



SEA GRANT NEWS

“Science Serving California’s Coast”

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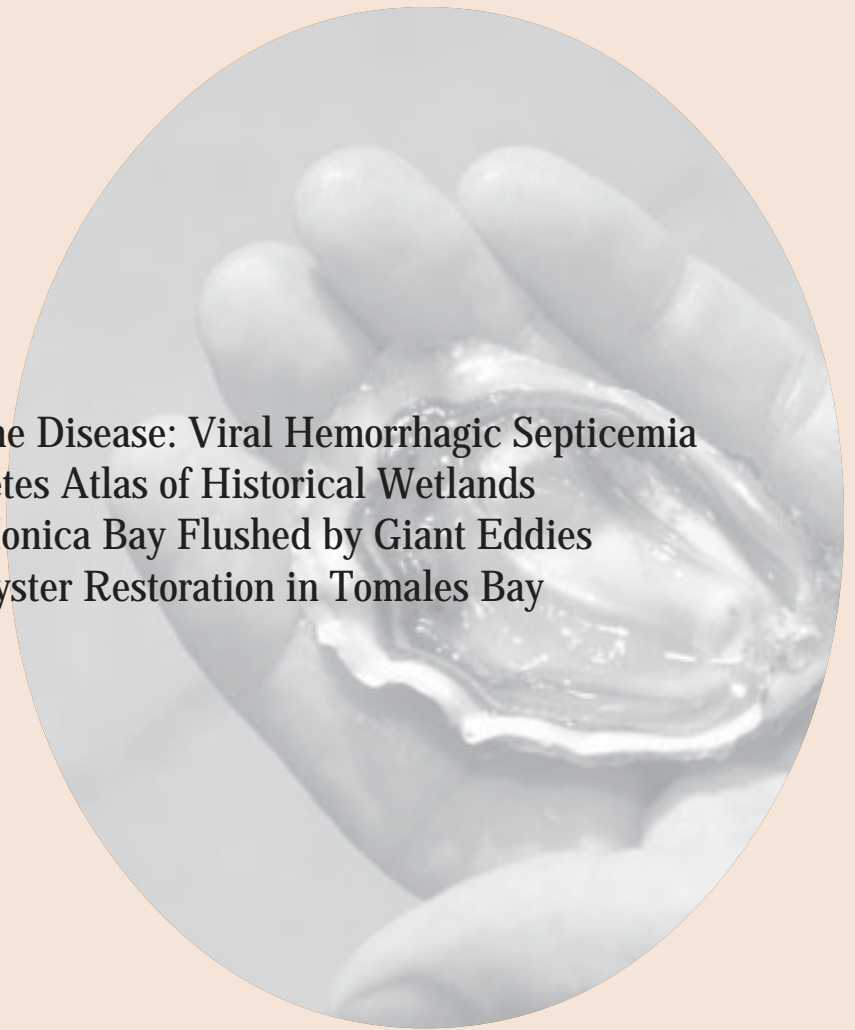


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An Update on Sardine Disease: Viral Hemorrhagic Septicemia



Last April, Australia's Biosecurity Office banned the importation of California sardines because of concerns the fish, imported to feed pen-raised bluefin tuna, might introduce a deadly fish disease. Sardines landed in California, or at least some of them, were contaminated by a virus first documented

in farmed trout in Europe. The virus attacks the lining of a fish's blood vessels, causing hemorrhaging, and may also attack the tissues that produce red and white blood cells. Fish with these symptoms have what is known as viral hemorrhagic septicemia (VHS).

Following negotiations with Australian officials, the ban was eventually softened to an interim restriction, under which California sardines may be imported so long as water temperatures at bluefin ranches stay above 15 degrees Celsius, believed to be a thermal barrier preventing disease transmission. Counter to intuition, warm water, not cold, reduces the virus' virulence. The interim provision states that future decisions on importing California sardines will take into account research at the University of California at Davis. This research, with support from California Sea Grant, is being led by fish pathologist Dr. Ron Hedrick.

