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Sardine Disease: Viral Hemorrhagic Septicemia

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Sardine Disease: Viral Hemorrhagic Septicemia

Abstract

In 2001, a potentially lethal pathogen was identified in sardines landed in Southern California. The pathogen was found to be a rhabdovirus with similarities to the rabies virus. The virus attacks the lining of a fish's blood vessels causing hemorrhaging. Fish with these symptoms have what is known as viral hemorrhagic septicemia (VHS), a disease that has caused mass fish kills in the wild and at farms. Although California sardines were infected with the VHS virus, none of the fish sampled showed symptoms of disease.

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Sardine Disease: Viral Hemorrhagic Septicemia

Ronald Hedrick and Kristen Arkush

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Background

In the fishery's glory days in the 1930s and early 1940s, fishermen landed more tons of Pacific sardine than any other fish in the Western Hemisphere. The fishery for *Sardinops sagax*, the scientific name for California's sardines, represented by weight a staggering 13 percent of the total global fish and shellfish catch. Due in part to basin-scale shifts in ocean climate coupled with intense fishing pressure, the stock collapsed in the 1950s. Since the late 1970s, the stock has been rebuilding itself, a trend resulting from better management of the fishery and a return of the warm-phase of the Pacific Decadal Oscillation. In 2000, California's purse-seine fleet landed more of the slender fish than it had in 20 years.

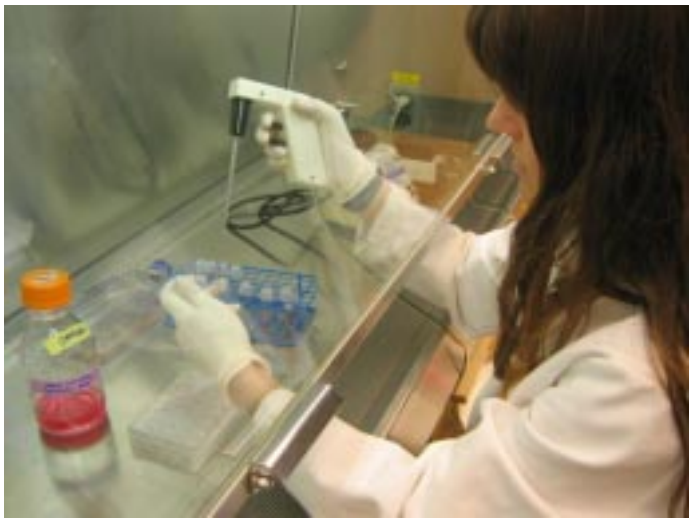
Canned sardines, once a centerpiece of the fishery, are no longer a main fishery product in California, however. Most of Southern California's sardines—about 95 percent of all sardines landed in San Pedro—are frozen in blocks and shipped to Australia, where they are used to fatten pen-raised bluefin tuna. Southern California exports about $12 million in frozen sardines annually.

Problem: Viral Hemorrhagic Septicemia

In 2001, a potentially lethal pathogen was identified in sardines landed in Southern California. The pathogen was found to be a rhabdovirus with similarities to the rabies virus. The virus attacks the lining of a fish's blood vessels causing hemorrhaging. Fish with these symptoms have what is known as viral hemorrhagic septicemia (VHS),

A healthy adult sardine (*Sardinops sagax*).

Adult sardine experimentally infected with viral hemorrhagic septicemia virus (VHSV).



Post-graduate researcher, Holly Mendonca, setting up a titration plate for VHSV. Photos by Kristen Arkush, Bodega Marine Laboratory

a disease that has caused mass fish kills in the wild and at farms. Although California sardines were infected with the VHS virus, none of the fish sampled showed symptoms of disease.

VHS is a fish disease. It poses no risks to human or marine mammal health, and the disease would not present problems for fishers and processors if it were not for the fact that California sardines are fed to bluefin in open-ocean net pens.

In April 2002, Australia's biosecurity office banned the importation of California sardines because of concerns sardines might introduce VHS. The ban was later softened to an interim restriction. Language in the temporary provision stated that further decisions on sardine imports would take into account research that at the time was being undertaken by professor Ronald Hedrick, a disease specialist at the School of Veterinary Medicine, University of California, Davis, and Kristen Arkush at Bodega Marine Laboratory. This work was funded, in part, by California Sea Grant in collaboration with the fishing industry and the National Marine Fisheries Service.

Project and Findings

In his now completed Sea Grant research, Hedrick and colleagues at the Western Fisheries Research Laboratory in Seattle examined the different genetic structures of VHS viruses in commercially caught fish along the West Coast of the United States and Canada. There are four genotypes of the VHS virus worldwide. Hedrick reported that all the fish he sampled were infected with different strains of the same one genotype. These strains were correlated with the specific geographic regions from which the fish were caught, with one exception. Some sardines from Southern California contained a highly virulent strain common to British Columbia, Canada. "The virus, under the right conditions, has the potential to cause mass kills," Hedrick said. Since the virus is more virulent in colder, northern waters, it is not clear whether Southern California would ever experience a mass fish kill.

Besides conducting genetic examinations, Hedrick and his research team at UC Davis and the Bodega Marine Laboratory tested the degree to which commercial freezing reduces viral loads. To do this, they injected 50 live adult sardines with the VHS virus, measured their viral loads, froze and then thawed them, and then remeasured their viral loads. All 50 fish harbored virus prior to freezing.

Hedrick and Arkush found that the commercial freezing process reduced viral titers by 64–100%. They also found that melt-water from fish was free of viral contamination. These findings offered persuasive evidence that the risk of introducing VHS is much less when the product is frozen.

International Implications

Because of Hedrick's research, Australia's biosecurity office lifted a ban on California sardines, which continue to be exported to Australia. His research has helped sustain the viability of this $12-million-a-year industry and contributed to policy decisions of trading partners.

Collaborating Organizations

Aquatic Animal Biosecurity, Australia
California Department of Fish and Game
California Seafood Council
Fishermen's Association
Fishing industry representatives: Diane Pleschner and Steve Seltzer
National Marine Fisheries Service
Pacific Fishery Management Council
Various commercial packers

Publications

Hedrick, R.P., W.N. Batts, S. Yun, G.S. Traxler, J. Kaufman, and J.R. Winton. 2003. Host and Geographic Range Extensions of the North American Strain of Viral Hemorrhagic Septicemia Virus. *Dis. Aquat. Org.* 55(3):211–220.

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