BUILDING CAPACITY OF ATLANTIC SALMON Salmo salar RAS PRODUCTION IN THE U.S. USING AN INDUSTRY DRIVEN STAKEHOLDER NETWORK (RAS-N): ENGAGEMENT AND EXTENSION EFFORTS

Catherine Frederick*, Yonathan Zohar, and John Stubblefield
University of Maryland and the
Institute of Marine and Environmental Technology

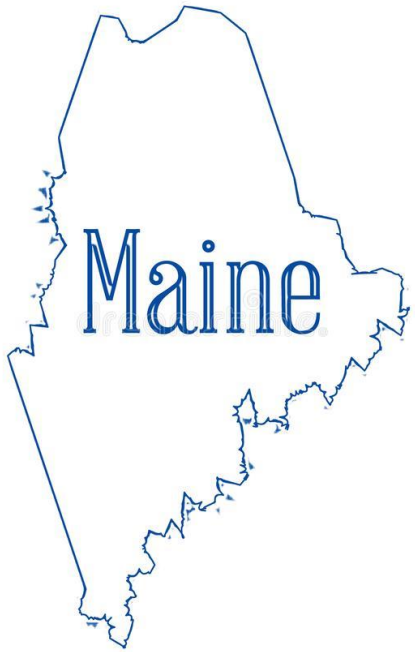
RAS-N

RECIRCULATING AQUACULTURE SALMON NETWORK

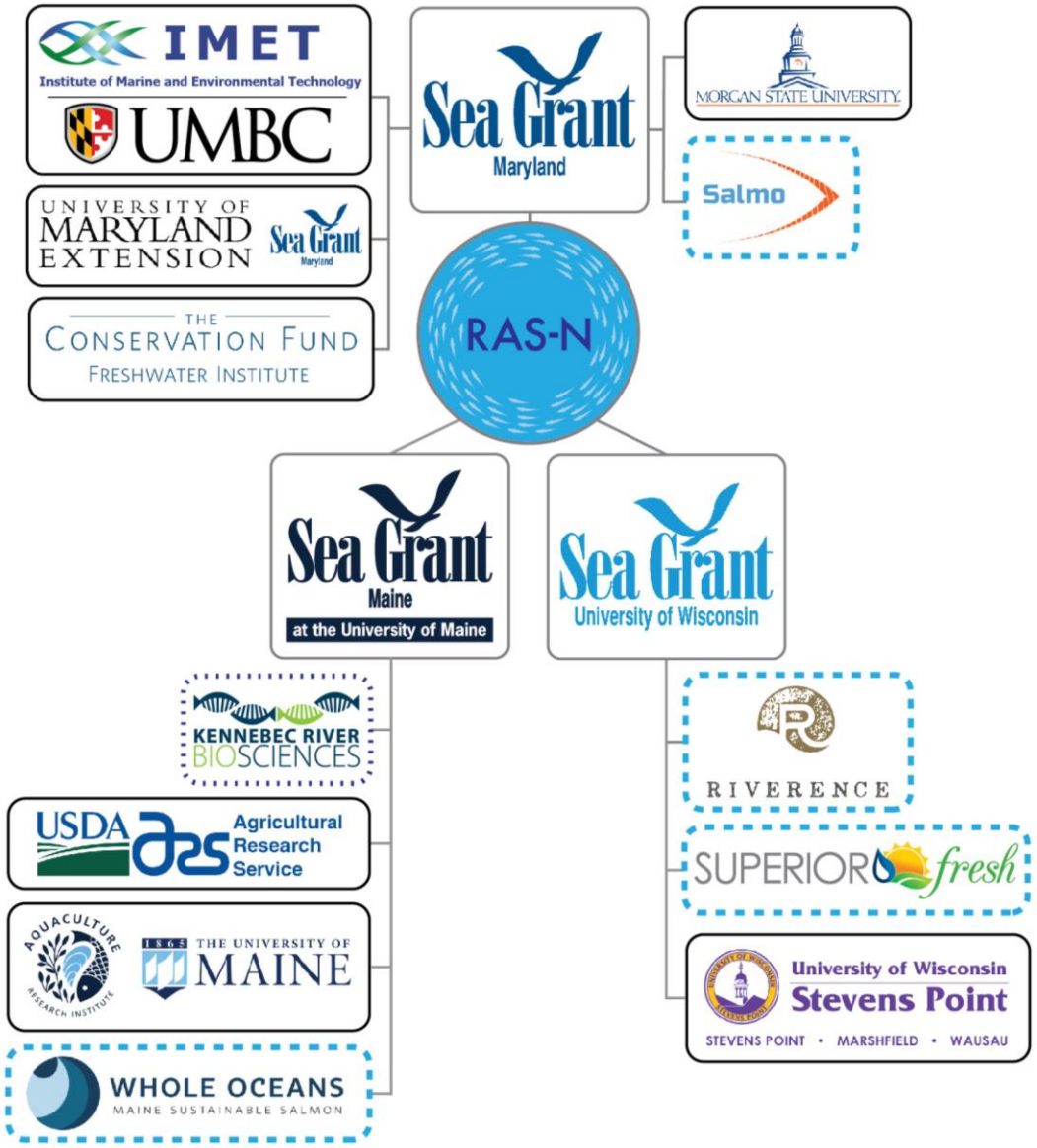
Sustainable • Innovative

Building Capacity Of Atlantic Salmon Production in the U.S. Through Strong Industry Engagement

