# University of California Cooperative Extension

## Sonoma County
## 2015 Annual Report

UC CE University of California
Agriculture and Natural Resources Cooperative Extension


*UCCE Sonoma County personnel. Photo by Steven Knudsen.*

*Front row:* Desiree Dela Vega, Abby Newman, Michael Lennox
*Middle row:* Becki Waskovich, Mariska Obedzinski, Diego Mariscal, Stephanie Larson, Judy Ludovise, Linda Peterson
*Back row:* Will Boucher, Nick Bauer, Sarah Nossaman Pierce, Zac Reinstein, Henning Fett, Andrew Bartshire, Mimi Enright, Paul Olin, Deborah Curle, Lisa Bell, Karen Giovaninni, Paul Vossen, Julia Van Soelen Kim, Rhonda Smith, Lucia Varela
*Not pictured:* Amelia Johnson, Jenna Dohman, Troy Cameron, Susan Foley, David Lewis, Rebecca Strode, Steven Swain, and hundreds of volunteer Master Gardeners and volunteer 4-H Adult Leaders

***March 2016***

## *A message to the County of Sonoma Board of Supervisors—Efren Carrillo, Chair; James Gore; Susan Gorin; David Rabbitt; and Shirlee Zane:*

University of California Cooperative Extension (UCCE) is honored to partner with the County of Sonoma. Our innovative programs address critical issues that maintain and increase the sustainability of agriculture and natural resources in Sonoma County. This annual report focuses on California's working landscapes which include: rangelands, forests, agricultural lands, wetlands, and grasslands; and provide goods and services ranging from food, forage and fiber to clean air, clean water and carbon sequestration. Because it has historically been difficult to measure the value of services these lands offer and the economic benefits they provide to local communities, many are at risk of being converted to other uses; threatening local communities with loss of agricultural income; harm to public health; and, destruction of natural infrastructure critical to climate adaptation. UCCE's strategic initiatives assist in recognizing and valuing the services provided by Sonoma County's working landscapes, and assist landowners and policy makers on land use decisions.

*Front cover: Cabernet Sauvignon leaf with symptoms of Pierce's disease. Photo by Rhonda Smith.*

Given a recent study that per-acre greenhouse gas (GHG) emissions from farmlands in California are an average of 58 times lower than those from the state's urban areas, and additional research showing natural landscapes such as oak woodlands can sequester millions of tons of carbon, UCCE's research and outreach approaches for addressing change, offers an opportunity to value and reward particularly important services provided by working landscapes.

UCCE continues the development of an incubator farm, partnering with other county departments, to increase land and food access to residents. It is through these collaborative efforts that beginning and aspiring farmers and ranchers will have lands on which to grow food and residents will have increased access to local foods.

UCCE's Master Gardener Program will teach back yard composting to home gardeners which will lead to a reduction of waste material into the landfill. UCCE Master Gardeners continue to reach out to the community with educational programs that demonstrate how to reduce water use through the "Garden Sense" program.

UCCE is at the forefront of research on key agricultural pest management issues to prevent crop loss from invasive insect pests that threaten our vineyards and farms. Advisors educate growers, vineyard managers, pest control advisors and field workers on the biology and management of key pests such as the European grapevine moth, light brown apple moth, vine mealybug, and olive fruit fly. UCCE Viticulture and Integrated Pest Management (IPM) Advisors provide vital research to the extremely important and ever-growing wine grape industry in Sonoma County.

Global warming from greenhouse gas accumulation could be tackled in part by improved understanding of pasture management and the potential for significant carbon sequestration on rangelands. UCCE will continue to conduct research to devise ways that ranchers and dairies may improve their bottom line, by using management practices that maximize ecosystem services, such as food protection, clean water, and scenic values.

Sudden Oak Death (SOD) disease is decimating thousands of acres of forest and landscape. UCCE continues to provide educational resources and SOD disease management guidance to the citizens of the County through cooperation with outside agencies and experts in neighboring counties.

UCCE 4-H program provides youth with opportunities to develop responsibility, resolve conflicts, master skills and practice making choices that will positively impact their future. We recognize the changing demographics in Sonoma County and are increasing outreach efforts to engage youth in the 4-H program in the Hispanic community.

UCCE will continue to facilitate and share research on additional benefits of working landscapes including, but not limited to, agricultural productivity from some of the most productive farmland on the planet; the importance of clean air and water; and, income from tourism and outdoor recreation.

