United States Department of Agriculture
National Institute of Food and Agriculture

# Oral and Poster Presentation Abstracts

6th National
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Western Regional Aquaculture Center
Northeastern Regional Aquaculture Center
North Central Regional Aquaculture Center
Southern Regional Aquaculture Center
Center for Tropical and Subtropical Aquaculture

# TABLE OF CONTENTS

## ABSTRACTS




USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Sea Grant

## POSTERS



## AGENDA

## PROGRAM EVALUATION

## CONFERENCE ATTENDEES

# EXTENSION SUPPORT OF AQUAPONICS FARMS IN HAWAII AND THE U.S. AFFILIATED PACIFIC ISLANDS

Harry Ako

University of Hawaii (retired)
hako@hawaii.edu

Aquaponics was initiated because fresh vegetables need to be imported into Hawaii and the U.S. Affiliated Pacific Islands, the latter by air. Research was based on the simple hydroponics system of Bernard Kratky and the high intensity fish culture and floating raft methods of James Rakocy. A Nutrient Flux Hypothesis was developed to guide research. The basis of the method was quantitative measurement inorganic nutrients taken up by lettuce plants through their life cycle. Nutrients were provided by tilapia (*Oreochromis urolepis hornorum*) eating a 42% protein feed. After system development, hardware and operating instructions were presented to the public in two extension publications and several workshops. Backyard systems that sprang up did not have too long a lifetime but several farms in Hawaii and American Samoa are still operational. Design errors were corrected and included shading of growbeds, allowing sunlight to impinge on fish tanks, or diluting plant nutrients by using too large fishtank or growbed water volumes. Other extension assistance was provided. Slow plant growth problems were diagnosed using farmer generated water chemistry measurements and included underfeeding fish, low dissolved oxygen levels in growbeds leading to poor root growth or denitrification. The typical farm occupied an acre, growbeds (133,000 L water) containing 18,000 plants, is fed by fishwater from 830 kg of fish being kept in 72,000 L of water and being fed 15 kg of feed/day. Capital costs were $212,000 (PingSun Leong and others). Annual operating costs were $66,000/year. The farm had a return on investment higher than a typical successful aquaculture farm but revenues increased as farmers have improved production and receive $4/lb or more for their organic certified produce. Actual revenue values will be shared at the meeting which demonstrate that aquaponics is lucrative.

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# EXTENSION'S ROLE IN THE 10-YEAR TRANSITION TO USDA FSIS INSPECTION OF CATFISH

Jimmy L. Avery

National Warmwater Aquaculture Center
Mississippi State University
P.O. Box 197
Stoneville, MS 38776

The 2008 Farm Bill amended the Federal Meat Inspection Act to include catfish. FSIS' initial Risk Assessment stated that applying the FSIS program would yield a reduction of 175,000 lifetime cancers, 91.8 million exposures to antimicrobials, and 23.3 million heavy metal exposures. After OMB review, the assessment was changed to prevention of roughly 2,300 illnesses from Salmonella annually. The definition of the term "catfish" was left to the Secretary of Agriculture to determine. Unlike the other animals under FSIS inspection, the Service has inspection authority over the conditions under which catfish is raised and transported to a processing establishment.

Extension involvement ranged from providing technical review of agency documents, advising commodity organizations, and creating educational opportunities for FSIS personnel, consumer organizations, and legislators. A technical committee of research and Extension specialists with experience in production, economics, and processing provided critical review of the proposed final rule. Education on catfish production and processing was provided to FSIS administration and staff in Starkville, MS and Washington, DC in 2009. An industry introduction and tour was given to national consumer organizations. These groups included Government Accountability Project, Food and Water Watch, Consumer Federation of America, Consumers Union and Center for the Science in the Public Interest. Their interest ranged from sustainability of seafood, water quality, transshipment and circumvention to food safety. Extension also served in the USDA FSIS Catfish Vulnerability Assessment Workgroup (Meeting and Teleconferences) in 2008 and 2015. Work Group Members assisted FSIS in the development of a vulnerability assessment for domestic catfish products. FSIS uses vulnerability assessments to identify the potential for intentional adulteration of regulated products.

In 2016, I was asked to make two trips to Washington, D.C. to provide technical information related to FSIS Inspection to US House representatives. These trips typically consisted of roughly 30 meetings with many additional informal drop-by visits to deliver informational packets. I participated in USDA FSIS Educational Meeting on Inspection of Siluriformes Fish in Stoneville, MS on January 27, 2016. The session provided an opportunity for participants to ask detailed questions on Siluriformes inspection. Most questions surrounded domestic slaughter inspection (primary), further processing (secondary) inspection, and imported Siluriformes product.

Current service includes technical review of *FSIS Compliance Guideline for Establishments that Slaughter or Further Process Siluriformes Fish and Fish Products March 2017* and response to two domestic recalls of catfish products.

# SOCIAL MEDIA AND TECHNOLOGY AS GAME CHANGERS IN POND MANAGEMENT EXTENSION

Marley Beem

Department of Natural Resource Ecology and Management
Oklahoma State University
Stillwater, Oklahoma 74078
marley.beem@okstate.edu

Social media and trends in certain developing technologies hold the promise of revolutionizing how pond owners are educated and farm ponds are managed.

Extension specialists perceive themselves as technical experts who are good at simplifying and making palatable the best methods of managing ponds. Most pond owners are uninterested in managing ponds and only seek assistance when a problem occurs. Social media promises to be an effective marketing tool to influence the large mass of pond owners to become proactive pond managers.

Developing technologies hold the promise of making best management practices much easier. Optical recognition systems, a new generation of autonomous underwater vehicles and other innovations promise to make it possible to effortlessly collect data on fish catch, directly cull overabundant size classes and identify and quantify the coverage of aquatic plants.

With social media and advanced technologies it should be possible to successfully implement the innovation-diffusion model to facilitate an active pond management "culture." The development timeline for such technological innovations is speculative but could be much shorter than many of us imagine. These emerging possibilities demand our thoughtful consideration, lest opportunities be lost or potentially harmful developments surprise us.

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**OPPORTUNITIES AND CHALLENGES FOR AQUACULTURE EXTENSION IN THE PACIFIC ISLANDS**

Meredith Brooks* and Maggie Ma

Center for Tropical and Subtropical Aquaculture
41-202 Kalanianaole Highway
Waimanalo HI 96795
mbrooks@ctsa.org

The Center for Tropical and Subtropical Aquaculture (CTSA) was established in 1986 to assist aquaculture development in Hawaii and the U.S. Affiliated Pacific Islands, and does so with its annual funding support for various research, demonstration, and extension projects. The Pacific region is home to an abundance of natural resources perfect for aquaculture production, including pristine ocean water and easy access to the EEZ and wild broodstock for hatchery production of target species. The opportunities are wide ranging, from small land-based community farms to large offshore aquaculture cages, which can be used to sustainably increase food security for the growing global population. However, challenges related to capacity building and the regional investment environment have seriously stunted the growth of the industry in the region.

It is not uncommon to have extension agents and other foreign experts work hard to transfer technology in the region, only for things to fall apart due to a lack of continued support and/or other logistical issues. Recent CTSA projects have taken a different approach to capacity building, emphasizing a "trainee becomes the trainer" model and focusing production on either non-fed species and/or species that can be fed with feeds made from locally available ingredients.

Although CTSA has experienced some success in these latest capacity building efforts, we have much farther to go to adequately address the most significant challenges facing our industry, which are 1) workforce development and retention, 2) local feed production, and 3) socio-economic conditions in remote islands. These challenges will be presented in detail at the conference to facilitate discussion.

**CREATING BETTER EDUCATIONAL VIDEOS FOR EXTENSION AND OUTREACH**

David Cline

Extension Aquaculturist
203 Swingle Hall
Auburn University, AL 36849
clinedj@auburn.edu

Welcome to the video age. The spread of high speed internet access and simple video editing software makes the creation and delivery of online educational videos easier than ever. YouTube videos provide an excellent mechanism for Extension specialists to share information and reach a large potential audience. Putting a Power Point presentation in video format does not make the most of this medium. The creation of good video content requires careful planning and practice. The average attention span of most adults is 15 minutes and students approximately 7-10 minutes. Most lecture presentations, however, last 30 minutes to an hour. How can you get your point across as quickly as possible? We must learn to provide entertainment in addition to education. YouTube suggests that the first 15 seconds of a video are critical for engagement and retention of the audience.

A central figure or "hero" and a story with a beginning, middle and end will go a long way towards retaining the attention of the audience. Join us for a discussion these and other simple tips and techniques that can improve your ability to create watchable or perhaps even enjoyable educational Extension videos.

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## AN OVERVIEW OF CONNECTICUT'S SEAWEED AQUACULTURE INDUSTRY

Anoushka Concepcion

Connecticut Sea Grant and Department of Extension
University of Connecticut
1080 Shennecossett Road
Groton, CT 06340

Cultivated seaweed, specifically the sugar kelp (*Saccharina latissima*), is a relatively new commercial crop in Connecticut. Five farmers deployed kelp seed-string last season and several more are in the process of obtaining regulatory permits to grow kelp in Long Island Sound in the coming years. The introduction of any new crop for human consumption raises certain questions and challenges. Connecticut Sea Grant and colleagues have been working to address public health concerns and processing options for seaweeds, in support of this nascent industry. This presentation will provide an overview on the background of seaweed cultivation, extension efforts related to regulation and processing, next steps and lessons learned.

# SHELLFISH SANITATION MODELS FOR NATIONAL GROWING AREA APPLICATIONS

Fred S. Conte* and Abbas Ahmadi

Department of Animal Science
University of California Davis
Davis California, USA 95616
fsconte@ucdavis.edu

Over the past decade, the authors have developed three shellfish sanitation computer algorithms and models applicable for managing national shellfish growing areas; and capable of addressing shellfish areas classified under the National Shellfish Sanitation Program (NSSP) protocols as Approved, Restricted, Prohibited, Conditionally Approved, and Conditionally Restricted. The models employ the identical protocols and equations mandated by the NSSP and Model Ordinance, but are capable of performing the analyses more accurately and in a fraction of the time required by other available means. For example, a 30-year analysis of a state's total sanitation database in a bay by bay analysis takes less than one minute. The models also incorporate an additional set of *"Pearl"* equations that calculate the upper limits of the Geometric Mean and the Estimated 90$^{th}$ Percentile of the fecal coliform concentrations and provide more sensitive and accurate measures of sanitation safety for consumption of shellfish.

The *Pearl* model can be used in one of two modes. In the stand-alone mode, *Pearl* can perform a multi-year analysis using observed fecal coliform data collected from within shellfish growing areas to determine if shellfish harvested from those areas may pose a human health risk for shellfish consumers. Shellfish growing areas that are identified as problematic through a stand-alone *Pearl* analysis are candidates for closure rule adjustments. Run in tandem mode with the *Aquarius* model, *Pearl* can be used to adjust closure rules and maximize the number of days a shellfish growing area can remain open to harvest with no increased risk of illness to shellfish consumers. Closure rules may be based on factors such as rainfall, tide, river flow, and river height (Indirect Rules). The third model, *Mermaid*, uses calculated datasets to detect problem growing areas where raw datasets are not available. *Mermaid* addresses Direct Rules, in which fecal coliform concentrations are used directly to establish closure status for areas classified as Approved, Restricted, or Prohibited. It also has the ability to handle mixed-test transitional databases of fecal coliform concentration samples (i.e. transitioning from a 3-Tube Test to a Membrane Filtration Test), and can reclassify individual sections within shellfish growing areas using the more sensitive *Pearl* formulas.

The three sanitation models have been field tested using shellfish sanitation datasets obtained from agencies in states of the Pacific, Gulf and Atlantic coasts of the United States. In all the tests, the results demonstrate that the application of the national NSSP standards fall short, and the *Pearl* equations establishing new Pearl Limits offer more adequate means of maintaining food safety for consumption of shellfish. The *Pearl* and *Aquarius* models are published in peer-reviewed engineering journals and their applications are published in environmental sanitation journals. The *Mermaid* model and its applications have been submitted and is under review for publication in engineering journals.

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**HIGHLIGHTS ON AQUACULTURE RESEARCH AND EXTENSION PROJECTS IN THE REPUBLIC OF PALAU**

Miguel A. Delos Santos

Aquaculture Researcher
Palau Community College-Cooperative Research and Extension
P.O. Box 9 Koror, Palau 96940
mdelo923@gmail.com

In furtherance of the development of sustainable aquaculture in the Republic of Palau, the Palau Community College-Cooperative Research and Extension (PCC-CRE) has been active in working with the local fish farmers and concerned local and national government agencies in various types aquaculture activities that are on-going in the country. Recent research projects are focused on the development of broodstock, seed production, nursery and grow-out of the five major indigenous commercially important seafood commodities: rabbitfish, grouper, milkfish, mangrove crab and tiger shrimp. Other potential aquaculture species are also being explored for future studies. PCC-CRE has also engaged in various extension activities that include site visits, providing technical assistance, hands on training and workshops to fish farmers and individuals interested in aquaculture, which will be discussed in detail during the presentation. These activities have been supported by funds coming from USDA-NIFA through the Land Grant Program of the College of Micronesia (COM-Land Grant) and the Center for Tropical and Subtropical Aquaculture (CTSA).

# WHY DO SO MANY AMERICANS REACT NEGATIVELY TO INCREASING AQUACULTURE IN THE US?

James S. Diana

School of Natural Resources and Environment
University of Michigan
Ann Arbor, MI 48109-1041 jimd@umich.edu

Walk past a koi or carp pond in a business park and you don't typically think of dinner. Yet in much of Asia small-scale fish ponds supply much of a family's protein needs. In America aquaculture usually elicits a neutral or negative response from people. In a country where the majority of food comes from large farms, feedlots, and dairies it seems odd that farming fish would take so much convincing of the American people.

One cause for this discrepancy is the negligible presence aquaculture has in peoples' lives, since North America only produces about 2% of the world's aquaculture. Many view fish farming facilities as eyesores, but in reality all agriculture changes the landscape. However, when we see row crops on the periphery of major cities, we view them positively as "Green Space". The perception of fish farms and agricultural fields is quite different, yet both result in the same thing—a major change in the natural ecosystem that was made to produce food.