IMET
Institute of Marine and Environmental Technology
UMBC
UNIVERSITY OF MARYLAND EXTENSION
Sea Grant Maryland
THE CONSERVATION FUND
FRESHWATER INSTITUTE
Sea Grant Maryland
MORGAN STATE UNIVERSITY
Salmo
RAS-N
Sea Grant Maine
at the University of Maine
Sea Grant University of Wisconsin
KENNEBEC RIVER BIOSCIENCES
RIVERENCE
USDA Agricultural Research Service
SUPERIOR fresh
AQUACULTURE RESEARCH INSTITUTE
THE UNIVERSITY OF MAINE
University of Wisconsin Stevens Point
STEVENS POINT • MARSHFIELD • WAUSAU
WHOLE OCEANS
MAINE SUSTAINABLE SALMON



Building Capacity Of Atlantic Salmon Production in the U.S. Through Strong Industry Engagement



Added Partners

AquaCon™

INNOVASEA

Benchmark Genetics

SKRETTING
a Nutreco company

Supporters

NORDIC AQUAFARMS
SUSTAINABLE AQUACULTURE

Exciton Clean
WATER TREATMENT

BioMar

ATLANTIC SAPPHIRE

Recirculating Aquaculture Salmon Network (RAS-N)

Targeted Working Groups

Research and Development

Brian Peterson (USDA-ARS)

Economics

Scott Knoche (Morgan State)

ECWFD

Adam Frederick (MDSG) and M.S. Tudor (UMaine)

Extension

Bill Hubbard (UMD)

Communications

Jennifer Smith (WISG)

Website Development

PMT and WISG

RAS-N

Recirculating Aquaculture Salmon Network (RAS-N)

Targeted Working Groups

Research and Development

Brian Peterson (USDA-ARS)

Economics

ECWFD

and M.S. (UMaine)

34 Individuals from:
6 Industry Partners
2 USDA Agencies
NOAA
3 Sea Grant Programs
1 non-profit
5 Universities

Extension

Bill Hubbard (UMD)

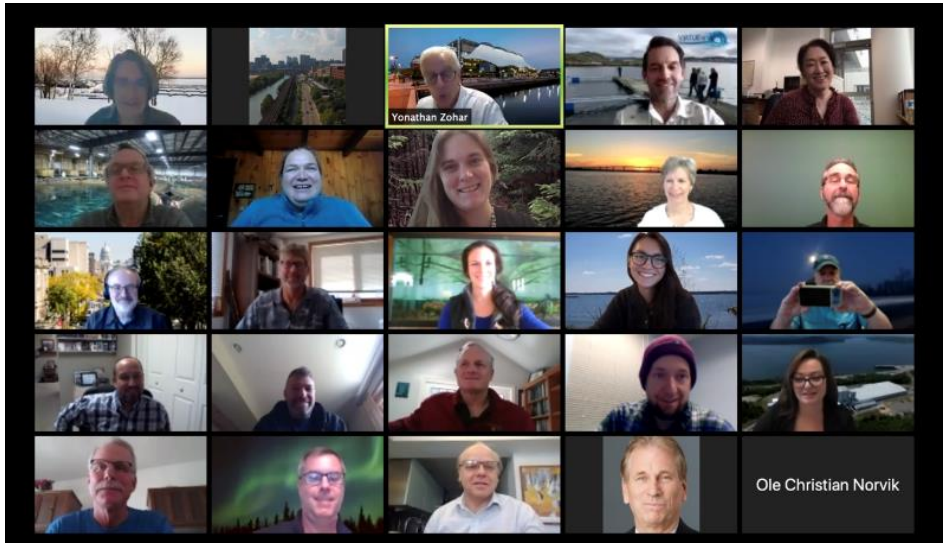
Communications

Jennifer Smith (WISG)

Website Development

PMT and WISG

Engage with Industry Stakeholders



Research and Industry Updates

Stakeholder Sessions, Panels and Surveys

Panels on Areas of Priority

Education Needs and Programming

2nd Annual RAS-N Workshop (October 8-9, 2020*)

Hosted by the Institute of Marine and Environmental Technology (IMET)
and Maryland Sea Grant

Workshop Registration: https://bit.ly/RASNWorkshop2020

**All times are Eastern Standard Time (EST)*

Wednesday October 7th

6:30PM – 7:30PM: Virtual Social Hour (Register for Social Hour: https://bit.ly/RAS-NSocialHour)

