

Sea Star

Geoduck Aquaculture

Washington Sea Grant Coordinates Effort to Understand What's at Stake

The pros and cons of geoduck farming have become topics of heated debate among shellfish growers and shoreline property owners in the Pacific Northwest. Both sides point to the lack of information about the effects of geoduck aquaculture on intertidal areas. In response, the Washington State Legislature recently asked Washington Sea Grant to gather information on geoduck farming, on which future decisions about the management of on-bottom shellfish aquaculture activities can be based.

As requested by the State Legislature, WSG will review existing scientific information on geoduck farming. "We will be contracting researchers to compile all the relevant literature on geoduck aquaculture in the Pacific Northwest and also for items about on-bottom aquaculture

for other types of shellfish, where applicable," says Raechel Waters, WSG's Associate Director. "It is our goal to assemble a base of information to help identify and evaluate any data gaps and information needs, which, in turn, will aid us in determining areas where additional research may be needed."

The Legislature has also asked WSG to select and manage scientific research contracts for the purpose of assessing the effects of geoduck aquaculture on the Puget Sound and Strait of Juan de Fuca environments. The research will examine key uncertainties relating to the ecosystem and

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Raechel Waters, WSG's Associate Director (above), will help coordinate the autumn workshop and contribute to the selection of subsequent research projects, which may include studies of hatchery-reared juveniles (right) and the potential environmental effects of geoduck farms (below).
Photo below: Taylor Shellfish

community effects of geoduck aquaculture and its implications for the health of existing wild geoduck populations.

The geoduck is North America's largest burrowing clam. Individuals can attain a shell length of 10 inches and typically weigh in at an average of one to three pounds, with an occasional specimen reaching a 15-pound heft. The most distinctive feature of this bivalve is its siphon, which can extend about three feet, enabling this animal to survive at what is known as a "refuge depth," far below the seafloor's surface, beyond the reach of most shellfish predators.

Geoducks are long-lived animals, capable of surviving in the wild for 150 years or more. They are broadcast spawners and a female may produce about five billion eggs in its lifetime. (In comparison, a human female produces about 500 eggs in her lifetime). With such fecundity and few predators, it's no wonder that wild geoducks are so abundant in Puget Sound. The Sound's geoduck population is currently estimated at 674 million pounds, of which approximately 163 million pounds are available for commercial harvest.

Commercial harvesting of geoducks from the wild began in the early 1970s and continues to this day. Until fairly recently, clams in this fishery were gathered from the wild, solely by scuba divers equipped with high-pressure water hoses to blast the deep-burrowing clams from the subtidal sediments. Geoducks imported to Asia can fetch prices of up to \$30 per pound, fueling a market currently estimated at around \$80 million annually in Washington and British Columbia.

Over the past decade, the harvest of wild geoducks has been augmented by geoduck aquaculture in intertidal areas. By planting geoduck seed from hatchery sources, shellfish farmers can produce market-sized geoducks in about four to seven years. Washington's geoduck farms are presently producing about 875,000 pounds of the clams per year. That



compares to about four million pounds of wild geoducks harvested from submerged tidelands each year. Totaled, the two figures account for nearly half the world's supply of geoduck meat.

Several potentially significant effects of geoduck aquaculture warrant close attention, according to WSG-funded researcher Carolyn Friedman, an associate professor with the University of Washington's School of Aquatic & Fishery Sciences. One of these pertains to the production of geoduck seed for large-scale plantings. Over-dependence on a single hatchery broodstock could reduce the genetic diversity among wild populations. That might make the state's geoducks less resistant to certain shellfish diseases and less adaptable to the range of conditions in Puget Sound and the Strait, Friedman says.

A second consideration is the effect of geoduck farming on intertidal and subtidal communities of animals and plants. Today's geoduck farmers use short segments of PVC pipe and plastic netting to exclude clam-eating predators during the young geoducks' initial years of growth. Whether the pipes and netting are altering the composition of eelgrass beds and other important nearshore habitats has yet to be determined, says Friedman.

The third topic of concern is centered around any possible damage to the intertidal habitat caused by the harvesting of farmed geoducks, including the removal of pipes and netting. Populations of aquatic plants, as well as marine worms, crustaceans, bivalves and other sediment-dwelling creatures, could be adversely affected by the disturbance to their habitats. Whether natural recruitment by populations outside of the acreage being farmed could offset any damage has yet to be determined.

