Waterlines

WESTERN REGIONAL AQUACULTURE CENTER

2016
ANNUAL REPORT

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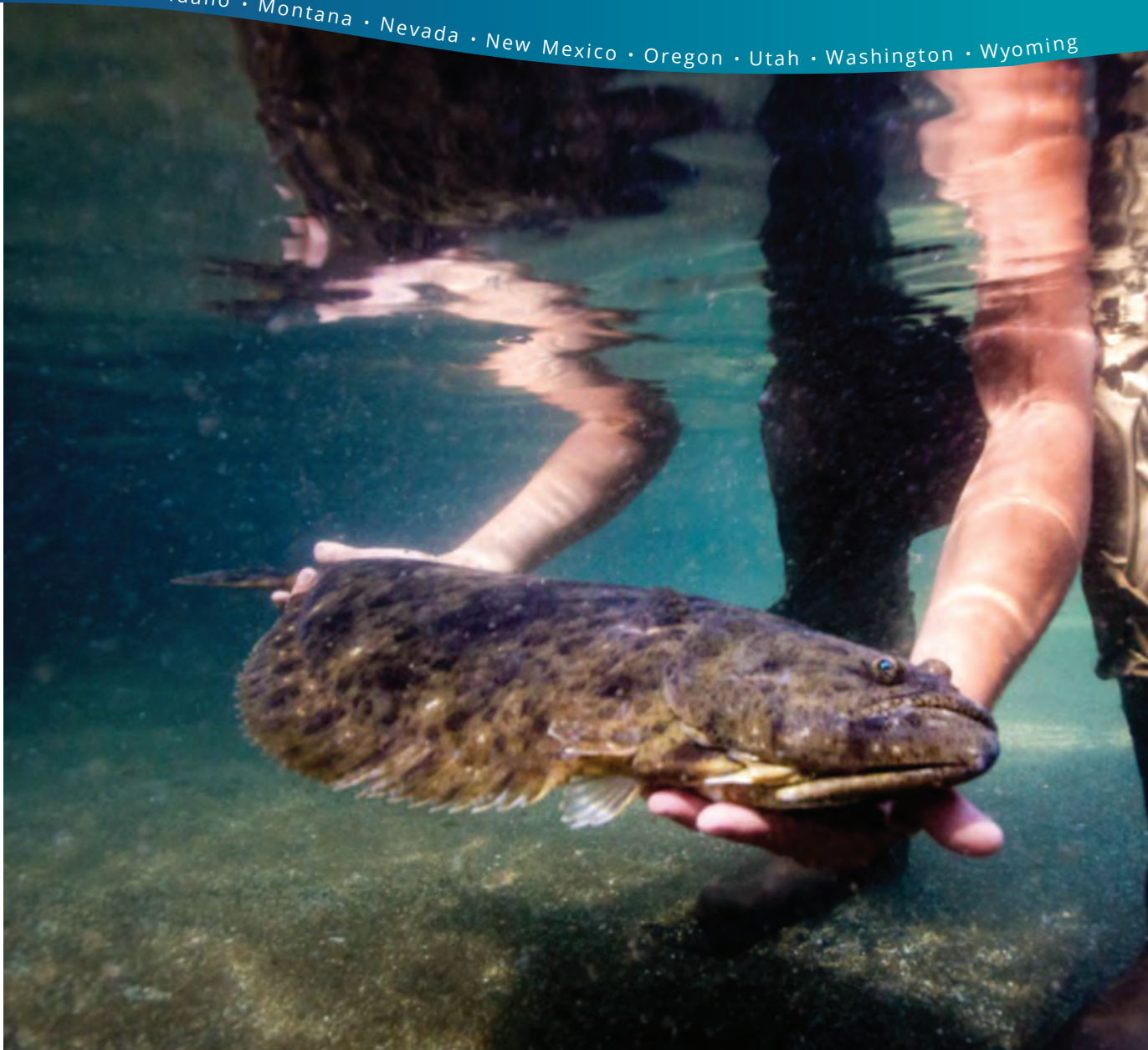
We are pleased to present this issue of *Waterlines*, featuring WRAC news, project highlights, and accomplishments from September 1, 2015 to August 31, 2016.

