annual growth rings of the trees are sensitive to precipitation and large growth rings are formed in years with high precipitation. These wet years with good tree-ring growth coincide with years of high flow in the Colorado River.

Since the 1970s scientists at UCLA and elsewhere have produced reconstructions of river flow on the Colorado using tree-ring records. These records show that in periods such as the late 19th century and the late 16th century there were severe sustained droughts on the Colorado that lasted up to a decade or more. Even more troubling is evidence from other studies for a centuries-long period of enhanced droughts throughout much of western North America in the 10th to 14th centuries. In view of the prehistoric record, the recent Colorado Basin drought is not exceptional and dry conditions could conceivably persist into future years.

PLANNING COLORADO RIVER WATER USAGE

The problems confronting the management of the Colorado River water under the original 1922 Compact are widely recognized by Upper and Lower Basin states and Mexico. Increasingly, the possibility of severe sustained drought as revealed by tree-ring records is playing a role in such considerations. Legal and political debate have long been features of management of the Colorado River and have become increasingly heated at state, national and international levels. One example is the lengthy battle between the IID, San Diego and the MWD over the allocation of Colorado River water for irrigation versus allocations to municipalities. Additionally, ecological concerns now play a greater role in water planning: reduced flows to the Colorado Delta in the Sea of Cortez are damaging delta ecosystems. And decreased flood flows caused through the

More water-efficient irrigation practices and crop selections can make significant contributions to lessening Southern California's need for Colorado river water.

control of the river by dams and reservoirs is harming riparian ecosystems in the Grand Canyon. Finally, the Salton Sea of California was created by an accidental release of Colorado River water from irrigation systems during 1905 to 1907. The Sea supports fish and migrant bird populations today but may become too saline to support current populations if more water from the Colorado is not allocated to it.

Against this backdrop of uncertainty and potential crisis, Southern California has taken some very positive steps. First, following the impact of drought in the 1980s and early 1990s, MWD users adopted conservation practices and other measures that have resulted in a significant decline in annual water usage. In 1990 the amount of water distributed by the MWD peaked at around 2.6 million acre-feet, 1.7 times more than the amount of water distributed today. The MWD continues to pursue conservation strategies and alternatives such as desalinization and waste water recycling.

Second, California, under the leadership of a state agency called the Colorado River Board, has instituted the 4.4 Plan to limit use of Colorado River water in California to 4.4 million acre-feet per year. The plan requires compromise agreements on water use and allocation between the MWD, IID, CVWD and other users, and institution of a number of conservation measures such as the lining of the All American Canal with impermeable material to stop the leakage of irrigation water. Within the 4.4 Plan, agriculture users will have the first three priorities to 3.85 million acre-feet of Colorado River water per year and the MWD will have fourth priority for 555,000 acre-feet.

The implementation of the 4.4 Plan will require adjustments in water supply and use by the MWD. The 4.4 Plan is to be implemented in stages and will result in a decline in Colorado River use from 5.2 million acre-feet to 4.6 million acre-feet to take place between now and 2010 to 2015. Further reductions will follow. The 4.4 Plan is now seen by some as a model for states' responses to develop a sustainable allocation system for Colorado River water.

The relatively long time lines in the 4.4 plan are reasonable in terms of developing conservation strategies and alternative water sources needed to shift dependence away from Colorado River water, but they also contain perils. First, the rapid growth of populations and water use in other Lower Basin states may lead to increasing strife between Nevada, Arizona, California and Mexico while the state attempts to implement the 4.4 Plan. Second, if the current severe drought is sustained along the Colorado system, there simply will not be enough water in the river to satisfy the needs of California alone,

The specter of severe and sustained drought beyond the magnitude of any drought experienced in the last 100 years could create a massive water and power crisis.

much less to be shared with the other states and Mexico. Should such a severe and sustained drought occur we could see one of the biggest water and power crises ever to confront the Southwest.

POLICY RECOMMENDATIONS

In light of the possibility of resource battles because of the low average flow of the Colorado, the potential for long term drought, and increasing regional populations, we make the following recommendations:

1. Aggressive implementation of the 4.4 Plan;
2. Continued efforts to increase water conservation and recycling in agricultural and urban districts;
3. Comprehensive planning for emergency water conservation, alternative supplies and reallocation of water between users within water management districts and between water management districts;
4. An integrated drought response strategy that examines the potential for, and response to, severe and sustained droughts.

GRADES

For water conservation and other measures taken following recent California droughts and the 4.4 Plan in response to current demands for Colorado River water. **Grade B+**

For long-term planning for the double threats of rapidly increasing population and water demand and the potential for severe and sustained drought of greater magnitude than any experienced in the past 100 years. **Grade D**

NOTES

1. River flow versus population data from US Bureau of Reclamation and US Census Bureau.

2. Data from Stockton, C.W. and G.C. Jacoby. 1976. Long-term surface water supply and streamflow levels in the upper Colorado River basin. Lake Powell Research Project Bulletin No. 18, Inst. of Geophysics and Planetary Physics, University of California, Los Angeles, 70 pp and Hidalgo-Leon, H.G., Piechota, T.C. and Dracup, J.A. 2000. Alternative principal components regression procedures for dendrohydrologic reconstructions, Water Resources Research, 36: 3241-3249.

Glen MacDonald is a Professor of Geography and of Ecology and Evolutionary Biology at UCLA. He is also the current Chair of the UCLA Geography Department. Following an undergraduate degree in Geography at UC Berkeley he pursued a M.Sc. in Geography at the University of Calgary and a Ph.D. in Botany at the University of Toronto. Before returning to California he taught for a number of years in Canada. His research focuses upon climatic variability over the past 10,000 years, the impacts of such variability on ecosystems and people, and the potential impacts of climatic variability and global warming in the future. He conducts research around the world and has been awarded the Cowles Award for Excellence in Publication by the American Association of Geographers twice, the University of Helsinki Medal and a Life Membership at Clare Hall, Cambridge. Glen MacDonald was raised in California and has benefited greatly from the state's natural and cultural diversity. He has two children and hopes that we will pass the same opportunities on to them.


GRADES A to F
Water
Quality

by Michael K. Stenstrom, Ph.D., P.E.

Professor, Department of Civil and Environmental Engineering

As the previous article demonstrates, water *supply* is of extraordinary concern to the long term health, welfare and economy of Southern California. But supply is not our only concern. The *quality* of the water we use—to drink, to swim, to irrigate—is also key to the region's future. Our previous Report Cards have dealt in various ways with the quality of our water: wastewater treatment plants and water conservation (1998), stormwater (1999), drinking water (2000), bottled water (2001), reclaimed water (2002) and stormwater regulations (2004). These reports have generally praised our region for its efforts to manage our water quality, although each report details at least some problems that require innovative solutions. But each of these Report Card articles examined only an individual piece of the water quality picture. In this report we integrate issues described in the previous Report Cards and discuss how water research, regulation and treatment systems are crucial not only for the Southern California environment but also for our long term economic health.

WASTEWATER TREATMENT

Southern Californians live primarily on the coastal plain. In order to provide adequate sewage treatment for our regional population, various jurisdictions have created large treatment plants, called coastal plants, that service this community. These plants discharge effluent into salt water through submerged pipelines that are several miles long. Traditionally, these plants have operated at lower efficiency than inland plants, based upon the belief that ocean discharge and the large dilution provided by the long pipe lines would mitigate environmental impacts. Inland communities are served by smaller plants, generally operating at higher efficiency and in many cases, providing source water for reclamation facilities.

In RC 1998, we gave treatment plants inland to the coast of California A grades because of their high treatment efficiency needed to provide reclaimed water. Since 1998, new regulations have required these plants to improve even more and to remove nitrogen, an important stimulus to eutrophication and a potential toxic material to human infants, fish and wildlife. The Sanitation Districts of Los Angeles County (LACSD) have largely completed the conversion of their inland plants for nutrient removal. The Inland Empire Utilities District has also met the challenge. The City of Los Angeles has begun conversion of its two inland plants. The "A" grade for inland plants in RC 1998 was well deserved and our treatment agencies have continued to build and maintain advanced technology wastewater treatment plants for environmental protection and water reclamation.

By contrast, the grade for coastal wastewater treatment plants in 1998 was low, only a C. The Report Card article described a long protracted process of legal battles, delays and expensive or failed projects. Major treatment agencies such as the City of Los Angeles and LACSD had not met Clean Water Act (CWA) goals other cities had generally achieved in 1977. The Orange County Sanitation Districts and the City of San Diego were operating with permits requiring only partial secondary treatment.

This situation has dramatically changed in the intervening seven years. The City of Los Angeles and LACSD

The Hyperion Wastewater treatment plant was the first large plant in the United States to achieve new EPA standards for land application of biosolids. The new "egg-shaped" digesters at the plant, while not required for thermophilic digestion, facilitate high temperature digestion by providing better mixing and reduced cleaning frequency.

Thermophilic digestion reduces Hyperion's power consumption from outside sources by 75 percent.

have each implemented full secondary treatment at their two major coastal plants and are now tackling the associated problems of secondary treatment—energy conservation and biosolids disposal. The City of Los Angeles has done well in being one of the first major US cities to achieve Biosolids A treatment. Biosolids A is a US EPA classification for biosolids that meet especially high standards for reduced pathogen and heavy metal content, and is generally required before biosolids can be applied beneficially for uses such as soil amendments. The City received an award for its use of high temperature solids treatment, called thermophilic digestion, at its Hyperion Treatment Plant. The plant recovers energy from biogas by treating it to remove sulfur compounds and burning it at the City's Scattergood power plant. This reduces Hyperion's power consumption from outside sources by 75 percent.

The situation has improved in other southern California locations as well. Voters in Orange County approved the conversion of county treatment facilities from partial secondary to full secondary. This contrasts with experience in Los Angeles that involved a 22-year legal battle. The Orange County Sanitation District is moving quickly to implement full secondary treatment at its two major treatment plants. The City of San Diego, while still believing that secondary treatment is not necessary, has been proactive in testing new technologies for secondary treatment in the event the City is required to upgrade its major plant at Point Loma. These plants are also participating in water reclamation projects, which are discussed below.

The treatment agencies are also making progress in reducing chlorine usage at treatment plants. Chlorination has traditionally been the most effective and least expensive way of disinfecting effluents. Over the past 20 years, however, research has shown that byproducts of chlorination can be harmful to the environment. Transportation of the chlorine from production facilities to consuming facilities is also a problem, and one or more fatal chlorine spills are reported each year in the United States. We are pleased to report our treatment agencies are making good progress to reduce chlorine usage by adopting more advanced technologies such as ultraviolet (UV) light disinfection. This technology is more expensive but has the advantage of reduced byproducts and the elimination of the transport of a hazardous chemical.

The Ballona Wetlands and the fresh water marsh, a facility designed to treat stormwater runoff from surrounding areas and protect the salt water marsh from excessive fresh water intrusion.

