

HAB *Report*

RECREATIONAL RAZOR CLAMMING: A CULTURAL PHENOMENON

It's a damp and chilly spring morning, and the sun is barely up, yet people fill the beach for miles. This is not a Southern California beach, with volleyball players, swimmers and sun worshippers. These beachgoers are clad in Gortex and boots and carrying odd-looking shovels and tubes. This is the Washington coast, and it's a razor clamming weekend.

In its heyday, razor clamming lured as many as 300,000 people per year to the coast, harvesting up to 13 million razor clams, according to the Washington State Department of Fish and Wildlife (WDFW). Those numbers have decreased considerably since the mid-1980s, as disease and overharvesting

reduced clam populations. An increase in outbreaks of domoic acid, a potent marine toxin first detected on the West Coast in 1991, has also limited razor clam harvesting in Washington.

Still, thanks to careful management of the razor clam fishery and monitoring for domoic acid, clamming remains a popular activity and an important economic boost for Washington's coastal communities. On a nice spring weekend day, it's not unusual for a thousand people per mile to be digging for clams along a beach. The WDFW estimates current annual "digger trips" at about 250,000, with a harvest of 2.5 to 3
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A clam digger going for the gold.

Spring Weekend Draws Thousands to Twin Harbors Beaches

On an Saturday morning in early May, Ernie Walls of Grays Harbor County walks the beach with the patience of a veteran razor clammer. His weapon of choice is an old-fashioned, short-handled, narrow-bladed shovel, not the more modern tube or "clam gun" that most of the other diggers are using today. He seems to know what he's doing, and the 12 good-sized clams in his bag serve as examples of his expertise. He needs three more to reach his limit.

"They seem to act different from year to year," Walls says. "Usually you can pound the sand with the shovel, and they'll show. But today, they seem to be deeper."

When he spots a crater, he starts digging about half a foot away from it, on the ocean side.

"You dig on the water side because they go down and turn toward the water. You don't want to hit them with the shovel and break the shell. If you dig next to them, they'll turn right into you," Walls says, reaching into the hole and pulling out clam number 13.

Walls is sporting a bandage on his right index finger. "That's why they call them razor clams," he explains.

At home, he'll soak the clams in fresh water to let them pump the sand out of their systems. Then he'll cut them out of their shells and remove the siphon, gills and digestive tract. He likes to dip them in egg, roll them in cracker crumbs and fry them.

Not far away, Jim and Donna Baker of McCleary, Wash., stroll the beach. Jim sports a bag of fresh clams tied to his waist, while Donna's backpack cargo is infant grandson Keegan. "This is just the second time Donna and I have done this," says Jim, "but I used to do this a lot with my family when I was a kid."

Makenzie, age 7, and her mother, Maria, from Lakewood, Wash., are not just fair-weather clammers. "It was raining the last time, and we didn't get many clams," says Makenzie. But they were drawn back, nevertheless, and will have little trouble digging their limit on this day.

Lee Evans did not have to travel far to get to Twin Harbors. "I live about mile up the beach," he says, holding up his bag of clams.

The Farthest Travel award goes to a family from Burlington, Skagit County, that goes clamming "two to three times a year," according to the father. As with so many others on the beach, it's a family tradition passed on from generation to generation.

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million clams.

Back in the old days, the razor clamming season was every day of the week for nine months. With the decline in clam populations, the state reduced the season to 15 to 35 days out of the entire year, mostly on weekends. The WDFW conducts population analyses of each beach and manages each as a

separate entity.

Along with resource management, razor clamming stakeholders also have had to confront increasing contamination of clams by marine biotoxins. Three outbreaks seriously disrupted the fishery: a year-long closure from November 1991 to November 1992; another year-long closure from October 1998 to October 1999; and a closure that began in October 2002 and continued well into 2003. This last closure alone was estimated to represent a \$10.4 million loss to Washington's small coastal communities.

"Clearly, for the sake of public health and the coastal economy, we needed to get a better understanding of these outbreaks," says Vera L. Trainer, harmful algal blooms program manager for the NOAA Northwest Fisheries Science Center.

In June 1999, coastal communities, businesses, tribes, and state and federal agencies formed the Olympic Regional Harmful Algal Bloom (ORHAB) partnership, with funding from the National Oceanic and Atmospheric Administration (NOAA). ORHAB investigates the origins of toxic algal blooms, monitors where and when they occur, assesses the environmental conditions conducive to blooms, and explores methods that can be used to reduce their impacts on humans and the environment. Working with WDFW, the result has been a safe, predictable, beach-by-beach clamming schedule that diggers and coastal communities alike can depend on.