IN THIS ISSUE

Photo: Kevin Stuart



USDA

United States Department of Agriculture
National Institute of Food and Agriculture

A Brief Message from Laura Hoberecht*

*AQUACULTURE COORDINATOR, WEST COAST REGION, NOAA FISHERIES

Greetings to WRAC and its constituents and stakeholders. I'd like to introduce myself to you and describe my position as a Regional Coordinator at NOAA (National Oceanic and Atmospheric Administration) Fisheries.

First, a brief background about NOAA's role in aquaculture: NOAA is part of the Department of Commerce, and Fisheries is one of six line offices within NOAA. Although the majority of aquaculture work is done through NOAA Fisheries, there are also ties to aquaculture through the Office of Oceanic and Atmospheric Research, primarily via Sea Grant, and through the National Ocean Service, primarily via the Coastal Zone Management Act.

Within NOAA Fisheries, aquaculture work is conducted through the Office of Aquaculture, which is based in Silver Spring, Maryland, with a focus on strategic planning, policy, and budget. Around the country, there are Science Centers that emphasize research to inform management and Regional Offices, where regional aquaculture coordinators are housed.

Aquaculture is a priority for NOAA as a way to increase the domestic supply of safe, healthy, and sustainable seafood, in addition to maintaining productive marine ecosystems through enhancement and restoration.

NOAA's regional aquaculture coordinators wear a lot of different hats, and the job is in large part defined by the aquaculture priorities for each region. For instance, in the Southeast and Pacific Islands regions, the coordinators have focused on offshore aquaculture in federal waters. In the Northeast region and here in the Pacific Northwest, much of the focus is on shellfish and salmon aquaculture.

Aquaculture identified as part of NOAA West Coast Strategic Plan 2016–2020: *www.westcoast.fisheries.noaa.gov/about_us/strategic_plan.html*

Photo: Courtesy of Laura Hoberecht

Will Stelle (NOAA West Coast Region Administrator), Betsy Peabody (Executive Director, Puget Sound Restoration Fund), and Laura Hoberecht on a tour of Penn Cove Shellfish mussel rafts.

The coordinators act as liaisons between the Office of Aquaculture, the Science Centers, industry, academia, and the general public, working to ensure priority research needs are met and up-to-date science is available for decision making. There are currently five regional aquaculture coordinator positions. The West Coast region has two: myself (Washington and Oregon), and Diane Windham (California).

I've been with NOAA Fisheries for nearly 20 years—starting as a contract field biologist with the Alaska Fisheries Science Center, moving on to the Southwest Regional Office, where I worked on eelgrass and Olympia oyster restoration, and then into my current position. I received my PhD from the University of Washington's School of Aquatic and Fisheries Sciences in 2005.

In my current position, much of my work has focused on improving the permitting process. In Washington, I co-lead the Shellfish Interagency

Permitting (SIP) Team, which includes representation from all entities that have regulatory or oversight roles in permitting shellfish aquaculture. The SIP Team has developed a suite of products to help shellfish farm applicants navigate the complex permitting process. Another component of my position is education and outreach. In order to educate people about the management and operation of salmon farms in Washington state, I have participated in a number of educational science forums.

Frequently, I organize aquaculture sessions at marine-oriented conferences. A recent example is the special session, "Local food production: growing seafood in the Salish Sea," held at the 2016 Salish Sea Ecosystems Conference.

I also coordinate tours—getting folks out onto farms to see what aquaculture really looks like. This fall, I had the opportunity to host Eileen Sobeck, Assistant Administrator for NOAA Fisheries.

I also had the privilege of hosting a crew from USDA, including Andrew Hammond (Director, Agricultural Research Station Pacific West Area Office). Both tours included shellfish and salmon farms in Puget Sound.

The connection of federal agency leadership to actual farmers can change perceptions, answer questions, and improve relations.

To learn more about aquaculture in the West Coast region, please visit: *www.westcoast.fisheries.noaa.gov/aquaculture/index.html*. Contact Laura at *hoberecht@noaa.gov* or 206-526-4453.

Spotlights *on the* West

Fred S. Conte Receives National Award

Congratulations to WRAC Board member Fred S. Conte, PhD, who received the 2016 Joseph McCraren Award for his outstanding contributions in promoting the growth of aquaculture. The award, named in honor of Joseph P. McCraren, the first chairman and executive director of the National Aquaculture Association (NAA), is the most prestigious honor given by the NAA. It was presented to Fred at the World Aquaculture Society conference in Las Vegas on February 23, 2016.