The idea that the ban might be reinstated, even hints that it could be, is enough to send shock waves through California's purse-seine fleet, particularly in San Pedro, which saw its last cannery close its doors in 2001. "The whole emphasis in the sardine fishery has shifted away from canning to the export market," said Diane Pleschner-Steele, a consultant to the wetfish industry. "Australia

Once the Western Hemisphere's Biggest Fishery

In its heyday in the 1930s and early 1940s, the Pacific sardine was the largest fishery in the Western Hemisphere, representing, by weight, a staggering 13 percent of all fish and shellfish landed worldwide. After World War II, when life in America was otherwise settling back to normal, those glory days came to an abrupt end. The sardine stock crashed; canneries closed their doors; and, a corner of history quietly died.

Scientists now know that basin-scale shifts in ocean climate were partially to blame for the sardine collapse. Sardine stocks in Mexico, the United States, Japan and Chile fluctuate in size somewhat synchronously with decadal-scale swings in climate. Present ocean conditions now favor the sardine; and, reflecting this, California's purse-seine fleet landed more of the slender fish in 2000 than it had in two decades. The fishery has also expanded in Mexico and Canada and in the state of Washington, where sweeping groundfish closures have redoubled attention on emerging stocks such as the sardine. In terms of the size of California's sardine stock, fisheries biologists speak of a "900-pound gorilla" living off our coast—a huge, untapped mass of fish thriving relatively far offshore.

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has been a stable market, and one that we want to keep.” Stable and lucrative. About 95 percent of all sardines landed in San Pedro are frozen in blocks and put on trans-Pacific container ships bound for Australia, about \$12 million annually from the Southern California region. That bluefin farmers can afford to import sardines from California, export tuna to Japan, and still turn a profit, is a testament to the incredible prices paid for bluefin, a sashimi epicure’s delight.

The VHS virus that Hedrick has been studying, and the one Australia wants to ensure it prevents importing, is a type of rhabdovirus with some similarities to the rabies virus. Although newly discovered in Southern California’s sardines, VHS has been around for a long time in Europe and was first documented in farmed trout in Denmark in the 1930s. Scientists believe that Baltic herring imported to feed Denmark’s farmed trout introduced the disease. VHS has since been found in trout, cod, pollock, hake, herring, sand lances, coho, chinook and Atlantic salmon, mackerel, and of course, sardine, in Canada and the United States. “All marine fish may be susceptible to VHS,” Hedrick said.

Despite the pervasiveness of the VHS virus in marine species, the virus has never been found in Australia; and, fish pathologists have had plenty of opportunity to find it if it were there. A herpes virus decimated Australia’s sardines twice in 1990s. During the course of examining legions of dead sardines, never once was VHS found. Australian officials desper-

ately want to keep it that way. “Australia’s Biosecurity office has grave concerns about introducing diseases,” Hedrick said, during a presentation at the December 2002 Trinational Sardine Conference in San Pedro. Fueling its fears, Australia suspects its herpes virus was introduced by fish imported for bluefin.

Australia is working on drafting an importation policy for sardines. Ramesh Perera, assistant manager of the department of Aquatic Animal Biosecurity in Australia, said, “The objective of the review is to determine the quarantine risk posed by importation (of sardines)...If the risk is found to exceed Australia’s appropriate level of protection, then a recommendation will be made to the Australian Quarantine and Inspection Service to implement appropriate risk management measures.”

VHS not only has implications for Australia but also for Mexico, and in particular Ensenada, which is the center for this region’s booming bluefin industry. As the industry grows, there will be an increasing demand for bluefin food. Sardines from places such as Magdalena Bay and Ensenada itself are the obvious sources. VHS has not yet been found in Mexico, but then nobody has looked. This, though, may soon change, as Hedrick has obtained 60 specimens from Ensenada and is

working with scientists in Mexico and California to secure funding to test them for disease.

