Washington Sea Grant University of Washington

# Sea Star

Autumn 2006

# Seafood in the 21st Century

## Meeting the Needs of Washington's Fish- and Shellfish- buying Citizenry

Newspaper headlines decrying the collapse of commercial fisheries and warning of contamination and disease in once-healthy fish and shellfish stocks — these attention-getting items have spurred the National Sea Grant Office to emphasize research and outreach in support of safe and sustainable seafood supplies.

Washington Sea Grant has been involved with these topics over several decades, hosting workshops and producing useful documents such as the *Northwest Seafood Processor's Glossary*. In recent years, however, the program's focus has changed, from efforts targeting the large-scale food processors to activities geared for smaller retailers of seafood products, as well as the consumers themselves.

"We've seen a rise in popularity of full-service counters at supermarkets," explains Steve Harbell, Marine Field Agent with Washington Sea Grant. "It's no longer a matter of selling frozen products or shrink-wrapped fillets on ice. As such, retailers now need to know much more about their wares, to establish the value of their products and answer customers' questions." Seafood • continued on page 2

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**Steve Harbell** 

The role of shoppers has changed in response to this shift. Shoppers need to know what they are buying — what's the difference between frozen and fresh, between wild-caught and farm-raised — and how to evaluate the real or perceived health risks that are associated with various products.

"We recognize that seafood consumers aren't necessarily scientists," Harbell says. "They can benefit from the knowledge we've gathered through our dealings with the industry and that we are eager to share with them."

Take, for instance, the issue of chemical contamination. "There's been plenty of media coverage of mercury and other contaminants in fish from the Great Lakes and, closer to home, among pen-raised salmon from Puget Sound," says Harbell. "The fact is, traces of contaminants are found in many of the foods we eat, including butter. Because they are concentrated in animal fat, you'll find detectable levels in many of our foods, still well below the U.S. Environmental Protection Agency's tolerance levels. So it's really a matter of relative risk, and the good news is that contamination in seafood is not a threat to diners in the Northwest." To give consumers the tools they need to weigh the issue and decide for themselves, Harbell routinely gives presentations on seafood safety to consumer groups and

Master Food Preservers, a WSU Extensionsponsored class. He recently participated in a session on seafood safety at the Sound Waters gathering in Coupeville, and has plans to offer similar sessions for seafood aficionados throughout 2007.

Harbell, along with Marine Advisory Services member Sarah Fisken and program leader Pete Granger, is presently discussing a training program with seafood retailers to enhance the expertise of seafood counter staff.

"Seafood staff, both new and seasoned, need training in where seafood comes from, how it is caught and processed, how to evaluate quality and handle seafood safely and efficiently, plus marketing, preparation and a range of other topics," says Granger.

It's an ever-changing marketplace," concludes Harbell. "We're here to help both buyers and sellers make the most of the challenges and changes they currently face."

## University Sound Partnership

A proposed new collaboration would leverage the knowledge base of Washington's two research universities to engage the public in conserving Puget Sound.

Through the University Sound Partnership, scientists and outreach specialists from the University of Washington and Washington State University would provide an innovative, community-based program to address serious environmental issues affecting the Sound. Washington Sea Grant (WSG) will play a key role in meeting these objectives.

For nearly four decades, WSG has developed outreach and education programs to translate university science for use in the marine environment. Working closely with Washington State University Extension, WSG will engage citizens in each Puget Sound county to give more than 1 million hours in public service and to implement best management practices to protect critical areas and improve water quality.

"This is a crucial moment in our region's history," says WSG Director Penny Dalton. "We're determined to do whatever we can to turn the tide of habitat loss and degradation and to motivate and train citizens to take more active parts in protecting and restoring Puget Sound. The University Sound Partnership would be a superb means for capitalizing on the combined knowledge base and outreach expertise of two powerful academic institutions."

The partnership will seek funding from the Legislature as part of the governor's Puget Sound protection initiative.

For more information on the Puget Sound Partnership, contact Penny Dalton at 206.543.6600 or *pdalton@u.washington.edu*.

# Device Detects Domoic Acid, ASP Danger, Thanks to WSG-Funded Project

**S** eafood aficionados are finding a good friend in the surface plasmon resonance (SPR) biosensor system, pioneered by Washington Sea Grant-funded scientist Clement Furlong, a geneticist with the University of Washington's departments of Genome Sciences and Medicine.