We concluded in the RC 1998 article on wastewater treatement that the region's environmental regulatory agencies had to "drag our treatment agencies, screaming and kicking" into new construction programs. The situation is quite different now, with goals accomplished in Los Angeles and Los Angeles County, and pro-active voters in Orange County voluntarily seeking improved wastewater treatment.

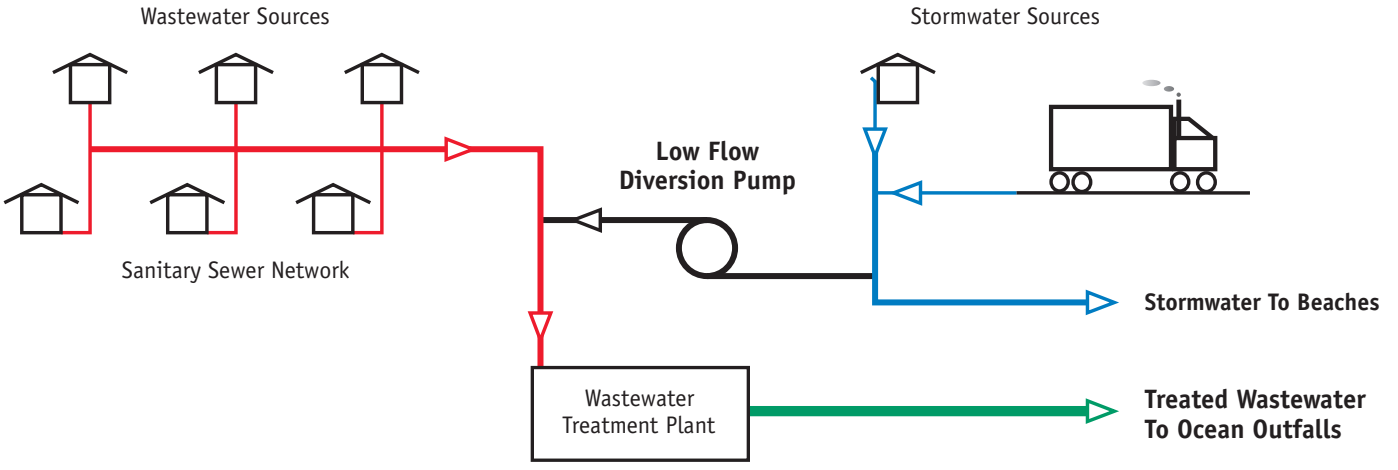
STORMWATER MANAGEMENT

We described Stormwater management in RC 1999 and RC 2004, noting major challenges, many of which were institutional as opposed to technical. We are pleased to report progress on all areas of stormwater management.

A major advance in stormwater management occurred when the Los Angeles Regional Water Quality Control Board enacted runoff controls for new and modified developments. In the past, new developments had no special requirement to mitigate stormwater runoff, other than to ensure no flood damage occurred. Every new development—by increasing impervious surfaces that do not absorb water—increases runoff to the Santa Monica Bay and taxes the existing surface drainage systems. This situation changed when the Regional Board required all new developments to treat or mitigate the impacts of the first 0.75 inches of rainfall. This means 60 to 70 percent of all storms will be completely treated, and the larger storms will be partially treated.

The new regulations have been criticized by developers as being too costly and having undefined benefits. Developers also criticized the regulations for being unscientific in failing to differentiate between high and low rates of rainfall, which may require different types of mitigation techniques. We disagree with these criticisms and believe the regulations are a large step forward for environmental protection. Though the new regulations cannot reverse the amount of impervious surface created by development, they will cap total runoff rate. And many of the stormwater management options required to implement the regulations, called best management practices (BMPs), will provide additional benefits. Grassy swales and infiltration areas create open space and, in the case of very large projects, habitat for birds.

A good example of environmental mitigation on new developments is the Playa Vista Project in Playa del Rey.



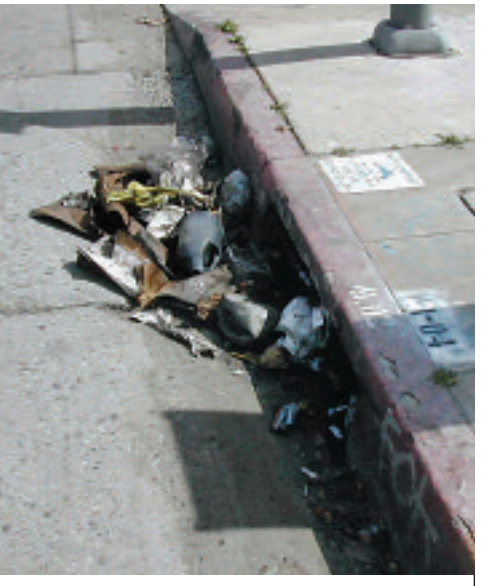
The separate sewer systems in Southern California are being converted to "hybrid systems" in order to divert summer low flow runoff into the wastewater treatment system via low flow diversion pumps.

Although the project was highly controversial and the topic of extensive litigation, it created several important environmental benefits that have been overlooked. The first is the stormwater management controls installed by the developer, which far exceed those required of other developments and set a good example for future developers to meet. The second is the construction of a freshwater marsh. The marsh was controversial because it occupied space formerly occupied by salt water marsh. The marsh provides treatment for runoff from the Playa Vista Project as well as surrounding areas such as Loyola Marymount University. In the case of the Playa Vista Development, runoff is treated by state-of-the-art source controls even before it enters the fresh water marsh. The fresh water marsh provides habitat, buffers the runoff flow rate, and improves its quality before being released to Ballona Creek. Bird watchers are already "seeing" the benefits of the new habitat. Finally, the fresh water marsh also protects parts of the salt water wetlands from fresh water runoff, which can be toxic to a salt water marsh.

There are other accomplishments. The City of Los Angeles has committed to providing the low flow diversions of runoff to the Hyperion treatment plant for its storm drains entering Santa Monica Bay. This technology and several others were described in RC 1999. This is an example of a simple technology that utilizes existing infrastructure in a new and innovative way, at low cost to taxpayers. This method of treating low flow runoff in a separate sewer system, called a hybrid sewer system, is being copied around the State, and other agencies, such as the Orange County Sanitation District, have adopted the concept. The days of stormwater puddles on public beaches, like the beach south of the Santa Monica pier, from stormdrains like the Pico-Kenter drain, are over.

Beach water quality continues to be a problem, but we are making progress. New regulations enacted by AB411 require more frequent and improved monitoring. The regulations created more postings and it initially appeared our beach water quality was getting worse. Closer examination of beach postings and closures, such as those in Huntington Beach, revealed that many problems were either long term issues exposed by the new regulations, or problems the reg-

It is remarkable that litter management remains an environmental problem. It is entirely preventable.



Accumulation of litter at a storm drain in downtown Los Angeles.

ulations created. For this reason the results have been mixed and technological barriers remain.

Beach water quality is quantified by a suite of bacterial measurements. The two most common are coliforms and enterococcus, which are not true pathogens but associated with pathogens, and for this reason are called indicator organisms. Coliforms (strictly fecal and thermo tolerant coliforms) were used over the past century with great success in predicting the pathogenic content of drinking water and treated wastewater. They are problematic in surface waters such as stormwater, and often appear even when pathogens are not present. More importantly, they require too much time to measure. An analysis by the Southern California Coastal Water Research Project (SCCWRP) showed that as many as 70% of the beach postings due to high bacterial counts could be in error. The reason is described as follows: a sample is taken on day 1 and analyzed by a laboratory; on day 2 the laboratory reports a high bacteria count, the beach is posted and additional samples are collected; on day 3 the laboratory reports that the bacterial counts are low, the beach is safe and the posting is removed. The problem is that the beach should have been posted on day 1 when counts were high, but was posted on day 2 when counts were low. Our technology is not adequate to implement the spirit of the new regulation.

In spite of this problem, the new regulations have had major benefits. They have exposed chronic infrastructure problems at Avalon, on Catalina Island, which have now been repaired. In some locations they have quantified the positive impacts of BMPs such as low flow diversions. They have stimulated research on new methods for quantifying beach water quality, and we look forward to rapid, molecular biology techniques to cure the monitoring problems. The topic of beach water quality will be explored more fully in a future Report Card article.

We continue to struggle with other stormwater problems. In RC 2004, we described the total maximum daily load (TMDL) regulatory concept, and the benefits it is providing. Litter management was one example. We continue to struggle with litter and the TMDL is still opposed by some cities and groups. It is remarkable that litter management remains an environmental problem. It is entirely preventable. The photo above shows an all too familiar situation. Caltrans also reports the most common items recovered in highway litter are cigarette butts. The enactment of a one cent per pack tax on cigarettes or other high litter potential items, with revenues given to the agencies responsible for clean up, such as Caltrans, would help mitigate our litter problems.

TMDLs are being used by regulatory agencies to create consensus solutions to reduce pollution emissions at reduced cost. In RC 1999, we noted the major source of many pollutants was stormwater, and suggested focusing efforts and funds on solving stormwater problems

rather than on improving wastewater treatment for those plants that have achieved full secondary treatment and implemented nutrient removal. The new TMDL for mercury pollution enacted in the San Francisco Bay area is a good example of how the process can work. There are many sources of mercury, as well as legacy pollution from past practices such as gold mining that are still having significant impacts. The TMDL reviewed known sources of mercury and found the most cost effective and most sustainable methods to reduce mercury discharge. An old mining area was identified as a high emitter, stormwater runoff was targeted—taking advantage of the BMPs that will be implemented to reduce emissions for a large number of pollutants—and pollution prevention practices were stressed. Reducing emissions from dental amalgams, reducing the mercury content of fluorescent bulbs and ensuring they are properly recycled, are all promising alternatives. The discharges from treatment plants were not reduced, recognizing that emissions were already low and additional reductions would not be cost effective. A challenge still exists from mercury emissions from coal-burning power plants. This is another example of how more scientific regulations can help us attain our goals.

The most gratifying report we make is on the passage of Proposition O. Last year Los Angeles voters approved by a 74% majority the expenditure of $500 million for environmental improvements. This is undeniable proof the public wants, and will pay for, environmental improvements. This measure, and the others discussed, go a long way toward making it safe to swim in Santa Monica Bay after a storm.

WATER RECLAMATION

RC 2002 described water reclamation efforts in Southern California, giving agencies an A for their efforts and the public a failing grade for not understanding the technology, and its risks and benefits. Water reclamation is an important resource because of the water supply problems described in the previous article.

There is some positive water reclamation news to report. The pioneering work at Water Factory 21 by the Orange County Water District, which reclaimed wastewater to prevent salt water intrusion and augment ground water supplies (a technology called indirect potable reclamation, see RC 2002) is being replaced by a project that is more than 10 times larger. The new project will receive treated wastewaters from the Orange County Sanitation District, reducing their discharge to the ocean. The new plant will treat the wastewater with new technologies, including micro-filtration, reverse osmosis and UV disinfection. The net result will be increased water supplies, reduced environmental impact on ocean waters, and reduced construction costs associated with deferring the need for an additional ocean diffuser.