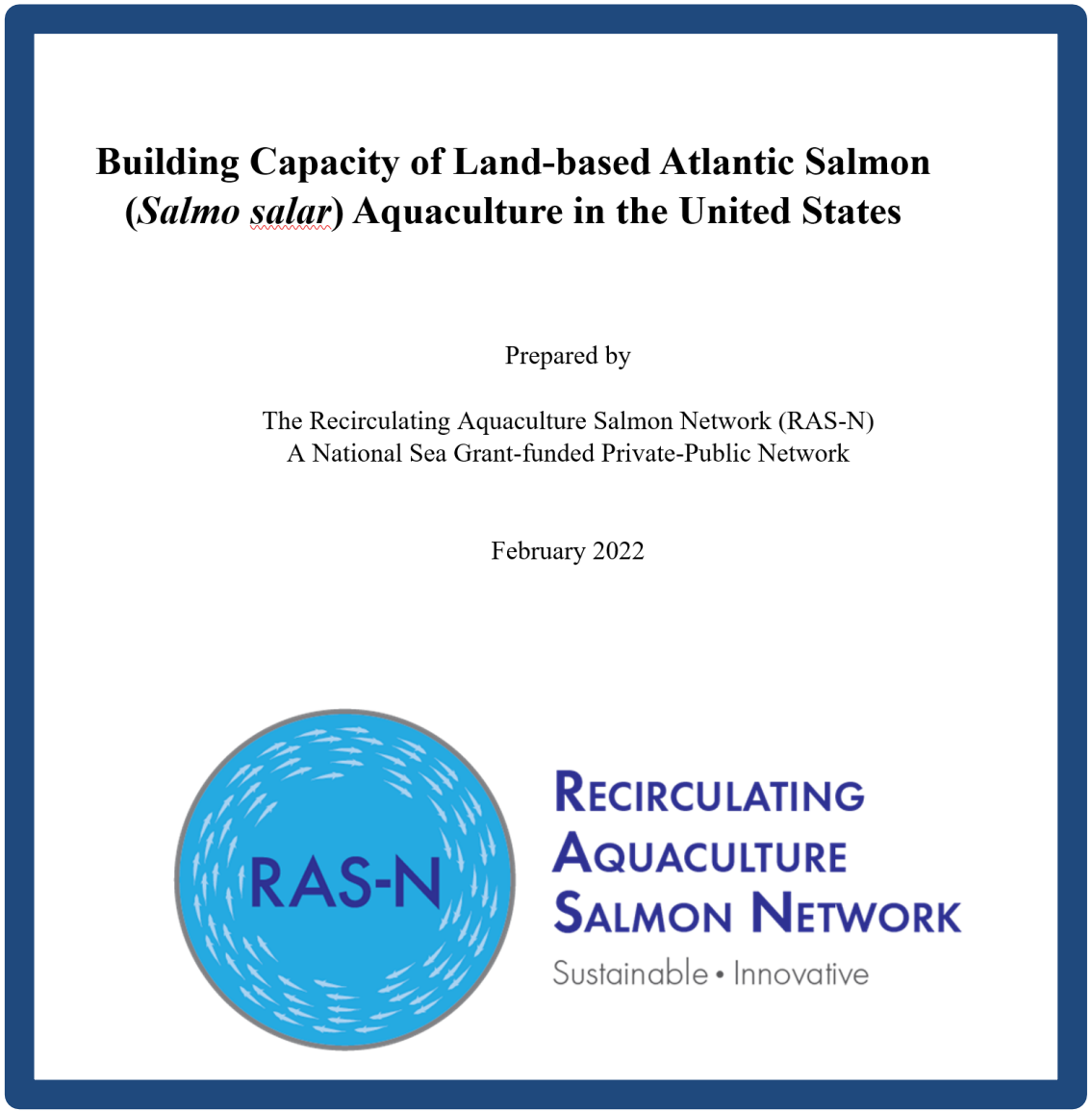
Thursday October 8th

10:00AM – 10:01AM: Call to Order – Yoni Zohar (IMET, MD)

10:01AM – 10:05AM: Welcome – Russell Hill (IMET - University of Maryland, MD)

RAS-N Extension: Develop a Concept Paper

Involved Work Groups: R&D, ECWFD, Extension, and Economic



RAS-N Extension: Develop a Concept Paper

Winter 2019
Stakeholder Workshop to Outline Topics

Spring 2020
Form Working Groups Around Topics

Summer 2020
Generating Content for Concept Paper

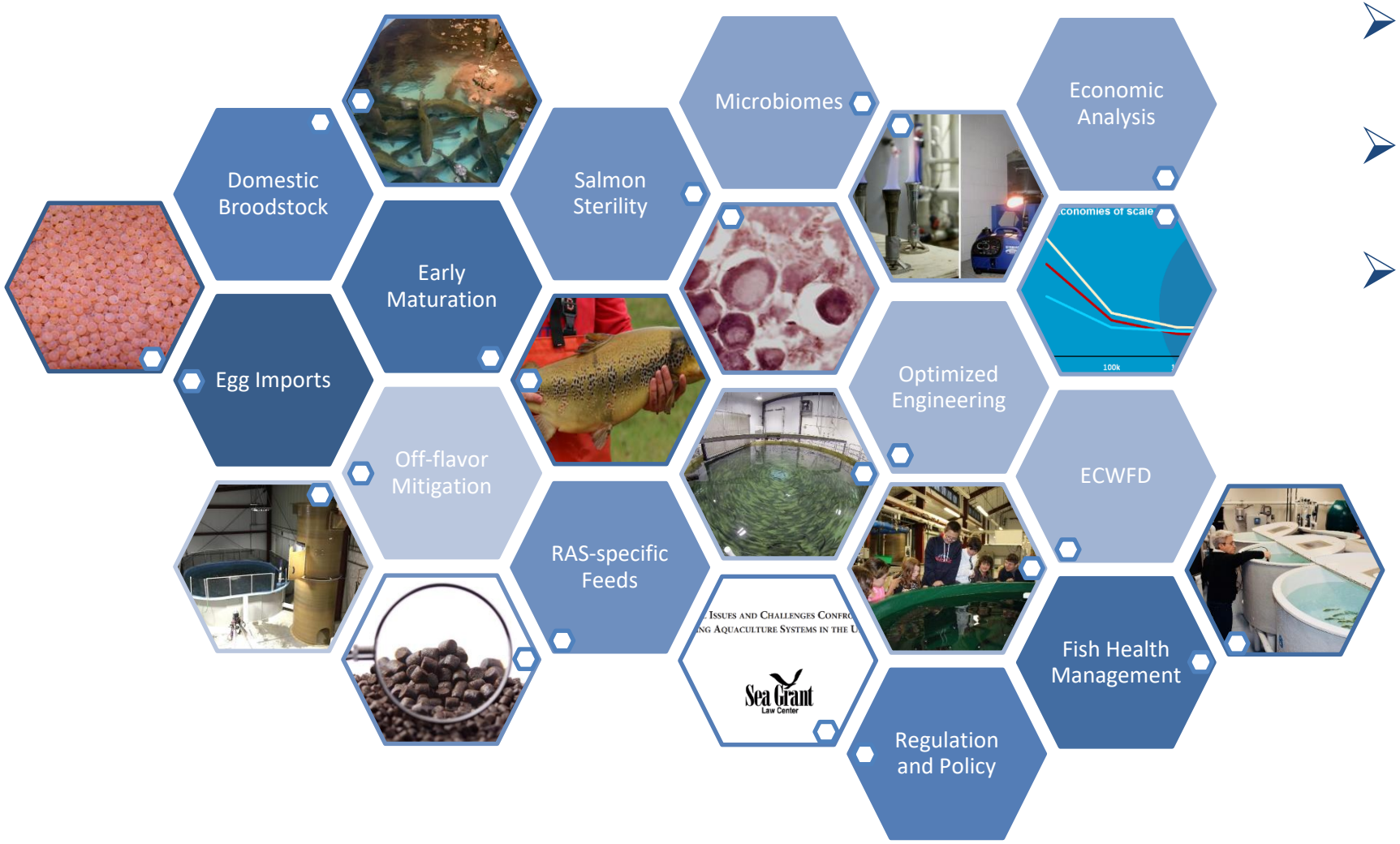
Fall & Winter 2020
Compiling Concept Paper and Meetings