ORHAB SUPPORTS REGION'S ECONOMIC AND HUMAN HEALTH

Healthy shellfish are a key part of Washington's coastal economy and of obvious importance to people who enjoy gathering and eating them. When beaches are closed to harvest because of high levels of toxins, local economies suffer, and public perception grows that eating shellfish is dangerous.



Anthony Odell testing for toxins.

But with research and careful monitoring in place, the likelihood of shellfish toxins affecting humans can be significantly reduced. That's the goal of ORHAB, the Olympic Region Harmful Algal Bloom partnership.

"With ORHAB, we now have a system in place that can give razor clammers and other shellfish harvesters great confidence that the shellfish they gather are healthy and safe," says Dr. Vera Trainer, program manager of the marine biotoxin group at the NOAA Northwest Fisheries Science

Center and lead investigator for ORHAB.

ORHAB was organized to develop collaboration and cooperation among federal, state and local management agencies, coastal Indian tribes, marine resource-based businesses, public interest groups and academic institutions. The ORHAB partnership investigates the origins of blooms of toxic algae, monitors when and where the blooms occur, assesses the environmental conditions conducive to blooms and toxification of intertidal shellfish populations, and explores methods that can be used to reduce HAB impacts on humans and the environment.

These actions can help coastal communities become more resilient to outbreaks of shellfish toxins. ORHAB provides these communities with tools for protecting public health, building consumer confidence in shellfish products, and enhancing local economies in the Olympic region.

The Makah and Quinault tribes, the Pacific Shellfish Institute, the University of Washington Olympic Natural Resource Center, and the Washington Department of Fish and Wildlife conduct ORHAB sampling at seven Washington coast locations with major razor clam beds and oyster or mussel aquaculture operations. Water samples are collected every week and tested for toxin, chlorophyll and nutrients. Razor clams are gathered and tested for the toxin, domoic acid.

ORHAB technicians provide a vital communications link along 300 miles of remote coastline, sharing information with other ORHAB partners and helping managers make decisions about coastal shellfish closures.

ORHAB monitors the toxic organism *Pseudo-nitzschia* and its toxin, domoic acid. Researchers also study the toxic alga that causes paralytic shellfish poisoning.

Toxins and Toxic Algae

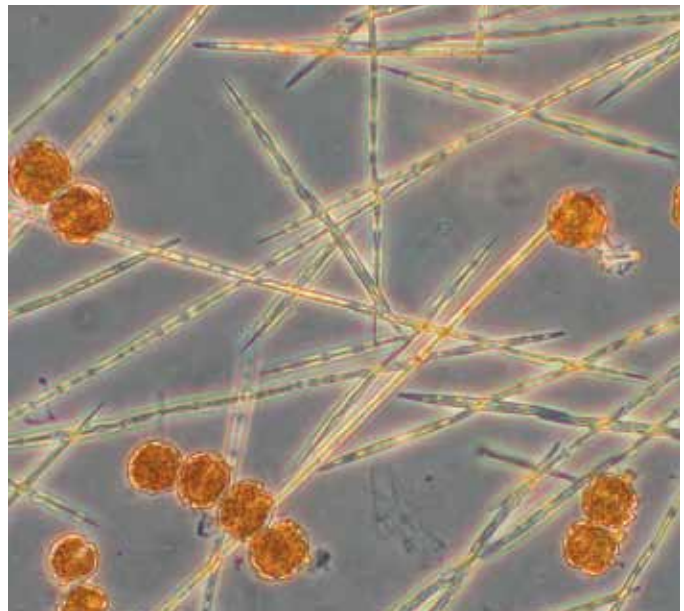
Paralytic shellfish poisoning (PSP) is caused when humans eat shellfish or crabs that have accumulated toxins by feeding on toxic algae. The toxins include saxitoxin and its derivatives, produced by a species of single-celled plankton called *Alexandrium*, a dinoflagellate. Beaches are closed to harvest when toxin measurements in shellfish or crab are at or above 80 micrograms per 100 grams of meat.

Since 1980, at least 183 cases of HAB-toxin illness and three deaths have been reported on the West Coast. Cases have been more prevalent in Alaska but have also been reported in Washington, Oregon and California. In August 2000, five people were hospitalized in Washington after eating mussels tainted with PSP toxins.