"That's why we need to gather and study additional data," says Waters. "There's been a tremendous surge in interest in geoduck aquaculture, but we just don't have enough information to assess the potential benefits and drawbacks to the ecosystem, or if there are measures that can be easily taken to offset any disruption of the natural systems in Puget Sound."

In conjunction with the data-gathering phase of the project, WSG will host a workshop this fall on the state of our understanding, focusing specifically



on the cultural, economic and biological aspects of geoduck harvesting. The workshop will draw on the expertise of national and international authorities. Their input will help others identify informational gaps and help set priorities for future WSG-funded research. One of several tangible products from this workshop will be a briefing document, summarizing the information presented at this event.

Following the workshop, WSG will solicit proposals for a series of research projects, intended to examine key uncertainties relating to the ecosystem and community effects of geoduck aquaculture and its implications for the health of existing wild geoduck populations. The State Legislature has identified an assortment of topics that warrant further scientific scrutiny, including possible impacts of the use of sterile triploid geoducks, similar to the so-called “sexless” oysters created in the mid-1980s by researchers at the University of Washington. Other research efforts could focus on geoduck parasites and diseases, impacts from geoduck harvesting, and the extent to which farmed geoducks alter the ecological characteristics of overlying waters while the tracts are submerged at low tide.

“Ours is the logical program to coordinate the research and disseminate key findings among the people who need it,” offers Waters. Indeed, WSG-supported research was instrumental in the development of the triploid oyster — a hatchery creation that today accounts for roughly one-third of all canned and jarred oysters sold in the state. In the early 1980s, WSG research and outreach efforts were important in establishing Washington’s Manila clam industry (see related story on Page 4). More recently, WSG-initiated research in geoduck clam genetics is providing insights into the management of wild and cultured stocks of these economically important bivalves. Several research projects on shellfish biology, ecology and disease are now under way.

WSG Water Quality Specialist Teri King has also facilitated and coordinated many State of the Oyster shellfish sampling events for waterfront property owners to determine the levels of pathogens in shellfish from their beaches. To protect shellfish operations from the effects of oil and chemical spills, WSG’s Oil Spill Prevention Education Specialist, Eric Olsson, assisted in planning and presenting an in-depth HAZMAT course for local shellfish growers. In addition, the program’s communications and outreach efforts have directly impacted Washington’s shellfish industry. *Small-Scale Clam Farming for Pleasure and Profit* and *Heaven on the Half Shell: The Story of the Northwest’s Love Affair with the Oyster* are considered the definitive works in their fields.

“We’re optimistic that Washington Sea Grant can help to resolve the geoduck controversy,” says the program’s Director, Penny Dalton. “In the past, we’ve demonstrated our commitment to marine habitat protection and to sustainable use of ocean resources. Our goal is to ensure that people understand geoduck issues and that good scientific information is available to manage geoduck aquaculture.”



Farmed geoducks are protected from predators by PVC pipe covered by plastic mesh.

Photo: Taylor Shellfish

New WSG-Nominated Knauss, Fisheries Fellows

Congratulations to Katrina Lassiter (UW School of Marine Affairs) and Deborah Glickson (UW Oceanography), newly accepted Dean John A. Knauss Marine Policy Fellows for 2008. This Knauss Fellowship program provides eligible graduate students with a year of work experience on the staff of the U.S. Congress or with a federal agency addressing marine issues. Over the years, more than 60 fellows have been selected from WSG nominations — more than any other Sea Grant program in the nation.

This spring, Lassiter defended her Master’s thesis on the assessment and design of signage as a strategy for marine environmental education in Island and Jefferson counties.

Over the summer, she’ll continue her work with the Northwest Straits Commission and assist in teaching a UW biology class. In the fall, she will present a paper at the Coastal and Marine Tourism Conference in Auckland, New Zealand, and then spend time traveling.

Glickson will be finishing her Ph.D. dissertation on the spatial pattern of geological processes in mid-ocean ridge systems and attending the ESRI Education User Conference in San Diego to learn more about integrating geographic information systems with education and outreach.

Congratulations also to Carey McGilliard (UW School of Aquatic & Fishery Sciences), who received the Sea Grant/NOAA Fisheries Fellowship in Population Dynamics for 2007-2010. Her work is focused on evaluating stock assessment methods and management strategies for spatially heterogeneous fish stocks. Carey defended her Masters thesis this spring and has begun working on her Ph.D.



Throughout the summer, **Communications Intern Megan Burbank**, a Smith student minoring in photography, will be photo-documenting various WSG events and funded research projects. Her contributions will greatly enhance WSG's stock of images for *Sea Star* and other Communications products, in print and online.