Spring & Summer 2021
Editing and 1st Round of Sharing w/ Chairs of Working Groups

Summer & Fall 2021
Editing and 2nd Round of Sharing w/ Sea Grant Leadership

Complete
Editing and Final Round of Sharing w/ External Advisory Panel

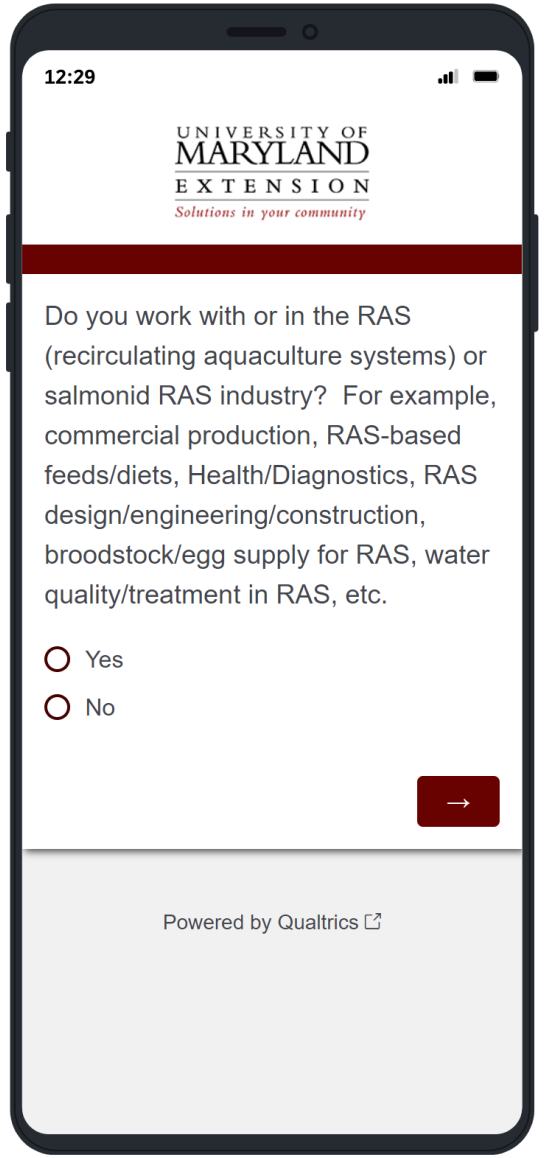
RAS-N Extension: Develop a Concept Paper



- 28 Contributors
- 15 Organizations/Companies
- 20 Pages Covering:
  - State of Supply and Production Practices
  - Needs/Barriers
    - ✓ Challenges
    - ✓ Potential Solutions

RAS-N Extension: Survey of Salmon RAS Priorities

Involved Work Groups: R&D and Extension



Broadcast Nationally and Internationally

30 Participants

RAS-N Extension: Survey of Salmon RAS Priorities

Technical and Biological Needs

1

Develop technologies and best practices to effectively mitigate off-flavor compounds

Identify variables and mechanisms that control presence of off-flavor compounds

Identify variable interactions that induce early sexual maturation

Develop technology for early detection of detrimental compounds (geosmins, sulfides, sulfites)

Identify human taste thresholds of off-flavor compounds

Develop mono-sex cultures and sterility techniques to reduce/eliminate early maturation

Develop precision aquaculture technologies to monitor and improve growth performance

Design RAS specific feeds that optimize health and growth while maintaining water quality

8

RAS-N Extension: Survey of Salmon RAS Priorities

Non-Technical Needs

1. Assess consumer preferences and willingness to pay
2. Invest in training capacity and increase reach of workforce development programs
3. Evaluate public perception of RAS and use of advanced technologies
3. Develop strategies for constructive dialogue with local communities