We look forward to our continued partnership in the years to come and thank you for your support.

Stephanie Larson, Ph.D.
County Director

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# Master Gardeners

*Master Gardeners planting county fair demonstration garden. Photo by Mimi Enright.*

**Mimi Enright, Master Gardener Program Manager**
**Paul Vossen, Program Advisor**

The UC Master Gardener Program of Sonoma County serves as a resource to provide science-based, environmentally sustainable horticultural information to all of Sonoma County's residents. We strive for diversity and inclusion in all aspects of our organization. In 2015, local Latino leaders helped to develop strategies for engaging a more diverse audience.

*Also in 2015*...Three hundred active Master Gardeners provided 20,217 volunteer service hours to teach County residents about sustainable landscaping, food gardening, composting, integrated pest management, water conservation and other topics. They reached over 18,458 people directly and 256,226 via the UCCE-Sonoma MG website.

- We helped local residents adopt sustainable landscape practices in their home gardens that reduce water usage, pesticide and herbicide use, and create a landscape more adaptable to drought and climate change.
- *Garden Sense* consultants conducted over 500 home visits to help residents save an estimated six acre-feet of water through lawn removal, irrigation changes and low water-use plantings. *Garden Sense* received an award from International Master Gardener organization for the program, a collaboration with the Sonoma County Water Agency.
- Through the *Home Compost Education Program*, the Master Gardeners diverted an estimated 14,311 tons of organic materials (kitchen scraps and yard waste) from the Sonoma County landfill.
- The 2015 Sonoma County Fair demonstration garden showcased sustainable, easy-to-implement, landscape practices.
- Master Gardener Food Gardening Specialists developed an educational video on practices that reduce water use. "Growing vegetables with less water" can be seen on their website.

*"The Master Gardeners helped me form a plan for my front yard and back garden that was practical and ecologically wise. Their insights and advice were invaluable!"* ***A Garden Sense client***

# Ag Ombudsman

*Photo courtesy of Petaluma Pumpkin Patch and Amazing Corn Maze.*

## Karen Giovannini, Agricultural Ombudsman

The Ag Ombudsman works with farmers and ranchers starting new ventures to understand and navigate the permitting process. She also works to help modify regulations that no longer serve the best interests of farmers, ranchers and the public, and to support the growth and sustainability of local agriculture.

*Limited Liability for Agritourism Operations.* Nearly half of US states have laws that reasonably reduce the liability risk to agritourism operations. The laws allow more farms to obtain the insurance needed to open their operations to the public. In California, the cost of insurance for these operations such as pumpkin patches and U-pick operations can be prohibitive. The Ag Ombudsman is working with farmers, local agricultural groups, and the UCCE Small Farm Program to build a case for this type of law with our state legislators.

*Local Poultry Processing.* The Ag Ombudsman has been working with Permit & Resource Management Department to find a localized solution for local poultry processing. In Sonoma County, options for processing meat birds are:

1. Take them to Sacramento or Modesto to be harvested at a USDA inspected facility.
2. Process birds on the farm. This second option requires a use permit—which is cost prohibitive—and that meat may only be sold direct-to-consumer, limiting the market potential.

*Outreach.* This is the 'too much-information age'. We all receive a barrage of information throughout the day, much of it is noise that we ignore. But don't ignore us! Finding the right ways to effectively communicate with our customers is becoming more and more difficult. We use a variety of outlets: website, emails, blog, Facebook, You Tube, Twitter, and the Farm Bureau's monthly *Farm News*. What information do you want from UCCE Sonoma County and how do you want to receive it? Let us know at **ucanr.edu/ucceSCoutreach.**


*"Karen has provided us with invaluable service in the last three years. She has helped us navigate and understand the often complex and contradictory regulations surrounding zoning laws and food & farming regulations in the county and state. She has also lent a sympathetic ear to our concerns. We are totally grateful for her service."* ***Janet & Corrie Leisen, Leisen's Bridgeway Farms***


# Incubator Farm

*Photo courtesy of SCAPOSD.*

## Linda Peterson, Incubator Farm Coordinator

Young-Armos is a 45-acre property located in Rohnert Park that is publicly owned, agriculturally zoned, historically farmed, and for the past several years was used for growing hay. This property is located in state and federally protected California tiger salamander (CTS) habitat. Historically, this property contained seasonal wetlands with special status vernal pool plant species. U.S. Dept. of Fish and Wildlife have a program called "Safe Harbor" which, with detailed planning, allows farming and restoration to co-exist. It's a win-win scenario.