Marine Conservation Specialist Ginny Broadhurst has been appointed interim director of the Northwest Straits Commission, following the departure of Lew Moore. Ginny has been managing the marine program for the Commission for the past four years. Her office is in Mount Vernon. Contact Broadhurst at 360.708.3559 or broadhurst@nwstraits.org.

Mark Gleason, a first-year Masters student with the UW School of Marine Affairs, is currently conducting research for WSG on training needs for counter staff in the retail seafood industry. WSG has offered such training in the past and is interested in assessing current needs as the industry becomes more active in marketing and selling sustainable seafood products.

WSG Marine Advisory Services and Alaska Sea Grant Marine Advisory Program are revising their *Fishermen's Direct Marketing Manual*. This popular publication assists commercial fishermen in selling their catches directly to consumers, restaurants and retailers. The original document was published in 2003 and the update should be ready for distribution in September. For more information about this project, contact Pete Granger, MAS Program Leader, at 206.685.9261 or pgranger@u.washington.edu.

Sea Grant and Shellfish: Lookin

by Carolyn White

Washington currently leads the nation in production of commercially farmed clams. Thirty years ago, before Washington Sea Grant became involved in nurturing the sustainable, environmentally sound use of marine resources, the scene wasn't nearly as rosy for clam farmers — or for shellfish aficionados in the Evergreen State.

Two clam species are commonly cultivated today: native littleneck clams (*Protothaca staminea*) and introduced Manila clams (*Venerupis japonica*). In relatively recent times, geoduck clams (*Panope abrupta*) have also been farmed (see related story on page one of *Sea Star*). Washington's Manila clam farming produces 8 million pounds of clams a year. At a retail price of approximately \$3.50 to \$4.50 per

pound that averages out to about \$32 million per year generated by this one species.

Until the 1960s, commercial clamming was a relatively small enterprise, focused primarily on the harvesting of native littleneck clams, using seed from wild stocks. At the time, the Manila clam, which had been inadvertently introduced in the 1930s and early 1940s, along with imported Pacific oyster seed, was underutilized. Its markedly different appearance from the native littleneck made this clam less appealing to consumers and, although Manilas were abundant and inexpensive, they were of little value to local diners.

With the influx of Vietnamese immigrants after the Vietnam War, the Manila clam's value began to escalate. "The Vietnamese people bought up the abundantly cheap Manila clams and began serving them in their restaurants," says Ken Chew, professor emeritus at the University of Washington's School of Aquatic & Fishery Sciences and a commissioner for the Washington Fish and Wildlife Commission. The word spread and, soon, non-Vietnamese diners began requesting the succulent non-native clam as a main course and side dish. Shortly thereafter, the Manila began appearing on restaurant menus throughout the state. By the late 1970s, the price of Manila clams matched that of the native littlenecks, and today they are by far the preferred and most lucrative steamer clam species farmed.

Before the Manila clam's rise to fame, however, Chew and fellow researchers had already proposed that this species be considered a candidate for

WSG-funded research on clams has paid off, to the tune of \$32 million a year.



At this year's National Aquaculture Extension Conference in Cincinnati, **Marine Field Agent Steve Harbell** moderated the session on shellfish aquaculture. The session included presentations on shellfish sanitation, restoration projects and shellfish ecology, as well as Harbell's talk about research and outreach results from several projects pertaining to the impacts of shellfish culture on estuarine systems on the West Coast.

Russ Herwig, WSG's Marine Ballast Water Specialist, and his UW research team will soon be working with a Texas company, Severn Trent De Nora, LLC, to evaluate the efficacy of their BalPure® ballast water treatment equipment onboard a SeaRiver Maritime petroleum tanker. The new equipment will be installed on the tanker this fall while she is in dry dock for periodic maintenance. At least three tests will be conducted in the Gulf of Mexico when the ship

is returning from Florida to a Texas refinery. Herwig previously performed preliminary studies of the treatment system in small-scale experiments conducted at the US Geological Survey field station on Marrowstone Island. The National Sea Grant Program is providing funds for the shipboard tests.

SEA GRANT PUBLICATIONS

Many marine-related publications are available from Washington Sea Grant. To order publications: WSG Publications, University of Washington, 3716 Brooklyn Ave. N.E., Seattle, WA 98105. 206.543.0555. sgpubs@u.washington.edu, wsg.washington.edu.

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aquaculture. However, much more information would be needed before this species could be cultivated. The clam's habitat requirements had yet to be determined, Chew recalls. "Some tidel flat areas had high populations of Manila clams, while other areas that appeared to be suitable had no clams at all," he says.