RAS-N Extension: Website for Outreach and Information Sharing

Involved Work Groups: Web Development w/ PMT and Communications

IMET
Institute of Marine and Environmental Technology

University of Wisconsin Stevens Point

Sea Grant
University of Wisconsin

Sea Grant
Maryland

John Stubblefield

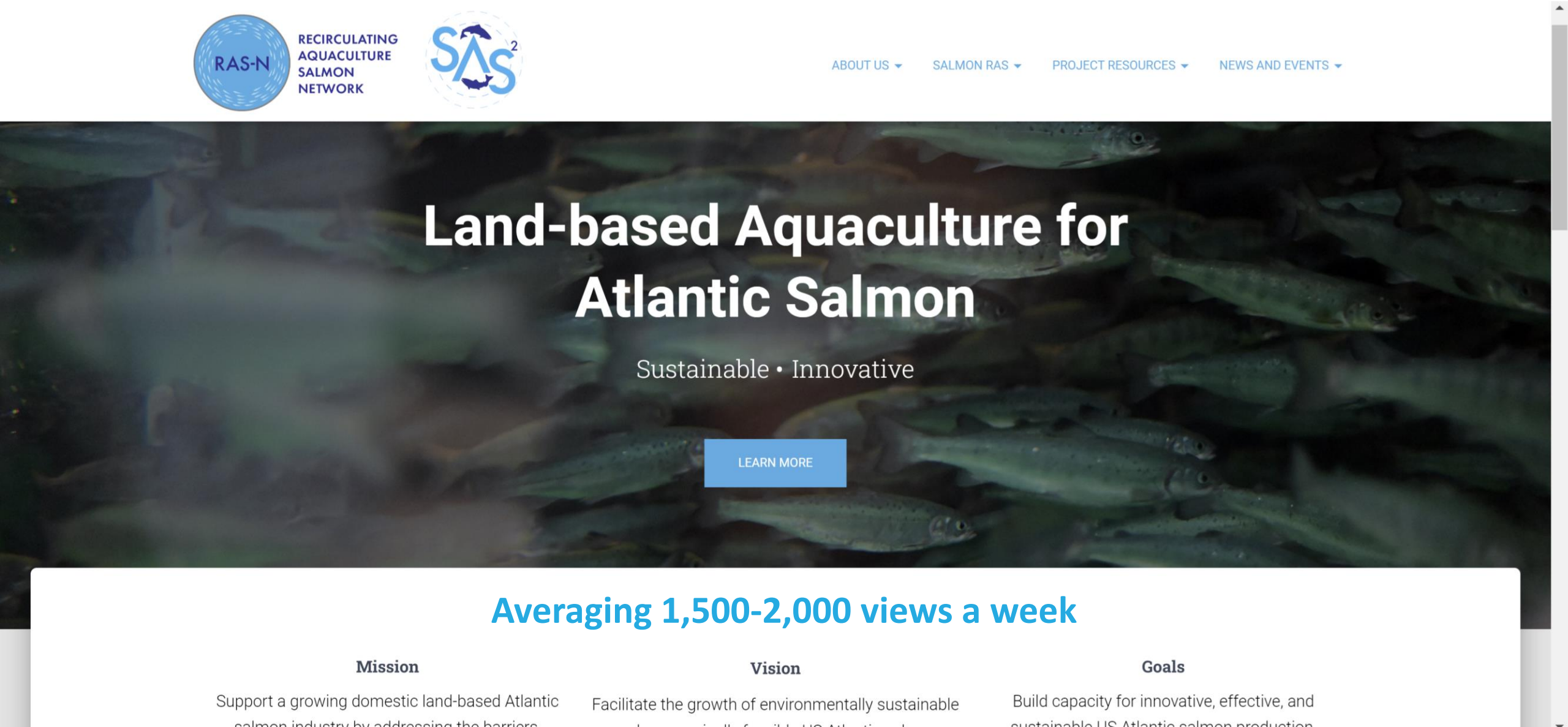
Emma Wiermaa

Jennifer Smith
Tom Xiong (not pictured)

Lisa Tossey

RAS-N Extension: Website for Outreach and Information Sharing

Website: ras-n.org



Averaging 1,500-2,000 views a week

RAS-N Extension: Website for Outreach and Information Sharing

RAS-N RECIRCULATING AQUACULTURE SALMON NETWORK

SAS²

ABOUT US | SALMON RAS | PROJECT RESOURCES | NEWS AND EVENTS

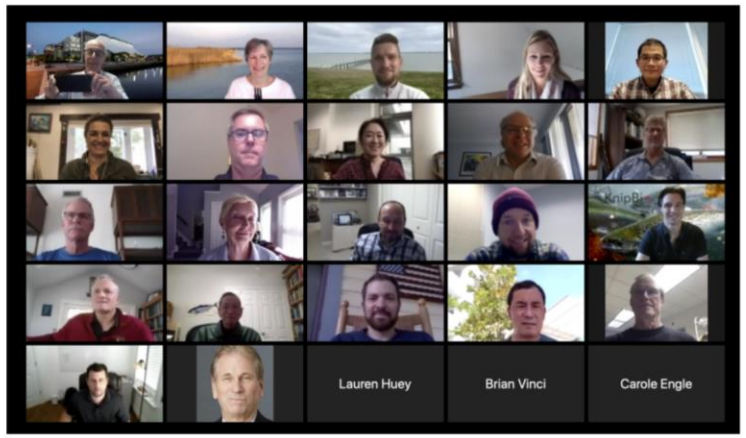
October 8-9, 2020: Second Annual RAS-N Workshop (virtual meeting)

Institute of Marine and Environmental Technology (IMET), Baltimore, Maryland

+ Program and Welcome
+ Plenary presentations
+ Off-flavor and Mitigation updates
+ Early Maturation updates
+ AquaFeeds R&D updates
+ RAS-N updates

Atlantic Salmon Production in Recirculating Aquaculture Systems (RAS): Economic Analysis and Feasibility - Kaitlynn Ritchie, Morgan State University's Patuxent Environmental & Aquatic Research Laboratory

Knowledge and Skill Guidelines for Atlantic Salmon RAS Technician - Catherine (Cat) Frederick, University of Maryland Sea Grant Extension Programs