In terms of Hedrick’s research, his efforts have focused on a couple key issues, a leading one being: Can the virus cause mass fish-kills? This question was examined through a genetic study of viruses extracted from fish samples. There are four genotypes of the VHS virus worldwide, he explained. His work has shown that fish from the U.S. West Coast and western Canada are infected with different strains of the same genotype. These strains are associated with distinct geographic regions, with one exception. Some sardines from Southern California contained a strain common in British Columbia. This same strain caused mass fish-kills there and in Alaska. “The virus, under the right



conditions, has the potential to cause mass kills,” Hedrick said.

It is not clear, however, whether “the right conditions” will ever, or have ever, occurred in Southern California. “In the history of our coast, we have never seen die-off like they have had in British Columbia,” said California Department of Fish and Game
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Trinational Sardine Conference

The Pacific sardine (*Sardinops sagax*) is a highly migratory pelagic species with three major subpopulations in North America. The northern subpopulation, the one targeted by California fishers, spawns in California and Northern Baja California in spring and then migrates as far north as British Columbia to spawn a second time in summer. The population's geographic range thus naturally connects the fishery, and its management, to three nations—the United States, Canada and Mexico.

To foster transboundary management of the fishery, the approach fisheries biologists believe is ultimately most appropriate, California Sea Grant initiated a forum for sharing international landings data and research findings, in essence a forum for working collaboratively to sustain the fishery. That forum became the Trinational Sardine Conference, an annual event attended in 2002 by about 50 resource managers, scientists and fishing industry representatives from Mexico, Canada and the United States.

Sea Grant supported the first Trinational Sardine Conference in 2000 in Ensenada. The 2002 conference was held at San Pedro in Los Angeles Harbor with support from the Southern California Commercial Fishing Association, California seafood processors and NOAA's Southwest Fisheries Science Center.

biologist Kevin Hill, currently the chair of the Pacific Fishery Management Council's Coastal Pelagic Species Management Team. The team sets regulations for the sardine fishery. "At the moment, the disease is significant because it is affecting the export business."

A second component of Hedrick's research focused on evaluating whether commercial freezing reduces viral counts enough to alleviate concerns about spreading disease. "As is often the case, the answer came out gray, not black or white," Hedrick said. In a series of experiments, he injected live sardines with the VHS virus, froze them, thawed them and retested them for infection. Many of the injected fish did not become infected, suggesting it is possible to develop immunity to the disease.

In those that were infected, freezing reduced viral counts significantly in some fish and completely in others. Hedrick plans to repeat his experiments before he reports his findings to Australian officials.

"We are encouraged that freezing does reduce the virus," Pleschner said, "but his results are preliminary."

Hedrick is also strongly convinced of the need for more research. For one, he said, the 15-degree-Celsius thermal barrier needs to be tested, to verify that it holds true for saltwater fishes. Experiments on fresh-water fish have shown that the VHS virus stops being virulent at waters above 15 degrees. Nobody knows if the same threshold holds for saltwater species, such as sardines.

Another issue is whether the virus might adapt to warmer water. Yet another is whether VHS poses a significant mortality risk to young pelagics. Nobody has studied VHS in young fish; all the work has been on commercially caught adults. "Young sardines might be most at risk," Hedrick said, "since in trout, young fish

are the ones that were most often fatally infected."

Conceivably, he said, VHS or other diseases could be partially responsible for fluctuations in



sardine stock size associated with shifts in ocean temperatures. ■■■

State Fellow Nick Haring Completes Atlas of Historical Wetlands

Journey back in time. The year is 1800. California is still a territory of Mexico. The motorcar has not been invented. Nobody has struck gold and yelled “Eureka!” We’re on horseback, on a dirt road near a small town on the coast. Surrounding us is a spongy wetland, crowded with birds—one in a seemingly endless network of rugged marshlands dotting the as yet undeveloped coast.