In 2009, 300 people attended a Community Food Forum, a one-day "think tank" for our local food system. One outcome was the "County Land for Food Production Report", created by UCCE. Due to high land costs in our county, there is strong community support for using public land for farming and ranching when possible.

Young-Armos is owned by Sonoma County Agricultural Preservation and Open Space District (SCAPOSD), and thus, by the people of Sonoma County. Working with our UCCE farm consultant and the SCAPOSD contractor, a new farm plan layout has created a scenario that would provide for both CTS habitat and seasonal wetlands along-side ecological farming and seasonal grazing of small ruminants.

UCCE jointly organized a public meeting in January 2015 to share the project and get community agreement. Sonoma County UCCE has been shepherding a transformation of this property, in partnership with SCAPOSD and our Technical Advisory Committee.

*Coming up...*

- UCCE reached out to Williamson Act landowners to offer its services and to determine if there is interest in getting a farmer or rancher on their land.
- We will partner with UCCE Marin to run monthly workshops for farmers and ranchers: FARMING 101.

*"If we are going to find new ways to grow food, preserve vital agricultural lands, nurture new farmers, educate the public, and deliver fresh, local food, we must identify creative, win-win strategies and initiatives."* ***Supervisor Shirlee Zane at January 2015 public meeting***

# Specialty Crops

*Kevin McEnnis of Quetzal Farm, and Paul Vossen. Photo by Sam Euston.*

## Paul Vossen, Specialty Crops Advisor

*Dealing with Drought.* Specialty vegetable, berry, and fruit tree growers struggled to manage limited water resources in 2015. Additionally, climate change manifested itself through unfavorable weather conditions (inadequate winter chilling) that reduced tree growth and fruit production and set up conditions for severe fire blight disease in apples and pears. Vossen hosted a one-day seminar on small-scale vegetable farming equipment that focused on managing cover crops and weeds to save soil-stored moisture; consulted individually with farmers, and presented four seminars on Growing Specialty Grains, Growing Cider Apples, Growing Berries, and Growing Olives. Our UCCE website provided information on managing fire blight and the effects of inadequate chilling on fruit trees. Water management was also addressed through the development of seven short videos on farming vegetables in drought conditions that are available on our UCCE-Sonoma website.

*Big Demand for locally Grown Barley and Hops for Beer and Cider Apples.* The micro-brewed beer and hard apple cider industries are booming and many local farmers and processors are interested in producing and buying more of the raw ingredients locally. However, there is a lack of local knowledge in variety selection, cultural practices, and pest control for growing barley, hops, and high-value cider apple varieties. Two apple cider variety demonstration orchards are being planned as well as two seminars on growing cider apples, andf growing hops.

*Availability of Compost Declines.* With the closing of the Sonoma Compost facility many commercial farmers and landscapers are left with scarce supplies and higher costs for compost. Together with the Santa Rosa Junior College and the Sonoma County Waste Management Agency, a 2016 seminar will teach farmers and landscapers about medium-scale, on-farm composting. This should help to reduce the need for trucking raw organic materials out of the county and bringing it back as finished compost.

*"In the best spirit of the true academic, Paul combines a passion for great outcomes with a complete lack of bias for any particular path. He is a committed collaborator who listens to all opinions then goes out and finds what is true and brings it to us all so that we can make better decisions about every aspect of farming. As a result, he is arguably the single most valuable and trustworthy resource in the industry – which is why as recently as last month, when confronting an issue with our groves, Paul was the first person I called. And, as always, his knowledge was current and informed by deep understanding of global best practices, and as a result his advice spot-on."* ***Ridgely Evers, Sonoma County farmer***

# Russian River Coho Salmon Monitoring Program

**Paul Olin, Program Advisor**

**Mariska Obedzinski, Monitoring Coordinator**

**Andrew Bartshire, Will Boucher, Nick Bauer, Desiree Dela Vega, Henning Fett, Amelia Johnson, Abby Newman, Sarah Nossaman Pierce, and Zac Reinstein, *Research Associates***

**Troy Cameron, Jenna Dohman, and Bekki Waskovich, *Americorps Interns***

Local partners include the Sonoma County Water Agency, the Watershed Stewards Program, Center for Ecosystem Management and Restoration, Gold Ridge Resource Conservation District, Occidental Arts and Ecology Center WATER Institute, Sonoma Resource Conservation District, and Trout Unlimited.