Another example is the West Basin project, near El Segundo, which is using Hyperion Treatment Plant effluent to produce Title 22 reclaimed water, barrier water and industrial use water. Three major refineries have displaced large fractions of their fresh water use with reclaimed water. Ironically, this was done not to save money, but to create a secure water supply during the next drought.

The failure of the East Valley Water Reclamation Project has taught us that we need to better inform the public and politicians about the safety, risks and benefits of water reclamation.

Agencies like the West Basin Facility will be providing water even during the next serious drought. This is one example of environmental improvements creating a better climate for business—a sustainable water supply.

Another positive development is the experience we have gained with failed projects. The failure of the East Valley Water Reclamation Project has taught us we need to better inform the public and politicians about the safety, risks and benefits of water reclamation. The plan died when it became a political football, with candidates for City offices wooing voters with statements like "toilet to tap" (see RC 2002 to learn why water reclamation is not toilet to tap). Voters and candidates need to understand that our water supplies already contain reclaimed wastewater, that we need to reclaim more in the future, and that it's low risk.

THE GRADES

We give mixed grades for the various responsible parties.

- The wastewater treatment agencies receive an **A** for complying with the Clean Water Act, being proactive in building new treatment plants and committing to improvements without lengthy legal fights.
- Our regulatory agencies, such as the Los Angeles Regional Water Quality Board, receive an **A** for adopting far reaching strategies that are sustainable, and using newer, more scientific approaches to regulation.
- The public receives a mixed grade—an **A** for supporting environmental improvements, such as Proposition O and secondary treatment at the Orange County Sanitation District, but an **F** for not working harder to solve problems like litter.
- Researchers receive a **C** for not being able to provide the needed technology to implement beach water quality regulations.

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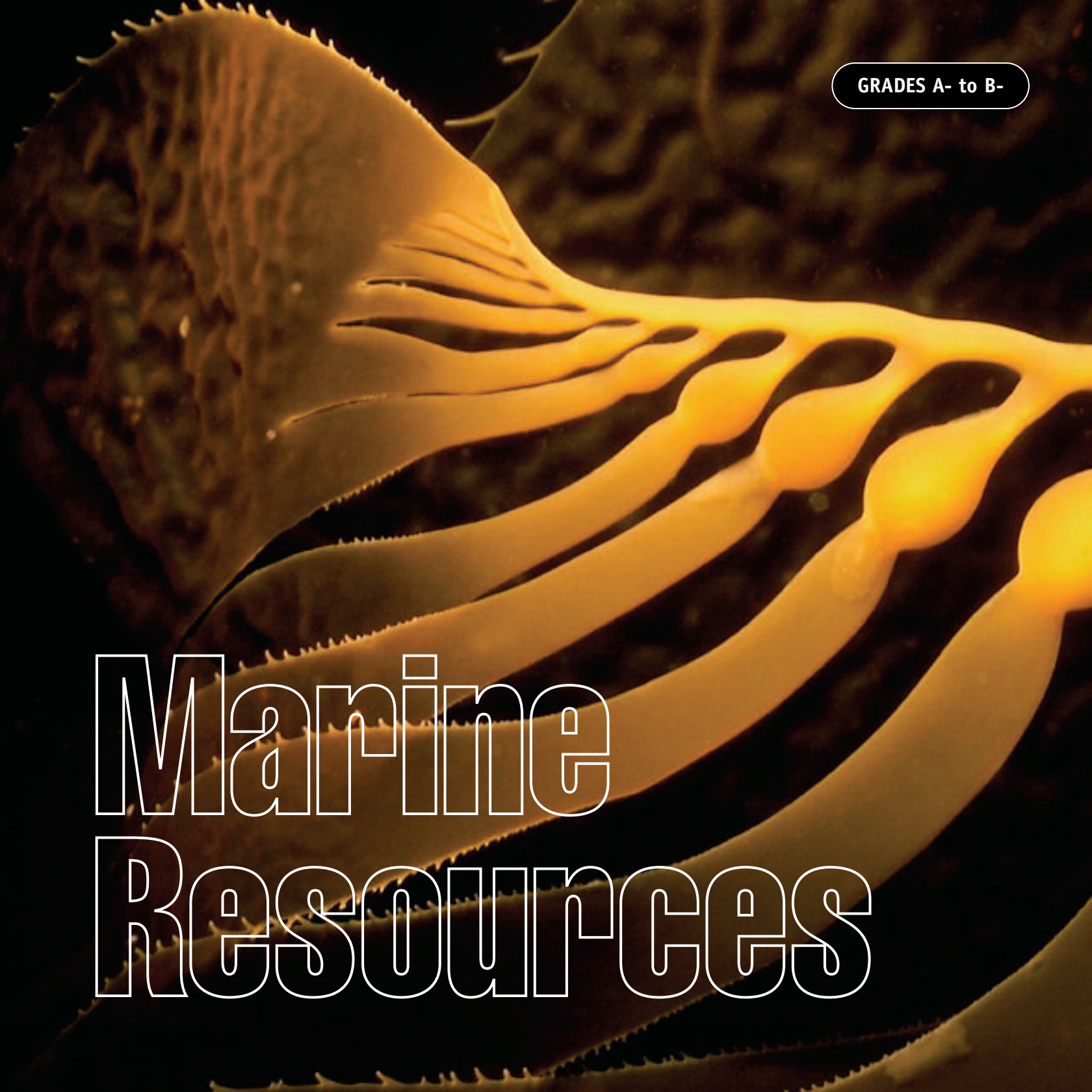
He teaches courses in water and wastewater treatment, mathematical modeling of environmental systems, and laboratory analysis. He has published over 200 papers in journals and conference proceedings. Stenstrom's most recent research focuses on stormwater management in highly urbanized environments such as Los Angeles.

Prior to joining UCLA, he worked for the Amoco Oil Company where he designed wastewater treatment facilities. He has won several awards including the Harrison Prescott Eddy Prize for innovative research (Water Environment Federation), the Walter L. Huber Award (ASCE), the Best Dissertation Award (Association of Environmental Engineering and Science Professors), the Dow Environmental Care Award, the Los Angeles Basin Section (California WEF) Research Award, and the EWRI Service Award.



GRADES A- to B-

Marine Resources

by Richard F. Ambrose, Ph.D.

Professor of Environmental Health Sciences, School of Public Health

As human use of ocean resources has grown over the past few decades, so has concern about impacts to these resources. At the national level, two blue-ribbon commissions have recently concluded that marine resources have declined to crisis levels, and that traditional management approaches must be changed radically to meet the challenge of protecting the nation's marine resources into the future. No similar comprehensive assessment has been conducted for marine resources in southern California, although there have been a number of narrower studies. This article focuses on Santa Monica Bay as an indicator of the state of southern California's marine resources.

Located adjacent to one of the largest urban areas in the United States, Santa Monica Bay is a popular area for recreation by residents and visitors alike. Each year, the Bay's beaches attract 50-60 million people who contribute more than $200 million to the local economy. Stretching from the Palos Verdes Peninsula to Malibu, the Bay's most conspicuous amenity is its broad sandy beaches for bathing and swimming, but it also supports abundant biological resources.

The value of Santa Monica Bay was recognized for thousands of years by the native Chumash and Gabrieleno/Tongva tribes, who had dense settlements along its coast. After losing to San Pedro in a bid for a deepwater port in the 1890s, the Santa Monica area was developed to attract tourists. With good access from Los Angeles through a network of electric trolley cars, the areas of Santa Monica, Playa del Rey and Venice increased in popularity. Initially attracted by the climate and beaches, early Los Angelinos soon discovered the rich marine resources, including fishing and harvesting invertebrates such as abalone.

As elsewhere in the United States, the rising population of Los Angeles along with increased industrialization created environmental damage to the Bay, and pollution became severe. The Bay was used as the repository for millions of gallons of untreated sewage and industrial discharges, including dangerous chemicals such as DDT, and the living resources of the Bay were degraded. At the same time, commercial and recreational fishing pressure increased and, as elsewhere, fish populations declined. After several decades of environmental regulations and other efforts to reverse damage to the Bay, what is the status of its important marine resources?

RESOURCE STATUS AND TRENDS

Kelp Beds Kelp beds are restricted to rocky bottom habitats, which are concentrated around the Palos Verdes Peninsula and Malibu coastline. Kelp beds are naturally dynamic, being particularly affected by El Niño events when storms rip out large areas of kelp. In Santa Monica Bay, however, these natural fluctuations have been overridden by two long term trends. Around Palos Verdes, kelp beds were practically eliminated in the 1950-60s, due largely to pollution from wastewater discharges and the associated population explosion of kelp-eating sea urchins. However, following large-scale restoration efforts and the clean-up of the wastewater discharges, the Palos Verdes kelp beds have partly recovered, and they now represent a valuable resource in the region (see Figure 1).

Kelp is an important resource in the Santa Monica Bay.

Rocky intertidal sites in Santa Monica Bay are heavily used; popular sites may receive up to 50,000 visitors per year along one 100 meter stretch of coast.

Along the Malibu coastline, kelp beds experienced a precipitous decline during the 1980s—which itself was a continuation of a long-term decline from the early 1900s—from which they have not yet recovered. The cause of the decline is not known, but is believed to be related to increased development, and perhaps sedimentation, in the region. Recent surveys of hard bottom habitat along the Malibu coast shows much less rocky habitat than existed 100 years ago. Although the kelp beds off the Palos Verdes Peninsula appear somewhat more stable, these beds, like the Malibu beds, are substantially less extensive than they were in the early 1900s. Thus, kelp bed resources are much less abundant than they were a century ago.

Although today's giant kelp forests support a rich and varied community of fish, invertebrates and algae, the kelp forest community is dramatically different from the one present 100 years ago. Before being driven locally extinct due to hunting for the fur trade, sea otters were keystone predators who fed voraciously on sea urchins, crabs, abalone, and other bottom-dwelling species. Other top predators, especially black sea bass, have been reduced to such low abundances by fishing that they are ecologically extinct; that is, they no longer play the roles they once did in the natural ecosystem. These ecosystem effects from harvesting top predators persist today.

Rocky Intertidal Like kelp beds, rocky intertidal habitats occur in Palos Verdes and Malibu. These rocky areas are under water during high tide, but during low tide a rich variety of marine animals and plants are exposed to the air, making these two areas popular places to view marine life up close. Rocky intertidal sites in Santa Monica Bay are heavily used; popular sites may receive up to 50,000 visitors per year along one 100 meter stretch of coast (see Figure 2). Long-time visitors to rocky intertidal habitats often comment on how much the rocky intertidal community has changed, and recent studies have confirmed some species are less common at heavily used sites compared to lightly used sites.

In spite of a decades-old ban, DDT concentrations remain high around the Palos Verdes Peninsula.

