

confluence

Promoting discovery, understanding, and resilience for Oregon coastal communities and ecosystems

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UO study moves seafood industry closer to farming gooseneck barnacles

By Tiffany Woods

A STUDY LED BY A UNIVERSITY OF Oregon (UO) marine biologist has moved the seafood industry one step closer to farming gooseneck barnacles, which are a pricey delicacy in Spain and a common sight on the west coast.

Funded by Oregon Sea Grant (OSG), researchers found that juvenile gooseneck barnacles in a lab grew at rates comparable to those of their counterparts in the wild.

Led by Alan Shanks, a professor with the UO's Charleston-based Oregon Institute of Marine Biology (OIMB), the researchers glued juveniles to textured, acrylic plates hung vertically inside 12 plastic tubes that were about twice the height and diameter of a can of tennis balls. Unfiltered seawater was pumped in, vigorously aerated and allowed to overflow. After a week, the barnacles began secreting their own cement.

Twice a day for eight weeks, the researchers fed the barnacles either micro-algal paste or brine shrimp eggs; a third group of barnacles was not fed anything but was left to filter food out of the seawater. Once a week the researchers measured the barnacles' growth. Those that were fed the brine shrimp eggs outgrew the other barnacles.

"The experiment has demonstrated that feeding is not dependent on high water velocities, and barnacles can be stimulated to feed using aeration and will survive and grow readily in mariculture," Shanks said.

He added that unlike high-flow systems, his low-flow "barnacle nursery" doesn't use as much energy or have expensive pumps



Gooseneck barnacles grow on top of thatched barnacles. (Photo by Julia Bingham)

to maintain.

Despite the encouraging findings, the researchers are cautiously optimistic.

"While our experiment showed promise, there is still a great deal of research which needs to be done to solve some of the barriers to successful and profitable mariculture," said research assistant Mike Thomas. "For example, inducing settlement of gooseneck barnacle larvae onto artificial surfaces has historically proven difficult and this makes

"The experiment has demonstrated that feeding is not dependent on high water velocities..."

the implantation of barnacles a laborious task. There are other methods of mariculture which need to be explored further for their efficacy before deciding on the best method.”

Another part of Shanks’ project involved conducting field research to see if there are enough gooseneck barnacles in southern Oregon to sustain commercial harvesting. The Oregon Department of Fish and Wildlife allows commercial harvesting of gooseneck barnacles on jetties but not on natural rock formations. Shanks hopes the agency will be able to use the results of his work when regulating their harvesting.



Seawater is pumped into plastic tubes containing juvenile gooseneck barnacles. Researchers glued the juveniles to textured, acrylic plates hung vertically inside the tubes. (Photo by Mike Thomas)

Researchers used photographs and transects to estimate the barnacle populations on eight jetties in Winchester Bay, Coos Bay, Bandon, Port Orford, Gold Beach and Brookings. They estimated that there are roughly 1 billion adult and juvenile gooseneck barnacles attached to these eight jetties but only about 2 percent are of commercially harvestable size.

“Our surveys suggest that wild populations are unlikely to sustain long-term

commercial harvest should the market significantly expand beyond its current size,” said researcher Julia Bingham.

She added that with the exception of jetties in Coos Bay and Winchester Bay, the other six jetties had such limited numbers of barnacles that even a “very small-scale harvest” – about 500 pounds per year per jetty – could wipe out harvestable-sized goosenecks on them in five years.

With a second round of funding from OSG that was awarded in 2017, Shanks and Aaron Galloway, an aquatic ecologist at the OIMB, are continuing the research. Their new work includes:

- studying how long it takes for a population to return to pre-harvest densities
- testing different glues and surfaces to see if harvested barnacles that are too small for market can be reattached to plates and returned to the ocean
- testing out bigger tubes for rearing barnacles in the lab to make them feasible for larger-scale aquaculture
- testing other diets, including finely minced fish waste from a seafood processing plant.

Additional reporting by Rick Cooper.

Oregon Sea Grant tells boaters where to go when they have to go

By Tiffany Woods

JENNY EAST CARRIES A PORTA-POTTY when she’s at work. She’s even been known to wear a crown and cape. As a result, she’s been nicknamed the Porta-Potty Princess.