With Washington Sea Grant funding, Chew and several other UW researchers collaborated with the Washington Department of Fisheries and with individuals within the shellfish industry on studies that would enhance Manila recruitment and optimize clam-farming techniques.

"It took years of research to study the biology and to test various methods to enhance Manila clam growth and survival," notes Chew. The studies would not have even been possible without the active participation of both small- and large-scale growers, who granted the use of their tidelands as study plots. It was a win-win situation, according to Chew. "In the process, the growers learned from us some of the important techniques that can be used to improve survival and growth of planted Manila clam seedlings produced in hatcheries," he says.

Chew and student researchers presented their findings every year at the WSG-sponsored Conference for Shellfish Growers, a forum that, to this day, allows researchers to share new information gleaned from current research with individuals in the aquaculture industry and resource management arena. In addition, Chew worked with several of his students to publish the now-classic *Guide to*



Manila Clam Culture in Washington, released by WSG in 1992. Essentially a compilation of all of the information that was gained from graduate student studies, the guide discusses the Manila clam's biology and life history, plus ways to reduce predation, prevent diseases, monitor for pollution, produce seed in the hatchery and raise juvenile clams to become harvestable adults.

Chew also worked closely with Derrick Toba, one of the original clam guide's authors, to produce *Small-Scale Clam Farming for Pleasure and Profit in Washington*, an updated summary of the original Manila clam guide, published by WSG in 2005. "All of the research that went into this guide has greatly assisted the Manila clam industry, providing a foundation of knowledge on which others within the industry can build," says Chew. "I'm grateful to Washington Sea Grant for recognizing the importance of shellfish aquaculture and for supporting activities that examine its place in our everyday lives."

At his UW laboratory, professor Ken Chew and others perfected Manila clam propagation techniques in the late 1980s.



Marcus Duke, WSG Web Editor

Welcome Aboard, Marcus Duke

Many of you already know Marcus Duke as the Webmaster, information specialist and archivist for the UW School of Aquatic & Fishery Sciences. In April, Duke became a member of the WSG team when he accepted the part-time position of Web editor with us. The accomplished technical editor is also directing his talents toward scientific document production, most recently for a series of reports by the Puget Sound Nearshore Partnership.

Duke's primary education was in classical music, having attended Performing Arts High School, Juilliard School of Music and Mannes College of Music in New York City. He moved to Washington in 1979, where he took a job with the UW's School of Fisheries Publications Office and, essentially, has remained in that capacity ever since.

"Marcus had already proved his worth over the past four years, working for us as an editor and Web authority, on a project-by-project basis," says Dan Williams, WSG Communications Manager. "We're fortunate to have him here on a steady basis."

Duke can be reached at mduke@u.washington.edu and 206.685.0171.

Kudos for King

At this year's graduation ceremony for UW College of Ocean and Fishery Sciences students, WSG Marine Water Quality Specialist Teri King was presented with an Outstanding Staff Award from COFS.

"We are all aware of the challenges facing Puget Sound to keep the water clean and healthy," Dean Arthur Nowell noted in his remarks at the ceremony. "Teri has organized dozens of meetings of shellfish growers, brought fourth grade school children to the Oyster Fest to learn about how oysters filter water and has organized such wonderful-sounding events as 'Septic Socials'... getting waterfront homeowners to meet and talk about how to improve septic systems so that the waters of Hood Canal are not contaminated."

Before joining the Washington Sea Grant team in 1990, King worked as a fisheries biologist for the Washington Cooperative Fish and Wildlife Research Unit. She also worked for the Alaska Sea Grant Program and as a biologist and chemist in the University of Washington School of Fisheries, aquaculture/genetics unit. In 2004, she received an Achievement Award from the Hood Canal Coordinating Council.