The rating scales produced by the Monterey Bay Aquarium and others are attempts to define sustainable practices for fisheries and aquaculture. However, simple definitions don't fully explore the question, "What is sustainable?" For example, should we consider wild-caught species of fish to be sustainable, when many fish populations are heavily overexploited? Should we encourage consumers to avoid farmed shrimp, when many shrimp farmers use sophisticated techniques to clean the water, reduce farm effluents, and control diseases?

Life-cycle assessments hold promise as a more objective method to evaluate the sustainability of seafood. Life-cycle assessment documents the total materials and energy used in a production system, including building the farm, growing the crop, and disposing of the waste as well as marketing, sales, and ultimate consumption of the product. These analyses not only evaluate energy use and material consumption but can also estimate the global warming potential, eutrophication potential, and a number of other environmental metrics of sustainability. Since a life-cycle assessment is quantitative, it can be used to compare widely diverging production systems. For example, shrimp as well as many other aquaculture products are comparable to chicken in the energy cost and environmental impacts for producing a kg of "meat" and are considerably lower than pork, lamb, or beef. Yet many environmental groups maintain aquaculture is a dirty industry and do not support expansion of aquaculture in the US.

In order to move forward, Americans need to know more about how ALL of their food is produced and the most sustainable methods of producing food. While thoughts about whether to eat farmed or wild seafood are in the minds of many people, most of the time you often cannot even determine the source of seafood you eat at a restaurant or buy at a store. In fact, about half of the fish purchased in restaurants are not even the species that is advertised. Clearly, we need to take seafood more seriously as a food source. Our purchasing habits and knowledge can drive the aquaculture sector to using more sustainable methods, but only when we make informed decisions in the marketplace.

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**SEAFOOD TECH UPDATE: FROM SOURCE TO TABLE**

John W. Ewart* and Doris T. Hicks

Delaware Sea Grant Marine Advisory Service
College of Earth, Ocean, and Environment
University of Delaware
Lewes, DE 19958
ewart@udel.edu

Seafood is a popular protein source worldwide, with ample nutritional research documenting that finfish, and shellfish are a healthy, low fat alternative to beef, poultry and pork. World population growth and economic development trends are the principal drivers of a steadily increasing demand for high quality seafood products. With static trends in fisheries and aquaculture production, and per capita seafood consumption at 14-15 pounds, US demand exceeds the available domestic supply. Over 90% of seafood consumed is imported resulting in annual trade deficits of $9-12 billion. Consumers are confused about seafood in their diet. They have received mixed messages and even outright misinformation from the media, and issue oriented NGOs about benefits and risks of seafood products and how they are produced.

Sea Grant and Cooperative Extension specialists have a key role in advancing public education and understanding of these issues. Food, health, seafood professionals and others need the most up to date information to better inform their local audiences and consumers about the nutritional benefits, handling, quality, and safety of seafood and controversial media related issues. Using in-service training, tours, demonstrations and seminar formats, the Aquaculture and Fish Tech 101 (AFT101) program <darc.cms.udel.edu/sgseafood> with Sea Grant support from 2014 to the present has held 4 regional workshops (East, West, Gulf Coasts and Great Lakes) in cooperation with regional extension colleagues, and has participated in annual conferences at national venues attended by health and seafood professionals and other target groups. The seafoodhealthfacts.org website, with more than 700,000 domestic and international page views, and direct links or search engine referrals from more than 840 sources provides current, science-based information to consumers, health and nutrition specialists and seafood industry participants.

The Seafood Tech Update: From Source to Table session reviews the major trends and future prospects affecting the international and domestic seafood industries. Updates related to seafood distribution and safety, nutrition and health, persistent media narratives and issues that influence consumer attitudes and their purchasing choices are also presented.

**ALASKAN MARICULTURE DIVERSIFICATION, INNOVATION AND TECHNOLOGY TRANSFER PROJECT**

Gary Freitag* and Quentin Fong

University of Alaska - Alaska Sea Grant
University of Alaska - Ketchikan
600 Stedman Street
Robertson/Hamilton Building
Ketchikan Alaska 99901

Alaska has vast growing areas and superior reputation of Alaskan seafood, and recent initiation of the Alaskan Mariculture Initiative[1] funded by a NOAA Saltonstall-Kennedy grant to the Alaskan Fisheries Development Foundation (AFDF) with a goal to aid in the development of a $1 billion industry within 30 years, has created some momentum and a broader interest in developing a safe, sustainable supply of seafood (and other products) through the mariculture of marine invertebrates and macroalgae. It can be argued that Alaskan mariculture is in the first stage, and that breakthroughs in culture technology, development of successful business models, and development of strategic partnerships are necessary steps for rapid mariculture growth in Alaska over the next 2-5 years. Mariculture in Alaska has had a long history in salmon enhancement with an annual value of $100 to $200 million over the last decade. However, the farm gate value of the mariculture of invertebrate shellfish has grown to just under $1 million since 1990, with only 28 of 63 farms having sales, and nearly 95% of the production coming from pacific oysters *Crassostrea gigas*. Growers cite seed availability, slow growth rates, labor costs, outdated technology, shipping costs and harmful algal bloom closures as factors limiting their profitability, and ultimately the growth of the industry. The key to mariculture success in Alaska is building on our target group, the existing mariculture industry and "early entrepreneurs" who have gained a foothold in mariculture in the state, focusing on improving the efficiency of species which are at or near commercialization Pacific oysters *Crassotrea gigas*, and encouraging the development of new species which are either high value like purple hinged rock scallops C*rassadoma gigantea* or have a fast growth rate in cold Alaskan waters macroalgae such as *Laminaria saccharina*. We are providing a focus on farm diversification in Alaska over the short term (*1-2 years, macroalgae seed production, outreach and grow-out trials*), as well as the long term *(3-5 years, oyster gear efficiency).* The aquaculture extension and technology transfer activities include two conferences and trade shows (2015 and 2016), business planning and technology transfer workshops, establishment of an Alaska macroalgal working group, developing a seaweed hatchery and nursery, environmental monitoring, and field grow-out trials using innovative gear and grow-out techniques. Removing bottlenecks to industry growth will result in a $8 million industry by 2020.

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**TODAY'S RESEARCH AND EXTENSION FOR TOMORROW'S SEAFOOD AND WORKING WATERFRONTS: NOAA AQUACULTURE**

Nikola M. Garber*, Michael Rust, and LaDon Swann

NOAA Sea Grant
1315 East West Hwy, R/SG
Silver Spring, MD 20910
nikola.garber@noaa.gov

US now ranks #17 in global production, per FAO SOFIA 2016 (table 9). The US has a $13.2 billion seafood trade deficit. Join me as we explore this deficit and how the Government (emphasis on Federal), University, and private sectors could reinvigorate the US waterfronts and local communities through business and job creation with safe and sustainable seafood. We will further explore "Why?" the public, interested stakeholders, and local, state, and Federal Governments should be interested.

**CONNECTICUT SEAFOOD: PUBLIC AWARENESS, PERCEPTIONS, PREFERENCES AND USE PATTERNS**

Tessa L. Getchis*, Anoushka P. Concepcion, Miriah Russo Kelly, and John Bovay

Connecticut Sea Grant and UConn Extension
University of Connecticut
Groton, CT 06340-6048
tessa.getchis@uconn.edu

Connecticut aquaculture is a multi-million-dollar industry, and is the primary source of the seafood supply. The state is a leading producer of molluscan shellfish and has a fledgling seaweed industry. One of the perceived impediments to growth of the aquaculture industry is limited public awareness about Connecticut farmed and wild-caught seafood. A 2016 pilot study of Connecticut residents revealed that fewer than half (46%) of respondents (n=579) were able to correctly answer questions related to the identification of Connecticut aquaculture products and their economic value. While there is a concerted effort to grow aquaculture, a lack of public awareness of the economic, environmental and social consequences of Connecticut aquaculture and local seafood production may not bode well for development. Aquaculture activity occurs primarily on publicly owned lands where public support for expansion is paramount.

The purpose of this study is to better understand public knowledge, perceptions and preferences for Connecticut farmed and wild-caught seafood products. The survey will be administered using Qualtrics™ and include questions on knowledge, perceptions, consumption patterns and frequency, and socio-demographics, as well as stated choice experiments to assess consumer purchasing preferences. The survey aims to identify the following about Connecticut residents:

1. Knowledge gaps about local aquaculture and wild-caught seafood
2. Perceptions and concerns about local aquaculture and wild-caught seafood
3. Top seafood products most frequently purchased, desired
4. Factors that matter most when buying seafood
5. Consumption frequency and quantity
6. Barriers to local seafood purchase and consumption

The results will inform the development of new public engagement programs on Connecticut aquaculture and seafood products, and help target specific socio-economic groups that would benefit from targeted messaging on these topics. Additionally, the consumer preferences data may be helpful to seafood producers, retailers and chefs who wish to diversify and improve marketing of local farmed and wild-caught seafood products.

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# AQUACULTURAL ENGINEERING EXTENSION IN NORTH CAROLINA: VENUES AND EVENTS

Steven Hall*, Melody Thomas, Alex Geddie, Matthew Campbell

Biological and Agricultural Engineering
North Carolina State University
Raleigh NC 27695 USA
shall5@ncsu.edu

Extension in aquaculture is healthy in North Carolina, while aquacultural engineering is a more specialized but important venture. The industry is modest ($54M in 2016) but growing. Hence, extension to the industry to enhance both productivity and sustainability is critical. A number of venues are available in the state, but very few of these have legitimate engineering focus areas. The Marine Aquaculture Research Center in Marshallburg, NC provides the opportunity to share with various constituencies, primarily community, commercial and research personnel, and is currently directed by Dr. Steven Hall of the NCSU Department of Biological and Agricultural Engineering. This facility is close to the North Carolina coast (a tidal creek allows us to draw marine water for use), but somewhat distant from major population centers. This facility, allows controlled experiments as well as demonstrations of practical engineering including equipment, emplacement and assessment of energy and waste management.

Another venue, the "fish barn" is located in suburban Raleigh, a metro area of approximately 1 million. This intermediate sized facility is located on the grounds of NCSU's farm. This allows groups of students, community members, engineers, and other practitioners to visit, but this is largely a freshwater facility of moderate size.

An on-campus facility housed at the Department of Biological and Agricultural Engineering has even less space but is more accessible to the 34,000 students at NCSU and the 8,000 faculty and staff members. Other venues focus on science but have limited engineering outreach. Finding ways to synergize with these venues (including the NC Aquaria; and research facilities run by public (UNC, NCSU) and private (Duke) universities as well as state and federal (NOAA) organizations will allow additional engineering extension impact in the state and region.

Events of interest include personal meetings, emails, phone calls, as well as small group field trips or focus groups, and large events such as field days. An example of this was the NCSU College of Life Sciences faculty leadership bus trip that visited aquacultural and agricultural venues in 2016. A larger event is the annual North Carolina Aquaculture Development Conference in New Bern. This was a success in 2017 and is in planning stages for 2018. This presentation will compare and contrast these venues and events for outreach and suggest effective steps to move the industry and the outreach program forward.

**COMMERCIAL AQUACULTURE HEALTH PROGRAM STANDARDS (CAHPS)**

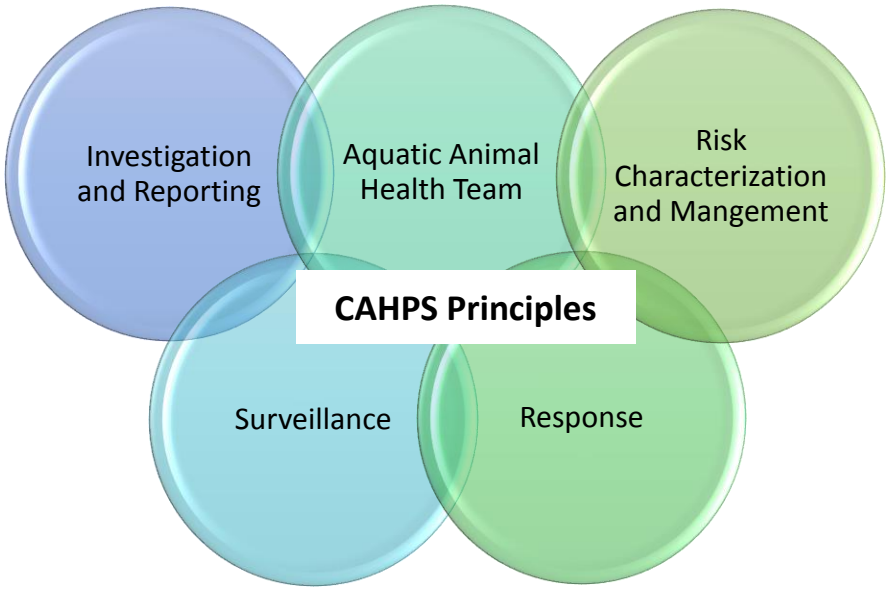
Kathleen Hartman, MS, DVM, PhD

USDA APHIS Veterinary Services
1408 24th Street, SE
Ruskin, FL 33570
Kathleen.H.Hartman@aphis.usda.gov

The National Aquaculture Association (NAA) and USDA APHIS Veterinary Services have developed Commercial Aquaculture Health Program Standards (CAHPS). These program standards establish a non-regulatory framework for the improvement and verification of the health of farm raised aquatic animals produced in U.S. commercial aquaculture industry sectors.

CAHPS is based on 5 principles intended to provide for early disease detection, surveillance, reporting and response for the control of aquatic animal pathogens—especially those listed by the World Organization for Animal Health (OIE)—and to prevent pathogen dissemination via movement and trade of aquatic animals.

CAHPS will support various business objectives including efforts to improve health management, protect and expand aquaculture business opportunities, promote and facilitate trade, as well as efforts to improve resource protection and environmental sustainability. The five principles of CAHPS are Aquatic Animal Health Team; Risk Characterization and Management; Surveillance; Investigation and Reporting; and Response.