Symptoms of PSP include numbness and tingling of the lips, tongue, face and extremities, difficulty talking, breathing and swallowing, and lack of muscle coordination. There is no known antidote for the biotoxin that causes PSP, and treatment is restricted to artificial respiration in life-threatening situations.

Domoic acid poisoning, also called amnesic shellfish poisoning (ASP), is caused when humans eat shellfish that have ingested species of single-celled plankton called *Pseudo-nitzschia*, which produce the toxin domoic acid. The closure level for domoic acid is 20 parts per million in shellfish.

The symptoms of ASP range from nausea, vomiting and diarrhea to muscle fatigue, disorientation and loss of memory. They usually occur between 30 minutes to 6 hours after shellfish are consumed. If the poisoning is not severe, the symptoms disappear within a few days. In extreme cases ASP can be lethal.



Pseudo-nitzschia (long diatom) and *Alexandrium* (round dinoflagellate) that are responsible for domoic acid poisoning and paralytic shellfish poisoning, respectively.

RAZOR CLAMS AND TRIBES

Shellfish have been a vital part of the subsistence and culture of Washington's Pacific coast tribes for centuries. Today, they are also an important part of tribal economies. The rise of the importance of shellfish has coincided with the rapid decline of many western Washington salmon stocks, due in large part to habitat loss from the region's rapid population growth. Shellfish are now an economic mainstay for many tribes, according to the Northwest Indian Fisheries Commission.

The right of tribes to continue to harvest shellfish "at usual and accustomed grounds," was confirmed by a series of treaties between Northwest tribes and the federal government that date back to the 1850s. Today, tribes work with the Washington Department of Fish and Wildlife (WDFW) to develop fisheries regimes to ensure harvest opportunities for tribal and non-Indians alike.

For coastal razor clams, the WDFW estimates clam populations on various Pacific beaches, then calculates the total allowable catch for each beach based on the population estimates. On co-managed harvest beaches, the tribal treaty right is 50 percent of the total allowable catch, and the general public is allowed to harvest the other 50 percent. On off-reservation beaches, the tribes co-manage the resource with the WDFW. On these beaches, the WDFW conducts population surveys on half of the beach, and tribes survey the remaining half. The Quinault Indian Nation also fully manages its on-reservation razor clam beaches.

Three of the Olympic Peninsula's federally-recognized Indian tribes, the Makah, the Quileute and the Quinault, are involved in monitoring of coastal harmful algal bloom species.

Razor Clams and Tribal Economies

Tribes process and sell shellfish commercially at home and abroad, bringing in substantial revenues. The tribes' commercial razor clam catches are sold to licensed buyers, who then sell them to the public for consumption or to commercial enterprises for other uses, such as crab bait. Tribes contribute as much as 60,000 pounds of razor clams annually to the commercial crab bait market. Taxes collected by some tribes from their members' shellfish sales help pay for tribal natural resource programs.

Tribal razor clam allotments require that a relatively small population harvests a large number of clams, so the clamming season is extended for tribes, generally lasting from August to May or June. Commercial digs, which used to last about two hours per day, have recently been expanded to three to four hours so that the tribes can obtain their limit. Members, most of whom use shovels instead of tubes, dig clams at almost every low tide during the season.

The vast majority of the tribes' razor clam harvest goes for commercial uses. About 5 percent is harvested for subsistence and ceremonial events. The Quinault Nation is the only tribe that commercially harvests razor clams in Washington.



Ceremonies and Subsistence

Among Washington's Pacific coast tribes, shellfish traditionally have been an important part of daily nutrition and have also played a central ceremonial role in weddings, funerals and other traditional gatherings. Clams and mussels were among the favored foods at potlaches – enormous feasts marked by the host's lavish sharing of food and gifts to demonstrate wealth and generosity. Shellfish were also dried and used as goods for trade with other tribes and European settlers.

A more modern tradition, which combines aspects of subsistence, commercial and ceremonial uses, is the Quinault Nation's annual "school clothes" dig. The dig is usually held near the end of August and is open to all tribal school children. For two to three hours, children can dig clams with no limit. Afterwards, they sell the clams to local markets for about \$1 to \$2 per pound. The money they earn is used to buy school clothes for the entire year.