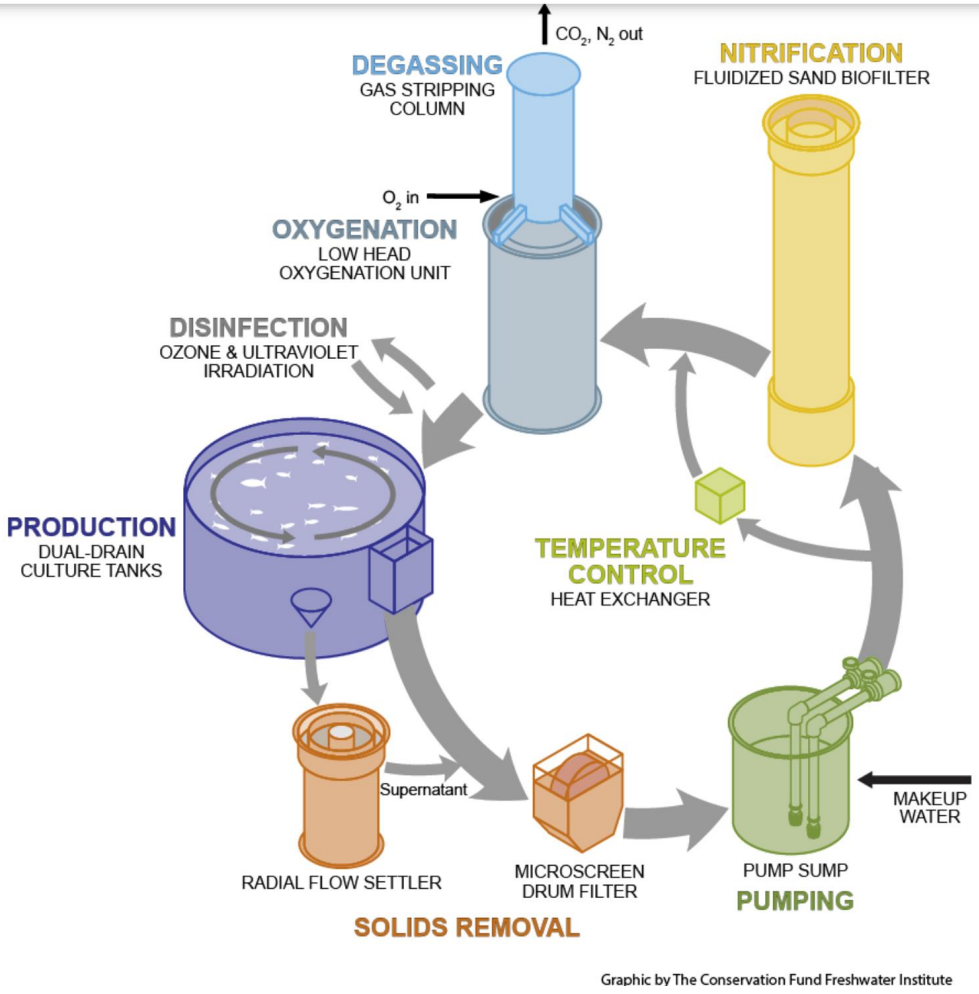
The RAS-N 2020 Workshop practiced social distancing by going virtual, hosting 170 people online

RAS-N Extension: Website for Outreach and Information Sharing

RAS-N RECIRCULATING AQUACULTURE SALMON NETWORK

SAS 2

ABOUT US | SALMON RAS | PROJECT RESOURCES | NEWS AND EVENTS



Graphic by The Conservation Fund Freshwater Institute

RAS-N Extension: Website for Outreach and Information Sharing

RAS-N RECIRCULATING AQUACULTURE SALMON NETWORK

ABOUT US | SALMON RAS | PROJECT RESOURCES | NEWS AND EVENTS

Step-by-step guide for RAS technology

+ Production

Solids removal

A mechanical filter, such as a microscreen drum filter or radial flow settler, is used to physically remove suspended solid waste (primarily fecal matter and some uneaten food), just like a colander. Water is physically cleaner after mechanical filtration but still must be treated through biofiltration processes to remove dissolved wastes before it is ready for reuse and fish use (see below). The solid waste is collected to be removed without hurting the environment. A promising approach is the use of marine microorganisms that very efficiently convert the solid waste to fuel-grade biogas. Solid waste is thus biologically treated without being discharged to the environment and bioenergy is generated in the process that can be used to offset the energy cost of the RAS farm.

+ Pumping/pump sump

+ Nitrogen Removal

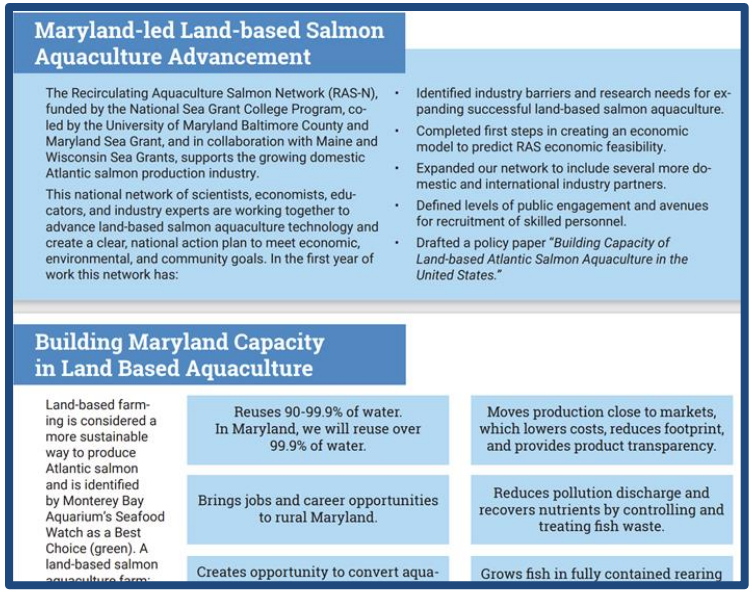
+ Temperature control

+ Degassing and oxygenation

+ Disinfection

RAS-N Extension: Communicating Information with Targeted Audiences

Involved Work Groups: Communications, Extension, and R&D



Maryland-led Land-based Salmon Aquaculture Advancement

The Recirculating Aquaculture Salmon Network (RAS-N), funded by the National Sea Grant College Program, co-led by the University of Maryland Baltimore County and Maryland Sea Grant, and in collaboration with Maine and Wisconsin Sea Grants, supports the growing domestic Atlantic salmon production industry.