"The SPR biosensor can detect the chemical remnants of pesticides and other toxic compounds in remarkably minute quantities — two or three parts per billion, in the case of protein toxin concentrations," says Furlong. "Plus, the sensor can detect these potentially lethal compounds quickly, on site, if necessary, at a fraction of the cost of analysis conducted in an off-site laboratory."

These attributes make the SPR biosensor ideally suited for rapid field quantification of toxin levels in shellfish and the sea water in which they live. In this way, consumers' concerns about domoic acid, the naturally produced compound responsible for amnesic shellfish poisoning (or ASP), can be allayed.

Domoic acid is a potent neurotoxin found in several members of the diatom genus *Pseudo-nitzschia*. During large blooms of these diatoms, filter-feeding marine organisms such as clams, oysters and mussels (as well as seabirds, crabs and other animals that eat



them) consume *Pseudo-nitzschia*, stockpiling the toxins these microscopic organisms contain. The toxins do not adversely affect the shellfish, but they can cause serious harm to those who feed on the shellfish's flesh. Symptoms of ASP include intestinal distress, short-term memory loss and difficulty breathing. In severe cases, ASP can be lethal.

"Detection of domoic acid in shellfish has become an essential part of effective fisheries management," says Furlong. "However, until recently, detection methods were cumbersome, costly and timeconsuming."

Furlong's device has changed all that. The key unit of the SPR biosensor is an inch-long chunk of black plastic, wired to a main processing element. The biosensor measures changes in the refractive index (or RI) on its gold-plated surface. If domoic acid is present in the sample being studied, it will displace or compete with antibodies binding to to the gold sensor surface. This causes the RI to decrease. The change in the RI is converted to an electronic signal, which can then be analyzed by sensor software.

Amply warned of the presence of *Pseudo-nitzschia* and domoic acid in Puget Sound or the Pacific Ocean coast, resource managers and park rangers can call a halt to shellfish harvesting at certain beaches, until the threat of ASP has passed.

Furlong is now looking at ways to direct the SPR biosensor toward other naturally occurring toxins in seafood. If all goes as planned, he may be the first to develop a reliable method for controlling ciguatoxin, a compound produced by the marine microalgae *Gambierdiscus toxicus* in tropical and subtropical seas. When diners ingest ciguatoxin in seafood, they may succumb to ciguatera, an extremely serious illness that, each year, affects an estimated 50,000 individuals worldwide.

Clement Furlong

The SPR biosensor, a tiny but powerful new tool for detecting the ASP toxin in shellfish.



arine Habitat V Specialist Jim Brennan is representing Washington Sea Grant at workshops on Jefferson County shoreline issues. The Puget Sound Action Team and the Jefferson County Marine Resources Committee are funding the workshops. Workshop topics include coastal geology, shoreline and estuarine ecology, water quality and human impacts to Puget Sound shorelines. Jim's presentation on October 14 in Port Hadlock, will examine marine riparian areas and their influences on the nearshore environment. For more information, contact Brennan at 206.616.3368 or jbren@u.washington.edu.

By collaborating with the University of Alaska, Eric Olsson, Washington Sea Grant's Oil Spill **Prevention Education** Specialist, is taking "distance learning" to new lengths. Eric is developing course modules for oil and hazardous material spill prevention and response. The modules will be part of a new University of Alaska online course targeting port and marina operators. Eventually, Eric intends to adapt his modules for use as stand-alone education and training tools. Contact Olsson at 206.685.8286 or olsson@ u.washington.edu.

### WSG Continuing Education Coordinator Julie Hahn,

who serves on the board of directors of the Northwest Marine and Aquatic Educators Association, was recently chosen to represent that group on the board of the National Marine Educator Association for 2006-2007. In addition to representing the region's interests on the national board, Julie will participate in outreach activities for both organizations at events throughout Alaska, Oregon, Washington and British Columbia.



# **Guest Editorial:** Shellfish Growers Catching the Susta



With this issue, we are inaugurating a new feature - a guest editorial by one of our partners in marine resource management, ocean technologies, ecosystem health, coastal economic and community development or education, training and public information. Interested in being considered for a future editorial? Contact Sea Star editor David G. Gordon at 206.685.8191 or *davidg*@ u.washington.edu. Photo: PCSGA.