Funding for this work was graciously provided by the Army Corps of Engineers, NOAA Fisheries, National Fish and Wildlife Foundation, and the California Department of Fish and Wildlife.

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The ongoing drought in California caused large stretches of Sonoma County creeks to dry up during the summer of 2015. With this increased drying, biologists observed endangered fish become trapped in dwindling pools. The UC documented late summer habitat conditions for salmonids on high priority streams and worked with private landowners and public resource managers to identify locations where fish were at risk of mortality due to drought. Together, these groups were able to save thousands of endangered fish by relocating them to perennial stream reaches or to the Warm Springs Fish Hatchery.

In 2015, the UC Cooperative Extension/California Sea Grant Coho Salmon Monitoring Program continued their mission of providing a successful year of monitoring, including the following:

- Conducted winter 2014-2015 spawner surveys as an important component of both the Russian River Coho Salmon Captive Broodstock Program and the Coastal Monitoring Plan—a collaborative, statewide effort being implemented in partnership with the Sonoma County Water Agency. Forty-eight adult fish were observed, with a spawner estimate of 397.
- Successfully installed and operated downstream migrant traps on three streams in order to estimate the number and migration timing of coho smolts leaving each system and to compare overwinter survival and growth of juvenile coho released the previous spring and fall.
- Conducted snorkel surveys to document spatial distribution and minimum counts of juvenile coho salmon and steelhead in 42 tributaries to the Russian River. More than 5,000 wild juvenile coho were observed in 20 of the creeks sampled.
- Completed field work for the 2015 oversummer flow and survival study implemented through the Russian River Coho Water Resources Partnership. Valuable information was gathered about the viability of our streams throughout the summer as habitat conditions related to the survival of coho salmon.
- Fish tracking antennas were continuously operated on 25 sites throughout the watershed in order to collect data on the movement, distribution, survival, and numbers of tagged fish at each life stage.

In the coming year, the coho salmon monitoring program is continuing to formalize our wetted habitat surveys as well as expanding monitoring to tributary streams further north in the watershed.

*Facing page: Surveyors Aaron Johnson and Troy Cameron at a waterfall on Willow Creek, a tributary to the Russian River. Photo courtesy of California Sea Grant.*


# 4-H Youth Development

*4-H after school club at Monroe Elementary. Photo by Diego Mariscal.*

**Judy Ludovise, 4-H Program Representative**
**Diego Mariscal, 4-H Outreach**

Many youth in Sonoma County are not engaging in learning opportunities afterschool. Nearly 50% of youth would go home and watch TV instead of engaging in afterschool programs. The main reasons are high costs and lack of transportation—these are even bigger obstacles if you are a low income family.

In response, the Sonoma County 4-H Program expanded into four elementary schools: Monroe, Biella, Cali Calmecac, and Brooks. It reached hundreds of children with summer programs and afterschool programs. It has also grown the community club model and summer camps as part of the efforts to reach underserved populations in Sonoma County.

And despite a higher percentage of parents working than ever before, over 150 parents stepped up to become 4-H project leaders. More Hispanics families are joining than ever before. To ensure these programs can help more families, 4-H has partnered with the Social Advocates for Youth, Community Action Partnership, the SRJC, and area high schools to provide volunteer mentors.

Growth of the 4-H afterschool program has been attributed to the leadership of the 4-H staff, exciting project lesson plans, dedicated volunteer mentors, and families. Having a dedicated outreach coordinator has made this possible. As 4-H responds to the changing demographics in Sonoma County, information about the opportunities available for youth is reaching an ever widening and diverse audience.

Our programs focus on the core mandates of 4-H: Community Service, Healthy Living and S.T.E.M. (Science, Technology, Engineering, Math) and they provide children the opportunity to learn important skills in a safe and positive environment. Children can learn important skills, such as: public speaking, creative writing, art and are also treated to sports programs that are non-competitive and focus on skill building and team work. Teens are trained to become mentors, leading projects for younger children.