This national network of scientists, economists, educators, and industry experts are working together to advance land-based salmon aquaculture technology and create a clear, national action plan to meet economic, environmental, and community goals. In the first year of work this network has:

- Identified industry barriers and research needs for expanding successful land-based salmon aquaculture.
- Completed first steps in creating an economic model to predict RAS economic feasibility.
- Expanded our network to include several more domestic and international industry partners.
- Defined levels of public engagement and avenues for recruitment of skilled personnel.
- Drafted a policy paper *"Building Capacity of Land-based Atlantic Salmon Aquaculture in the United States."*

Building Maryland Capacity in Land Based Aquaculture

Land-based farming is considered a more sustainable way to produce Atlantic salmon and is identified by Monterey Bay Aquarium's Seafood Watch as a Best Choice (green). A land-based salmon

Reuses 90-99.9% of water. In Maryland, we will reuse over 99.9% of water.

Moves production close to markets, which lowers costs, reduces footprint, and provides product transparency.

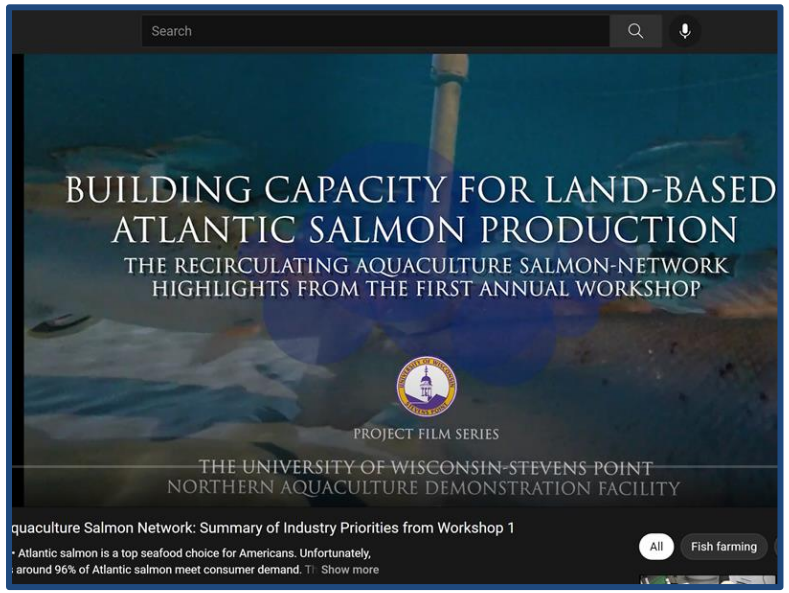
Brings jobs and career opportunities to rural Maryland.

Reduces pollution discharge and recovers nutrients by controlling and treating fish waste.

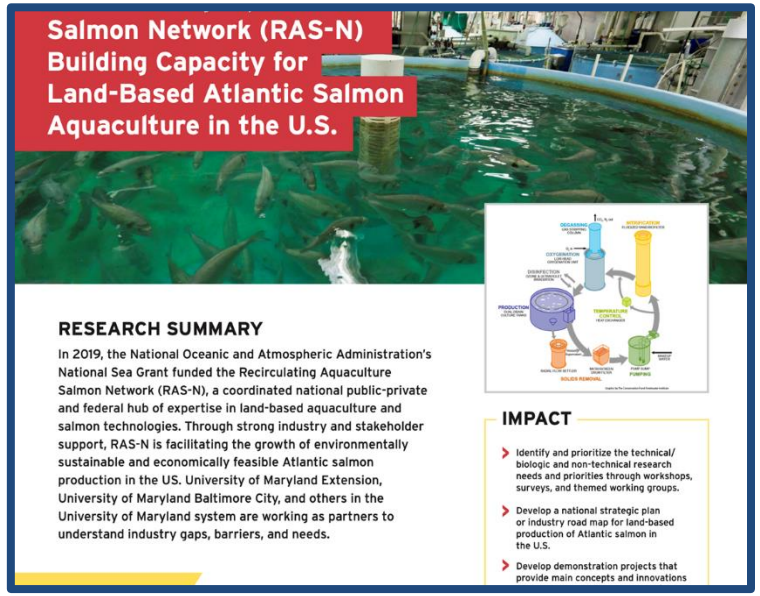
Creates opportunity to convert aqua-

Grows fish in fully contained rearing

Hill Visits: One-Pager
MDSG and UMD Extension



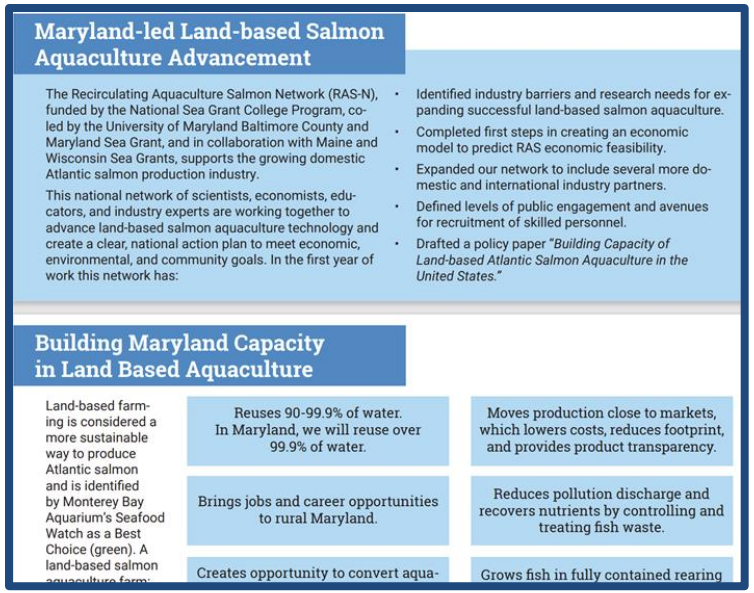
YouTube Video Highlights
UW-Stevens Point NADF