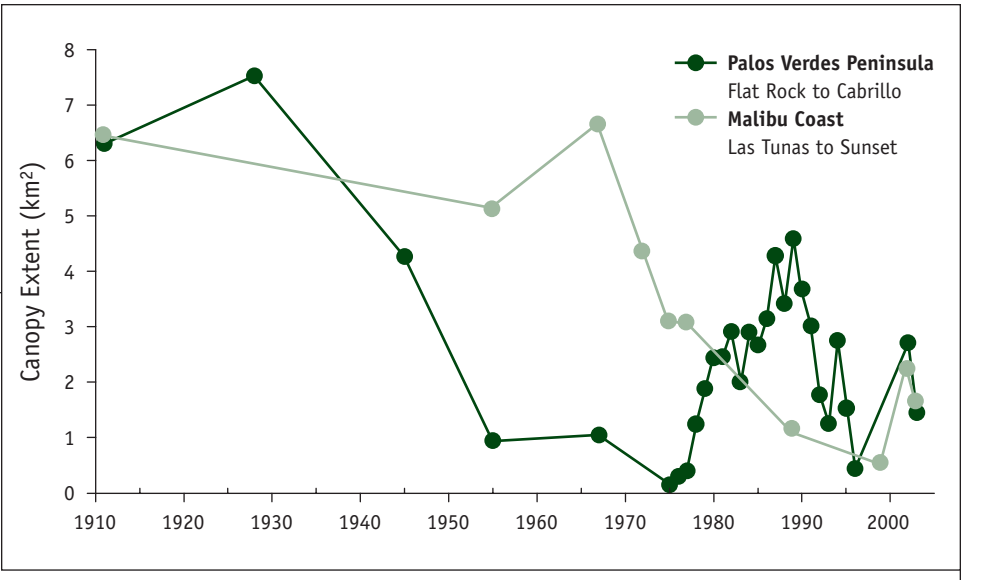


Figure 1. Change in kelp bed areas in Palos Verdes and Malibu over time. Data from California Department of Fish and Game and MBC Applied Environmental Sciences.

Other species, such as black abalone, have disappeared completely due to overharvesting. Few large individuals are found of a conspicuous limpet, the owl limpet, also due to overharvesting. The loss of large individuals may have greater population consequences for this species than one might expect because of its interesting life history: owl limpets start life as males and then change sex to females when they grow larger. Thus, harvesting the largest limpets removes most of the females from a population, reducing the population's chance to sustain itself. Other species are sensitive to trampling by visitors to the tidal area.

Although it is clear that collecting and trampling have affected many species, we don't know how much water quality problems are affecting intertidal organisms. Studies done in the 1950s indicated wastewater discharges reduced algal species diversity, and many studies have shown that intertidal organisms can be affected by water pollution. However, there are no recent studies to show whether intertidal organisms in Santa Monica Bay are currently being affected by poor water quality.

Soft Bottom Most of Santa Monica Bay consists of soft-bottom habitat. Until recently, the animals living in this habitat were severely affected by wastewater discharges, with areas around discharge points having degraded communities. Following improvements in sewage treatment beginning in the 1970s, these communities recovered well, and today the animals close to sewage discharge points are similar to those in other areas of the Bay.

DDT has had a particularly severe impact on the organisms of Santa Monica Bay, an impact felt throughout southern California. Montrose Chemical Corporation, a major manufacturer of DDT, discharged millions of pounds of DDT through the municipal sewer system and onto the Palos Verdes Shelf. Recent surveys estimate that more than 100 tons of DDT remain in the sediments off of Palos Verdes. DDT, which is bioconcentrated up the food chain, resulted in near-extinctions of some species (peregrine falcons, brown pelicans, bald eagles) and serious human health risks to people eating some fish species caught in the Bay. In spite of a decades-old ban, DDT concentrations remain high around the Palos Verdes Peninsula, and fish advisories still warn fishers not to consume a number of species caught in Santa Monica Bay.

Nonpoint source pollution is currently the major source of impact to the soft bottom community. This pollution source includes stormwater runoff as well

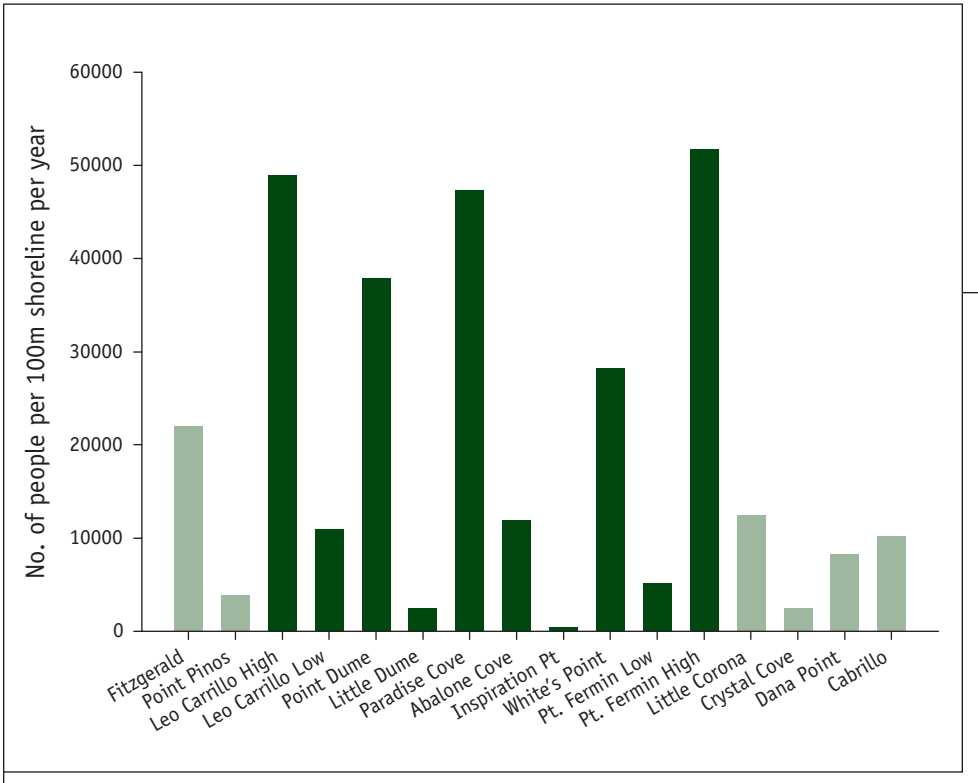


Figure 2. Visitor use at California intertidal sites. Data for Santa Monica Bay (dark bars) from Ambrose and Smith (2004); for other sites from various sources as summarized in Tenera (2003).

as dry weather flows resulting from irrigation and other types of runoff. As the regional human population grows, the amount of nonpoint source pollution grows, and efforts to control nonpoint sources have not been as effective as past efforts to control point source pollution. The previous article on water quality provides some reason for optimism in controlling nonpoint source pollution.

Fish In the 1960s and 1970s, concern about the health of Santa Monica Bay was heightened by the regular occurrence of clearly unhealthy fish with tumors, lesions and fin erosion. Following passage of the Clean Water Act and subsequent reduction of contaminants in wastewater discharges, water quality in the Bay improved (see below) and the number of fish with conspicuous anomalies decreased. Currently, individual fish appear to be healthy, although some species continue to have high concentrations of contaminants in their tissues (see DDT discussion above).

Although the health of individual fish is better than 30 years ago, the status of fish populations is largely unknown. The Bay once supported a commercial fishery, but commercial fishing has been banned from the Bay. Recreational fishing, however, is still popular from the shoreline, piers and boats. Surprisingly, there has been no systematic scientific assessment of fish populations in the Bay. As in many places, our information about fish populations in the Bay comes from fisheries data, principally the catch per unit effort of fishing. Since fishing effort and catch vary in response to changes in climate, availability of alternative fish species, and economic and other factors unrelated to the size of fish populations, fisheries data may not reflect the true status of fish populations. Since no fisheries-independent data are available, we do not know the status of fish stocks in Santa Monica Bay. What we do know about the fisheries suggests that some fish stocks are healthy, while others are likely depleted.