*"Leadership, responsibility, commitment, self-esteem, and compassion. Whether these qualities come to them through raising an animal, sewing an article of clothing, speaking in front of a crowd, building and launching a rocket, participating in a community service event or one of the other countless activities available through 4-H, nothing brings me more joy than to see the smile on a young person's face when they realize they've "nailed it".* ***Amanda Schell, Volunteer Board President***

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# Range Management

*Photo by Sarah E. Moffitt.*

## Stephanie Larson, Ph.D., Livestock & Range Management Advisor

*Transformation*. Almost 50% of the land In Sonoma County is rangeland, covering over half a million acres. While the primary use of rangeland has been livestock grazing to produce food and fiber for well over a century, there is now an increased interest in, and demand for, access to grazing areas that has brought livestock/recreation interactions to the forefront. These interactions have led to the elimination of grazing from some public lands; thus, reducing the public land managers' ability to manage vegetation and protect conservation values. Removal of grazing can also lead to increased fire fuel loads and risk of fires. While grazing and recreational uses of land may at times be at odds, these uses can also be compatible, even mutually beneficial. Conflicts can be minimized through educational opportunities and thus, the benefits of these concurrent uses maximized.

*Addressing change.* To maintain proper livestock grazing and rancher stewardship on Sonoma County's rangeland, UCCE took the lead on public education and outreach to educate park users on animal behavior, and the environmental and economic importance of cattle grazing on public lands. Educational materials have been created to improve park users' compliance with closing gates and controlling dogs; reducing negative interactions with livestock, and thus increasing park users' comfort while enjoying Sonoma County's public lands. UCCE also worked with local ranchers, changing behavior and understanding to minimize negative interactions between livestock and public; by providing tools for ranchers to help explain livestock behavior to park users, and informing ranchers of effective strategies to avoid conflicts. Livestock grazing and recreation can co-exist and provide multiple ecosystem services; however, park users, park managers and ranchers need to be well informed.

*Future plans.* UCCE will work with Regional Parks to create signage and videos that illustrate strategies to avoid livestock conflict including selection and placement of livestock and effective communication with the public.

*"To maintain proper livestock grazing and rancher stewardship on Sonoma County's rangeland, UCCE took the lead on public education and outreach to educate park users on animal behavior, and the environmental and economic importance of cattle grazing on public lands. Educational materials have been created to improve park users' compliance with closing gates and controlling dogs; reducing negative interactions with livestock, and thus Sonoma County's public lands."* ***Supervisor Shirlee Zane***

# Regional Food Systems

*Julian Van Soelen Kim radio interview on KOWS FM. Photo by Julia Van Soelen Kim.*

## Julia Van Soelen Kim, Regional Food Systems Advisor

The North Bay Food System program supports innovative changes that focus on a more socially just, economically viable, and environmentally sustainable food system for Sonoma County and the North Bay.

In 2015, The North Bay Food Systems Advisor provided a variety of educational opportunities for small-scale and diversified farmers that included a Specialty Foods Workshop for aspiring food entrepreneurs; a Wholesale Market Tour for local farmers to explore new market opportunities in the Bay Area, and a Pastured Poultry Workshop for small-scale commercial poultry producers. One hundred five farmers and ranchers attended.

The Food Systems Advisor helps foster a more directed regional food system, as a member of the Sonoma County Food System Alliance, supporter of the Sonoma County Food Action Plan, and as facilitator and participant in Food Policy Councils across the North Bay (Napa, Mendocino, and Marin). The food system advisor also co-organized a training for academic colleagues on conducting policy-relevant research (Extension as Urban Policy Advisors, December 2015, Sacramento).

Future plans: Looking forward, the Food System Program will continue to raise awareness of innovative and research-based solutions that support a flourishing local food system. Specifically, 2016 brings a state-wide research project on Food Policy Councils, in which the Food Systems Advisor will study the role these groups play in using science-based information to enhance local food systems planning, coordination, and policy development.

*"The Food Systems Advisor provides larger-scale food systems context, real world examples, academic research capacity, and a background in participatory-based research. Through her work, she engenders trust and an over-arching commitment to solutions that benefit multiple stakeholders, especially the community's most vulnerable."* ***Suzi Grady, Petaluma Bounty***

# Viticulture & Integrated Pest Management

*Cabernet Sauvignon vine with Pierce's disease. Photo by Rhonda Smith.*

**Rhonda Smith, Viticulture Advisor**
**Lucia Varela, Ph.D., Integrated Pest Management Advisor**

The Viticulture and IPM Advisors are members of a team with UC Berkeley researchers who are beginning to investigate the reasons why in the last few years more North Coast vineyards have lost vines to Pierce's disease.