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**USDA NIFA AQUACULTURE UPDATE: EXTRAMURAL RESEARCH, EXTENSION OPPORTUNITIES, AND INTERAGENCY ACTIVITIES**

Gene W. Kim, Ph.D.

USDA NIFA
National Program Leader for Aquaculture

The USDA National Institute of Food and Agriculture supports extramural aquaculture research, extension, and education. The NIFA Aquaculture research portfolio totals about $20 million, and is comprised of diverse funding mechanisms, research topics, production systems, and species. A primary goal of these efforts is to support the development of an environmentally and economically sustainable U.S. aquaculture industry. NIFA also provides leadership, on behalf of the Secretary of Agriculture, to facilitate the coordination of all federal programs in aquaculture through the Interagency Working Group on Aquaculture. This presentation will include details on NIFA programs that support aquaculture research and extension, grantsmanship tips for prospective applicants, stakeholder input opportunities, and interagency aquaculture coordination activities. The intended outcome will be for extension personnel to be able to inform stakeholder inquiries on opportunities for research funding and stakeholder input opportunities.

# HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) FOR SEAFOOD SAFETY AND PREVENTING THE MOVEMENT OF AQUATIC INVASIVE SPECIES

Ronald E. Kinnunen

Michigan Sea Grant – Michigan State University
710 Chippewa Square – Ste. 202
Marquette, MI 49855
kinnune1@msu.edu

Hazard Analysis Critical Control Point (HACCP) consists of identifying safety hazards, determining where they occur, monitoring these points and recording the results. HACCP involves day-to-day monitoring of critical control points by production employees. The Seafood HACCP regulation that is enforced by the U.S. Food and Drug Administration (FDA) is based on the belief that commercial fish processors can understand the food safety hazards of their products and take reasonable steps to control them. Commercial fish processors are required either to obtain formal training for one or more of their own employees or to hire trained independent contractors to perform the HACCP functions. Michigan Sea Grant Extension became certified to conduct the training, offered 25 three-day Seafood HACCP courses in the Great Lakes region, with an average cost of $100, and trained 653 commercial fishers, processors, and aquaculturists. Michigan Sea Grant Extension made over 200 follow-up visits to fish processing facilities to assist with HACCP plan development and record-keeping systems.

The potential exists for aquatic invasive species (AIS) to spread to uninfested waters through the transport of wild harvested baitfish and aquacultured fish. Baitfish and aquaculture industries are diverse and complex, as are their risks of spreading AIS. Most industry segments pose no or very low risk of spreading AIS. To deal effectively and fairly with this potential vector, it is important to characterize the industry according to their risks of spreading AIS. Without adequate risk assessment of individual operations, regulations could be imposed which would unnecessarily negatively impact the economy of these industries and still not effectively reduce the risk of spreading AIS. One approach to this problem is to apply the HACCP concept similar to that used by the seafood industry to minimize seafood consumption health risks. The advantages of this system are that it can effectively deal with a diverse industry, it has proven to be a good partnership between industry and government regulators, and when properly applied is effective. The HACCP approach concentrates on the points in the process that are critical to the safety of the product, minimizes risks, and stresses communication between regulators and the industry. The baitfish and aquaculture industries have been proactive in using the HACCP approach to prevent the spread of AIS by participating in training programs and implementing HACCP plans that are specific to their operations. Michigan Sea Grant Extension has conducted over 40 AIS-HACCP one-day training programs in the North Central Region of the U.S.

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**GROWING SUGAR KELP AND ITS MARKETS: OPPORTUNITIES AND BARRIERS IN THE NORTHEAST U.S.**

Dawn M. Kotowicz, PhD*, Azure Cygler, and Carole Engle, PhD

Coastal Resources Center/Rhode Island Sea Grant
220 South Ferry Road
Narragansett, RI 02882
dkotowicz@uri.edu

Seaweed farming and harvesting for human consumption is a valuable industry, valued at $5 billion annually, that is just beginning to take hold in the Northeast U.S. Sugar kelp (*Sacchirina latissima*) farming, specifically, is a viable form of diversification for shellfish farming and capture fisheries, with its primary growing season in the winter. As this nascent industry gains its footing, focus groups with seaweed growers and regulators have been conducted to understand their perspectives on establishing a market for this new product for the region. Initial results from the growers' focus group described different types of potential market opportunities for fresh and processed sugar kelp, such as those that capitalize on existing relationships with buyers of growers' shellfish. A focus group with regulators explored the complexity posed by differing state regulations and areas of uncertainty in regulating kelp growing and marketing in the region. However, an uncertain regional regulatory framework could be a significant barrier, posing difficulties for purchasing and transporting seed, selling fresh or processed seaweed, and marketing across state lines could be barriers to creating a robust regional market for this product. This paper presents some of the initial findings from work with growers based in Rhode Island and regulators from throughout the region.

# PIT FALLS AND HONEY TRAPS IN AQUACULTURE FARM MANAGEMENT – AN ECONOMIC PERSPECTIVE

Ganesh Kumar

Thad Cochran National Warmwater Aquaculture Center
Mississippi State University
Delta Research and Extension Center
Stoneville, Mississippi 38776
gkk27@msstate.edu

Aquaculture is a management-intensive business with enterprise success often solely relying upon the on-farm management strategies. High level of investment in facilities and equipment and high operating capital requirements often demand competent managers/owners who is well versed to changing economic, market and regulatory conditions. This presentation is intended to drawn the attention of extension agents to fundamental principles of production, business management, economic feasibility, and technology choices affecting aquaculture business. Common miscalculations leading to overestimation of profits and long term profitability are addressed. Several luring aquaculture ventures, products, and technologies that targets investors without providing all the associated latent costs often prove costly to entrepreneurs. Agents and managers should take extra precautions to follow scientifically proven technologies and practices before relying on "snake-oil research and results" provided without enough scientific backing. Sound business planning and reliable extension supports are becoming increasing key for improving farm efficiencies.

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**DEVELOPING A RESEARCH PROGRAM TO ADDRESS SHELLFISH GROWERS NEEDS: NINIGRET POND - A CASE STUDY**

Dale Leavitt*, Robert Rheault, and Heather Kinney

Center for Economic and Environmental Development
Roger Williams University
Bristol, RI
dleavitt@rwu.edu

In recent years, there has been a rapid and substantial increase in oyster plantings on leases in a concentrated portion of Ninigret Pond (Charleston, RI). Since the initial development of oyster farms on the pond, farmers have noted decreasing growth rates and increasing mortality on their sites. A coalition of Ninigret Pond oyster farmers were successful in soliciting funds from the state of Rhode Island to allow them to develop a study of the dynamics of the pond that might explain why their oyster production seemed to be decreasing. However, they were hard pressed to actually form a research plan to address the questions they had posed, namely were food levels being depleted in the vicinity of their farms and could they establish an optimal stocking density for the six congruous farms along the barrier beach of Ninigret Pond. As a result, the farmers approached their aquaculture professionals in the state to assist them with designing and completing a study of the oyster production dynamics on the pond.

Following two meetings held to expand on the primary objectives to the study, an experimental design was developed. The objectives were:

- Objective 1: Monitor seasonal variation in food levels along a transect cutting through the existing farms in Ninigret Pond.
- Objective 2: Measure oyster survival and growth at various stocking densities within the six participating farms.
- Objective 3: Evaluate the condition of oysters growing at the various stocking densities.

The plan included direct data collection by the participating shellfish farmers coupled with more intensive monitoring of field environmental conditions by a research team consisting of an aquaculture extension researcher and a field/laboratory technician. The growers evaluated the effect of varying bag stocking densities on overall oyster growth and mortality while the researchers monitored flow patterns and food supply in the vicinity of the farms on three separate occasions representing three seasonal conditions.

The study results suggested that while food resources in the pond were consistently adequate, a localized effect of growth depression was noted in bags as the stocking density increased. Growth depression with increasing stocking density is likely the result of a very low rate of food flux through the oyster bags, due to a very low flow of water moving through the farms. Farmers needed to adjust their stocking density to accommodate this observation.

Details of working with farmers to conduct joint research will be discussed, including both the advantages and disadvantages of research by committee.

# NARF-NET: USING DEMONSTRATION FARMS TO SHOWCASE NEW AQUACULTURE TECHNOLOGIES

Dale Leavitt*, Tessa Getchis, and Matthew Griffin

Center for Economic and Environmental Development
Roger Williams University
Bristol, RI 02809
dleavitt@rwu.edu

Overall, it is well documented that demonstration farms are a highly regarded means to affect technology transfer. Developing effective technology transfer methods is one of the most critical issues that aquaculture extension agents must undertake, thus we adapted the demonstration farm approach to showcase new technology to oyster farmers in the northeastern U.S. region.

Building off a recent program, developed by Bill Walton and Diane Murphy, we expanded their concept of a local research farm network to one that was distributed through the five coastal states of New England and New York (the Northeast Area Research Farm Network – NARF-Net). Two new shellfish growing technologies were selected to be showcased on commercial oyster farms within the region, where each technology was evaluated on commercial farms and the results showcased in farm demonstration days in each state, open to all interested individuals.

The first of the two technologies selected utilized specialized oyster bags that were designed to rotate, or flip, with the tide; thereby resulting in a continuous tumbling motion for oysters held in the system. First suggested in 1987 by an Australian inventor, the flip-bag system was adopted by John Lentz, a west coast oyster grower, and has been expanding in use throughout the northwest since then. Noted for producing a high quality oyster, this technology had not been applied to the Eastern oyster (*Crassostrea virginica*) nor had it been viewed in the northeast.

The second technology selected for demonstration was testing novel growth media for the bag culture of the northern hard clam (quahog – *Mercenaria Mercenaria*). Also first developed on the west coast, it had potential to allow oyster growers to introduce a second species to their culture operations without a large scale modification of their growout gear. Using inert materials originally developed for hydroponic plant culture, expanded clay pellets may provide the physical support needed to grow infaunal bivalves out of substrate.

Starting with the evaluation of each technology, Aquaculture Extension Agents were recruited in each of the participating states to identify farms willing to participate in the demonstration. Up to six farms in each state were selected and provided with gear, seed and the assistance needed to install the technologies on their farms. The Extension Agents then assisted the investigators with data collection on the performance of the technologies. After evaluation, the results of the studies combined with details on equipment set-up were developed for presentation at on-site farm workshops showcasing the successes and failures of the adopted technologies.

The results of the demonstration farm strategy of introducing and showcasing new culture technologies as well as allowing for expanded networking opportunities among aquaculture extension agents and farmers from all corners of the Northeast will be discussed.

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## HISTORY, COLLABORATIONS, AND CHALLENGES OF THE IDAHO TROUT INDUSTRY

John R. MacMillan

Clear Springs Foods
Buhl, Idaho

The Idaho trout industry presents a storied tapestry. The globally unique freshwater resource of the Eastern Snake Plain Aquifer, an underground water resource about the size of Lake Erie, attracted early settlers including visionaries familiar with the recently introduced science of fish propagation. Tapping into demand created by various acclimatizing societies, a brood stock egg station was built in 1904 with the expectation that rainbow trout eggs would be produced and the eggs would be sold throughout the US and the world. But without ready means to distribute the eggs, the effort soon failed but the idea of farming rainbow trout in the Magic Valley was born. Today, Idaho houses the largest portion of the rainbow trout industry of the US. Trout produced here are primarily intended for human consumption. Throughout its existence, this trout industry sector has had to navigate turbulent waters of cutthroat business competition, problems with contaminated feeds, heavy environmental regulation, theft of its water resources, introduction and spread of devastating fish pathogens, and steadily increasing cost of fish production. Key to its success has been individual perseverance, improvement in the science of trout aquaculture and various technological developments, education, marketing, and various collaborative efforts when need arises.

**FDA UPDATE ON FISH DRUG APPROVALS AND VETERINARY FEED DIRECTIVES**

Jennifer Matysczak

Center for Veterinary Medicine
US Food and Drug Administration
Rockville, MD 20855
jennifer.matysczak@fda.hhs.gov

This presentation will provide an update on what drugs are approved for use in fish and other aquatic species, recent changes requiring veterinary oversight for certain drugs, and regulations and policies applicable to drugs used in fish and other aquatic species; and share resources for more information and ways to continue to stay informed on these topics.

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**CONSTRAINT ANALYSIS ON FISH FARMING AND EXTENSION NEEDS IN NORTHWESTERN HIMALAYAS, INDIA**

Muruganandam M*, Steve R Chipps, and PK Mishra

Fulbright Visiting Scientist
Department of Natural Resource Management
College of Agriculture and Biological Sciences
South Dakota State University
Brookings, SD 57007
mail2mmm20@gmail.com

Prevalence of ignorance, misconceptions amongst the ethnic communities and extension related problems affect adoption of improved technologies significantly in northwestern Himalayan region in India. Often, effective extension approaches are as essential as the development of technologies *per se* since ineffective extension of technologies would cause poor adoption of even the time-tested technologies. At this context, a survey was conducted to test the hypothesis that the extension problems constraint and remedying constraints would improve fish farming. Fifty general farmers each from both foothill and mid-hill Himalayas totaling 100 drawn randomly covering various qualification and age status from representative watersheds of the region surveyed. In addition, farmers and trainees of ICAR-Indian Institute of Soil and Water Conservation (ICAR-IISWC), Dehra Dun drawn from different study regions numbering over 30 respondents interviewed. The problems-cause diagrams that included various socio-economic, socio-cultural, biophysical, technical and extension constraints for lack of fish farming or integrated fish farming drawn with the help of villagers, field observations, expert opinion and limited farm surveys and experimentation.

We have identified high ranking misconceptions including negative apprehensions of farmers and ground-level constraints of fish farming, prevailing interfaces between water conservation and fisheries development. Most farmers, up to 80% had over 15 mythical ideas about fish farming. Also, unscientific and faulty fish farming practices, such as stocking more fish seedlings, excessive water exchange or flow-through if water existed, application of no or little lime and fertilizers to maintain water quality and no surveillance for disease monitoring and control through regular netting and prophylactic and preventive measures were observed even in few existing fish farms. Lack of capital, ownership of ponds or water resource and critical inputs besides lack of knowledge were the high-ranking problems in most farmers (over 70%).