Fred is the aquaculture specialist at UC, Davis and an advisor with the California Aquaculture Association. He has had a productive and highly accomplished career in originating and implementing innovative and sustained programs that have had a positive and lasting impact in advancing the field of aquaculture through knowledge and improved production processes.

Adapted from: CAA Staff. (2016, February 29) Notable News: Fred S. Conte, PhD Receives National Award for Contributions in Aquaculture. Retrieved from: *http://caaquaculture.org/2016/02/29/fred-s-conte-phd-receives-national-award-for-contributions-in-aquaculture/*

Steve Harbell Retires from WRAC Board

Long-time WRAC Board member, Steve Harbell, announced his retirement in January 2016. His contributions to WRAC have been invaluable: He has also served as a member and/or Chair of the Extension Subcommittee, Strategic Planning Committee, Executive Committee, Long-Term Impacts Ad-Hoc Committee, and Editorial Committee.

Based in Grays Harbor, Steve retired from his position at Washington State University Cooperative Extension several years ago while continuing as a marine extension specialist for Washington Sea Grant. His depth of knowledge, exceptional communication skills, and deep dedication to everyone he worked with, will truly be missed. All the best in your retirement Steve!

An in-depth interview with Steve can be found in Waterlines 2012 (*depts.washington.edu/wracuw/publications/pdfs/waterlines2012.pdf*).




WRAC Project Highlights

September 1, 2015–August 31, 2016

Full annual reports available at:
depts.washington.edu/wracuw/research/current_research.html

1 Determination and Practical Application of Egg Quality Measures Toward Reliable Culture of High-Value Marine Finfish Species

Annual Progress Report

Principal Investigators: Kevin Stuart, *Hubbs-SeaWorld Research Institute (HSWRI)*; Ronald B. Johnson, *NOAA NMFS Northwest Fisheries Science Center (NWFSC)*; Frederick Goetz, *NOAA NMFS NWFSC, Reut Division, Manchester Research Station;* John Hyde, *NOAA NMFS Southwest Fisheries Science Center;* Gordon Murdock, *Animal and Veterinary Science, University of Idaho*

Outreach Representative: Paul Olin, *California Sea Grant, Extension Program, University of California San Diego*

Industry Advisor: Jim Parsons, *TroutLodge*

Project Monitor: James Nagler, *University of Idaho, Department of Biological Sciences and Washington State University/University of Idaho Center for Reproductive Biology*

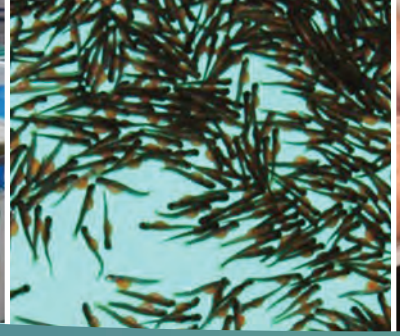
ISSUE: As capture fisheries on the West Coast are under pressure, and the need for sustainable alternative sources of marine finfish increases, it is critical to develop best management practices for marine finfish producers. In addition, the success rate for rearing high-value marine finfish species such as California halibut (CH), California yellowtail (CYT), and sablefish is highly variable.

RESPONSE: The primary goal is to elucidate which determinants of egg quality may be critical to hatchery success. Researchers intend to use this information to develop management practices and simple predictive egg quality measures and mitigate or eliminate potential causes of poor quality eggs in multiple finfish species.

RESULTS: Parentage results showed that spawning events for CYT typically involve a single female and multiple males. Researchers found that CYT will spawn in smaller tanks and accept a semi-moist formulated diet. They also showed that changes in broodstock diet can be measurable in the eggs produced. Proximate analysis, fatty acid analysis, and parentage assessment for the CYT, along with egg quality metrics can be linked to determine the makeup of good and bad eggs.

IMPACTS: The information collected has made a significant impact on HSWRI broodstock management protocols. Findings and approaches applied in this project should translate meaningfully to other species in commercial development in the United States. Information will be presented in multiple sessions in Aquaculture America 2017 in San Antonio, TX.