Although she doesn’t actually sit on her mobile throne, she does put it on display during outreach events when she’s talking to recreational boaters about proper sewage disposal. “If humor gets someone to come talk with me, then OK,” she says.

As the boating outreach coordinator with Oregon Sea Grant (OSG) and the Oregon State University Extension Service, she

informs boaters of the approximately 80 locations in the state where they can find floating restrooms, pump out their holding tanks or flush away the contents of their portable toilets. She also checks those facilities for wear and tear and talks with maintenance staff and boaters about any problems they may have with them, such as a broken pump or an untidy facility. Then she works with the staff and the Oregon State Marine Board to resolve issues.

Since she was hired in December 2015, East has twice inspected about 40 facilities along the coast, Willamette Valley and

“If humor gets someone to come talk with me, then OK.”

Columbia River. Based at the OSU Extension Service's office in Beaverton, she has traveled from Brookings to Astoria and even to Hermiston, Detroit Lake and the Fern Ridge Reservoir west of Eugene. Through her visits, she learned that some marina employees needed training on how to service the facilities. So she collaborated with the marine board and OSG's communications team to produce a series of videos on how to maintain and winterize the facilities and troubleshoot problems with them. In 2017, OSG also produced two short videos that encourage boaters to empty their portable toilets and holding tanks at designated facilities.

Wherever boaters congregate, East has been there with her booth, informational handouts and porta-potty. She has attended yacht club meetings, the Portland Boat Show, the Saltwater Sportsmen's Show, Fleet Week in Portland and a holiday lighted-boat parade; been interviewed on the radio about her work; and spoken to and joined the Oregon Women's Sailing Association. East informs boaters about the Clean Vessel Act grant program, which provides funds to states for the installation and maintenance of the waste disposal facilities. She also gives boaters a sheet with locations of the facilities, and directs boaters to BoatOregon.com, where they can find an interactive map of the sites. She aims to understand boaters' motivations for using – or not using – the facilities, and she asks them where else



In a training video for maintenance staff, Jenny East demonstrates how to winterize the pump in a facility where boaters pump out their onboard sewage. (Photo by Vanessa Cholewczynski)



Jenny East helps marinas obtain signs that direct boaters to sewage disposal facilities. (Photo by Lynn Ketchum)

they'd like to see them installed.

"Jenny's energy, enthusiasm and ability to easily talk to boaters about a sensitive issue has been tremendous," said Ashley Massey, the public information officer for the marine board. "Not a lot of people want to discuss their human waste habits. But when Jenny starts the conversation off with, 'Do you know what this is?' and then points to a photo of a waste disposal station and then her porta-potty, a connection is made. People are put at ease, and the real conversation begins. That takes talent."

East's work is the continuation of a partnership with the marine board that dates back to 2011. With the board serving as an adviser, her predecessors with OSG surveyed boaters about their knowledge of the disposal facilities and their preferred ways of receiving information. Using feedback from marina staff, OSG created signs promoting the facilities. In 2013-14, OSG also hired contractors to produce two videos that humorously encourage boaters to empty their portable toilets at designated facilities and to use the two dozen floating restrooms on Oregon's lakes and reservoirs.

"They laid a great foundation that I could build from," East said.

"Jenny's energy, enthusiasm and ability to easily talk to boaters about a sensitive issue has been tremendous."

Study: No need to alter Dungeness crab management based on genetic data

By Rick Cooper

DUNGENESS CRABS ALONG THE WEST coast are highly connected genetically, and as a result, there's no need to change harvesting regulations to account for distinct subpopulations, according to a new study.

In the study, which was funded by Oregon Sea Grant (OSG), researchers also found high levels of genetic diversity among Dungeness crabs along the west coast, which is essential to the long-term viability of any species and the fishery, said lead researcher Kathleen O'Malley, the state fisheries genet-

icist with Oregon State University's College of Agricultural Sciences.

"Our findings didn't raise any red flags, such as evidence of low genetic diversity or distinct subpopulations that might warrant alternate management strategies," she said.

The study also found that the farther apart the crabs are, the more genetically different they are.