The scientific and logical explanation on realities of over 15 superficial subscriptions on fisheries science prevalent in the region is given based on descriptive analysis in light of available literature. Needed policy, extension approaches, institutional arrangements and support provisions to clear misconceptions and promote adoption of recommended small-scale fish farming technologies are discussed. The scenario observed and recommendations made in our study hold good for most part of India and other countries with similar ethnic and agrarian situations.

# PAST, PRESENT AND FUTURE RESEARCH ON OSTREID HERPESVIRUS 1 INFECTIONS OF THE PACIFIC OYSTER IN TOMALES BAY, CALIFORNIA

Paul Olin*, Colleen A. Burge and Carolyn S. Friedman

California Sea Grant
UC San Diego
Scripps Institution of Oceanography
133 Aviation Blvd., Suite 109
Santa Rosa, CA 95403
polin@ucsd.edu

Large-scale sporadic mortalities of juvenile Pacific oyster, *Crassostrea gigas* have occurred in Tomales Bay, California for 20 years. The Ostreid herpesvirus 1 (OsHV-1) is the identified causative agent consistently associated with mortalities, with a confirmed infectious etiology. OsHV-1 is a global pathogen of bivalve molluscs, although detection in the United States is limited to Tomales Bay and nearby Drakes Bay. OsHV-1 is a member of the Order *Herpesvirales*, sharing common morphological criteria with vertebrate herpesviruses, although sequence data indicates a tenuous relationship. OsHV-1 was classified as the first member of an invertebrate herpesvirus family, Family *Malacoherpesviridae*. Sequence data indicate that multiple global variants of OsHV-1 exist, and the virus detected in Tomales Bay is not identical to any one variant. Elevated water temperatures are consistently associated with oyster mortalities in Tomales Bay, and may trigger viral replication and/or transmission of OsHV-1 to naïve juvenile oysters. Laboratory trials indicate qPCR and RT qPCR can be used to demonstrate virus replication and gene expression. Survival of young Pacific oysters in Tomales Bay is dependent on outplant time, size, and oyster stock indicating genetic improvement and development of biomarkers for improved survival of Pacific oysters infected with OsHV-1 is possible. Since 2008, an economically devastating increase in *C. gigas* mortality in France has been associated with a new genetic variant OsHV-1 µvar, which is lethal to all life history stages. OsHV-1 µvar continues to spread in Europe and a similar variant causes losses in Australia, New Zealand, and Asia. OsHV-1 µvar's ability to kill seed and adults heightens concern over this variant relative to its progenitor, OsHV-1, which is lethal to larvae and seed only. OsHV-1 resistance has been shown to confer resistance to µvar. Recent studies demonstrated the ability to select for resistance to OsHV-1 and we propose studies to evaluate selection of resistance to both OsHV-1 µvars and their progenitor in US oyster lines. Extension education and outreach to oyster growers and the regulatory community will be a critical component of managing these pathogens and ideally preventing their further spread.

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**STATUS UPDATE FOR THE AQUACULTURE WEBINAR SERIES**

D. Allen Pattillo

Department of Natural Resource Ecology and Management
Department of Agricultural and Biosystems Engineering
Iowa State University
Ames, IA 50011
Pattillo@iastate.edu

Information transfer is a central theme of extension, and delivering that information to the appropriate audience in the appropriate fashion is critical to creating impacts. Knowing the proper method of program delivery for a given audience is challenging, particularly during an age of rapid technology change. Currently, one of the most cost effective methods of information transfer is streaming audio and video via the internet to a computer, smart phone or other digital device. For extension specialists to successfully maximize their technology transfer capabilities, they must embrace current and audience appropriate technology.


During 2016-17, the North Central Regional Aquaculture Center joined forces with the National Aquaculture Association and the United States Aquaculture Society to develop and deliver a series of aquaculture-related webinars designed to bring together science and business to expand and strengthen the United States aquaculture industry. The target audience included producers currently engaged in aquaculture, those looking to get into business, educators helping others understand aquaculture, and consumers that want to be better educated. The goal was to enhance their knowledge and move them forward on their journey to success. This presentation provides as status update on the current progress of webinars produced, those in planning, and future directions for the series. The evaluation of this program will be discussed.

# PUBLIC PERCEPTIONS AND ATTITUDES TOWARDS AQUACULTURE

Kwamena Quagrainie

Department of Agricultural Economics
Purdue University
West Lafayette, IN 47907
kquagrai@purdue.edu

Consumers have generally been concerned about risks posed by aquaculture. From the demand side, health risk appears to be more prominent, and it is associated with seafood consumption. There are federal and state seafood consumption advisory warnings particularly aimed at children, pregnant mothers, and consumers with low immune systems. Other consumption-side concerns are that farmed fish have higher contaminant loads, are more expensive, and are nutritionally inferior to wild-caught seafood. From the production side, the negative environmental impact is highlighted the most. Indeed, farmed salmon and shrimp species have particularly bad reputations, and studies point to an increasingly negative attitude towards farming these species. While some information from both the production side and demand side suggests that these concerns / perceptions may be justified, they are inhibiting the demand for aquaculture products, particularly by new seafood consumers. Consequently, general demand for seafood in the US has remained fairly stable. The increasingly warnings and food labels have made it difficult for consumers to assess risks associated with general seafood consumption.

Consumers are getting overwhelmed with information from different sources, such social and mass media, internet, retailers, government, consumer organizations, etc. Some consumers rely on such information to assess risks and to ensure healthy food choices. Consumer perceptions about aquaculture are associated with negative information that have changed beliefs as such information increases over time; continuing diffusion of information among consumers; and the vocal impact of environmental advocates.

Perceptions do influence the acceptance of aquaculture products. The plethora of negative information suggest a need to digest the varied information, and assess how they impact consumer beliefs, perceptions, and consequent impact on demand. It is difficult to make generalizations about consumers' acceptance/rejection of aquaculture; therefore, countervailing strategies should be aimed at improving the rate at which positive information about aquaculture is presented to the consuming public. It will also be useful to distinguish between micro-strategies targeted at consumer attitudes towards aquaculture, and macro-strategies targeted at broader attitudes towards seafood as a whole.

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**AQUACULTURE: WHERE WE CAME FROM – WHERE WE ARE NOW – HOW DID WE GET HERE – WHERE ARE WE GOING**

Leo Ray

Fish Breeders of Idaho
P.O. Box 479
18374 Hwy. 30
Hagerman, ID 83332
leoray@fishbreedersofidaho.com

Fifty years ago, aquaculture supplied less than 1% of our seafood. Now aquaculture supplies over 50% of our seafood. Ocean production is maxed out. Increased consumption must come from aquaculture. The increased consumption can come from the U.S. or we will import it. If we grow that increased consumption, the Universities and extension will need to assist farmers in designing, growing, processing and marketing those aquaculture products.

**USDA ARS AQUACULTURE RESEARCH AND ASSESSMENT OF AQUATIC GENETIC RESOURCES**

Caird Rexroad

USDA ARS Office of National Programs
George Washington Carver Center
5601 Sunnyside Avenue
Beltsville, Maryland 20705
Caird.Rexroadiii@ars.usda.gov

The ARS National Program for Aquaculture conducts research and technology transfer to support a thriving domestic industry based on improved genetic stocks and scientific information on biotechnologies and management practices to ensure a high quality, safe supply of healthful seafood and aquatic products. Approximately 40 scientists and their collaborators located at various laboratories across the Nation seek to develop technologies that improve yields, production efficiencies, product quality, and aquatic animal health in catfish, rainbow trout, Atlantic salmon, striped bass, and Pacific and eastern oysters. The specific components of this program are:

1. Selective Breeding, Directed Reproduction, and Development of Genomic Tools;
2. Nutrient Requirements and Alternative Protein and Lipid Ingredients;
3. Health of Aquatic Animals;
4. Sustainable Production Systems; and
5. Product Quality and New Products.

Given USDA's research towards the genetic improvement of farmed animals, the Department of State recently requested that USDA take the lead in preparing the US Country Report in support of the Food and Agriculture Organization's assessment of the world's aquatic genetic resources. This assessment is intended to identify opportunities for enhancing the contributions of aquatic genetic resources to food security and rural development; assist countries in determining their needs and priorities for the conservation and sustainable use of aquatic genetic resources; and raise awareness among policy-makers. Through the Interagency Working Group on Aquaculture, USDA is partnering with other Federal Agencies and the National Aquaculture Association to complete the Country Report for submission in June 2017.

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## A BLUEPRINT FOR OYSTER AQUACULTURE IN GEORGIA

Dr. Mark Risse*, Tom Bliss, Dominic Guadagnoli, Jill Gambill, and Jill Andrews

Marine Extension and Georgia Sea Grant
The University of Georgia
1030 Chicopee Complex
Athens, GA 30602
mrisse@uga.edu

Georgia is launching a new industry in aquaculture, cultivating oysters for the lucrative half-shell market. Nationally, consumer demand for high-quality, raw-bar-grade oysters is rising. At the same time, the regions traditionally sourcing this product have experienced a decline in supply, resulting in an increase in price and profit margin. This has created a prime opportunity for Georgia to enter the aquaculture market.

The University of Georgia, Georgia Department of Natural Resources and Georgia Department of Agriculture are partnering to expand the Georgia aquaculture industry, with the goal of gaining enough growers to sustain a private, commercial oyster hatchery. By working together and leveraging resources, this partnership seeks to follow the example of Virginia, who has shown what state investment in the single oyster market can produce. In just 10 years, Virginia expanded their oyster harvest value from $196,125 in 2004 to $27.96 million in 2014. We have developed a blueprint for Georgia Oyster Aquaculture that outlines critical needs to grow the industry from its current state of 10 permitted growers to 50 in the next 5 years.

Using both state and federal investment, the University of Georgia Oyster Hatchery opened in 2015 at the UGA Shellfish Research Laboratory on Skidaway Island, Georgia. At full capacity, the hatchery will produce 15 million oyster spat with an estimated harvest value of $3- 5.25 million. Additional investment in oyster research, training for shellfish growers, resource management and consumer safety is needed to sustain continued growth and realize the goals and actions outlined in this collaborative Blueprint for Georgia Oyster Aquaculture. In addition to the impacts on economic development, it is expected that expansion in this industry will lead to water quality improvements through education and restoration.

**AERATION CHOICES, TRENDS, SUCCESSES AND FAILURES**

Bob Robinson

Fisheries Biologist
Kasco Marine
800 Deere Rd
Prescott, WI 54021
Bob.r@kascomarine.com

Dissolved oxygen is the single most important water quality parameter as it relates to overall fish farm profitability. On larger farms it can be the second largest expense after fish feed. If not managed correctly, failure is inevitable.

Successful aeration includes making sure that the entire water column is evenly circulated to eliminate both thermal and chemical stratification.

Recent management strategies include increased aeration/circulation rates to allow up to 20,000 pounds of channel catfish production at harvest per acre. Other approaches are to increase aeration/circulation but feed at a higher rate resulting in faster growth and reduced risk. In fish ponds up to 10% of the feed applied goes uneaten. Of the feed fed to the culture animals a greater percentage is excreted as waste when compared to the feed used for growth. Getting oxygen to the sediment water interface will speed up the rate of decomposition, increase redox, and reduce oxygen demand.

This presentation will focus on:

- Changes/trends in oxygen/circulation techniques.
- Successes as well as failures with systems and designs.
- Harvest density limits for pond and tank culture.
- Management of phytoplankton blooms to control cyanobacteria and off-flavor as well as prevention of fish-kills from algae crashes.

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**AQUAPONIC EXTENSION: WHOSE JOB IS IT ANYWAY?**

Robert Rode

Aquaculture Research Lab
Purdue University
W. Lafayette IN 47906
rrode@purdue.edu

Aquaponics, the blending of aquaculture and hydroponics has become very popular over the last 5-10 years. Although at least half the technology and potential revenue comes from plants, aquaculture extensionists are usually the first contact for information. A comprehensive understanding of aquaponics must consider not only fish production via RAS technologies, but also horticulture (hydroponics), building issues, lighting, food safety, organic standards and plant pest control to name a few. Do aquaculture extensionists have the resources available, and is there enough scientific information available to make sound recommendations? Additionally, do potential funding agencies (research and extension) have a good handle on what these type of operations need for support? Is it a fad or the future and are we able to influence that?

# USING AN EXTENSION APPROACH TO ADDRESS AN EMERGING INDUSTRY CONCERN: A CASE STUDY OF WINTER FISH LOSSES IN ARKANSAS

Luke A. Roy*, Anita M. Kelly, Nathan Stone, Carole R. Engle, Jeonghwan Park, Matthew A. Smith, Herbert E. Quintero

School of Fisheries, Aquaculture & Aquatic Sciences
Auburn University, Auburn, AL
royluke@auburn.edu

Fish farmers in Arkansas reported large losses of fish in the spring of 2013 when they began to harvest their ponds. The largest losses were observed by farmers raising fathead minnows, golden shiners, and centrarchids such as bluegill and redear sunfish. Other fish affected to a lesser degree included goldfish, grass carp, largemouth bass, and hybrid striped bass. Thirty-four baitfish and sportfish farmers in Arkansas were interviewed by phone or by a farm visit by UAPB Extension personnel to document this event. Unusual fish losses were defined by losses in excess of what would normally be expected to occur on their farm in a typical year. Baitfish and sportfish farmers in Arkansas experienced unusual winter fish losses on 2,900 water hectares and losses were catastrophic on a large number of farms. The water hectares affected represented 36% of the baitfish production in the state. In many instances farmers reported losing more than 50% of their crop. Most farmers did not observe any dead fish in their ponds over the fall and winter months and did not become aware of these losses until harvest in the spring of 2013. Fish less than three inches in length represented the vast majority of losses. Farmers shared several theories during a meeting organized by Extension personnel with a series of expert scientists who served as a resource during the meeting. Initial theories expressed included: 1) extreme temperature fluctuations, 2) increased predation by diving ducks, 3) drift from fungicide/insecticides sprayed from airplanes, 4) cold winter temperatures, and 5) reduced winter feeding. A comprehensive and systematic approach was developed to search for management solutions to avoid similar losses in the future and has continued from 2013 to the present. This approach included the establishment of collaborative research projects targeting specific topics with a number of state and federal agencies, 1862 land grant universities, and 1890 research and Extension. These studies included winter feeding regimes and field studies to document fish consumed by a problematic diving duck, the lesser scaup. Dissemination of results to stakeholders has occurred through a number of different venues and is currently ongoing.