Today, with a tribal razor clam subsistence limit of 100 clams per person per dig, it's apparent that clams are a regular part of tribal member's daily meals. This high level of consumption has some researchers worried about the effect of chronic daily exposure to low levels of paralytic shellfish poisoning (PSP) and domoic acid toxins. Studies are under way to determine whether such exposure has long-term harmful effects.



Quinault Technician Helps Keep Clams and Public Health

Given the razor clam's importance to the culture, economy and subsistence of the Quinault Indian Nation, keeping the clam a safe and healthy food source is critical to the tribe.

Meet Jonnette Bastian. As both a Quinault Nation member and an ORHAB technician, she could be considered symbolic of the joint effort to maintain the razor clam harvest and preserve public health.

Because the Quinault Indian Nation can authorize digs for commercial, ceremonial and subsistence purposes or to supply the tribal food bank, timely testing of razor clams is vital. Bastian, who began working for ORHAB three years ago with no prior experience as a technician, learned how to conduct Enzyme-Linked ImmunoSorbent Assay (ELISA) tests for detection of biotoxins. Last spring, for example, tests conducted by Bastian on samples from Grenville beach confirmed that large numbers of razor clams harvested in a ceremonial dig were safe to eat. As Bastian says, "My job is to make sure the clams harvested are safe for human consumption. Public health is my number-one priority."



Jonnette Bastian conducting an ELISA test for toxins.



RAZOR CLAMS DRAW TOURISTS, BUT HABS AND TOXINS CAN SPOIL THE PARTY

When beaches open for recreational razor-clam digging on Washington's outer coast, an average of 12,000 people per day take advantage of the opening, according to a report by Professor Dan Huppert and graduate student Karen Dyson of the University of Washington's School of Marine Affairs. The report estimates that razor-clammers will spend 242,000 "clammer days" and \$100 per trip at various beaches along the coast in 2008.

Do the math, and the importance of razor clams to Washington's coastal economy becomes clear. Conversely, when domoic acid outbreaks close beaches to shellfish harvesting, the impacts on recreation and tourism – and local economies – are significant.

Larry Smith, owner of The Alaskan Motel in Westport, Wash., and president of the Westport-Grayland Chamber of Commerce notes that restaurants, hotels, outfitters, gas stations and other retailers benefit substantially when tourists flock to the coast for a razor-clamming weekend.

"By and large, we've done really well with the clam digs," Smith says. "It does fill up our motel. And you can imagine that

the same holds true for other businesses. It certainly is a positive economic factor."

But nature doesn't always cooperate. A HAB event that began in November 1991 forced year-long beach closures in Washington and Oregon. In Washington alone, razor clamming activity decreased by more than 240,000 trips, valued at almost \$7 million. A domoic acid outbreak in 1998 again closed razor clam beaches for an entire year, at an estimated cost of \$12 million in lost recreation spending and \$7 million from tribal commercial harvests.

The study by the University of Washington and the NOAA West Coast Center for Oceans and Human Health, completed in 2008, estimates that a cancelled season affecting all clam digging on the coast could cost the area almost \$22 million in lost revenue.

Smith says his business has experienced only "a couple" of cancelled harvests in the seven years he's owned his motel. "But when it happens, it leaves a void for us," he says. "When a beach is closed, we can't make up that business – especially in the winter months."

Estimated costs of a closure of the recreational razor clam fishery — for both an average weekend and digging season (generally October to May).

<i>Expenditure Categories</i>	North Beaches		South Beaches		All Beaches	
	<i>Avg. Opening</i>	<i>Season</i>	<i>Avg. Opening</i>	<i>Season</i>	<i>Avg. Opening</i>	<i>Season</i>
Hotel	\$387,561	\$1,413,306	\$508,691	\$2,952,918	\$980,037	\$4,664,901
Camping	\$24,949	\$88,034	\$89,515	\$527,937	\$119,502	\$632,426
Restaurant	\$276,956	\$1,009,741	\$635,210	\$3,663,012	\$970,342	\$4,876,440
Groceries	\$123,373	\$445,805	\$422,705	\$2,473,291	\$571,121	\$3,003,677
Gas and Oil	\$343,016	\$1,248,040	\$826,303	\$4,798,982	\$1,241,124	\$6,297,083
Ferry Tolls	\$2,768	\$9,503	\$952	\$6,193	\$4,335	\$17,789
Other Transport	\$3,009	\$10,773	\$64,686	\$359,638	\$67,966	\$370,582
All other retail	\$132,828	\$491,769	\$247,525	\$1,429,720	\$408,611	\$2,022,903
TOTAL	\$1,294,460	\$4,716,971	\$2,795,587	\$16,211,691	\$4,363,039	\$21,885,801

(Data courtesy of Dan Huppert, UW School of Marine Affairs.)