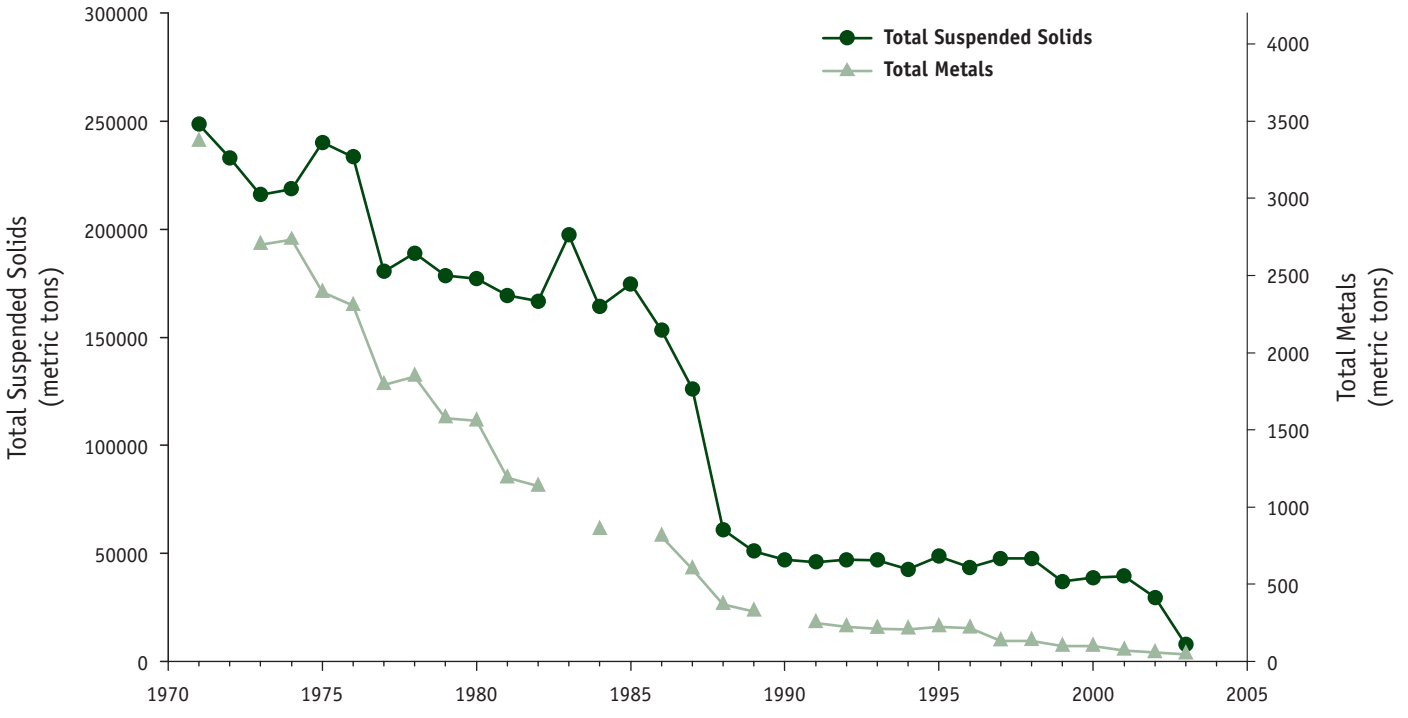


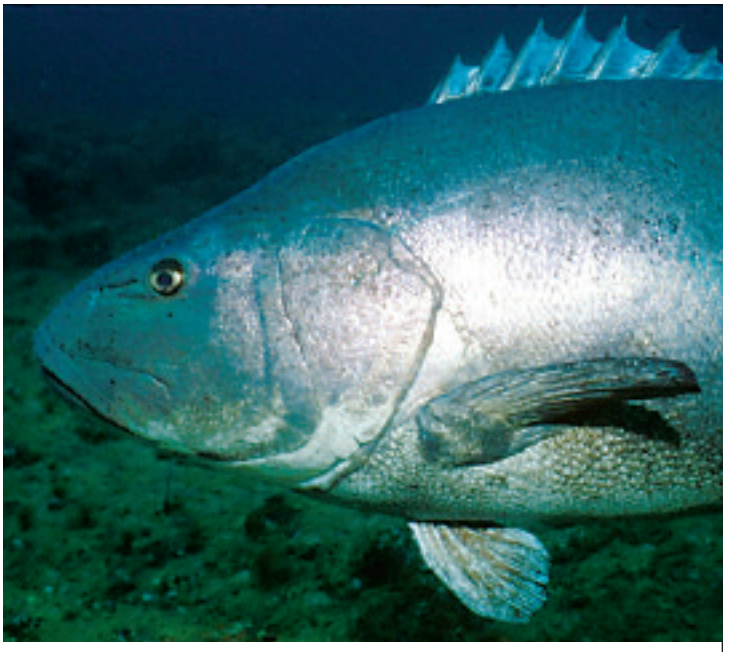
Figure 3. Decline of key pollutants after enactment of the Clean Water Act of 1972. Annual pollutant loads from Hyperion and JWPCP Wastewater Treatment Plants. Figure by permission of SMBRC; data sources SCCWRP, CLAEMD, LACSD.

MANAGEMENT

Concern about the health of Santa Monica Bay and its marine resources captured the public's attention in the 1960's, mirroring concerns throughout the United States about environmental degradation. Although not as dramatic as the 1969 conflagration of Cleveland's Cuyahoga River, tumors and lesions similar to those observed for Santa Monica Bay fish were found in fish throughout the country, and were partly responsible for the public concern that culminated in the passage of the Clean Water Act of 1972 (CWA). The CWA resulted in a rapid reduction in the contaminants in wastewater discharged to Santa Monica Bay (see Figure 3). However, the CWA was less successful at controlling the more diffuse non-point sources of contamination (such as storm drains). Although currently a number of efforts are underway to control pollution from non-point sources, this discrepancy reveals a limitation with the approach of using national legislation to protect local marine resources. As a consequence, the effectiveness of the Los Angeles Regional Water Quality Control Board, which implements most sections of the CWA in Santa Monica Bay, has been mixed.

In part because of these limitations, there have a number of key legal actions that have influenced the health of Santa Monica Bay. Lawsuits by environmental groups such as Heal the Bay, Natural Resources Defense Council and the Santa Monica Baykeeper have resulted in improved sewage treatment and the implementation of important water qual-

Black abalone was so heavily overharvested that it can no longer be found in the Santa Monica Bay.



Black sea bass are now ecologically extinct in the Santa Monica Bay.

ity regulations. As noted earlier, one of the most critical sources of pollution in Santa Monica Bay is the large deposit of DDT off the Palos Verdes Peninsula. In 1990, the U.S. Government and State of California filed suit under the federal Superfund law against Montrose Chemical Corporation (the manufacturer) and many other entities. The lawsuit was settled in 2000 for $140 million, to be used to restore affected bird and fish populations and to restore opportunities to fish for uncontaminated fish, as well as to address the contaminated sediments offshore and public health risks.

Since 1988, government efforts to clean up Santa Monica Bay have been guided by an unusual coordination of local, state and federal agencies and other local stakeholders through the Santa Monica Bay Restoration Commission (SMBRC). The SMBRC has created a vision for improving the Bay ecosystem, produced a management plan, coordinated efforts by various groups, and funded research to fill data gaps and projects to improve water quality or restore habitats.

Although substantial progress has been made towards reducing water pollution in the Bay, past efforts have focused less on protecting and restoring marine habitats. The scientific community has focused recently on the value of using Marine Protected Areas (MPAs) for both ecosystem protection and fisheries management, and the recent Marine Life Protection Act has initiated a process for developing a network of marine reserves in California. Despite good scientific evidence for the ecological benefits of marine reserves, their implementation has been controversial, particularly among sportfishing groups. Several MPAs already exist in Santa Monica Bay, but they provide little real protection to marine resources. There currently are no no-take marine reserves in the Bay that prohibit harvesting of all species. Moreover, even though collecting is prohibited at many of the popular rocky intertidal sites, there is little enforcement and collecting is rampant. Existing regulations also do nothing to

Perhaps the most encouraging sign about the future of marine resources in Santa Monica Bay is the tremendous public support for improving conditions in the Bay. The Bay enjoys substantial stakeholder involvement from organized environmental groups such as Heal the Bay and the Santa Monica Baykeeper as well as from many individuals.

reduce the impacts of trampling in the intertidal areas.

There have been relatively few attempts to restore the Bay's marine resources. Kelp restoration helped the Palos Verdes kelp beds to recover in the 1970s, and there are again efforts to restore kelp beds along the Malibu and Palos Verdes coastlines. The money from the settlement of the DDT lawsuit will be used for a variety of purposes, including restoring fishing opportunities and fish habitat in Santa Monica Bay, possibly by constructing artificial reefs in the Bay. Restoration of the Bay's rocky intertidal resources will depend on the elimination of both collection of intertidal organisms and trampling from visitors. Although this has been accomplished elsewhere in California, it would require a dramatic shift in attitude about open access to coastal habitats and there are currently no specific plans for implementing such a management technique in the Santa Monica Bay. It might be politically simpler to restore key intertidal species. For example, black abalone disappeared from Santa Monica Bay intertidal habitats after extensive harvesting, and they might be re-established at sites with adequate enforcement against collecting. However, their restoration is complicated by the fact that a disease has since virtually eliminated black abalone from southern California, so restoration would depend on the availability of resistant individuals.

Perhaps the most encouraging sign about the future of marine resources in Santa Monica Bay is the tremendous public support for improving conditions in the Bay. The Bay enjoys substantial stakeholder involvement from organized environmental groups such as Heal the Bay and the Santa Monica Baykeeper as well as from many individuals. Recently, there has been an influx of funds from bond acts and legislation for safer beaches, improved water quality, and preserving and restoring habitats. In 2000, State Propositions 12 and 13 passed, providing $2 billion for the acquisition and improvement of parks, including $700 million to the County and City of Los Angeles. In 2002, State Propositions 40 and 50 passed, providing $5 billion for clean drinking water, safe beaches and coastal waters, and wildlife and open space protection. Most recently, in November 2004 the voters of Los Angeles passed a $500 million bond act to help the City clean up stormwater.

There are currently many projects focused on implementing actions to improve the quality of water in the Bay as well as projects to restore kelp forests in the Bay. The challenges remaining are many, since the simplest and least expensive approaches have already been implemented. It is likely some species will not return to their former prominence for decades, if ever. Even in these cases, though, there is reason to be optimistic about their long-term prospects. For example, black sea bass have begun to recover after decades of low abundances through a combination of closure of the fishery and a ban on nearshore gillnet fishing that had been catching black sea bass incidentally. Most importantly, the commitment to protecting the marine resources of the Bay is strong and widespread, and with the recent availability of funds for water quality improvement and restoration, the prospects for improving the status of marine resources in the Bay are excellent.

Kelp forest in Malibu following restoration efforts.

The commitment to protecting the marine resources of the Bay is strong and widespread, and with the recent availability of funds for water quality improvement and restoration, the prospects for improving the status of marine resources in the Bay are excellent.

GRADES

Status Of The Resources The marine resources of Santa Monica Bay (and elsewhere in southern California) suffer from being so close to a large metropolis. The Bay's oceanography coupled with recent management actions result in a rich marine fauna and flora, certainly in better condition than it was 30 years ago but still suffering the effects of historic (e.g., removal of top predators) and recent (e.g., harvesting and trampling of rocky intertidal organisms) impacts. There are also critical gaps in our understanding about the status of some resources. The grade might drop to a C if, for example, studies demonstrate ongoing impacts of water quality on rocky reef organisms or depressed fish populations. **Grade B-**

Agencies Marine resources in Santa Monica Bay are managed and influenced by the actions of a broad array of local, state and federal agencies. Many of these have been effective at protecting and restoring the resources of the Bay. For example, the Santa Monica Bay Restoration Commission is focused entirely on the Bay, and the Los Angeles Regional Water Quality Control Board has been working hard to implement stormwater regulations that would protect the health of the Bay (given a grade of A in the 2004 Environmental Report Card). Some municipalities, such as Santa Monica, have acted decisively to minimize their impact on the Bay's resources. These agencies have had mixed success in protecting the Bay, however, in part because of the complexity of the environmental and political conditions. Moreover, a number of local governments (often those away from the coast, whose watersheds nonetheless drain into the Bay) have chosen to resist regulatory attempts to improve water quality. In addition, critical information gaps remain and the protection of rocky intertidal communities has been ineffective. **Grade B**

Community Support Santa Monica Bay enjoys tremendous support from the community. Non-profit groups such as Heal the Bay and the Santa Monica Baykeeper have played a critical role in focusing the public's attention on the problems of the Bay and in encouraging (sometimes through litigation) agencies to act to protect the Bay. These organizations provide a model for how science-based advocacy can influence environmental policy, with significant effects on the resources of the Bay. Local citizens have literally voted with their wallet, passing state and local propositions that are providing much-needed funds to improve the resources of the Bay. On the other hand, many members of the public remain ignorant or apathetic about their impacts on the resources of Santa Monica Bay, and the resulting non-point source pollution is a serious problem for the Bay. It is a difficult task, but agencies and non-profits

Yet many members of the public remain ignorant or apathetic about their impacts on the resources of Santa Monica Bay, and the resulting non-point source pollution is a serious problem for the Bay.

must do a better job educating the general public about how their activities impact Santa Monica Bay, and why they should care. **Grade A-**

ACKNOWLEDGEMENTS

Much of the information in this chapter was compiled by the Santa Monica Bay Restoration Commission (SMBRC) for its 2004 State of the Bay report.

I thank the SMBRC staff and my fellow Technical Advisory Committee members for their help in compiling these data. The SMBRC also supported the research on the impacts of visitors on rocky intertidal communities. The opinions expressed are those of the author.