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## AN INNOVATIVE EDUCATIONAL PROGRAM: AQUACULTURE BOOT CAMP (ABC)

Matthew A. Smith*, Han-Ping Wang, Jordan Maxwell, Paul O'Bryant, Dean Rapp, and Zhi-Gang Shen

Ohio Center for Aquaculture Research and Development
The Ohio State University South Centers
1864 Shyville Rd
Piketon, OH 45661
smith.11460@osu.edu

The Ohio Center for Aquaculture Research and Development (OCARD) at the Ohio State University, in partnership with Ohio Aquaculture Association (OAA) and others, have developed and currently operate the Aquaculture Boot Camp (ABC). The ABC program utilizes a "3-I" (**Intensive, Intermediate, Introductory**) training and multi-faceted approach, including classroom and hands-on training, paired with industry mentoring to enhance the sustainability of new and beginning aquaculture/aquaponic and next generation farmers in Ohio and the Midwest. OCARD is the first aquaculture unit to receive this type of project from USDA.

The ABC program offers new and next generation farmers **3-I** levels, 3 areas and 3 types of integrated *training in aquaculture/aquaponic production and business management strategies.* The "**3-I levels**" are**: Intensive**, an in-depth level involving immersion in a year-long hands-on training and classroom/mentoring program; **Intermediate**, a mid-level involving participation in a variety of learning activities and workshops; and **Introductory**, a general or entry level where sharing of information is the goal, and involving participation in the ABC-2 online education and webinars. The "**3 areas**" are general/traditional aquaculture, recirculating aquaculture/aquaponics, and related business and marketing. The "**3 types**" are hands-on, classroom/mentoring, and internet/webinar.

ABC Phase 1 was successfully run from 2012 to 2015. After participation in two ABC intensive classes in 2013 and 2014, students, on a scale of 1 being strongly disagree and 4 being strongly agree, reported an average of 3.5 when asked if the program met their expectations, and they would recommend this program to their business partners or relatives. ABC and OAA internships and mentoring is available for students that wish to participate. ABC Phase 2 started January 2017 with 33 students (total of >70 applicants) and will run through 2019. This Phase is building on the successes of Phase 1 and heavily incorporates aquaponics into the monthly learning modules due to the system's popularity in Ohio and the Midwest. Many students attended the OAA-ABC annual conference where networking with established farmers was encouraged. Several outside speakers are also being brought to Ohio educate the students.

**COPPER SULFATE TOXICITY TO VARIOUS FISH: ROLE OF ALKALINITY/HARDNESS**

David L. Straus

USDA - Agricultural Research Service
Harry K. Dupree - Stuttgart National Aquaculture Research Center
Stuttgart, AR 72160
Dave.Straus@ars.usda.gov

Copper sulfate has been used in fisheries since the 1890's. This compound is currently used to control parasites (mainly Ich) on fish and fungus (*Saprolegnia*) on fish eggs, and has also been used in the past to control columnaris on fish, although antibiotics are the common treatment now. In our lab's efforts to gain an FDA-approval for copper sulfate, we are well-aware that there is a great deal of information on the toxicity of copper, especially in low-alkalinity waters; however, much of this information is fragmented, and a comprehensive guide of copper toxicity and safe concentrations in various water chemistries is not available. In addition, historical data does not always include alkalinity, which is crucial when determining toxicity.

Therefore, our lab is in the process of developing this data across a wide range of species. Experiments have been initiated to observe the toxicity and safe levels of copper sulfate in 5 reconstituted waters, per APHA methods, on 13 species of fish; future studies may include bacteria, parasites and algae. The alkalinity of these synthetic waters ranges from 10 – 245 mg/L, and the hardness ranges from 10 – 320 mg/L. Data will include a 48h LC50 value for each species in each water, but more importantly, the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC). This information can be used to approximate safe treatment levels; however, application must be tailored to fit specific species and individual water quality and chemistry.

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## SEA GRANT 10-YEAR AQUACULTURE VISION

LaDon Swann

Mississippi-Alabama Sea Grant Consortium
Auburn University Marine Extension and Research Center
swanndl@auburn.edu

For nearly 50 years, the National Oceanic and Atmospheric Administration's (NOAA) National Sea Grant College Program (NSGCP) has invested in the development of sustainable marine and Great Lakes aquaculture businesses. For example, a $26-million investment in aquaculture research and technology transfer from 2012-2015 led to an economic impact of $200 million and included the creation or retention of 8,000 jobs.

Sea Grant will likely be investing $50 to $100 million in aquaculture research and technology transfer over the next 10 years. A clear vision will help guide strategic investments to support and expand the aquaculture industry. In March 2015, the Sea Grant Association established a committee to develop a 10-year vision for aquaculture investments by NOAA's NSGCP. The purpose of this 10-year vision is to (1) determine Sea Grant's most appropriate roles over the next 10 years, and (2) identify priority research and outreach strategies leading to sustainable economic development, environmental conservation and social well-being.

NOAA Sea Grant's 10-Year Aquaculture Vision: Sea Grant's integration of research, outreach and education will be instrumental in creating and applying aquaculture products, tools and services to foster the expansion of a sustainable U.S. marine and Great Lakes aquaculture industry.

# MARINE AQUACULTURE OUTREACH AND EDUCATION AT THE AQUARIUM OF THE PACIFIC

Kimberly D. Thompson* and Jerry R. Schubel

Aquarium of the Pacific
320 Golden Shore, Suite 100
Long Beach, CA 90802
KThompson@lbaop.org

Well-managed wild-capture fisheries and marine aquaculture will play an increasingly important role in our food supply for the health and wellbeing of people and the environment. Marine aquaculture can produce a healthy food source with fewer environmental impacts relative to other animal proteins. It can be produced using less freshwater and land resources and with fewer greenhouse gas emissions. Despite these advantages, the U.S. lags behind the rest of the world in marine aquaculture production and continues to rely heavily on seafood imports—more than 90 percent of its supply. Aquaculture accounts for more than half of the imports and most of it is from Asia and other countries that may not have the strong environmental standards the U.S. has in place to ensure that operations are safe and sustainable.

Public perception plays an important role in the future of marine aquaculture development in the U.S. Even with regulatory confidence in the science and tools available to inform decisions, perception-based concerns can influence permitting decisions and hinder aquaculture development. Aquariums and science institutions have a unique opportunity to engage visitors with strategic outreach messaging to educate the public about marine aquaculture's role as a conservation tool. The Aquarium of the Pacific and its Seafood for the Future program have a strong history of bringing together experts from diverse backgrounds to develop education and outreach resources for relevant ocean science and conservation topics. We have played a leading role in educating the public about responsible seafood, with an emphasis on the need for marine aquaculture. Our efforts include the development of exhibits, programs, and videos, some of which have received national and international recognition.

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**FROM GRADUATE SCHOOL TO CAPITOL HILL – ENHANCING THE STUDENT PATHWAYS TO AQUACULTURE WORKFORCE DEVELOPMENT**

Shiyu (Rachel) Wang* and Samuel Chan

Office of Aquaculture, NOAA Fisheries
National Sea Grant College Program
1315 East West Highway, Suite 12603
Silver Spring, Maryland 20910
shiyu.wang@noaa.gov

Students today will be an important workforce tomorrow shaping the future of aquaculture in science, extension, policies and industry. We will explore workforce development pathways from graduate school to the aquaculture workforce through the lens of past NOAA Sea Grant Knauss fellows who have worked on aquaculture. Using longitudinal evaluation methods, we interviewed past fellows on the motivations, barriers, skills and drivers that they experienced as aquaculture fellows and how these experiences have shaped their career and preparations in aquaculture and allied field fields. The longitudinal evaluation included discussions with fellows on: 1) What are the skills necessary for a student to transition from school to the workforce? 2) What did they learn about aquaculture extension through the fellowship? 3) Where are they now in the aquaculture workforce? and 4) What are some gaps they identify for the aquaculture extension? The presentation aims to stimulate discussion between both students and Extension specialists to foster the development of Extension approaches to engaging stakeholders to in understanding/overcoming barriers to advancing aquaculture.

**THE MICHIGAN NETPEN EXPERIENCE – PART I**

Chris Weeks* and Ron Kinnunen

Michigan State University
weekschr@msu.edu

In October of 2014, a report conducted through a Michigan Sea Grant Integrated Assessment identified netpen aquaculture as one potentially viable way to substantially increase seafood production in Michigan. Shortly thereafter, two proposals for new commercial scale facilities were presented to state agencies for consideration. Heavy opposition to netpen aquaculture immediately came forward by various groups in media, public forums and proposed legislation, including a bill that, if passed, would have eliminated virtually all commercial aquaculture production in Michigan. Over the course of these developments, the State of Michigan formed a scientific advisory panel, held stakeholder presentations and public comment forums, and commissioned five reports intended to inform stakeholders on potential ecological, regulatory and economic impacts to the Great Lakes from netpen aquaculture in Michigan waters. In March of 2016, the Michigan Departments of Agriculture and Rural Development, Environmental Quality, and Natural Resource agencies released a synthesis report recommending that state agencies do not pursue commercial netpen aquaculture in the Great Lakes on reasons of ecological and environmental risks, uncertainties, added costs to the state, and lack of regulatory authority to register such facilities. These events are described from an aquaculture extension viewpoint.

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# EDUCATING THE FUTURE AND PRESENT WORKFORCE THROUGH INTERACTIVE, HANDS-ON APPLICATIONS OF AQUACULTURE

Emma Wiermaa*, Greg Fischer, and Chris Hartleb

University of Wisconsin-Stevens Point
Northern Aquaculture Demonstration Facility
Bayfield, WI 54814
715-779-3262
ewiermaa@uwsp.edu

Aquaculture is currently the fastest growing food production system in the world. Although the global aquaculture industry is increasing in size and production, the workforce needed to support the industry is lacking in educated and experienced individuals. Availablility of a skilled aquaculture workforce is becoming a major impediment for industry advancement.

The University of Wisconsin-Stevens Point has very unique workforce development program that utilizes higher education courses and two state-of-the-art research facilities for aquaculture and aquaponics. This program incorporates K-12 and public education, internship and technician opportunities as well as workshops and technical assistance to train and advance the industry. The research facilities include the UWSP Northern Aquaculture Demonstration Facility (UWSP NADF) and the UWSP Aquaponics Innovation Center (UWSP AIC). Together the UW Stevens Point aqua-business education courses and research facilities encorporate key concepts for educating a skilled workforce including hands on experience and applied learning.Through industry applied research projects students work alongside expert staff to raise a variety of speices at all life stages in various systems. This distinctive opportunity creates a unique and qualified aquaculure and aquaponics skillset, which is recognized by industry partners. This leads to a very high job placement rating of over 90%.

Iniating curiosity and understanding of aquaculture and aquaponics at a young age is a head start to educating a future workforce and developing public awareness. The UW Stevens Point aquaculture and aquaponics program outreaches to students K-12 across Wisconsin and has been a direct leader in encorporating aquaponics and aquaculture systems into classrooms of local schools. With these partnerships, schools have the opportunity to include students in various aquaculture activities that educate through hands-on knowledge and experiences, and may spark interest for a future career in aquaculture. Regarding higher education, UW-Stevens Point is the only university in Wisconsin to offer an aquaculture minor and the first in the nation to offer semester-long college aquaponic courses and a professional aquaponics certificate. With these opportunities and internships at the UWSP NADF and UWSP AIC, students recieve a well rounded education, working with a diversity of cold and cool water fish species at all life stages as well as various rearing systems including incubation, larval, pond, raceway, aquaponics, and indoor recirculation systems. Interns and technicians assist expert staff to perform applied research projects that directly relate to the aquaculture industry. Because of UW-Stevens Point courses and the hands on experience and applied learning, students are receiving a world-class education and unique skillset that leads to high job placement to directly benefit the industry.

# THE TERMS EDUCATION, ADVOCACY, AND PROMOTION IN AQUACULTURE EXTENSION PROGRAMS: WHAT DO THEY MEAN AND WHERE AND WHEN TO DRAW THE LINE?

Forrest Wynne

Kentucky State University
McCracken County Extension Office
2025 New Holt Road
Paducah, KY 42001
Forrest.Wynne@kysu.edu

Aquaculture programs housed in land grant universities have the mission of educating students and conducting applied aquaculture research. Extension is charged with the delivery of these research results to various user groups, agencies and to the public. In aquaculture, the terms education, advocacy and promotion may be used incorrectly or interchangeably. When conducting programs, extension personnel should understand the difference between these terms and their related actions.

According to the online Meriam Webster Learner Dictionary, education is simply defined as "the act or process of teaching someone especially in a school, college or university." Whereas, advocacy is defined as "the act or process of supporting a cause or proposal: the act or process of advocating something." A positive example of advocacy would be, supporting the development, distribution and use of peer reviewed aquaculture information that would enhance aquaculture education. A negative example of advocacy would be publicly supporting a cause that is based more on personal opinion than science.

Promotion is defined as "something (such as advertising) that is done to make people aware of something and increases its sales or popularity." Public perception of the act of promotion may extend well beyond generating awareness or even popularity. Promotion is often viewed as a vehicle to increase product sales and profit. It is appropriate for aquaculture extension personnel to support and deliver science based information on aquaculture development, production, processing and marketing practices. Other promotional practices would seem less appropriate or even self-serving. These would include: promoting one aquaculture product over another, trying to convince growers to increase or decrease farm size or production, or attempting to convince growers to enter or exit the industry.