Photos: Kevin Stuart, Mike Rust

2 If You Feed Them, Will They Grow? A Dietary Approach to Improving the Growth of Juvenile Cutthroat Trout

Annual Progress Report

PRINCIPAL INVESTIGATORS: Christopher A. Myrick, *Fish, Wildlife, and Conservation Biology, Colorado State University;* Biswamitra Patro and Madison Powell, *Aquaculture Research Institute, University of Idaho;* Wendy Sealey, *USFWS, Bozeman Fish Technology Center*

Outreach Representative: Gary Fornshell, *Univ. of Idaho Extension*

Industry Advisors: Jeremy Liley, *Liley Fisheries,* David Brock, *Rangen, Inc.,* Jackie Zimmerman, *Skretting USA*

Project Monitor: Rick Barrows, *USDA, Hagerman, ID*

ISSUE: While there are commercially available feeds for rearing trout, none is formulated specifically for cutthroat trout. The goal is to build upon the WRAC-funded work of Myrick et. al. 2010 to identify suitable feeds for the production of market-sized cutthroat trout.

RESPONSE: Researchers will conduct trials to evaluate growth of cutthroat trout fed a single experimental diet manufactured into flake, or sinking and floating pellet forms. They will also compare the performance of commercial and experimental diets. Nutritional requirements of juvenile cutthroat trout will be determined in three phases: 1) lysine requirement, 2) optimal digestible protein to digestible energy ratio, and 3) optimal vitamin and mineral mixture concentration.

RESULTS: In both premium commercial and experimental diets, those with high protein:lipid provided the best growth. In 2016, a lysine requirement trial was conducted with Snake River cutthroat trout and preliminary data indicated that fish grew more as the dietary lysine level increased. Studies also found that cutthroat trout performed poorly on flake feeds.

A feeding trial to determine optimal digestible protein (DP) and digestible energy (DE) ratios was conducted on sub-adult Yellowstone cutthroat trout. There was no significant effect of dietary DP, DE or their interaction on the growth performance and feed utilization indices. However, overall growth performance of fish on the experimental diets was better than that of fish on the commercial control diet. Mineral analysis of fecal samples is underway and will be helpful to determine the suitable levels of dietary DP and DE for cutthroat trout.

IMPACT: The information on lysine levels, DP to DE levels, optimal vitamin and mineral premix supplementation, along with unsuitability of flake feeds, should help aquaculture producers and the feed industry select appropriate feeds for improved growth performance of cultured cutthroat trout.

Photos: Molly Webb and Courtesy of Work Group members

3 Triploids, Tetraploids, and Successful Metamorphosis in Purple Hinge Rock Scallop (*Crassadoma gigantean*)

Annual Progress Report

PRINCIPAL INVESTIGATORS: Jonathan P. Davis, *Puget Sound Restoration Foundation*; Brent Vadopalas, *School of Aquatic and Fishery Sciences, University of Washington*; Benoit Eudeline, *Taylor Shellfish Co.*

Outreach Coordinators: Paul G. Olin, *UC Sea Grant Extension Program, UC San Diego/Scripps Inst. of Oceanography*; Carolynn Culver, *UC Sea Grant Extension Program, Scripps Inst. of Oceanography, UC San Diego and Marine Science Institute, UC Santa Barbara*

Industry Advisor: Sue Cudd, *Whiskey Creek Shellfish Hatchery*

Suggested Project Monitor: Gary Freitag, *U of Alaska Fairbanks*

ISSUE: Rock scallop aquaculture production on the West Coast has market potential and substantial interest and investment from the shellfish industry. Barriers to sustainable culture include husbandry during settlement and metamorphosis to the juvenile stage and regulatory impediments due to genetic stock structure, population size, and distribution. Knowledge of optimal conditions for culture will inform coastal marine spatial planning efforts.

RESPONSE: Continue the WRAC-funded work of Olin et al. to advance sustainable rock scallop aquaculture, including production of triploids and refining grow out techniques.