"This means that migration, by adults or dispersing larvae, may be geographically limited," O'Malley said. "This is an interesting finding given that Dungeness crabs were previously assumed to be widely dispersing."

The findings came after O'Malley and her master's student Tyler Jackson analyzed the DNA from more than 7,000 adult Dungeness crabs. These crabs were collected at 33 sites along an approximately 745-mile stretch from Washington to California in 2012 and 2014.

"Prior to this study, we knew very little about the genetics of Dungeness crab," O'Malley said. "This research is the most detailed assessment of the genetic connectivity of Dungeness crab to date."

The researchers found that the degree of genetic connectivity among Dungeness crabs differed between years. They attributed the result to varying ocean conditions – including the seasonal transition from downwelling in winter to upwelling in summer – that influence the dispersal of larvae.

To better understand how ocean conditions influence this dispersal, O'Malley has initiated a subsequent study to examine the genomic diversity among Dungeness crab megalopae (their final larval stage) off the Oregon coast. The graduate student on this project, Elizabeth Lee, is partially funded by a Robert E. Malouf Marine Studies Scholarship from OSG.

Jackson and O'Malley also looked at the genetic connectivity between adult Dungeness crabs at three sites along the Washington coast and at five sites in Puget Sound.



Kathleen O'Malley holds a Dungeness crab. With funding from Oregon Sea Grant, she found that Dungeness crabs along the west coast are genetically diverse and don't belong to distinct subpopulations. (Photo by Lynn Ketchum)

Results indicated that genetic connectivity appears to be strong throughout most of Puget Sound, although one area, Hood Canal, was genetically distinct. Additionally, crabs in the sound differed genetically from crabs along the coast.

Jackson attributed these findings to the direction of ocean currents and the long water retention in Hood Canal and Puget Sound, which limits the dispersal of larvae. Jackson said the results from Puget Sound, which were published in the journal *Marine Biology*, support the current management strategy there.

During the 2016–17 season, fishermen in Oregon landed 20.4 million pounds of Dungeness crabs, which they sold for a record \$62.7 million, according to the Oregon Department of Fish and Wildlife. Dubbed the official state crustacean, Dungeness crabs make up the most valuable single-species commercial fishery in Oregon.



Dungeness crabs are fresh off a commercial fishing boat in Newport, Ore. (Photo by Stephen Ward)

Additional reporting by Tiffany Woods.

Crabbers offer ideas on how to reduce injuries at sea

By Gregg Kleiner and Tiffany Woods

WEST COAST CRABBERS AND FACULTY with Oregon State University and Sea Grant programs in Oregon and Washington have been exploring ways to reduce injuries at sea.

The effort is part of the Fishermen Led Injury Prevention Program, which was funded by the National Institute for Occupational Safety and Health.

“The ideas are generated by the fishermen, and the goal is that the solutions are voluntarily embraced and are not imposed,” said Laurel Kincl, the leader of the project and a professor in OSU’s College of Public Health and Human Sciences.

To gather the suggestions as well as build rapport with the fishermen, nine community members with ties to the fishing industry were contracted, including several fishermen’s wives. They surveyed 365 crabbers in Washington, Oregon and California about the types and number of injuries they may have experienced during the 2014–15 crabbing season.

The crabbers reported 65 injuries, 36 of which required them to take time off work or change how they worked. Of those 36, sprains and strains were the most frequent, with 13 incidents. Out of the 36 injuries, hands, arms and shoulders were the most

commonly injured body parts, with 17 reports (see graphic). Nine of the 36 injuries occurred while handling gear on deck, and seven happened while hauling in gear.

When asked what they thought contributed most to injuries, fishermen gave answers that included inattention, weather and sea conditions, and inexperience. When asked what they thought was the most important thing for staying safe, responses

“...the goal is that the solutions are voluntarily embraced and are not imposed.”



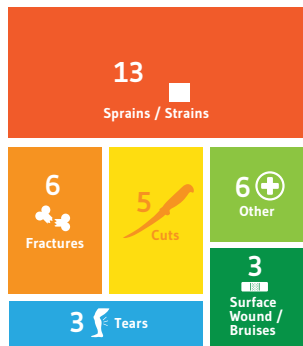
Crew members on the Delma Ann haul in a crab pot and hit it against a banger bar to force the crustaceans out of the pot. Because of a fisherman’s suggestion, researchers are looking for ergonomic banger bars. (Photo by Oregon Sea Grant)

included having a good captain and crew, being aware, and taking care of oneself.