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# USDA NIFA SOUTHERN REGIONAL AQUACULTURE CENTER PUBLICATIONS, VIDEO, AND COMPUTER SOFTWARE PROJECT

Jimmy L. Avery* and Todd Sink

USDA NIFA SRAC
National Warmwater Aquaculture Center
PO Box 197
Stoneville, MS 38776
Jimmy.avery@msstate.edu

When this project was initiated, fewer than half the states had educational materials covering the major aquacultural species in their state. The concept of using the SRAC program to produce timely, high-quality educational materials is based upon the benefits of centralizing the production process while using a region-wide pool of expertise to develop materials. Distribution is then decentralized through the nationwide network of Extension Specialists and County Agents including the National eXtension Initiative. The result is widespread availability of high-quality educational materials for scientists, educators, producers, students, and the general public which in turn leads to increased or improved efficiency aquaculture production, improved awareness of aquaculture products and the nutritional benefits of seafood, and increased aquaculture investment.

A committee of Extension Specialists and researchers solicit input on publication and digital product needs from their counterparts across the region. These suggestions are prioritized during an annual meeting of the committee based on need and available funding. The best talent from within and outside the region are then recruited to submit proposals to develop these products.

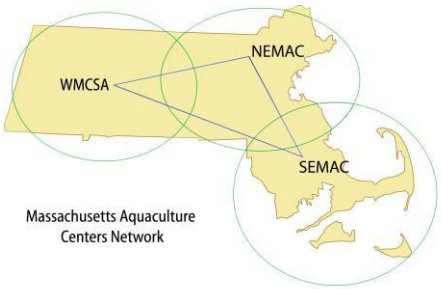
The target audiences for this project are educators, consumers, producers, potential investors, students, and the general public. Publications and videos produced by SRAC are increasingly used in educating high school and college students about aquaculture. These programs heavily utilize SRAC publications and videos for educational purposes but usage is impossible to measure because access to the information is gained from many different Internet sites, through file sharing, and digital downloads of PDFs.

Since the start of the project, more than 294 technical fact sheets (276 in the current catalog), 89 update revisions, 7 web presentations, 7 software programs or web tools, and 31 videos have been produced through the SRAC PVCS Project. In the current reporting year alone, 47,492* unique users from 170 countries and territories used the SRAC Publications website, https://srac.tamu.edu/, to view or download SRAC publications 233,342* times. SRAC videos were viewed on the SRAC YouTube channel 43,099 times during the current reporting period. The AquaPlant website, created with funding from the SRAC PVCS Project, had 312,349 unique users that viewed 2,507,344 webpages during the reporting period. These users were from 209 countries/territories. These analytics demonstrate that the SRAC Publications, Videos, and Computer Software project truly has worldwide reach and impact.
*Web-based analytical tracking and reporting methods.

# THREE CENTERS PROMOTE SUSTAINABLE AQUACULTURE IN MASSACHUSETTS

Joseph K. Buttner*[1], Mark Fregeau[1], Scott Weston[1], Diane C. Murphy[2], Joshua Reitsma[2], Abigail Archer[2], and Andy J. Danlchuk[3]

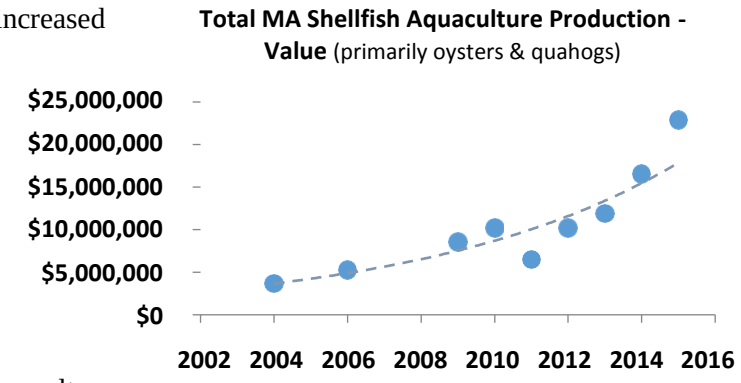
Department of Biology
Cat Cove Marine Laboratory
Northeastern Massachusetts Aquaculture Center
Salem State University Salem, MA USA jbuttner@salemstate.edu




Recognizing the social, cultural, ecological, historical,and economic value of sustainable aquaculture, the Commonwealth of Massachusetts established in 1997 three Aquaculture Centers to support its emerging aquaculture industry: NEMAC (1, NorthEastern Masschusetts Aquaculture Center), SEMAC (2, SouthEastern Massachusetts Aquaculture Center), WMCSA (3, Western Massachusetts Center for Sustainable Aquaculture). For 20 years the Centers have guided growth of the Commonwealth's 'Blue Economy' through applied research, demonstration projects, and training programs. Each Center focuses on challenges and opportunities unique to its area, but considerable collaboration occurs facilitated by the Massachusetts Aquaculture Association, which works closely with the Centers and regulatory agencies.

NEMAC promotes and supports aquaculture as a hatchery for softshell clams and through education, research and outreach primarily north of Boston. Its efforts include both fresh and marine aquaculture. SEMAC serves 95% of the State's 331 shellfish growers on 98% of MA's 1,130 shellfish farm acres. Its effort target Cape Cod, the South Shore and Islands. WMCSA provides training and assistance to aspiring and practicing aquaculturists in Western Massachusetts. The core geographic range of each Center is 50-100 miles.

Since establishment of the Centers, the value of Massachusetts aquaculture production has increased more than three-fold from $5.9 million in 1998 to $23.1 in 2012 (USDA Census for Aquaculture, 2002, 2012). In 2015 alone, Massachusetts shellfish aquaculture was valued at $23 million (DMF Report, 2015) and supported in excess of 1000 jobs (MA Shellfish Aquaculture Economic Impact Study, 2015). Aquaculture in Massachusetts is currently the state's 5th most valuable agriculture product and Massachusetts is the 18th largest aquaculture producing state (USDA Census of Agriculture, 2012).

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## 2016 ARKANSAS CATFISH SPLIT-POND VERIFICATION PROGRAM RESULTS

Larry Dorman*, Anita Kelly, and George Selden

University of Arkansas Pine Bluff
Aquaculture/Fisheries
Pine Bluff, Arkansas 71601
dormanl@uapb.edu

Crop verification in Arkansas is an integral part of the Extension education program. The first verification efforts involving cotton were began in the late 1970's. Soon other traditional row crops were added to the verification program. Catfish verification became a part of the efforts in the 1990's. As the economic situation worsened for the catfish industry new technologies were needed to improve production efficiencies. One such technology is the split-pond production system. This technology was soon added to the verification program and is proving very successful. Results from 2016 show production levels ranging from 11,400 pounds per acre to over 19,300 pounds per acre.

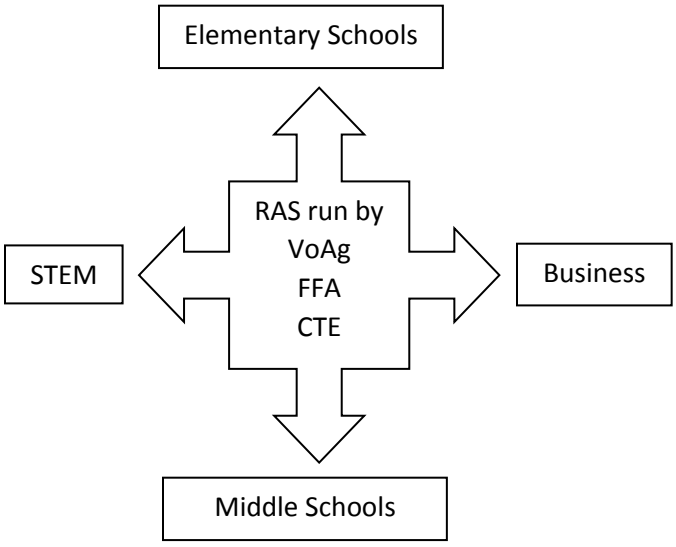
# PROVIDING TEACHERS WITH INFORMATION, SUPPORT, AND A PATHWAY TO SUBJECT MATTER INTEGRATION: METHODS CURRENTLY EMPLOYED BY UAPB

C. Bauer Duke III

Aquaculture and Fisheries Center
University of Arkansas at Pine Bluff
1200 North University Drive
Pine Bluff, AR 71601
dukeb@uapb.edu

In 1994, the University of Arkansas at Pine Bluff began supporting High School teachers who use recirculating aquaculture systems (RAS) to teach agriculture and vocational skills. From humble beginnings of supplying fish and RAS operational advice, this poster graphically shows the variety of methods now used to connect with teachers. A web site, workshops, newsletters, demonstrations, working models, fish transports, RAS and fish diagnostics via email and house calls, presentations at the school and state level, and references to curricula developed by other extension institutions across the nation.

*Aquaponics Working Model*




The current goal is to push this information beyond the high school level and the predominant FFA/Agriculture/Career and Technical Education (CTE) domain and create an understanding among teachers and students that success requires integration. Services are now available down to Kindergarten and over to STEM and business classes with the idea that although an RAS is often located at the agriculture portion of a school, other classes within the school and other schools within the district may use that site as a nearby field trip and continuous laboratory to assist with new Arkansas education standards implemented in Fall 2017.

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**A COLLABORATION BETWEEN EXTENSION AND INDUSTRY TO RESOLVE THE DISAPPEARING GOLDEN SHINER PHENOMENON**

Anita M. Kelly*, Julieann Jacobs, and Luke A. Roy.

Aquaculture/Fisheries Center
University of Arkansas at Pine Bluff
Pine Bluff, AR
fishdoctress@gmail.com

Often researchers and Extension personnel deal with projects that are difficult to solve. Collaboration between industry partners, researchers, and Extension personnel can provide a useful means to solve these problems. For example, in Arkansas, baitfish producers annually experience the "disappearing Golden Shiner *Notemingus crysoleucas* phenomenon". Fish farmers reported losses ranging from 20-80% annually. Interviews with the producers determined that losses were not from theft, low dissolved oxygen, depredation or disease. Most farmers did not observe dead fish in the pond, but rather noticed losses when harvesting. Based on this information, an approach was designed to determine the cause and then provide a solution. This approach included research projects targeting water quality parameters and collaborative research projects with industry partners. These studies included laboratory toxicity studies, bacterial application rates, and water quality testing. Results have been disseminated to stakeholders through a number of different venues and are still on-going.

**DELAWARE STATE UNIVERSITY MOBILE MEAT PROCESSING LAB (MMPL) CURRICULUM DEVELOPMENT AND IMPLEMENTATION**

Dennis McIntosh

Delaware State University
1200 N. DuPont Hwy.
Dover, DE 19901
dmcintosh@desu.edu

While traditional 'value-added' approaches work particularly well for clientele who are growing ethnic and other vegetable crops, those growing meat goats, niche market poultry, or fish have fewer 'value-added' options, and a much more rigorous regulatory framework within which to operate. Major hurdles that continue to face many of our current and prospective meat producers are access to USDA certified processing facilities, and sufficient knowledge of animal slaughter and fabrication. This limits their ability to capitalize on the local food movement (more specifically access to locally produced meats) that is sweeping the nation. In FY2011 we applied to the 1890 Capacity Building Program and secured funding to upgrade the technology delivery abilities of DSU Cooperative Extension through the initiation of a Mobile Meat Processing Lab (MMPL). This represented step one of a larger initiative to offer extension programming in food safety with respect to animal slaughter and meat processing. Specifically, with the FY2011 funding, we built the necessary infrastructure, namely a 40' all-aluminum trailer that will be outfitted for use as a mobile slaughter house and fabrication facility. As a second step, in FY2013 we received funding to create the necessary curriculum training modules and establish a network of demonstration 'docking' stations. The curriculum is intended to ensure our clientele have the necessary training (ex. HACCP, SSOPs, GMPs, butchering) to enter into value-added meat products markets. The docking stations help ensure that we have a minimum number of adequately prepared sites from which we can deliver our programming. Collectively the curriculum, docking stations and the MMPL itself will allow us to provide hands-on learning opportunities in animal slaughter and meat processing. The third step in our initiative was a proposal to expand the reach and depth of our extension programming in food safety by providing advanced training in meat processing and quality for our small farmers. We also proposed to provide support to the K-12 agri-science students and teachers across DE in their animal science, meat judging and food safety initiatives. In addition, we will increase the educational opportunities for DSU students in the Animal and Poultry Science, General Agriculture, and Food Safety undergraduate programs, as well as the graduate Agriculture Education program by creating a series of courses in meat science. Collectively the MMPL, curriculum, and docking stations allow us to provide hands-on learning opportunities in animal slaughter and fabrication to our small farmers to ensure that their meat products are safe and wholesome. Our latest step in this initiative will enable us to increase our extension impacts further by working with agri-science teachers and students, who are the next generation of farmers.

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## COMMERCIAL DEMONSTRATION OF KAOLINITIC CLAY FOR PROTECTION OF *Flavobacterium columnaris* IN SPORTFISH

Nilima Renukdas*, Luke A. Roy, Anita M. Kelly, L. Matthew Barnett, Ben H Beck, David Heikes, Robert P. Glennon, Phil Jones

UAPB Fish Health Services
University of Arkansas at Pine Bluff
2001 Hwy 70 East, Lonoke, AR
renukdasn@uapb.edu

Sportfish farms in Arkansas routinely battle Columnaris disease, which is caused by *Flavobacterium columnare*. Columnaris is especially prevalent during the feed training of centrarchids such as largemouth bass and immediately following harvest of crappie, redear sunfish, and bluegill while they are being held in load out sheds prior to being sold. Largemouth bass fingerlings are brought in from the pond and held indoors for several weeks in vats during the feed training process. A commercial research demonstration trial was devised with two commercial sportfish farms in Arkansas to test the efficacy of kaolin clay to prevent outbreaks of Columnaris. Kaolinitic clay (source: Imerys, Georgia, USA) was utilized as a prophylactic treatment for largemouth bass, crappie, bluegill, and redear sunfish. Participating producers treated vats of fish with 1 ppt kaolin and 0 ppt kaolin (control) as a prophylactic treatment and also during active Columnaris infections. Vats were treated on commercial farms and then samples of fish were brought to the UAPB Lonoke Fish Health Services Laboratory. Gills, fins, and tissues of treated and non-treated fish were examined visually for the presence of columnaris both before and after prophylactic treatment. Fish tissue samples were also sampled to confirm the presence/absence of Columnaris using real time PCR. The demonstration is currently ongoing (2017), however, preliminary data suggests that fish treated with kaolinitic clay while being feed trained and during holding periods prior to sale are having less incidences of Columnaris.