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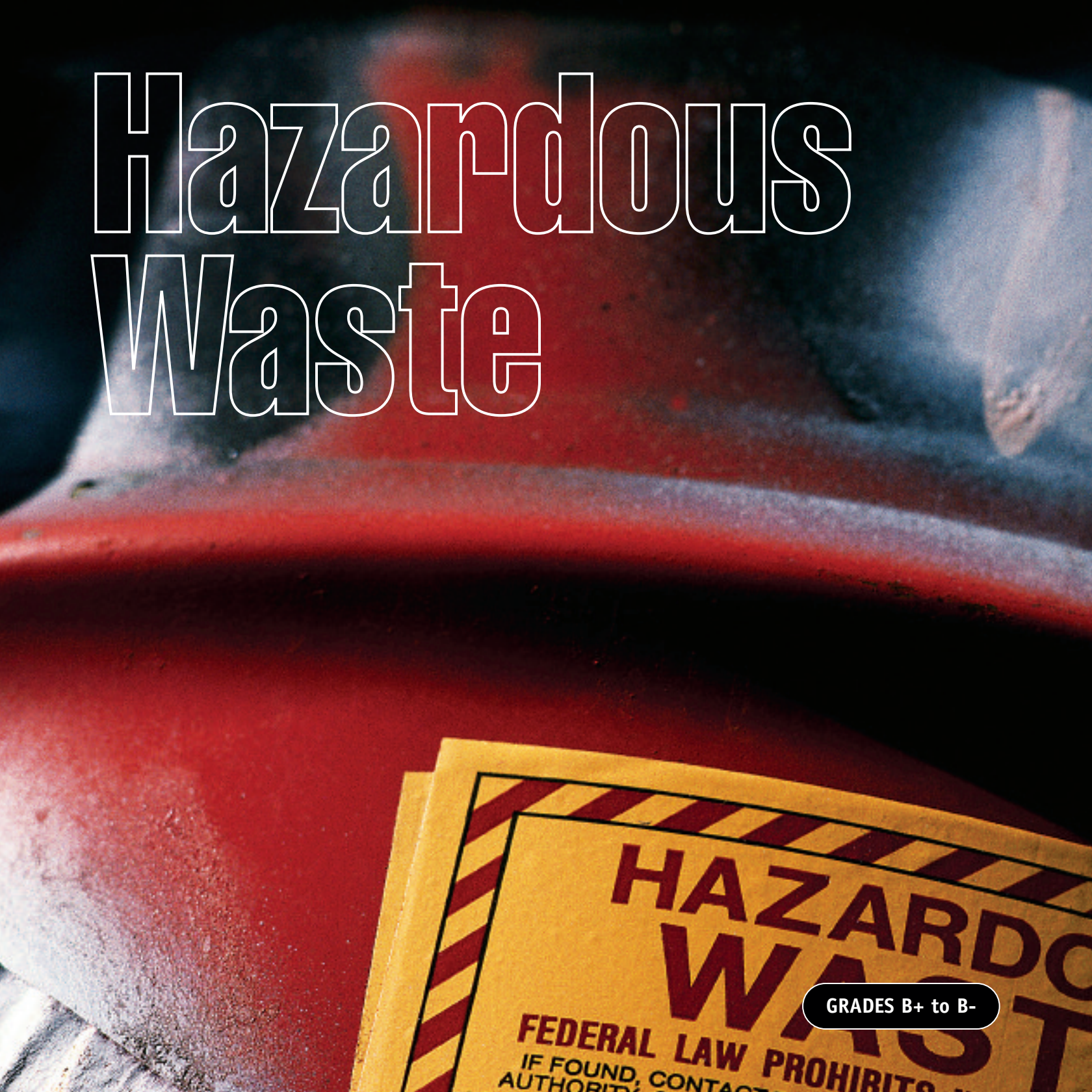
Richard F. Ambrose is Professor of Environmental Health Sciences and Director of the Environmental Science and Engineering Program in UCLA's School of Public Health. His research focuses on the ecological aspects of environmental problems, particularly in coastal environments. His current research includes the restoration of degraded wetlands and other coastal habitats; monitoring change in rocky intertidal habitats (with a particular focus on being able to detect effects of oil spills) using a network of monitoring sites throughout California, assessing human activities in rocky intertidal habitats and determining ways to restore degraded intertidal communities, evaluating alternatives for managing watershed-level ecological problems, and assessing the effectiveness of wetland mitigation required under the Clean Water Act. Professor Ambrose received his B.S. in Biological Sciences from UC Irvine and his Ph.D. in Marine Ecology from UCLA. He is Chair of the Scientific Advisory Panel of the California Coastal Commission overseeing a large marine mitigation project, and he serves on technical advisory panels for the Santa Monica Bay Restoration Commission and the Southern California Wetlands Recovery Project.

Hazardous Waste



GRADES B+ to B-

by W. Bowman Cutter, Ph.D., Assistant Professor, UC Riverside Department of Environmental Science

J.R. DeShazo, Ph.D., Associate Professor, UCLA Department of Public Policy

Southern California has experienced a variety of crises resulting from the release of hazardous waste and toxic substances. The mishandling of hazardous waste by industry has created the region's 23 superfund sites. Leaks from underground storage tanks, owned primarily by gas stations, have contaminated important sources of drinking water from groundwater. Soil contamination has led to difficult problems with urban redevelopment and school placement. These problems are particularly important because they degrade water and land resources, both of which are in short supply in Southern California.

Recently California restructured its regulatory approach to try to deal more effectively with these hazardous waste releases. We describe this effort, focusing upon the regulation of underground storage tanks and hazardous waste generators, and compare the regulatory performance of county and city governments in Southern California. Although we show that hazardous waste releases and underground storage tank leakages are declining, we document areas of inadequate rates of inspection, enforcement actions and compliance strategies. We conclude by recommending specific changes in 1) the targeting of oversight efforts towards counties rather than cities, 2) setting fees to more adequately support local staffing needs, 3) creating monitoring systems to track progress towards compliance once a violation is detected and 4) strengthening local legal capacity for enforcement.

REGULATORY RESTRUCTURING

Until 1993, the public response to problems of hazardous waste management was incomplete and fragmented. The prior approach was a poorly designed system of delegation to local governments. Under the overlapping jurisdiction of the State Water Quality Control Board, the Department of Toxic Substances Control, and CalEPA, over 1300 local government agencies had fragmented jurisdiction. Each agency regulated some aspect of hazardous waste generation or treatment, or storage by firms. This "let a thousand flowers bloom" approach to local regulation produced some excellent regulatory programs, but led to a lack of consistency and uniformity. Many businesses complained of confusing and contradictory requirements from multiple regulators with often overlapping responsibilities.

In 1993, then-Governor Pete Wilson supported legislation for the Certified Unified Program Agency (or CUPA) program, which mandated the consolidation of six major hazardous waste programs by 1997 into one agency in each responsible local government.[1] This push was driven in part by a desire to ease the regulatory burden on business by decreasing the number of overlapping inspections, fees, and permits. However, the legislation also contained provisions intended to improve the monitoring and enforcement of hazardous waste laws, requiring that every area be under the jurisdiction of a county or city CUPA and instituting minimum inspection procedures and frequencies.

The CUPA program generally operates under the auspices of the Federal Resource Conservation and Recovery Act (RCRA). RCRA mandates the tracking and monitoring of hazardous waste from its generation to its disposal. The

Leaking underground storage tanks and hazardous waste generators represent the two largest toxic threats in Southern California.

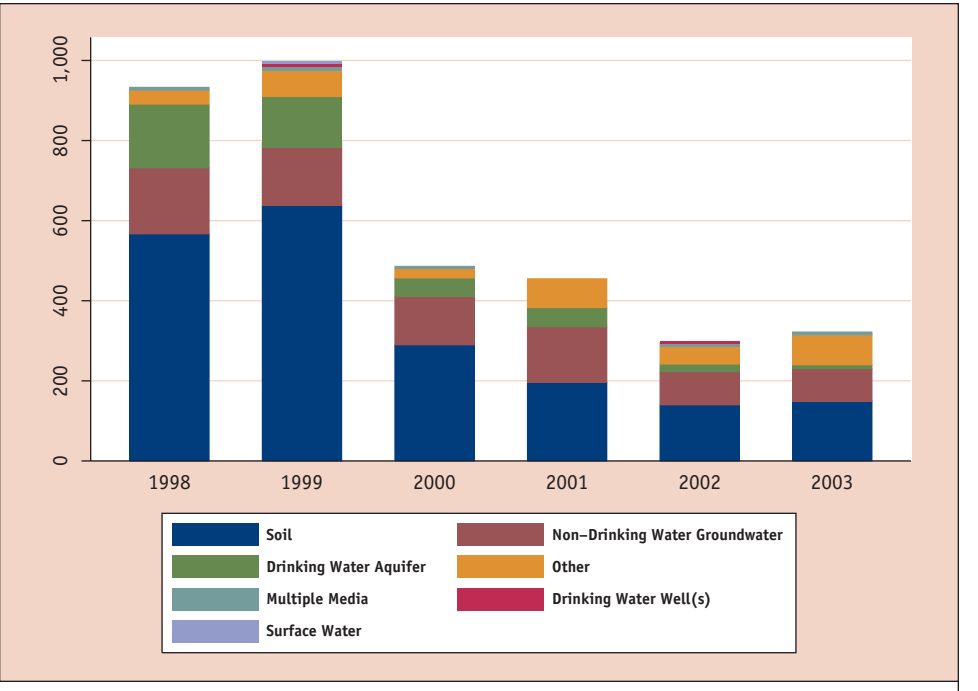


Figure 1. Reported leaks from underground storage tanks by media affected.

Department of Toxics Substances Control (DTSC) is charged with ensuring that RCRA requirements are followed in California. It delegates authority to local governments who implement the CUPA program through inspections and enforcement actions in four areas: storage tanks, hazardous waste generating facilities, safety plans for hazardous waste releases, and treatment and recycling facilities. The DTSC then oversees CUPA efforts and is directly responsible for some larger facilities.

An interesting feature of the CUPA program is that cities can assume responsibility for implementing hazardous waste programs if they petition their surrounding county and it approves. This selection process has produced a set of cities with distinctive characteristics. One might expect that volunteer cities are likely to prefer a higher level of regulation than their surrounding county. The state and the surrounding county are likely to veto cities that might want lower levels in light of the state minimum inspection regime and other performance requirements. As we will see shortly, this conjecture turns out to be true in the case of the underground storage tank (UST) and hazardous waste generator (HWG) programs, where various indicators of regulatory effort show the involved cities are doing a better job of regulation than counties.