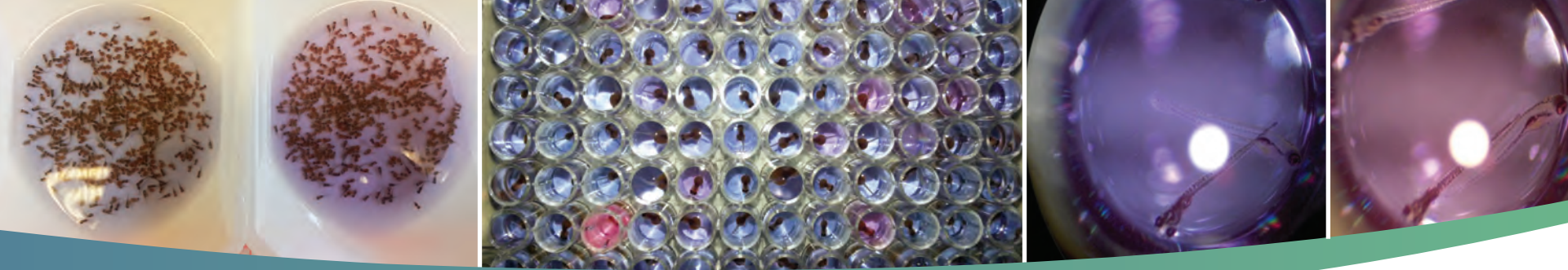
RESULTS: Separate groups of triploid and diploid rock scallops were produced from the same gamete pools, reared through the larval stage, and placed in a settlement system. The initial triploid induction rate was 82%. The hatch rate of the triploid group was approximately 1%, thus expected ultimate yields are low. Because hatch rate in diploid controls was only 20%, poor gamete quality was suspected.

Efforts to produce tetraploid (4N) rock scallops were hampered by low maturation rates in broodstock and poor spawning success. To circumvent this problem, more easily procured gametes from Pacific oysters were used as proxies in 4N induction trials.

Rock scallops produced in 2014 were monitored for growth, cementation, and survival. Good growth and survival overall were observed, with variation among sites. Cementation typically commenced at 25–30 mm. Following the initial cementation phase, few scallops reattached to available substrates. This behavior appears related to size.

IMPACTS: Triploid induction techniques in rock scallops have not yet been fully optimized, and tetraploid induction using diploid parents appears to have been successful to the veliger stage using Pacific oysters as a proxy. Grow out trials provide valuable information to prospective growers on yield at different sites in Washington waters.

Photos: Joth Davis



4 Efficient, Rapid Assay for Predicting the Growth Rate of Aquaculture Species Based on Metabolic Rate of the Fertilized Egg

Termination Report

PRINCIPAL INVESTIGATORS: Benjamin Renquist, *University of Arizona;* Kenneth Overturf, *USDA/ARS-Hagerman Fish Culture Experiment Station*

Outreach Representative: Gary Freitag, *University of Alaska*

Industry Advisor: Leo Ray, *Fish Breeders of Idaho*

Project Monitor: Matt Powell, *University of Idaho*

ISSUE: Growth of fish depends on many conditions, including dominance, feed availability, water quality, and water temperature. The AlamarBlue® assay can be used to identify broodstock that pass along the highest genetic potential for growth to their offspring and evaluate treatments that may modify the epigenetic potential for growth (e.g., nutrition, water temperature, salinity).

RESPONSE: Confirm that the AlamarBlue® assay, developed in zebrafish, can be applied to tilapia and also test its applicability in predicting growth rate of oysters.

RESULTS: Researchers established that tilapia embryos with the highest metabolic rate maintain a growth advantage over embryos with the lowest. Application of the AlamarBlue® assay was extended to include skeletal muscle and caudal fin explants and, as the explant mass increased, so did the signal generated from this assay, increasing with time. Initial results suggest a modest improvement in feed efficiency in tilapia that have a high metabolic rate, and preliminary trials suggest that metabolic rate more robustly affects growth rates in fish reared in water temperatures below those ideal for growth.

Researchers confirmed that this assay can also be applied to measure metabolic rate in oyster D-larvae and spat. The signal increased with time of exposure to the assay. Metabolic rate of the 3-month oyster spat was highly correlated with body mass. Researchers found that temperature and salinity robustly alter oyster spat metabolic rate.

IMPACT: Researchers have shown that selecting embryos with a high metabolic rate allows them to identify tilapia that will grow more quickly. Results suggest that even in the absence of improved gain:feed ratio, the selected fish grow more quickly, which will prove extremely useful in broodstock selection. This work will be applicable across finfish species. Efforts to commercialize the process should allow for industry implementation. The oyster work shows that this assay can also be applied to mollusks. A *Journal of Visual Experimentation* video and an eXtension presentation video are available at *https://acbs.cals.arizona.edu/people/benjamin-renquist*.