# WESTERN REGIONAL AQUACULTURE CENTER: EXTENSION OUTPUTS, IMPACTS AND FUTURE OUTLOOK

Rossana Sallenave

Department of Extension Animal Sciences and Natural Resources
New Mexico State University
P.O. Box 30003, MSC 3AE
Las Cruces, NM 88003
rsallena@nmsu.edu

The Western Regional Aquaculture Center (WRAC) serves the 12 western states, which encompass a large and diverse region with many different marine and freshwater aquaculture species. The main commercial species produced in the region are rainbow trout, white sturgeon, tilapia, catfish, and Pacific oysters, but there are several other minor finfish and shellfish species as well. The Board of Directors, consisting of twelve members from industry, research and extension, meets twice a year to oversee the program. Priorities for new and continuing research and outreach in the western region are based on recommendations made by a twelve member Industry Advisory Council representing all industry sectors and geographic zones, together with a Technical Committee consisting of twelve researchers and eight extension specialists, which meet annually to review on-going and proposed projects.

To ensure that extension is an integral part of all funded WRAC projects, each research project must include an extension component. Target audiences, outreach goals, activities, outputs and outcomes must be clearly identified in the proposal, and a funded participant responsible for outreach must be identified from the inception of the project. Extension efforts with these projects include publications, web-based materials, presentations, videos, and workshops. A minimum of one outreach publication is required for all WRAC-funded projects.

There is a wide range of aquaculture industry activity within the western region, but WRAC strives to involve all twelve states in project work. The current eight projects funded by WRAC include work group members from Alaska, Arizona, California, Colorado, Idaho, Montana, Oregon, and Washington. The topics covered by these projects address a number of industry priority issues such as developing new aquaculture species, growing aquaculture, innovations in diet nutrition, aquaculture opportunities through genetics, and production of high quality water for shellfish culture.

In an ongoing effort to document the impacts of WRAC-funded research on the different aquaculture industries, extension specialists have completed a report summarizing the impact of low phosphorus feeds developed by WRAC researchers on feed manufactures (primary audience) but also on the producers. A similar report summarizing the impacts WRAC research has had on developing the farmed sturgeon industry in the West is ongoing.

WRAC will continue to serve the western aquaculture industry through its research and outreach efforts by focusing resources on areas of high priority. Extension efforts will continue to help strengthen the applicability and relevance of research results to the industry, and to document the impacts of WRAC-funded projects on commercial aquaculture throughout the western states.

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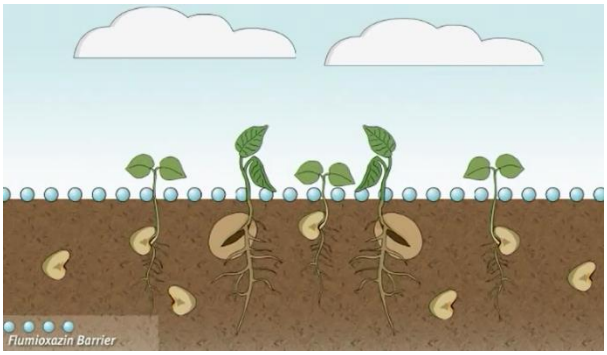
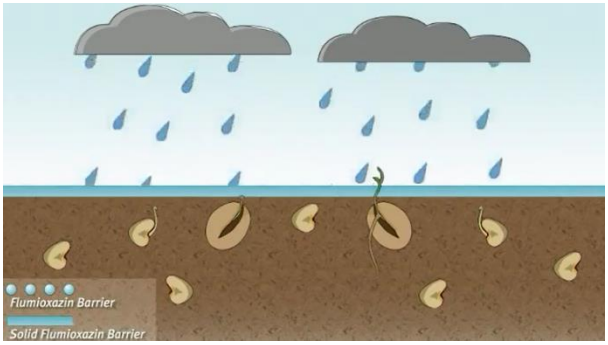
**FLUMIOXAZIN AS A POTENTIAL PRE-EMERGENT TREATMENT FOR SUBMERSED AQUATIC WEEDS**

George Selden

Aquaculture/Fisheries Center
University of Arkansas at Pine Bluff
Pine Bluff, AR 71601

The active ingredient Flumioxazin is a contact herbicide approved for aquatic use under the trade name Clipper. It is also approved for use under the trade name Valor for control and/or suppression of certain weeds in Cotton, Dry Beans, Field Corn, Soybean, Peanut, Sugarcane, Sweet Potato, Fallow Land and to Maintain Bare Ground on Non-Crop Areas of Farms. One of the recommended uses for this herbicide is as a pre-emergent herbicide. The manufacturer advertises that the product can be applied to bare ground, where if it is activated by rainfall or overhead watering, it will form what is called a "solid flumioxazin barrier". There have been anecdotal reports that this also occurs if it is applied pond bottoms, and activated, prior to filling. In early May 2016, this product was applied in a 20' band around four, 8-acre baitfish ponds on the Coldstream farm in Paragould, AR. These ponds were checked regularly throughout the summer and no growth of submersed aquatic weeds (excluding algae) was observed.




# National Aquaculture Extension Conference
# Riverside Hotel
# Boise, Idaho
# June 6 – 8, 2017

## Monday, June 5th

3:00 – 6:00 pm Registration…… **Convention Center Lobby**

6:00 – 8:00 pm Welcome Reception…… **Aspen Room**

## Tuesday, June 6th

7:00 – 8:00 am Breakfast…… **North Star**

7:00 – 9:00 am Registration…… **North Star Landing**

**Program**…… **North Star**

8:00 Introduction
Gary Fornshell, University of Idaho and Forrest Wynne, Kentucky State University

**Plenary**

8:15 Marine aquaculture outreach and education at the Aquarium of the Pacific
Kim Thompson* and Jerry Schubel, Aquarium of the Pacific

8:45 Seafood tech update: from source to table
John Ewart* and Doris Hicks, University of Delaware Sea Grant Marine Advisory Service

9:15 Sea Grant 10-year aquaculture vision
LaDon Swann, Mississippi-Alabama Sea Grant Consortium

9:45 History, collaborations, and challenges of the Idaho trout industry
Randy MacMillan, Clear Springs Foods

10:15 – 10:45 **Break**…… **North Star**

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10:45 Why do so many Americans react negatively to increasing aquaculture in the US?
Jim Diana, University of Michigan Sea Grant

11:15 Public perceptions and attitudes towards aquaculture
Kwamena Quagrainie, Purdue University

11:45 – 12:45 **Lunch**..... **North Star Landing**

Aquaculture – where we came from – where we are now – how did we get here – where are we going?
Leo Ray, Fish Breeders of Idaho

**Communications and Extension Program Updates**..... **North Star**

12:45 Social media and technology as game changers in pond management extension
Marley Beem, Oklahoma State University

1:00 Status update for the aquaculture webinar series
Allen Pattillo, Iowa State University

1:15 Creating better educational videos for extension and outreach
David Cline, Auburn University

1:30 An innovative educational program: Aquaculture Boot Camp (ABC)
Matthew Smith*, Han-Ping Wang, Jordan Maxwell, Paul O'Bryant, Dean Rapp, and Zhi-Gang Shen, Ohio State University,

1:45 From graduate school to Capitol Hill – enhancing the student pathways to aquaculture workforce development
Rachel Wang* and Samuel Chan, National Oceanic and Atmospheric Administration, Office of Aquaculture

2:00 Educating the future and present workforce through interactive, hands-on applications of aquaculture
Emma Wiermaa*, Greg Fischer, and Chris Hartleb, University of Wisconsin-Stevens Point

2:15 Opportunities and challenges for aquaculture extension in the Pacific Islands
Meredith Brooks*and Maggie Ma, Center for Tropical and Subtropical Aquaculture

2:30 Highlights on aquaculture research and extension projects in the republic of Palau
Miguel A. Delos Santos, Palau Community College – Cooperative Research and Extension

2:45 Aquaculture engineering extension in North Carolina: venues and events
Steven Hall*, Melody Thomas, Alex Geddie, and Matthew Campbell,
North Carolina State University

3:00 Constraint analysis on fish farming and extension needs in Northwestern Himalayas, India
M. Muruganandam*, South Dakota State University, Steve Chipps, and PK Mishra

3:15 - 3:45 **Break**..... **North Star**

**General Session**..... **North Star**

3:45 Today's research and extension for tomorrow's seafood and working waterfronts: NOAA aquaculture
Nikola Garber*, Michael Rust, and LaDon Swann, National Oceanic and Atmospheric Administration, Sea Grant

4:00 USDA ARS aquaculture research and assessment of aquatic genetic resources
Caird Rexroad III, United States Department of Agriculture, Agriculture Research Service

4:15 USDA NIFA aquaculture update: extramural research, extension opportunities, and interagency activities
Gene W. Kim, United States Department of Agriculture, National Institute of Food and Agriculture

4:30 Pit falls and honey traps in aquaculture farm management – an economic perspective
Ganesh Kumar, Mississippi State University

4:45 Aeration choices, trends, successes and failures
Bob Robinson, Kasco Marine

5:00 The terms education, advocacy, and promotion in aquaculture extension programs: what do they mean and where and when to draw the line?
Forrest Wynne, Kentucky State University

5:15 **Poster Session - 3 minute briefings**..... **North Star**

USDA NIFA Southern Regional Aquaculture Center publications, video, and computer software project
Jimmy L. Avery* and Todd Sink, United States Department of Agriculture, National Institute of Food and Agriculture, Southern Regional Aquaculture Center

Three centers promote sustainable aquaculture in Massachusetts
Joe Buttner*, Salem State University, Mark Fregeau, Scott Weston, Diane C. Murphy, Joshua Reitsma, Abigail Archer, and Andy J. Danlchuk

2016 Arkansas catfish split-pond verification program results
Larry Dorman*, Anita Kelly, and George Selden, University of Arkansas at Pine Bluff

Providing teachers with information, support, and a pathway to subject matter integration: methods currently employed by UAPB

C. Bauer Duke III, University of Arkansas at Pine Bluff

A collaboration between extension and Industry to resolve the disappearing golden shiner phenomenon
Anita Kelly*, Julieann Jacobs, and Luke A. Roy, University of Arkansas at Pine Bluff

Delaware State University Mobile Meat Processing Lab (MMPL) curriculum development and implementation
Dennis McIntosh, Delaware State University

Commercial demonstration of kaolinitic clay for protection of *Flavobacterium columnaris* in sportfish
Nilima Renukdas*, Luke A. Roy, Anita M. Kelly, L. Matthew Barnett, Ben H Beck, David Heikes, Robert P. Glennon, and Phil Jones, University of Arkansas at Pine Bluff

Western Regional Aquaculture Center: extension outputs, impacts and future outlook
Rossana Sallenave, New Mexico State University

Flumioxazin as a potential pre-emergent treatment for submersed aquatic weeds
George Selden, University of Arkansas at Pine Bluff

5:45 - 6:30 **Poster Reception – no-host bar**..... **Aspen**

6:30 - 9:30 **Dinner**..... **Aspen**

## Wednesday, June 7th

6:00 – 7:15 **Breakfast**..... **Aspen**

7:30 **Leave hotel for tours all day** *(*buses board outside the Convention Center Lobby)*

- Idaho Aquatics
- Catfish Farm (Fish Breeders of Idaho)
- University of Idaho Hagerman Fish Culture Experiment Station
  **Lunch Sponsored by Idaho Aquaculture Association*
- Magic Springs (Evaqua Farms)

## Thursday, June 8th

7:00 – 8:00 **Breakfast**..... **North Star**

**Program**..... **North Star**

8:00 AM Introduction Gary Fornshell and Forrest Wynne

**Plenary**

8:15 Commercial Aquaculture Heath Program Standards (CAHPS)
Kathleen Hartman, United States Department of Agriculture, Animal Plant Health Inspection Service, Veterinary Services

8:45 FDA update on fish drug approvals and veterinary feed directives
Jennifer Matysczak, Food and Drug Administration, Center for Veterinary Medicine

**Freshwater Session**..... **North Star**

9:15 Aquaponic extension: whose job is it anyway?
Robert Rode, Purdue University

9:30 Using an extension approach to address an emerging industry concern: a case study of winter fish losses in Arkansas
Luke Roy*, Auburn University, Anita Kelly, Nathan Stone, Carole Engle, Jeonghwan Park, Matthew Smith, and Herbert Quintero

9:45 Copper sulfate toxicity to various fish: role of alkalinity/hardness
David Straus, United States Department of Agriculture, Agriculture Research Service

10:00 Extension's role in the 10-year transition to USDA FSIS inspection of catfish
Jimmy Avery, Mississippi State University

10:15 Extension support of aquaponics farms in Hawaii and the U.S. affiliated Pacific Islands
Harry Ako, University of Hawaii

10:45 – 11:15 **Break**..... **North Star**

**Great Lakes Aquaculture Session**..... **North Star**

11:15 Hazard Analysis Critical Control Point (HACCP) for seafood safety and preventing the movement of aquatic invasive species
Ron Kinnunen, Michigan State University

11:30 The Michigan netpen experience – part 1
Chris Weeks* and Ron Kinnunen, Michigan State University

11:45 – 12:45 **Lunch**..... **North Star Landing**

**Marine Session**..... **North Star**

12:45 An Overview of Connecticut's seaweed aquaculture industry
Anoushka Concepcion, University of Connecticut

1:00 Alaskan mariculture diversification, innovation and technology transfer project
Gary Freitag, University of Alaska-Ketchikan

1:15 Past, present and future research on ostreid herpesvirus 1 infections of the pacific oyster in Tomales Bay, California
Paul Olin*, University of California San Diego, Colleen Burge, and Carolyn Friedman

1:30 A blueprint for oyster aquaculture in Georgia
Mark Risse*, University of Georgia, Tom Bliss, Dominic Guadagnoli, Jill Gambill, and Jill Andrews