COUNTING CLAMS

Managing the razor clam resource is a balancing act: provide people with ample harvesting opportunities without jeopardizing clam populations. Biologists from the Washington Department of Fish and Wildlife (WDFW) put a lot of effort into collecting razor clam population information, so the state can set responsible harvest levels.

Every summer after clam season closes, the WDFW conducts a razor clam population survey along the 57 miles of clamming beaches on Washington's coast. This survey work tells scientists whether the razor clam population is at a healthy, sustainable level. The clams must be reproducing at a rate sufficient to replace the clams that have died naturally or been taken by predators or clam diggers. The population estimates dictate the length of the clamming season and the number of clams people can harvest. Is the clam population decreasing? If it is, the state will shorten the clamming season, helping the population recover and leading to longer seasons and more harvesting in the future.

To get the most accurate population estimate, the WDFW samples every mile along all 57 miles of open clamming beaches. On tribal beaches, the WDFW and the tribes split the work 50-50. At every mile, biologists run a line, or transect, perpendicular to the water, reaching from the upper limit of the clam bed, farthest away from the water, down to the water's edge. The upper limit could be as far as 600 feet from the water. Every 50 feet along this line, the surveyors make six circular holes, or "plots", either to the north or south of the line. Each plot is 0.5 square meters in area and about one meter deep and surrounded by an aluminum ring. Water is pumped into the plots through a high-pressure hose, which liquefies the sand in the plot. Clams float to the surface, where they are collected, counted and measured.

When the entire beach has been surveyed in this manner, the team calculates the clam population by taking the average number of clams per transect and expanding that density to the total survey area. The population numbers are considered fairly



WDFW employees pump water into a "plot" as part of a razor clam population survey.

accurate, because of the large number of plots per beach.

Ultimately, the careful survey work will help determine the sustainable yield for each beach. More information on razor clam population estimates is available from the WDFW at www.wdfw.wa.gov/fish/shelfish/razorclm/razorclm.htm.



UPCOMING MEETINGS AND EVENTS

2009 Satellite Workshop to the Gordon Research Conference

Early Warning and Integrated Management of Natural Toxin Events

June 19-20, 2009

Mount Desert Island Biological Laboratory, Salisbury Cove, Maine

www.mdibl.org/courses/grcsat09.shtml

2009 Gordon Research Conference on Mycotoxins and Phycotoxins

June 21-26, 2009

Colby-Sawyer College, New London, New Hampshire

www.grc.org/programs.aspx?year=2009&program=mycotoxins

North Pacific Marine Science Organization (PICES) 2009 Annual Meeting

Understanding ecosystem dynamics and pursuing ecosystem approaches to management

October 23-November 1, 2009

International Convention Center, Jeju Island, Korea

www.pices.int/meetings/annual/PICES-2009/2009-background.aspx

PICES Marine Environmental Quality Workshop and Lab Demonstration

Cyst-forming HAB species

October 23-24, 2009

International Convention Center, Jeju Island, Korea

www.pices.int/meetings/annual/PICES-2009/2009-background.aspx

Fifth Symposium on Harmful Algae in the U.S.

November 15-19, 2009

Ocean Shores, Washington

www.whoi.edu/habsymposia/

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2725 Montlake Boulevard East
Seattle, WA 98112



Published by NOAA's Northwest Fisheries Science Center
Produced by Washington Sea Grant
Funded by NOAA's West Coast Center for Oceans and Human Health
Technical Supervision — Vera Trainer, Northwest Fisheries Science Center
Keep up to date on West Coast HAB issues through the NWFS-C Web site (nwfs.noaa.gov)
hab), which features recent HAB findings from researchers, state reports and HAB occurrences, and provides links to other relevant sites, including ORHAB.
We acknowledge the following for their contributions to this newsletter:
Dan Ayres, Washington Department of Fish and Wildlife; Jonathan Bastian and Joe Schumacker, Qunaut Indian Nation; Dan Huppert and Karen Dyson, School of Marine Affairs, University of Washington; and Stuart Hyde, NOAA Hollings internship.
Photograph on page four, *The Mussel Gatherer*, is by Edward S. Curtis, from the collection of Northwestern University.

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