LEAKING UNDERGROUND STORAGE TANK REGULATION

Each of the seven Southern California counties has designated one of its agencies (commonly their environmental, public health, or fire departments) as its CUPA agency. In addition, 11 cities have volunteered to run CUPA agencies. Among CUPA programs, the leaking underground storage tanks and hazardous waste generators represent the two largest toxic threats in Southern California. The principal public concern about underground storage tanks in recent years has been the contamination of groundwater supplies with MTBE, a gasoline additive. In response to the MTBE crisis, California increased the required inspection frequency for tanks from triennially to annually, effective in FY 2000-01. Another concern about CUPAs is whether they have the ability to carry out their enforcement responsibilities, in part because localities must involve the local District Attorney for many types of violations. In response,

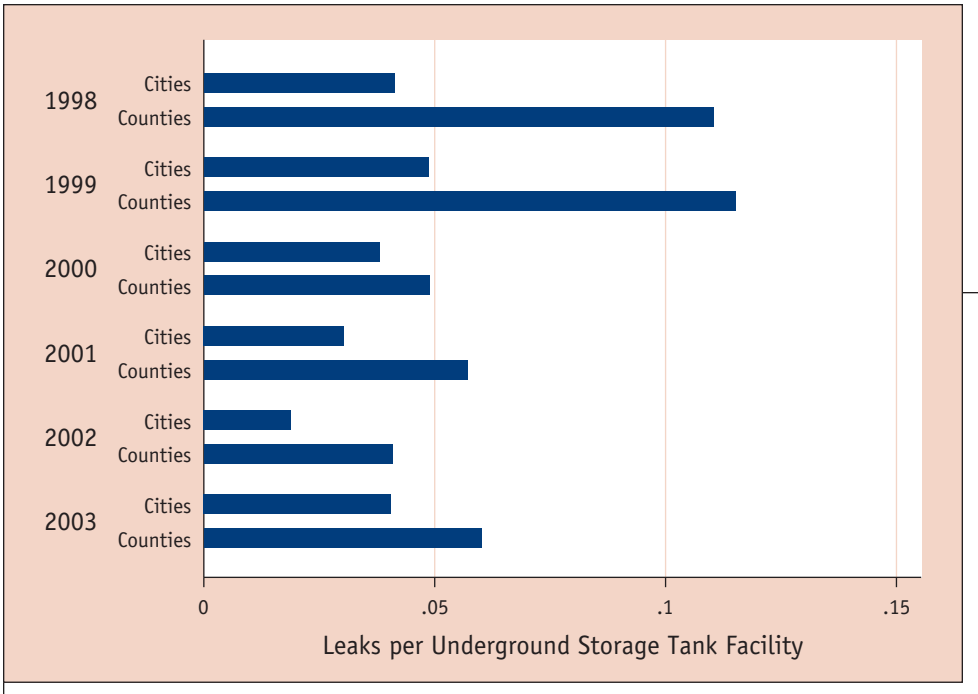


Figure 2. Reported leaks from underground storage tanks.

Cities on average do far more inspections per underground storage tank facility than counties.

there are ongoing efforts to provide all CUPAs with an administrative enforcement ability to avoid using the DA and to save costs.

Issues of groundwater contamination, especially by MTBE, have grown in importance. The CUPAs are the front-line regulators of USTs, which are responsible for the lion's share of MTBE contamination, as well as contributing to other soil and water contamination. A key event in UST regulation was the requirement that all tanks be upgraded to new, more leak-proof standards by the end of 1998. By the end of 1999, most tanks were in compliance. The data from Southern California show that the tank standards upgrade seems to have reduced the number of leaks substantially.

Because most of the leaks from USTs occur in the county CUPA's jurisdiction (as opposed to in the 11 cities), it is not surprising these declines in leaks mostly occurred in the County CUPA. Figure 2 shows a similar trend for the average number of leaks per facility with a UST.

The average rate of leaks has declined in both the city and county CUPAs since tanks were upgraded to the 1998 requirements. The graphs also raise several interesting questions. For example, the decrease in the leak rate is much more substantial for counties. The graph also shows that cities on average have fewer leaks per UST facility, even in the post 1999 period, at a time when there should not be significant differences in tank construction. It is also difficult to attribute these differences to differences in the size or type of facilities between cities and counties, since well over 90% of the UST facilities are gas stations which almost all have the same number of USTs (3 to 4 on average).

What accounts for the differences between cities and counties? The intensity of regulation may account for some of this observed difference in leak rates. Cities on average do far more inspections per UST facility than counties. Over the entire period of CUPA operation, cities conducted close to double the number of inspections that counties did (about 1.1 inspections/year for cities versus about 0.6 inspections/year by counties). For the recent period of FY 2001-2003, cities conducted approximately 1.2 inspections per year while counties have improved to 0.63 inspections per year. Our data show counties are not meeting the State requirement of annual inspections whereas cities are slightly above the requirement. In FY 2003 only 1 of 6

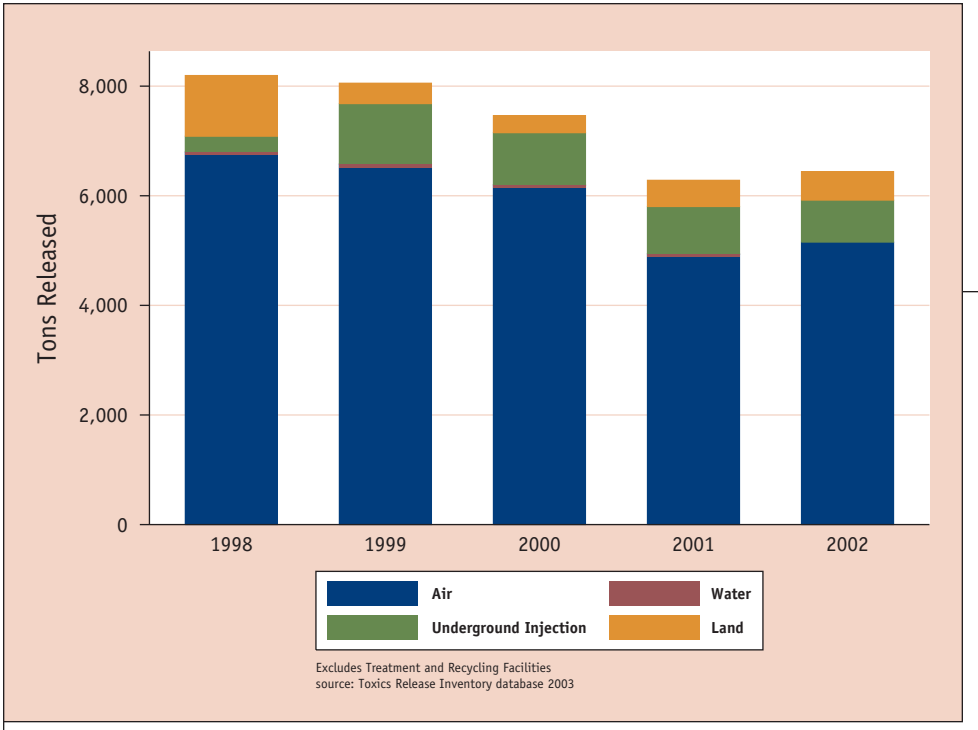


Figure 3. Hazardous waste environmental releases.

counties averaged at least 1 inspection/year while 8 of 11 cities averaged at least annual inspections in the UST program. These proportions persist to the present time.

Of course inspections are just one part of the enforcement story. For effective enforcement, local governments must follow up on inspections by correcting any violations they find through formal or informal enforcement actions. Again, it appears cities are outperforming counties when we look at the ratio of enforcement actions to violations. In recent years (FY 2001-2003), the weighted average[2] of enforcement actions/violations shows cities respond with almost twice as many enforcement actions for each violation. Counties do pursue more formal enforcement actions—civil, criminal, or administrative cases—which are more likely to produce larger fines. This may be because lower levels of monitoring mean that violations become more egregious before they are discovered.

The City CUPA programs appear to be generally in compliance with state requirements and to be pursuing vigorous UST regulatory enforcement programs. However, the county CUPAs have much more work to do to raise their inspection frequency up to state-mandated minimums. In addition, it appears the County CUPAs can do more to pursue the violations they do uncover in their inspections. Recently introduced State legislation that would give all CUPAs the ability to assess administrative penalties might assist the counties in increasing their enforcement. The combination of greater inspection and enforcement frequency could help counties lower the tank leak incidence rate to city levels and slow further degradation of Southern California's soil and water.

HAZARDOUS WASTE MANAGEMENT REGULATION

The Hazardous Waste Generators and Large Quantity Generators programs regulate a wide variety of businesses from small paint shops to dry cleaners to large manufacturing concerns. Unlike the UST program, the state does not track all releases of pollutants from facilities in these programs. However, the federal Toxics Release Inventory (TRI) database tracks hazardous waste releases from a wide variety of (mostly manufacturing) facilities. The TRI database overlaps con-

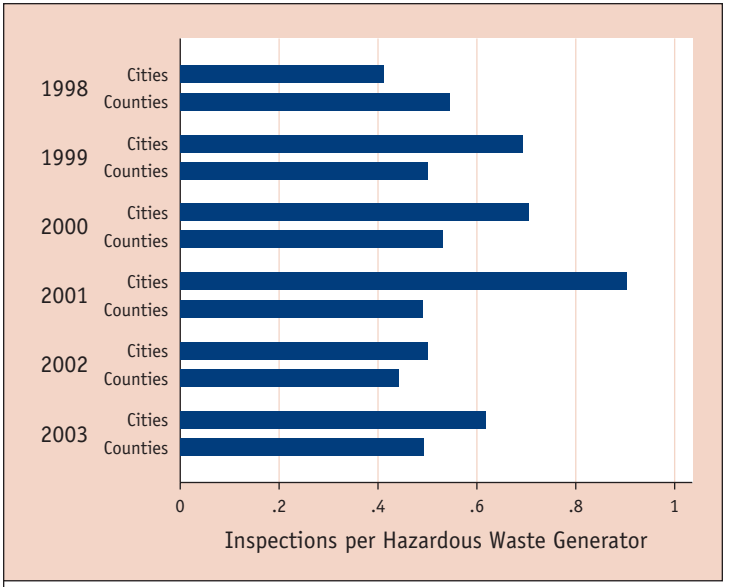


Figure 4. Mean inspections per facility for hazardous waste generators.

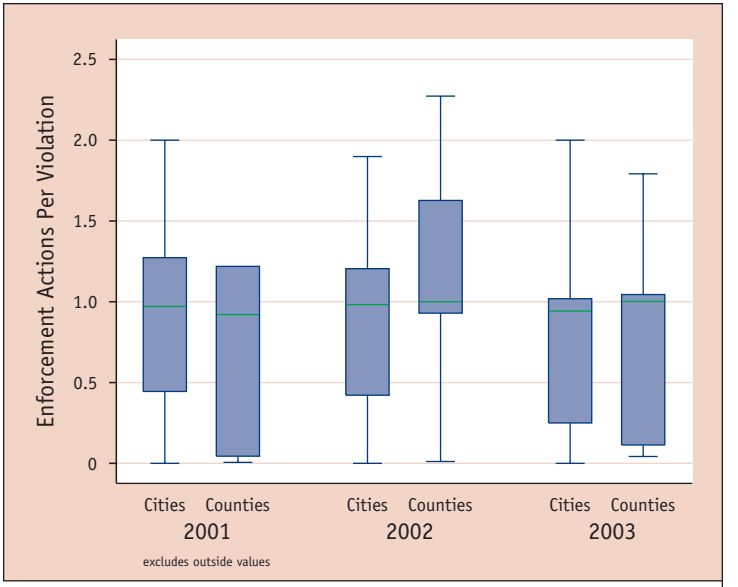


Figure 5. Enforcement rates per violation for hazardous waste generators.

siderably with the firms in these programs and gives us our best picture of toxic pollutant trends in Southern California.