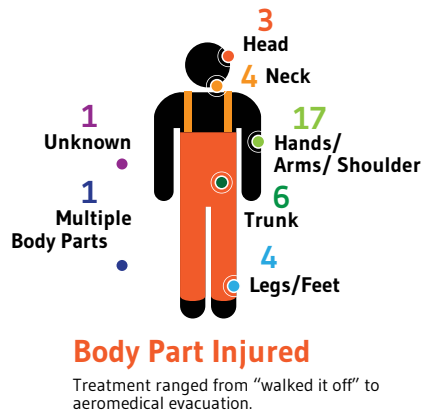
Fishermen expressed a need for a fishing-specific first-aid and CPR course. As a result, a wilderness medicine expert was invited to the Oregon towns of Newport and Astoria to train fishermen on how to treat medical conditions and at-sea injuries such as cuts, broken bones, dislocated shoulders and hypothermia.

Type of Injury

Of 36 limiting injuries



(Graphic by Allison Walkingshaw)



Another fisherman suggested looking at the design of banger bars, which are metal bars that are welded to the tables where crabs are sorted. Crab pots are hoisted over and slammed against the bars to force the crabs onto the table.

"Some say the bars make it easier on fishermen's wrists and backs if positioned

correctly," said Kaety Jacobson, a marine fisheries Extension specialist with Oregon Sea Grant (OSG) and a partner on the project. "But there's not a standard design, so crabbers make their own – if they use them at all. We're pretty sure someone has come up with the ideal banger bar, so we're trying to find that design and share it with the community."

Jacobson has used the OSG Fisheries Extension Facebook page to survey fishermen about the use of the bars. With this information, she said, Sea Grant could create an Extension publication on what a banger bar is and why fishermen use them. It could also include photos or schematics of designs that work better. The team also conducted a similar survey on Facebook about the use of anti-slip mats, as well as safety chains that are connected to the hydraulic pulleys that haul the crab pots onto the boat.

Jacobson and the nine community members also interviewed 57 experienced deckhands and boat captains about what makes a good crew, how to size up a boat to see if it's safe, and what to look for when signing a contract to become a crew member. Jacobson and her team plan to share their results with novice or aspiring crewmembers.

"We'll put these findings in an infographic or factsheet that we'll post on social media or mail out so that fishermen looking for work can have that resource," she said.

Women's roles in Oregon fishing industry are changing, study says

By Rick Cooper

One fisherman's wife said she entered the "politics of fishing" when fishing quotas were starting to be implemented.

WOMEN HAVE ALWAYS PLAYED AN important role in Oregon's commercial fishing industry, even if they don't actually fish or work on boats, but their roles are changing, according to a study funded by Oregon Sea Grant (OSG).

The study, which was published in the journal *Marine Policy*, was based on a series of oral-history interviews conducted mainly with fishermen and their wives. Sarah Calhoun, a former master's student in Or-

regon State University's Marine Resources Management program, conducted interviews with 15 women and 10 men from the coastal Oregon towns of Astoria, Warrenton, Garibaldi, Newport and Port Orford. She also interviewed a fisherman's wife from Morro Bay, Calif.

The study could help government agencies set policies that take into account their potential impacts on the well-being of entire fishing communities, said Flaxen Conway,

a community outreach specialist with OSG Extension and a co-author of the paper.

Conway, who is also a professor in OSU's College of Liberal Arts, noted that a federal law, the Magnuson-Stevens Fishery Conservation and Management Act, requires policymakers to consider how management policies could affect the economic and social well-being of fishing communities.

Women's contributions to the fishing industry are not always visible and are continually evolving, she said. They have traditionally performed onshore legwork roles, such as provisioning vessels and taking care of the financial side of the business, she said. But some of those interviewed noted an increase in the number of women involved in research or management – such as serving on task forces and commissions – sometimes because of increasingly complex regulations and markets.