Photos: Benjamin Renquist

5 The Economic Impact of Regulations on Shellfish and Trout Aquaculture Growth in the Western United States

Annual Progress Report

PRINCIPAL INVESTIGATORS: Carole R. Engle, *Engle-Stone Aquatic$ LLC, Virginia Polytechnic and State University*; Fred Conte, *UC Davis*; William Hanshumaker, *Oregon State University*; Bobbi Hudson, *Pacific Shellfish Institute*

Outreach Coordinator: Gary Fornshell, *University of Idaho*

Industry Advisor: Bill Dewey, *Taylor Shellfish Farms*

Project Monitor: Gunnar Knapp, *University of Alaska*

ISSUE: Quantifying the impact that the federal and state regulatory environment has on the United States aquaculture industry will provide a basis for changes that would streamline the regulatory process to improve the current state of affairs and promote the development and growth of aquaculture, in accordance with the goals of the 1980 National Aquaculture Act.

RESPONSE: Investigators will gather detailed information on the regulations faced by West Coast shellfish growers and western region trout farmers; estimate the total costs associated with these regulations; and disseminate project results broadly to industry associations and aquaculture research and extension specialists for use in discussions with policy makers. Data will be collected through two surveys: West Coast shellfish growers (Yr 1) and western region trout farmers (Yr 2).

RESULTS: Funding became available in late February 2016. The Work Group met at the project's onset at Aquaculture 2016. The group reviewed the objectives and project timeline and discussed development of the list frames for each survey, the survey instrument, and key regulatory issues that needed to be captured. They agreed to focus first on the shellfish survey and then seek to begin development and initiation of the trout survey as early as possible.

IMPACT: This information could prove useful to policy and decision makers when making important decisions regarding legislation and statutes. Furthermore, if the findings demonstrate that regulations represent a significant factor in costs of aquaculture production, it may indicate that the regulatory environment creates a hurdle for US aquaculture development by limiting new entrants.

Detailed analyses of the redundancies in reporting and information requests would provide guidance on specific actions that could be taken to share permitting data or otherwise reduce the time delays often reported by producers. Quantitative estimates of the increased costs due to both state and federal regulations would demonstrate the types of regulations and the corresponding compliance requirements that have created the greatest adverse effects on US aquaculture.

Photos: Jonathan van Senten, Gunnar Knapp




6 Determining Causes, Costs, and Benefits of Triploidization to Improve Sturgeon Caviar Production.

Annual Progress Report

PRINCIPAL INVESTIGATORS: Andrea Schreier, Joel Van Eenennaam, Anne Todgham, and Fred Conte, *UC Davis*; Molly Webb, *Bozeman Fish Technology Center*; Shawn Young (*Kootenai Tribe of Idaho*

Outreach Representative: Fred Conte, *UC Davis*

Industry Advisors: Peter Struffenegger, *Stellar Biotech*; Linda Lemmon, *Blind Canyon Aqua Ranch*

Project Monitor: Kevin Fitzsimmons, *University of Arizona*

ISSUE: The potential costs and benefits of spontaneous triploid (12N) production to the white sturgeon industry have not been explored. One potential benefit is that 12N sturgeon have larger eggs and possibly a female-biased sex ratio.

RESPONSE: The objectives of this project are to 1) determine how spontaneous triploid white sturgeon are produced, 2) develop and validate a blood smear technique to assign ploidy level in white sturgeon, 3) evaluate non-reproductive females and their ploidy levels, 4) evaluate sex ratio and performance of 8N and 12N white sturgeon reared in a common environment, and 5) disseminate findings to sturgeon producers and conservationists.

RESULTS: Research results indicate that when spawning white sturgeon, it is important to monitor each female early enough to determine when oviposition begins, otherwise *in vivo* oocyte aging will result in over-ripe eggs and increased autopolyploidy. Coulter counter analysis appears to be a promising tool to assign ploidy to 8N, 10N, and 12N white sturgeon.

Researchers found that some non-reproductive females were 10N and that the 10N fish showed reduced development relative to normal 8N counterparts. The finding of non-reproductive females that were 8N indicates that factors other than ploidy can affect reproductive development. Investigators have provided some of the first evidence of differences in basal stress parameters and basal immune function between 8N and 10N white sturgeon.