Pierce's disease is lethal in grapevines. It is caused by a bacterium that resides in many plants - natives and ornamentals that do not show disease symptoms. Diseased vines are usually adjacent to riparian habitats and landscaped areas that contain sharpshooters, insects which transmit bacteria from those plants to grapevines.

Recently, Pierce's disease has occurred in nontraditional areas and vine loss has jumped in normal "hot spots." Mild winter temperatures are known to increase Pierce's disease incidence, which may have occured in the North Coast. In 2016 we will be investigating if more sharpshooters are carrying the bacterium to vineyards in Sonoma and Napa County research sites. That knowledge will allow us to develop management strategies that growers can implement to reduce Pierce's disease in their vineyards.

*"We can't keep doing this."* ***Grower who replanted hundreds of vines in 2015 that died of Pierce's disease.***

# Sudden Oak Death

*Zach Anaya of The Wildlands Conservancy, and Lisa Bell. Photo by Paul Vossen.*

**Lisa Bell, Program Coordinator**
**Paul Vossen, Program Advisor**

Over 163,000 acres of Sonoma County's forests and woodlands are infested by sudden oak death (SOD). The current drought is limiting the spread but when rainfall levels return to normal or beyond this disease will once again multiply and spread. The program goals are to limit the many impacts of SOD through monitoring and education. At public meetings and through one-on-one field visits, the Program Coordinator and 15 trained Master Gardener SOD Specialists educate individuals and groups on SOD biology, detection and management. Funding is provided by a grant from the USDA Forest Service. 2016 accomplishments include:

- *Award of Excellence* received from the Western Cooperative Extension Directors Association.
- 10 public meetings to educate home owners and land managers regarding disease biology, diagnosis, and prevention—along with management strategies.
- 16 field visits with individual land managers, parks personnel, and professional arborists to identify SOD infected trees and discuss management options.
- 305 hours of public education by volunteer Master Gardener SOD Specialists.
- Coordinated the *SOD Blitz* for monitoring disease spread by directing the efforts of 60 people in the collection and diagnosis of leaf samples in forests and urban lanscapes thoughout the county.
- Cooperated with USDA Forest Service to aerially survey and map new areas of SOD infestation in Sonoma County.
- Coordinated field visits to infested Sonoma County forests with research plant pathologists from California Department of Food and Agriculture, CAL FIRE, and University of Tennessee.
- Maintained UCCE Sonoma SOD website with up-to-date information.

*"I run a tree service here in Santa Rosa. I've been doing work for a lot of years here, grew up in the industry with local companies. I really have a passion for what I do and I have to say that the workshop, conference, seminar, the informational thing you had last evening…it's one pf the best I've been to. It was very informative, it was right to the point. I haven't sat and in so little time gained so much information… But I really want to say that I appreciate what you did, it was very helpful, I think it's good for the industry as well, keeping the professionalism up."* ***Fred Frey, Vintage Tree Care***

# Aquaculture

*Mature male purple-hinge rock scallop. Photo by Joe Newman.*

**Paul Olin, Ph.D., Sea Grant Extension Program, Marine Science**

Purple-hinge rock scallops are a highly desired shellfish with the potential to be farmed by shellfish growers from California to Alaska. To accomplish this researchers from California and Washington state have teamed up with the Bodega Marine Laboratory to learn more about conditioning of broodstock and strategies to improve hatchery protocols to enable the production of millions of baby scallops, known as seed, that could be farmed in a variety of nets and plastic mesh bags. This would help to diversify the product line for existing shellfish growers and provide consumers with a healthful, fresh, locally produced scallop.

Over the past year scallops have been successfully spawned multiple times at the lab and researchers have consistently produced millions of larvae. The research challenge is in increasing survival of these larvae so that after spending approximately 20 to 30 day in the water column as pelagic larvae, a higher percentage are able to successfully settle and metamorphose into a small scallop with a fully formed shell. Researchers are focusing on this transitional phase using a variety of aeration techniques and adjustments in the algal diets fed to the scallops to improve survival. They are also evaluating a number of different settling substrates to determine the optimum settling surface to increase successful metamorphosis and survival.

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