By Robin Downey, Executive Director, Pacific Coast Shellfish Growers Association

The sustainable seafood movement is taking the marketplace by storm. References to sustainable seafood abound in newspapers, magazines, grocery store aisles and even restaurants, with a growing number of labels and guides that tell consumers their wild-caught or farmed seafood product was sustainably produced or sourced. The non-profit world is investing heavily in expanding the seafood sustainability cause. The Packard Foundation has invested \$10 million, and leveraged another \$10 million in private funds, to establish Sea Change, an investment fund intended to do just that.

There's no denying that the "sustainability wave" is changing the way the world shops, and the way retailers buy. Evidence of that can be seen in Wal-Mart's recent decision to purchase shrimp only from producers that carry the Aquaculture Alliance label and wild products that are endorsed by the Marine Stewardship Council (MRC). Whole Foods Market, the world's largest retailer of natural and organic foods, has also recently announced they will only purchase seafood with the MRC label.

Farmed molluscan shellfish top the list for sustainability features — no feeds are required, no growth hormones are administered and, by the very act of feeding, the shellfish themselves help to keep marine waters clean. However, no program has existed that allow shellfish farmers to compete in this niche market.

Pacific Coast shellfish growers are rectifying that situation through the creation of a new environmental certification program. The "Pacific Coast Shellfish (PCS) – Certified Sustainable" label is designed to tie in with the Pacific Coast Shellfish Growers Association Environmental Codes of Practice. Produced through financial assistance from NOAA and Washington Sea Grant, the codes serve as the foundation for growers to develop their own individual environmental farm management plans. To participate in the program, growers are required to develop their own farm plan and implement best management practices accordingly on their farms.

A non-profit organization, the Certified Sustainable Shellfish Council, is being formed to oversee the program. The Council includes representatives from the environmental community, chefs, retailers and research and development institutions, in addition to growers. While the certification program is intended to serve the West Coast initially, organizers envision that it may have applicability on a broader,

### SEA GRANT PUBLICATIONS

Many marine-related publications are available from Washington Sea Grant.

To order publications: Washington Sea Grant Publications, University of Washington, 3716 Brooklyn Ave. N.E., Seattle, WA 98105. 206.543.0555. Fax 206.685.0380. sgpubs@u.washington.edu, wsg.washington.edu.



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# inable Seafood Wave

possibly national scale in the future.

The Washington State Department of Agriculture (WSDA) has provided funds to develop marketing materials for the new labeling program, which growers will be unfurling at local shellfish festivals and events beginning this fall. WSDA funds will also help launch a new "Chef Connection" initiative to introduce the program to chefs in the coming year.

Let's watch and see, with aid from WSDA, support from NOAA and Washington Sea Grant, and leadership from the Pacific

Coast Shellfish Growers Association, to what new heights the sustainability wave will carry us in 2007.



## New Director for National Sea Grant Office

WSG welcomes Leon Cammen, new director of NOAA's National Sea Grant College Program. Cammen has been with Sea Grant since 1990 and has served as a program officer, research director, acting deputy director and, most recently, acting director. Since 2004, Cammen has been the program manager for NOAA's ecosystem research program. He is the author of more than 30 publications in marine ecology and biological oceanography.



Leon Cammen Photo: NOAA.

## **Crabber/Towboat Lane Meeting**

Agreement on November 9, at the Port of Astoria, Oregon. Details of this carefully crafted agreement, which established areas where crab gear would not be set, providing lanes for tug and barge traffic, will be discussed. Your input will help fine-tune the process, which has already saved millions of dollars in gear and vessel repair costs for both user groups. For meeting details, contact Steve Harbell at *shrbell@u.washington.edu* or 360.3875.9331.

## The Season for Skill-Building

Cooler temperatures signal the start of a new season of marine safety and technical training workshops, offered by Washington Sea Grant. First on the roster is a Commercial Fishing Vessel Safety Course, November 13 -15 in Long Beach, Washington. Other classes — on Salmon Quality, Diesel Engine Repair and Safety at Sea — will soon follow. For details or to register for these learning opportunities, some US Coast Guard-approved, contact Sarah Fisken at *sfisken@ u.washington.edu* or 206.543.1225 or Steve Harbell, at *shrbell@u.washington.edu* or 360.875.9331.