One fisherman's wife said she entered the “politics of fishing” when fishing quotas were starting to be implemented. “It was really obvious that our boat and our community was going to be entirely left off it [if] we weren't at the table to participate in the really finer details of the design of the [catch shares] program, and so that's when I got involved,” she said.

Another fisherman's wife noted, “...more women and fishermen's wives are much more aware of the regulatory issues than they were 20 years ago, and are much more active...self-educating or attending the meetings, or pushing their husbands out the door [to a meeting] and telling them, ‘You need to go to this.’”

The increasing complexities of the fishing industry have increased women's need to turn to social support groups such as the Newport Fishermen's Wives and to adapt by learning new skills, said Conway.

For example, one fisherman's wife described the challenge of understanding fishing quotas: “How do I open a quota share account, how do I trade quota, how do I transfer it from account to account?” she asked. “That's the kind of constant learning [that's necessary] as regulations change. And



Sara Skamser and her husband, John, design and make fishing nets as owners of Foulweather Trawl in Newport. Skamser, who was previously a fisherman and welder, was one of 16 women interviewed for a research project funded by Oregon Sea Grant about how women's roles have changed in Oregon's commercial fishing industry. (Photo courtesy of The Pew Charitable Trusts)

I think that the learning curve – as opposed to 20 years ago – [has] grown exponentially.”

As one fisherman's wife put it: “Fishing isn't what it used to be. It isn't the same. So I think you have to be able to adapt to change.”

Conway agreed. “I've always been really impressed with the resilience of the fishing community, and this work has showed us that adaptation has actually resulted in a major change in the roles women play in the family business.”

“Fishing isn't what it used to be. It isn't the same. So I think you have to be able to adapt to change.”



Michele Longo Eder stands in front of the fishing vessel Timmy Boy, which she and her husband, Bob, own. Eder, one of the interviewees in the study, was an attorney whose practice included an emphasis in marine and fisheries law. (Photo by Chris Becerra for Oregon State University)

Summer interns grow professionally and personally

By Tiffany Woods

TEN CURRENT OR RECENT undergraduates now have a better understanding of various marine science careers and their own aspirations, thanks to internships organized and supported by Oregon Sea Grant (OSG).



Katie Gregory rakes up cockles as part of a survey that compares their densities in an area where they're commercially harvested versus in an area that is recreationally clammed.

The interns, who beat out about 150 other applicants, were enrolled in or recently graduated from universities in California, Connecticut, New York, Oregon and Pennsylvania. For 10 weeks, they worked for the following:

- Oregon Department of Fish and Wildlife
- Oregon Department of Land Conservation and Development
- South Slough National Estuarine Research Reserve in Charleston
- U.S. Department of Agriculture
- U.S. Environmental Protection Agency
- Wild Rivers Coast Alliance in Bandon

The interns were paired with a mentor and assigned to a project. For some projects,

the interns:

- waded into bays to set up cameras that monitored how crabs and fish behaved around two different types of oyster aquaculture systems
- went door-to-door, surveying coastal residents about their thoughts on Oregon's marine reserves
- encouraged people to share photos on social media of the highest tides of the year in Oregon to help coastal planners visualize how rising sea levels may affect communities
- trapped invasive European green crabs in the South Slough to track their population and distribution
- collected water samples in Tillamook Bay
- browsed websites of professional photographers with the aim of hiring several to promote southern Oregon's natural beauty
- helped organize a marine-themed Bingo activity at a pub and two barbecues "with a side of science" to inform fishermen and the public about marine reserves.

The interns, who wrote about their experiences on OSG's blog for scholars, grew not only professionally but also personally. They improved their cooking skills, learned how to cope with homesickness and sedentary office work, pondered where they want to live, and thought about their career aspirations.

In their free time, they explored Oregon and got to know each other. They went camping, played beach volleyball, watched a solar eclipse, swam in Crater Lake and hiked to the tree line at Mount Hood.

"Thank you, Sea Grant, for pushing our bounds and asking us to grow," Sarah Coffin wrote in her final blog post. "I am leaving this internship a better and more hopeful person than I came."

To watch a video about the internship program, go to bit.ly/2fGPgFw. To read the blog, go to bit.ly/2xXix9F.

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