IMPACTS: Based on findings so far, researchers can make specific recommendations. If producers wish to reduce 12N production, they can avoid spawning females beyond the industry standard of 3–4 hours after oviposition. Researchers continue to recommend that all 12N sturgeon be removed from farm breeding pools so that 10N offspring are not produced.

Photos: Fred Conte; spoon: ALLEKO/iStock/Thinkstock

WRAC Outreach: In The Press and At The Podium

September 1, 2015–August 31, 2016

JOURNAL PUBLICATIONS

Conte FS, Ahmadi A. (Submitted). Application of the Mermaid shellfish sanitation model using a Virginia shellfish dataset during the transition from a multiple-tube test to the Membrane Filtration Test. Journal of the American Society of Agricultural and Biological Engineering, Applied Engineering in Agriculture.

MASTER'S THESIS

Owens CE. 2016. Evaluating dietary and behavioral impacts of commercial-type diets on the growth and anti-predator responses of Snake River Cutthroat Trout (*Oncorhynchus clarkii behnkei*). MS Thesis, Colorado State University, Fort Collins, CO. 59p.

PRESENTATIONS AND POSTERS

Armbruster L, Stuart K, Drawbridge M, Johnson RB. California yellowtail (*Seriola dorsalis*) egg quality and chemical composition. Aquaculture America, Las Vegas, NV, February 22–26, 2016.

Clarke B, Leal M, Todgham AE. Predicting and assessing the stress and immunity responses of different ploidy white sturgeon under warming conditions. UC LEADS (Leadership Excellence Through Advanced Degrees) Research Symposium, University of California Davis, Sacramento, CA, March 4, 2016.

Clarke B, Todgham AE, Schreier A. Developing blood smear analysis for assigning white sturgeon ploidy groups. University of California Davis Undergraduate Research Symposium, May 2016.

Conte FS, Ahmadi A. Ground-truthing the shellfish sanitation model Pearl using public health sanitation data sets from Pacific, Gulf, and Atlantic States of the United States. Aquaculture America 2016, Las Vegas, NV, February 24, 2016.

Davis J. Aquaculture development for native species in the Salish Sea. Keynote Address to the NW Fisheries Science Center 5th Science Symposium, Seattle, WA. April 5, 2016.

Davis J. Emerging species and maintenance of sustainable approaches to aquaculture of seaweeds, rock scallops and other species in the Salish Sea. 2016 Salish Sea Ecosystem Conference, Vancouver, BC, Canada, April 13–15, 2016.

Davis J, Saksa K. Developments in the commercialization of purple-hinge rock scallop aquaculture *Crassadoma gigantea*. Meeting of the World Aquaculture Society, Las Vegas, NV. February 22–26, 2016.

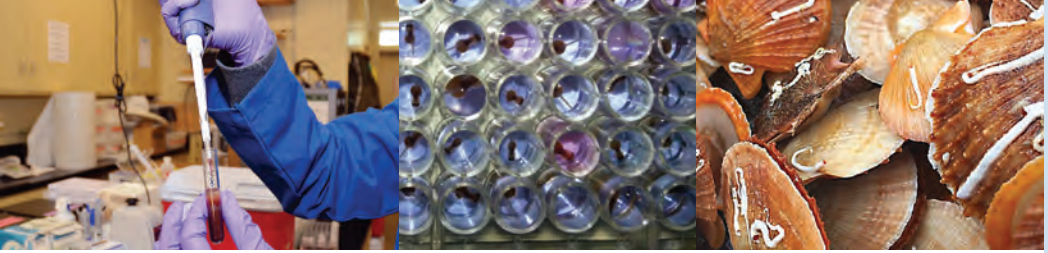
Davis J, Saksa K. Prospects for purple hinge rock scallop cultivation on the west coast studies on aquaculture potential. 69th Joint Annual Meeting of the National Shellfisheries Association Pacific Coast Section and the Pacific Coast Shellfish Growers Association, Hood River, OR, September 22–24, 2015.

Engle CR, van Senten J. Fish farming costs: how much is due to regulations? Idaho Aquaculture Association, Twin Falls, ID, June 11, 2016.