Workshop attendees get in-depth training that can save money and lives on the open sea.

# State of the Oyster Study Keeps Tabs on Shellfish Sites

his past summer's unusually warm temperatures brought increased levels of the disease-causing bacterium *Vibrio parahaemolyticus* in oysters from southern Puget Sound and throughout Hood Canal. To prevent outbreaks of the disease among oyster lovers, Hood Canal and South Puget Sound residents began collecting shellfish samples from their beaches. The samples were submitted to a private certified lab for *Vibrio* testing.

As she has done for several prior summers, Teri King, Washington Sea Grant's Marine Water Quality Specialist, worked with the residents to ensure that the shellfish were collected properly and delivered expeditiously to the lab for testing. She helped with the staffing of several shellfish sample drop-off sites and assisted residents to interpret the lab tests. If the test results revealed high bacteria levels, she recommended actions that people could take to keep their beaches disease-free.

According to King, Hood Canal watershed resident Judy Likkel launched the project in 1987 – the year that a large shellfish growing area in Lower Hood Canal was closed by the Washington State Department of Health (DOH). The cause of that closure was fecal colliform bacteria, an indicator of animal or human feces in the oysters' watery surroundings. Likkel's State of the Oyster Study encouraging neighbors and friends to start gathering shellfish samples on their beaches for testing. The samples were also tested for *Vibrio*. Waterfront property owners paid a modest fee for this service.

Today's State of the Oyster Study has a distinct, neighborly feel. Individual test results are shared with fellow shoreline dwellers and summarized in *Oyster Gnus*, a grassroots publication featuring Delilah, the Talking Oyster. Deliah often speaks in rhyme: in August, for example, she reported, "Slurping raw oysters was a bummer this summer."

Now, with support from the Puget Sound Action Team, Washington Sea Grant will pick up the tab for test fees if Hood Canal residents will survey their waterfront properties for signs of failing septic systems — prime contributors of fecal coliform bacteria.

"This is one more way that citizens, state agencies and Washington Sea Grant can collaborate to ensure that Puget Sound's resources will be safe and delicious," says King.



At a drop-off site in Belfair, WSG's Teri King (right) accepts samples from a State of the Oyster Study participant.

# Fun and Informative — Fall Gatherings

Look for our booth at two of our favorite fall venues in Seattle. We'll be there, along with an assortment of give-aways and Sea Grant publications.

## Saturday, November 4 at Elliott's Oyster New

Year Bash, a food-lover's paradise and fundraiser for shellfish restoration projects, hosted by Elliott's Oyster House on the Seattle waterfront. For information and tickets, visit the Elliott's Web site, *www.elliott'soysterhouse.com/ony.cfm* or call the restaurant at 206.623.4340. November 16 - 18 at Pacific Marine Expo, the

West Coast's largest marketplace for the working waterfront, at the Qwest Field Event Center in Seattle. A highlight this year: an "Understanding Salmon Markets" seminar, conducted by WSG's Pete Granger, as part of a four-hour Fishing Business mini-conference hosted by the Alaska Sea Grant College Program. For information, visit the Expo site, *www. pacificmarineexpo.com/06/public/enter.aspx* or contact Pete Ganger at *pgranger@u.washington.edu* or 206.685.9261.

# What Makes *Heterosigma* Slick? UW Researchers Aiming to Find Out

n the summer months, when rain follows a hot, dry spell, a planktonic organism known as *Heterosigma* forms clusters, or blooms, on the surface of northern Puget Sound and the Juan de Fuca and Georgia straits. When this happens, the ordinarily lifesupporting plankton community becomes deadly to almost every fish it encounters.

A recent bloom near the Strait of Juan de Fuca killed many thousands of fish, mostly penned salmon, valued at more than \$2 million. Fish in net pens are particularly vulnerable to *Heterosigma*, but wild salmon, forage fish and many other organisms in the affected water column also can be harmed.

Two University of Washington researchers, Biology Professor Rose Ann Cattolico and School of Oceanography Associate Professor Daniel Grunbaum, are doing cutting-edge research to find out what stimulates this particular species of algae. Their work on *Heterosigma* is funded by Washington Sea Grant.