Figure 3 shows total tons of hazardous waste environmental releases in Southern California.[3] For all years, about 80% of environmental releases are airborne, with the rest split between underground injection and soil. Since the inception of the CUPA program, total releases are down 27%. The CUPA program may be responsible for some portion of that decline, but it is likely that larger economic factors such as the decline in industrial output in Southern California explains some of the decline.

An examination of inspection rates again shows cities doing more than counties. Over FY 2001-2003, cities averaged 0.81 inspections/facility per year while counties averaged 0.43. Although this gap is narrowing it is due to a drop in cities' inspection rates, declining to 0.65 inspections/facility per year while counties remained at a rate of 0.43.

For the large quantity generators, there are not large city-county differences. Counties undertake slightly more inspections per year but this is probably because cities have few or no Large Quantity Generators.

Figure 4 shows the inspection rate trends for Hazardous Waste Generators. We computed a 3-year average of inspections/facility to determine whether jurisdictions were on average completing enough inspections to meet state requirements. Under this measure, by 2003 9 of the 11 cities and 4 of 7 counties were making enough inspections to fulfill state requirements. Cities are doing better than counties on this measure, but a slight majority of counties are completing enough inspections to fulfill their requirements.

Our final measure of regulatory effort is the enforcement rate. Figure 5 shows the distribution of enforcement rates. The median enforcement rates for both cities and counties hover around 1.0, meaning on average Hazardous Waste Generator violations are followed up by at least one informal or formal enforcement action. There are no significant differences between cities and counties on this measure.

Bowman Cutter is an Assistant Professor of water resources management at U.C. Riverside in the Department of Environmental Science. His research examines environmental regulation, the effects of the federal and state division of responsibility over environmental programs, and state and local environmental enforcement efforts. Current projects examine the effect of water pricing on water pollution and analyzing the cost-effectiveness of using stormwater to recharge Los Angeles area aquifers. He worked on environmental and agricultural topics in the Peace Corps in Bolivia and received his Ph.D. in economics from UCLA.

Local governments must follow up on inspections by correcting any violations they find through formal or informal enforcement actions. Again, it appears cities are outperforming counties.

RECOMMENDATIONS AND CONCLUSIONS

In Southern California, there has been a substantial reduction in environmental releases of hazardous waste since the inception of the CUPA program but significant improvements are needed to achieve uniform compliance with the goals of the Resource Conservation and Recovery Act and state statutes.

Cities are by and large putting enough effort into their inspection programs to fulfill state requirements, although the declining inspection rates for cities in the past several years bear watching. However, a much smaller proportion of counties are conducting enough inspections to satisfy state requirements. Clearly, the remaining counties need to improve their efforts, especially since the triennial inspection standard that we used to judge their performance is a low bar to meet.

Two policy changes would improve inspection behavior by CUPA. First, many CUPAs implement inspection fee structures that partially or fully support the staffing levels needed to achieve compliance. One way to increase CUPAs' enforcement capacity is for the State (via the Department of Toxic Substance Control) to set minimum fees based on the cost of fully-compliant inspection rates. This minimum fee structure should be based on the CUPA with the lowest statewide costs and indexed to the state rate of wage inflation. Second, the Department of Toxic Substance Control needs to increase its technical assistance and its oversight to counties. Both actions are needed since counties appear less able and willing to undertake adequate inspections.

The adequacy of CUPA enforcement behavior is much harder to evaluate.[4] This is because no firm-specific violation or enforcement data are currently

The combination of greater inspection and enforcement frequency could help counties lower the tank leak incidence rate to city levels and slow further degradation of Southern California's soil and water degradation.

reported. More critically, the CUPAs do not have a system to monitor whether compliance occurs after a violation is identified. The Department of Toxic Substance Control should support the creation of a common uniform database that tracks firms' progression from the initial discovery of violation through enforcement, if any is needed, and back into a state of compliance. In addition, the State has long recognized the need to strengthen CUPA's legal capacity to develop the evidentiary basis for prosecuting violators. Better tracking and documenting the extent of firms' non-compliance behavior would also strengthen CUPA legal capacity.

GRADES

Cities **B+**
Counties **B-**

NOTES

1. Under and above-ground storage tanks, Hazardous Waste Generators, California Accidental Release Prevention Program (CalARP), Hazardous Release Response Plans and Inventories (HMMRP), Permit by Rule, and Large Quantity Generators.

2. Weighting by number of UST facilities, so that small jurisdictions do not overly sway the mean.

3. These facilities also generate waste that is transferred off-site for recycling or disposal, but we do not include this waste because it may not end up in Southern California and because there may be some double-counting of these transfers in the current TRI database.

4. Both the Legislative Analyst's Office ("Analysis of the 2000-01 Budget Bill: State Agencies Can Do More") and the California State Auditor ("DTSC: The Generator Fee Structure is Unfair, Recycling Efforts Require Improvements, and State and Local Agencies Need to Fully Implement the Unified Program") have noted weaknesses in CUPA enforcement capabilities and performance.

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About the UCLA Institute of the Environment

WHAT IS THE IOE?

We are a community of scholars focused on finding sustainable solutions to major environmental problems. Our members and constituents represent a broad array of academic disciplines, research interests, policy concerns and outreach avenues. Los Angeles is our home, and it provides a rich mixture of urban environmental health challenges and opportunities for enhanced resource management. But our interests span the globe, from tropical ecosystems to innovative energy technologies.

WHAT DO WE DO?

- We create partnerships for new research that cross the traditional boundaries of science, social science, humanities, law, business, public health and public policy, to name a few.
- We develop new policy solutions that affect the global, regional and local environments, and work with non-governmental organizations, including businesses and environmental organizations, as well as government agencies to maintain a lively debate.
- We develop educational programs to meet the needs of today's students, whether they are environmental professionals or citizens of the world.

UCLA

THE NEW "GREEN" HEADQUARTERS FOR THE UCLA IOE

In June, 2005, the UCLA Institute of the Environment moved its headquarters into the third floor of the newly constructed La Kretz Hall, a three-story, 20,000-square-foot facility named for UCLA alumnus Morton La Kretz, the principal donor to the $8.5 million project. It is the first certified "green" building on the UCLA campus.

La Kretz Hall will provide classrooms for undergraduate education and distance learning, office space, and facilities for academic conferences. A conference center on the first floor includes a 350-seat auditorium, two 20-seat breakout seminar rooms, and a 45-seat classroom that can be equipped for distance-learning classes.

La Kretz Hall was designed by The Smith Group architectural firm and constructed by West Coast Nielsen.

WHAT DOES IT MEAN TO BE "GREEN"?

Rapidly renewable and low-emitting materials, operable windows, and low energy consumption will make La Kretz Hall the first UCLA facility certified by the prestigious U.S. Green Building Council LEED (Leadership in Energy and Environmental Design) Green Building Rating System.

The efficient mechanical systems in La Kretz Hall have sensors to measure and verify carbon dioxide content and overall air quality, providing a better working environment and lowering the building's energy consumption. The design includes infrastructure for future installation of building-integrated photovoltaic (BIPV) panels to provide a renewable

La Kretz Hall

source of energy. A displacement air system, which supplies ventilation from the floor rather than the ceiling, will reduce electricity usage even further. To encourage bicycle commuting, members of the Institute of the Environment will have access to protected bicycle storage, changing rooms and showers.

The building sits on top of an existing 5-million gallon tank, which supplies chilled water to UCLA's air conditioning systems. Stacking the new construction above an existing structure allowed the university to save valuable land space and avoid the environmental impact of developing a new site.

Other "green" design aspects of La Kretz Hall that satisfy certification standards of the US Green Building Council include:

- Use of recycled materials in construction. The building steel contains 80% recycled content. Other materials, such as rebar, concrete, gypsum wall board, miscellaneous metals, and concrete treads also use recycled content
- Reuse of existing land, reducing the environmental impact of the new construction
- Light colored paving based on the UCLA standard, and an Energy Star roof to eliminate the "heat island effect"
- Interior and exterior lighting is designed to permit views of the night sky and reduce the impact on the nocturnal environment
- Carbon dioxide monitors guarantee indoor air quality
- Drought-tolerant plants instead of paving, and vines to cover the water tank and minimize storm water runoff, increase on-site filtration and reduce contaminants
- Premium water efficiency inside the building, which uses 20% less water than required by the Energy Policy Act of 1992, including water-conserving plumbing fixtures that exceed EPA requirements
- Heating, ventilation, air conditioning, service hot water, lighting, and other regulated systems are all designed to reduce energy use and cost
- Natural ventilation and displacement supply in the auditorium
- Accessible areas are dedicated to separation, collection and storage for recycling paper, glass, plastics and metals generated by building users
- Low-emitting materials including adhesives, paints, coatings, carpet, and composite wood
- Use of recycled furniture and flooring throughout the IoE offices.

From the Director, continued

Behind the Report Card are two very talented editors, Ann Carlson and Arthur Winer. These two professors took on the responsibility of selecting the authors and working with them to put the articles into a format that includes high-level graphics and illustrations, then shepherding the whole document through publication and release, for the second consecutive year. Their dedication to the environment is remarkable. Happily, they are not alone at UCLA in their enthusiasm for tackling multi-disciplinary, multi-faceted environmental problems.

This has been a landmark year for UCLA's Institute of the Environment. Our new office, atop La Kretz Hall, gives us a light-filled, highly functional, energy efficient space from which to carry out our mission of bringing people together to think about ways to address important environmental issues through interdisciplinary research, teaching and public service. Nearly 400 guests (including our benefactor Morton La Kretz and his family) attended the opening ceremony in the new science lecture hall that fills most of the lower two floors. The guests were treated to a provocative lecture by Professor Jared Diamond, whose latest book, Collapse, reminds us of the ways in which many formerly vital societies in the past have vanished because they failed to recognize the need to change in the face of a loss of important natural resources. The Report Card essays remind us that while there is much to encourage us in Southern California's efforts to grapple with the threats of pollution, waste and changing climate, we have a long way to go to achieve a healthy and sustainable environment. The authors have provided some of their own ideas and proposals; to continue the conversation, please visit the IoE website and feel free to communicate with us at our new address, shown inside the front cover.

RC 2005

Southern California
Environmental Report Card 2005
UCLA Institute of the Environment

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