Jackson M, Davis J, Vadopalas B, Hauser L. Investigating local adaptation in Washington State purple hinge rock scallops. 69th Joint Annual Meeting of the National Shellfisheries Association Pacific Coast Section and the Pacific Coast Shellfish Growers Association, Hood River, OR, September 22–24, 2015.

Jackson M, Davis J, Vadopalas B. Update on development of commercial hatchery production techniques for purple hinged rock scallops. 69th Joint Annual Meeting of the National Shellfisheries Association Pacific Coast Section and the Pacific Coast Shellfish Growers Association, Hood River, OR, September 22–24, 2015.

Lowell N, Davis J, Vadopalas B, Hauser L. Assessing population structure and local adaptation of rock scallops to inform aquaculture practice. 69th Joint Annual Meeting of the National Shellfisheries Association Pacific Coast Section and the Pacific Coast Shellfish Growers Association, Hood River, OR, September 22–24, 2015.



Photos, l to r: Fred Conte, Benjamin Renquist, Joth Davis

Owens CE, Sealey WM, Conley ZB, Myrick CA. 2016. Growth of juvenile Snake River cutthroat trout (*Oncorhynchus clarkii behnkei*) fed commercial type diets. Aquaculture America, Las Vegas, NV, February 22–26, 2016.

Owens CE, Myrick CA, Sealey WM, Fornshell G, Conley ZB, Hink A. 2016. The influence of diet on the growth and behavior of juvenile Snake River cutthroat trout (*Oncorhynchus clarkii behnkei*). Colorado–Wyoming Chapter American Fisheries Society Annual Meeting, Laramie, WY, March 1–3, 2016.

Owens CE, Myrick CA, Sealey WM, Fornshell G, Conley ZB, Hink A. The influence of diet on the growth and predator-avoidance behavior of juvenile Snake River cutthroat trout (*Oncorhynchus clarkii behnkei*). 12th International Congress on the Biology of Fish, San Marcos, TX. June 12–16, 2016.

Stuart K, Johnson RB, Armbruster L, Drawbridge M. Manipulation of arachidonic acid in the diet of adult California yellowtail (*Seriola dorsalis*). Aquaculture America, Las Vegas, NV, February 22–26, 2016.

ON THE WEB

Renquist BJ. 2016. Applying a test developed to combat obesity and diabetes to improve growth in fish, mollusks, and crustaceans. eXtension *https://learn.extension.org/events/2803*

Williams SY, Renquist BJ. 2016. High Throughput Danio Rerio Energy Expenditure Assay. JoVE.;(107):e53297. [This is a video posting of scientific work.]

IN THE MEDIA

Snyder, C. (2016, June 27) Regulations take a bite out of aquaculture. For the *Times-News*. Retrieved from: *https://magicvalley.com/business/agriculture/regulations-take-bite-out-of-aquaculture/article_95d6c975-dae5-54cc-8f68-5462cc2ae128.html*

WRAC Extension Publication

Evaluating Ingredients for Aquafeeds: Alternative Protein for Trout Feeds. Technical Report. Participants: Fornshell G, Sealey M, Ross C, Myrick M, Gaylord T, Barrows F. 2016.

This technical report describes the evaluation of two experimental feeds with alternative ingredients and one commercial control feed during a production trial at a commercial trout facility in Idaho. In addition to the usual production metrics measured, product quality was evaluated using taste test panels, and a basic cost comparison analysis was conducted.

Feed costs account for a significant portion of operating expenses for trout producers, ranging from 40 to 60% of operating expenses. Producers therefore have a strong incentive to optimize feed efficiency.

To request a print copy, contact the WRAC Administrative Office. The pdf will be posted online on the WRAC website: *depts.washington.edu/wracuw*

From left to right: plant protein diet, animal protein diet, and commercial trout diet.

Photo: Wendy Sealey

Waterlines
Western Regional Aquaculture Center
School of Aquatic & Fishery Sciences
Box 355020
University of Washington
Seattle, Washington 98195-5020

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Editor, WRAC *Waterlines*
School of Aquatic and Fishery Sciences
College of the Environment
University of Washington
Box 355020, Seattle, WA 98195-5020

phone: 206-685-2479
email: *wrac@uw.edu*
web: *depts.washington.edu/wracuw*

Visit our website at:
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