1:45 Shellfish sanitation models for national growing area applications
Fred Conte* and Abbas Ahmadi, University California Davis

2:00 Connecticut Seafood: Public awareness, perceptions, preferences and use patterns
Tessa Getchis*, Anoushka Concepcion, Miriah Russo Kelly, and John Bovay, University of Connecticut

2:15 NARF-net: using demonstration farms to showcase new aquaculture technologies
Dale Leavitt,* Roger Williams University, Tessa Getchis, and Matthew Griffin

2:30 Growing sugar kelp and its markets: opportunities and barriers in the northeast U.S.
Dawn Kotowicz*, University of Rhode Island, Azure Cygler, and Carole Engle

2:45 Developing a research program to address shellfish growers needs: Ninigret Pond – a case study
Dale Leavitt*, Roger Williams University, Robert Rheault, and Heather Kinney

3:00 – 3:30 **Break**..... **North Star**

3:30 Advocacy in extension and public outreach - Panel members
Sam Chan, Gene Kim, Fred Conte, Larry Dorman, Caird Rexroad, III, Mike Rust

4:30 Evaluations Forms and Wrap up Gary and Forrest

# National Aquaculture Extension Conference Boise, Idaho

June 6-8, 2017

Program Evaluation

## Tuesday, June 6

| Plenary Speakers | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| Kim Thompson | 5 | 4 | 3 | 2 | 1 |
| John Ewart | 5 | 4 | 3 | 2 | 1 |
| LaDon Swann | 5 | 4 | 3 | 2 | 1 |
| Randy MacMillan | 5 | 4 | 3 | 2 | 1 |
| Jim Diana | 5 | 4 | 3 | 2 | 1 |
| Kwamena Quagrainie | 5 | 4 | 3 | 2 | 1 |
| Leo Ray | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

| Session: Communications and Extension Program Updates | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

| Session: General | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

United States Department of Agriculture
National Institute of Food and Agriculture

| Session: Posters | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

## Wednesday June 7

| Tours | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| Idaho Aquatics | 5 | 4 | 3 | 2 | 1 |
| Catfish Farm (Fish Breeders of Idaho) | 5 | 4 | 3 | 2 | 1 |
| University of Idaho Hagerman Fish Culture Exper. Station | 5 | 4 | 3 | 2 | 1 |
| Magic Springs (Evaqua Farms) | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

## Thursday June 8

| Plenary Speakers | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| Kathleen Hartman | 5 | 4 | 3 | 2 | 1 |
| Jennifer Matysczak | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

| Session: Freshwater | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

| Session: Great Lakes Aquaculture | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

| Session: Marine | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

_____

| Panel: Advocacy in Extension and Outreach | Most useful / interesting | | | | Least useful / interesting |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |

Comments _____

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## Food & Lodging

| | Very Good | | | | Poor |
|---|---|---|---|---|---|
| **Food** | | | | | |
| Monday Night Reception | 5 | 4 | 3 | 2 | 1 |
| Poster Reception | 5 | 4 | 3 | 2 | 1 |
| Breakfasts | 5 | 4 | 3 | 2 | 1 |
| Lunches | 5 | 4 | 3 | 2 | 1 |
| Dinner | 5 | 4 | 3 | 2 | 1 |
| **Hotel Accommodations** | 5 | 4 | 3 | 2 | 1 |

Comments _____

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USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Sea Grant

## Reflection

### List three key takeaway messages from this conference.

1. _____
2. _____
3. _____

### List three action items that we as a national network should focus on over the next five years.

1. _____
2. _____
3. _____

### In favor of a 2022 National Aquaculture Extension Conference?

Yes No

Comments: _____

_____

_____

# ATTENDEES

**Harry Ako**
Center for Tropical
and Subtropical Aquaculture
41-202 Kalanianaole Hwy
Waimanalo, HI 86795
808-457-7670

**Michael Annett**
Pentair Aquatic Eco-Systems
16063 Via Norte
Lake Elsinore, CA 92530
951-678-9857
919-721-2866

**Jimmy Avery**
MSU-ES & USDA NIFA SRAC
PO Box 197
Stoneville, MS 38776
662-686-3273
662-402-6544

**Marley Beem**
Oklahoma State University
008C Agriculture Hall
Stillwater, OK 74078
405-744-3854
405-564-3177

**Grant Blank**
Delaware State University
1200 North Dupont Hwy
Dover, DE 19901
302-857-6405
302-943-3065

**Meredith Brooks**
Center for Tropical
and Subtropical Aquaculture
41-202 Kalanianaole Hwy
Waimanalo, HI 86795
808-292-1323

**Joseph Buttner**
Salem State University
Department of Biology
Salem, MA 01970
978-542-6703
978-793-0446

**Lindsay Carroll**
AquaFish Innovation Lab
Oregon State University
Corvallis, OR 97333
541-737-4262

**Samuel Chan**
NOAA - Sea Grant
1315 E.W. Highway
SSMC3 11170
Silver Spring, OR 97330
503-679-4828
503-679-4828

**David CLINE**
Auburn University - ACES
203 Swingle Hall
Auburn, AL 36849
334-844-2874
334-844-2874

**Anoushka Concepcion**
CT Sea Grant/UConn
1080 Shennecossett Road
University of Connecticut
Marine S
Groton, CT 06340
860-405-9105
401-965-1075

**Fred Conte**
University of California - Davis
Department of Animal Science
Davis, CA 95616
530-752-7689
530-574-7930

**Kenneth Corpron**
Best Aquaculture Practices
Two International Drive, Suite 105
Portsmouth, NH 03801
603-317-5000 x 155
208-329-2949

**Miguel Delos Santos**
Palau Community Community
Cooperative Research & Extension
PO Box 9
Koror, HI Palau 94940
808-259-3168

**Jim Diana**
University of Michigan
440 Church Street
Ann Arbor, MI 48109-1041
734-763-5834
734-223-8353

**Larry Dorman**
University of Arkansas - Pine Bluff
1200 N. University
Mail Slot 4912
Pine Bluff, AR 71601
870-265-5440
870-265-3281

**C. Bauer Duke III**
University of Arkansas - Pine Bluff
1200 N. University Drive
Pine Bluff, AR 71601
870-575-8121

**John Ewart**
University of Delaware Sea Grant
Marine Advisory Service
700 Pilottown Road
Lewes, DE 19958
302-645-4060
302-381-0578

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

NOAA
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Sea Grant

**Kevin Fitzsimmons**
University of Arizona
Forbes 306
1140 E. South Campus Drive
Tucson, AZ 85719
520-820-0643
520-820-0643

**Gary Fornshell**
University of Idaho
630 Addison Avenue West
Suite 1600
Twin Falls, ID 83301
208-735-4419
208-404-3665

**Gary Freitag**
Alaska Sea Grant
University of Alaska - Fairbanks
600 Stedman St
Ketchikan, AK 99901
907-617-8990
907-617-8990

**Nikola Garber**
NOAA Sea Grant
1315 East West Highway, R/SG
Silver Spring, MD 20910
301-734-1088
202-669-3552

**Tessa Getchis**
Connecticut Sea Grant
UConn Extension
1080 Shennecossett Road
Groton, CT 06340-6048
860-405-9104
860-367-4602

**Steven Hall**
NCSU
210 Weaver Admin BAE NCSU
Raleigh, NC 27695
225-281-9454
2252819454

**William Hanshumaker**
Oregon State University - Hatfield
Marine Science Center
2030 Marine Science Dr.
Newport, OR 97365
541-867-0167
541-961-3098

**Kathleen Hartman**
USDA APHIS Veterinary Services
1408 24th Street, SE
Ruskin, FL 33596
813-477-7019

**Anita Kelly**
University of Arkansas - Pine Bluff
Lanoke Fish Health Services
PO Box 357
Lonoke, AR 72086
501-676-3124

**Gene Kim**
USDA/NIFA
800 9th Street SW
Washington, DC 20024
202-401-1108
202-531-0636

**Ronald Kinnunen**
Michigan Sea Grant
Michigan State University
710 Chippewa Square, Suite 202
Marquette, MI 49855
906-226-3687

**Dawn Kotowicz**
Coastal Resources Center
Rhode Island Sea Grant
220 South Ferry Road
Narragansett, RI 02882
401-874-6152
401-874-6152

**Ganesh Kumar**
Mississippi State University
Delta Research & Extension Center
PO Box 197
Stoneville, MS 38776
662-686-3586
870-489-6679

**Andrew Lazur**
University of Maryland Extension
2115 Symons Hall
College Park, MD 20742
301-405-7992
301-789-5256

**Dale Leavitt**
Roger Williams University
220 MNS, 1 Old Ferry Road
Bristol, RI 02809
401-450-2581
401-450-2581

**Cheng-Sheng Lee**
Center for Tropical
and Subtropical Aquaculture
41-202 Kalanianaole Hwy
Waimanalo, HI 86795
808-259-3107

**Maggie Ma**
Hawaii Pacific University
41-202 Kalanianaole Hwy
Waimanalo, HI 86795
808-259-3168

**Randy MacMillan**
Clear Springs Foods
PO Box 712
Buhl, ID 83316
800-635-8211

**Niang Mamadou Sileye**
Isra Institut Senegalais
De Recherches Agricoles
Pole de recherche de Hann
Route du front de terre
Dakar, AK 2241
00221778477323
00221778477323

**Jennifer Matyszak**
FDA Center for Veterinary
Medicine
7500 Standish Place
Rockville, MD 20855
240-402-0588

**Dennis McIntosh**
Delaware State University
1200 N. DuPont Hwy.
Dover, DE 19901
302-857-6456

**Kathryn Mitchell**
Kentucky State University
100 Pinnacle Ct. Apt. 111
Frankfort, KY 40601
502-597-6140
256-466-6259

**Muthiah Muruganandam**
South Dakota State University
Department of Natural
Resource Management
Brookings, SD 57007
605-688-6121

**Manoj Nair**
College of Micronesia
Land Grant Program
PO Box 1179
Kolonia Town
Pohnpei, MP 96941
691-320-2462

**Paul OBryant**
Ohio State University
1864 Shyville Road
Piketon, OH 45661
740-289-2071
740-222-8341

**Paul Olin**
California Sea Grant
133 Aviation Blvd, Suite 109
Santa Rosa, CA 95404
707-565-3449
770-292-4445

**Allen Pattillo**
Iowa State University
NCRAC
339 Science Hall 2
Ames, IA 50014
515-294-8616
404-274-8052

**Alexander Primus**
University of Minnesota
College of Veterinary Medicine
612-625-2489

**Kwamena Quagrainie**
Purdue University
403 West State St
West Lafayette, IN 47907
765-494-4200

**Leo Ray**
Fish Breeders of Idaho
P.O. Box 479
18374 Hwy. 30
Hagerman, ID 83332
208-837-6114

**Charlotte Regula-Whitefield**
Office of United States Senator
Lisa Murkowski
522 Hart Office Building
Washington, DC 20510
202-224-6139

**Nilima Renukdas**
University of Arkansas - Pine Bluff
PO Box 357
Lonoke, AR 72086
501-676-3124

**Caird Rexroad, III**
USDA/ARS
5601 Sunnyside Avenue
Bldg. 4-2106
Beltsville, MD 20705
301-504-5925
304-620-5234

**Mark Risse**
Marine Extension
and Georgia Sea Grant
University of Georgia
1030 Chicopee Complex
Athens, GA 30602
706-542-5956
706-202-9576

**Bob Robinson**
Kasco Marine
2243 Summerset Court
Kronenwetter, WI 54455
715-241-8227
715-574-4784

**Robert Rode**
Purdue University
5675 W 600 N
W. Lafayette, IN 47906
765-583-0351
765-418-5509

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

NOAA
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Sea Grant

**Luke Roy**
Auburn University
529 Centreville Street
Alabama Fish Farming Center
Greensboro, AL 36744
334-624-4016
334-218-9619

**Michael Rust**
NOAA
Office of Aquaculture
2725 Montlake Blvd E
Seattle, WA 98112
206-860-3382
206-384-0226

**Rossana Sallenave**
New Mexico State University
Dept. of Extension Animal
Sciences & Natural Resources
Las Cruces, NM 88003
575-646-6093

**Lisa Schiavinato**
California Sea Grant
9500 Gilman Drive, MC #0232
La Jolla, CA 92093
858-822-2708

**George Selden**
6000 Charity Ct
Jonesboro, AR 72404
870-540-7805
870-540-7805

**Matthew Smith**
Ohio State University
1864 Shyville Road
Piketon, OH 45661
740-289-2071
256-458-0967

**Jim Steeby**
Sunflower Aqua
PO Box 52
Inverness, MS 38753
662-247-2915
662-822-8541

**Dave Straus**
USDA/ARS
USDA/ARS SNARC
P.O. Box 1050
Stuttgart, AR 72160
870-672-8265
870-308-3458

**D. LaDon Swann**
Mississippi Alabama Sea Grant
Consortium
12740 Dauphin Island Pkwy
Coden, AL 36523
251-648-5877
251-648-5877

**Kim Thompson**
Aquarium of the Pacific
320 Golden Shore, Suite 100
Long Beach, CA 90802
562-951-5388
626-327-7723

**Soe Tun**
University of Arizona
PO Box 210036
Tucson, AZ 85721-0036
520-820-0643
520-820-0643

**Shiyu (Rachel) Wang**
NOAA
1315 East West Hwy, Suite 12603
Silver Spring, MD 20910
301-427-8340

**Christopher Weeks**
Michigan State University
480 Wilson Road
13 Natural Resources Building
East Lansing, MI 48824
517-353-2298
517-745-1562

**Emma Wiermaa**
UW-Stevens Point Northern
Aquaculture Demonstration Facility
PO Box 165
Bayfield, WI 54814
715-779-3262
651-341-2648

**Forrest Wynne**
Kentucky State University
Cooperative Extension Program
McCracken Co. Extension Office
2025 New Holt Rd.
Paducah, KY 42001
270-554-9520
270-556-2375

**Graham Young**
Western Regional Aquaculture
Center
School of Aquatic and Fishery
Sciences
University of Washington
Seattle, WA 98195
206-543-4291