"Conditions were perfect" for the most recent bloom, Cattolico says. "Runoff from the Fraser River creates low-salinity water over high-salinity water. The organisms swim up toward the surface and get trapped in the low-salinity water. Low salinity suppresses normal turbulence across the layer, so the *Heterosigma* stay there – like foam on the top of your latte."

Grunbaum, who specializes in biological oceanography, is studying spatial ecology – how organisms move around and find what they need to survive. *Heterosigma*, he says, has two unusual characteristics, compared to most other algae. First, it is unusually tolerant of a wide range of salinities. This means that it can survive and even thrive in low-salinity surface layers, where it can form a "slick" — a dense and toxic bloom.

Second, *Heterosigma* cells are fast and determined swimmers. This swimming behavior may be key to the formation of harmful blooms, because the two most important resources *Heterosigma* needs for rapid growth — sunlight and nutrients — are found in different parts of the water column. "*Heterosigma* cells' unusually strong swimming ability lets them 'commute' between deep water, where they acquire nitrogen and other nutrients, and shallow water, where they can get the sunlight they need to convert those nutrients into more *Heterosigma* cells," Grunbaum says.

At least that is what happens under normal circumstances. Under special conditions that are not

yet fully understood, *Heterosigma* cells swim up but do not go down again. This results in huge aggregations of potentially toxic cells – a harmful algal bloom, or HAB. Low-salinity surface layers appear to be one of those conditions. "We used to think that high numbers of *Heterosigma* cells cause a toxic bloom" says Grunbaum, "but now we think HABs are formed by a two-stage process. Having a large cell population is like loading a gun; it takes an environmental event like a low-salinity layer to pull the trigger."

Understanding how cells' swimming behavior interacts with environmental triggers to cause HABs is the focus of Grunbaum's research on *Heterosigma*. When *Heterosigma* blooms, do cells change how they move? Does some kind of "pack behavior" take over? If their behavior changes, how does it change, and can the changes leading to harmful blooms be predicted? These are some of the questions Grunbaum is tackling.

Cattolico, meanwhile, is growing *Heterosigma* to explore some fundamental questions about how the organism works when it resides in a laboratorygenerated slick. "How differently does a cell function when it is living in a diffuse versus a jammedtogether state?" she asks. "Does a slick-residing cell produce different toxins or more potent toxins? How quickly does a slick-restrained *Heterosigma* population increase? Do slicks favor cells that are genetically programmed to have an increased survival in the "jammed" state?"

*Heterosigma* must photosynthesize to survive. Cattolico and colleagues have just mapped out the DNA in the organism's chloroplasts. This information will now allow her to better analyze how these slick-restrained cells respond to different environmental signals.

This genetic information will also enable Cattolico and Grunbaum to "fingerprint" strains of *Heterosigma* from different parts of the world. They intend to study the strains' behaviors to see if they have different mechanisms for forming slicks. Well before slicks begin to form and cause harmful effects in Puget Sound or the Straits, samples from seawater and sediments could perhaps tell observers about the type or types of *Heterosigma* that are present, their origins, how efficient they are at forming slicks, and how toxic those slicks could be. This would be valuable information for the state's commercial fishing and aquaculture industries, as well as for fisheries and industries throughout the world.



Heterosigma is a single-celled alga in the family Raphidophyceae. Because it lacks a rigid cell wall, it can change its shape. Most often it looks like a "swimming cornflake," according to NOAA scientists.





In a flask without a low-salinity layer (top), a dense population of Heterosigma cells remains mixed throughout the water column. However, when a low-salinity surface layer is added (bottom), the cells rapidly aggregate into a toxic slick.

# Fresh Fellowships/Internships Report



The newly updated *Fellowships* for the Future presents a photoillustrated overview of opportunities for undergrads, graduate students and doctoral and post-doctoral candidates to gain direct experience in marine policy-making, industrial innovation, coastal planning, communications and marine population dynamics and resource management. As this helpful document notes, Washington Sea Grant leads all other Sea Grant programs in successfully placing fellows in these disciplines. The document is available in a downloadable PDF format on the Washington Sea Grant Web site www.washington.edu) or by mail (large-quantity orders only) at spubs@u.washington.edu or 206.543.0555.



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