Traditionally, historians have been the ones to look back in time and ruminate on what was in days past. This, though, has changed as politicians—and society as a whole—have become increasingly interested in global environmental change. Today biologists in a hundred indirect ways are asked to

speculate on how the natural world used to be—its polar ice, sea level or fisheries abundance.

In California, wetlands are one of our most vital historical ecosystems, and one of our rarest. The best guess is that about 90 percent of the state’s wetlands have been dredged, filled or drained in the last century. The remnants support a high proportion of the state’s federally protected endangered species.

California Sea Grant has long supported state and federal mandates to protect wetlands, most recently, through our support of California Sea Grant State Fellow Nick Haring, a former master’s student in marine ecology at California State University at Northridge. As a State Fellow, Haring spent nine months

working at the California Coastal Commission, the agency which issues building permits for coastal development and which is charged with meeting government mandates to preserve wetlands.

The bulk of his time as a State Fellow was spent digitizing a set of hand-drawn maps from the 1800s,

showing the historical location and extent of various wetland habitats in Northern California. The images were put in a GIS-compatible format and soon will be posted on the California Coastal Commission’s Website for public viewing and use. The maps dovetail nicely with an atlas of historical wetlands in Southern California produced by the California Coastal Conservancy. Together, they will provide the first comprehensive digital atlas of California’s historical wetland areas.

“You can look around and see the need for really good science to direct policy,” Haring said of his project. “I know this project is going to be useful to resource managers, policy makers, scientists and lawmakers.” The maps will help the agency, and anyone interested in how wetlands have changed over the last 100 years, to make informed decisions on what to do with the remaining wetlands and to identify which areas are most suited for restoration.

With his fellowship now over, Haring left for Jamaica in mid-January 2003 to study coral reef die-offs. After that, he hopes to land a career in marine resource management at a government agency. He hopes to stay in the Golden State.

Eureka! ■ ■ ■



Pollution in Santa Monica Bay Flushed by Giant Eddies

Crushed by people, choked by Los Angeles smog, soaked in bacteria-laden storm water—Santa Monica Bay is one of the nation’s most polluted waterways. There are, however, ocean processes that dilute pollutants with water from the open ocean, a process known aptly as flushing.

In the case of the Santa Monica Bay, it seems that flushing is achieved through the action of giant eddies (10- to 50-kilometers wide) shed from the California Current system offshore. The eddies are formed as the southward flowing California Current and the northward flowing California Counter Current wend their way through the complex bathymetry of the Southern California Bight. This conclusion is based on output from a high-resolution ocean circulation model developed by UCLA researchers Keith Stolzenbach and James McWilliams. According to their model, a single eddy can engulf nearly the entire bay, its swirling currents sweeping out the bay’s grimmest corners. According to the Sea Grant scientists, when an eddy is not present, exchanges with the open ocean are quite meager and pollutants stagnate. ■■■

Sea Grant Assists Oyster Restoration in Tomales Bay

Sea Grant Interim Director of Extension Paul Olin is collaborating with scientists at the UC Cooperative Extension program and Romberg Tiburon Center at San Francisco State University on a pilot project to restore native Olympia oyster populations in Tomales Bay in Marin County. The group has built about 12 artificial reefs, each made by placing shucked oyster shells on the bay’s bottom, and will build another 12 this spring. Native oysters, it is hoped, will use the shell mounds to form living reef colonies. Silting from stream erosion and runoff has buried existing reef material in the bay.



UC researchers place a reef of shucked oyster shells in Tomales Bay in the hopes of reviving the native oyster population. Photo: University of California.

A major goal of the project is to document the degree to which oyster reefs enhance fish and invertebrate life. If the reefs prove to be viable ways of enhancing native species, more expansive reefs conceivably could be built as part of larger restoration effort or as mitigation for development projects such as the proposed expansion of the San Francisco airport, Olin said. ■■■



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