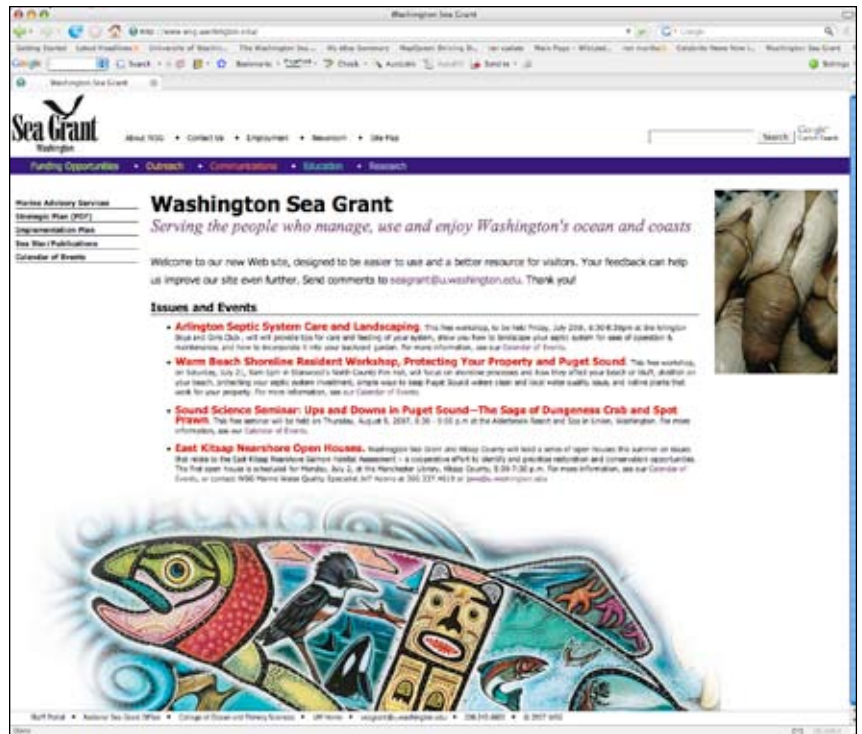
New WSG Publication

Gathering Safe Shellfish in Washington is an updated eight-page guide for recreational harvesters on the state's bounteous bivalve beaches. It describes paralytic shellfish poisoning and its relationship to "red tides," and includes illustrations of commonly harvested shellfish in Washington. Especially useful are the Web addresses and toll-free phone numbers of shellfish safety hotlines in Washington, Oregon, California and British Columbia. This indispensable document is available online, in a downloadable PDF format, at wsg.washington.edu/mas/pdfs/SafeShellfishBooklet.pdf. For multiple copies, contact WSG Publications at sgpubs@u.washington.edu or 206.543.0555.



WSG's Fresh Face in Cyberspace

Have you visited our Web Site lately? We think you'll be pleasantly surprised. Every page has been redone, and several new user-friendly features have been added. Still more changes and additions are in the works, so bookmark this link, wsg.washington.edu, and drop by for the latest on WSG programs, services and special events.



Photos: Megan Burbank

Washington Sea Grant Safety Training

All in a Day Aboard the *Aldabaron*

In June, MAS outreach specialists Sarah Fiskén, Steve Harbell and Eric Olsson traveled to the north Olympic Peninsula, to conduct a Sea Safety and Survival workshop aboard the *Aldabaron*, a commercial purse seiner, moored at the Port of Port Townsend's Boat Haven.

Clockwise from top left: three skippers and four crewmembers were put through the paces, as they learned how to work with hand-held flares; maneuver in an inflatable life raft; respond to a simulated fire in the ship's cabin; and don survival suits and link up, forming a chain of survivors at sea.

To find out about future opportunities to participate in a Coast-Guard-approved training, contact Sarah Fiskén at 206.543.1225 and sfisken@u.washington.edu or Steve Harbell at 360.875.9331 and sharbell@u.washington.edu.

Boater Information System Goes Live, with Support from WSG



Just in time for the balmy weather, WSG-funded researchers David Jones and Janet Olsonbaker, both with the UW's Applied Physics Laboratory, have launched their new Boater Information System, or BIS.

Delivered via a Web portal, this useful decision-making tool will help the region's sailing and

motoring enthusiasts plan trips on Puget Sound. To develop BIS, Jones, Olsonbaker and others surveyed 610 weekend cruisers, sailors, windsurfers, kayakers and commercial and sport fishers. They then analyzed how these people use information and what decisions they would need to make in planning their outings. Throughout the three-year development cycle, an 18-member BIS Advisory Board critiqued the development of both the products and their delivery to various types of boaters.

BIS shows the interaction of four types of boaters' most requested data — winds, currents, tides and temperature — for up to 72 hours, at 12-kilometer resolution. With this new tool, boaters can overlay these different types of data on the same chart, creating a composite view of various kinds of forecasts. They can also draw a route on the chart of Puget Sound and see the latitudes and longitudes for each selected waypoint.

Of interest to racing sailors is the interaction of currents and winds at critical passages. "BIS can tell them at a glance if their selected route is a wise choice at a particular time of day," says Olsonbaker. "That's the real genius of BIS."

BIS is accessible at http://bis_portal.apl.washington.edu.



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