State Fair Posters
UMD Extension

RAS-N Extension: Communicating Information with Targeted Audiences

Involved Work Groups: Communications, Extension, and R&D



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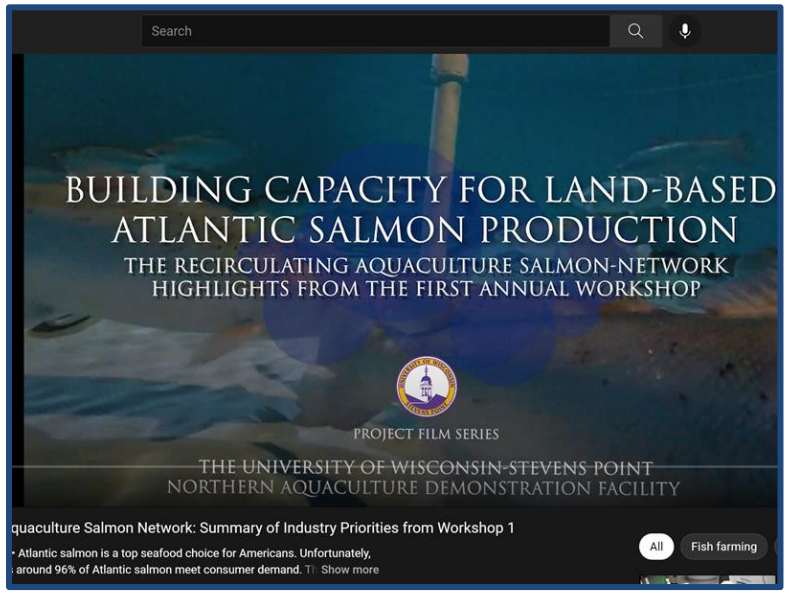
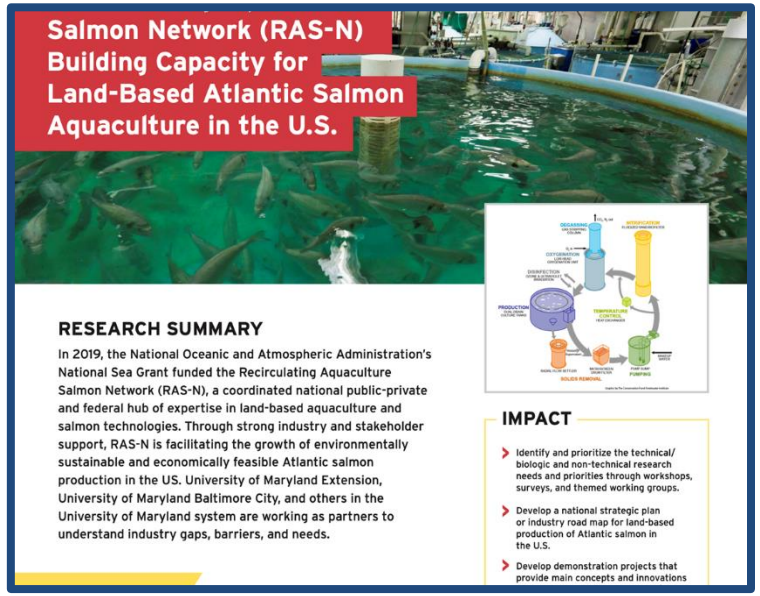




Hill Visits: One-Pager
MDSG and UMD Extension

2022
MD Aquaculture
One Pager -MDSG

YouTube Video Highlights
UW-Stevens Point NADF

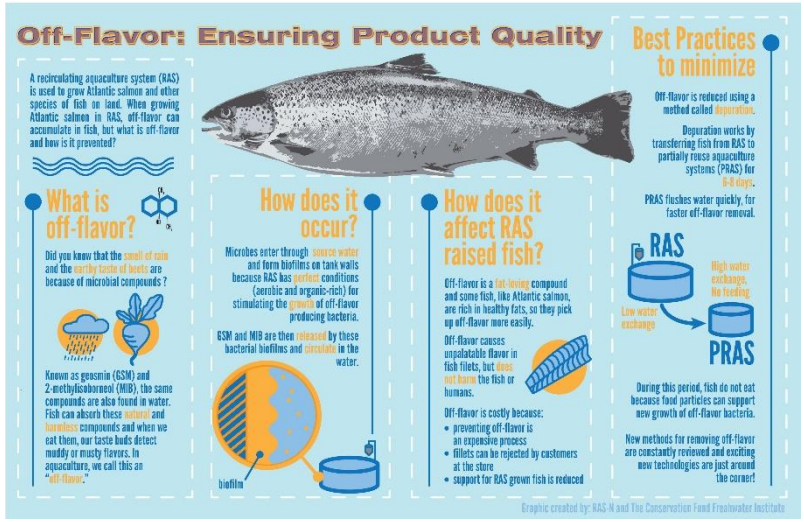
Wisconsin Lake
Talk Series

State Fair Posters
UMD Extension

Agriculture
Awareness Days
and Seminar
Series with Horn
Point Lab

RAS-N Extension: Collaboration Efforts for Traditional Extension Products

THE CONSERVATION FUND
FRESHWATER INSTITUTE



Kata Sharrer (not pictured)

1865 THE UNIVERSITY OF MAINE

Laura Rickard

UNIVERSITY OF MARYLAND EXTENSION

Allen Patillo

(including SAS2 efforts)

More Extension Efforts

Continuing Communication & Outreach w/ Targeted Audiences

Facilitating Technology Transfer & Programming Integration

Road Map & Strategic Plan

What Happens with RAS-N?

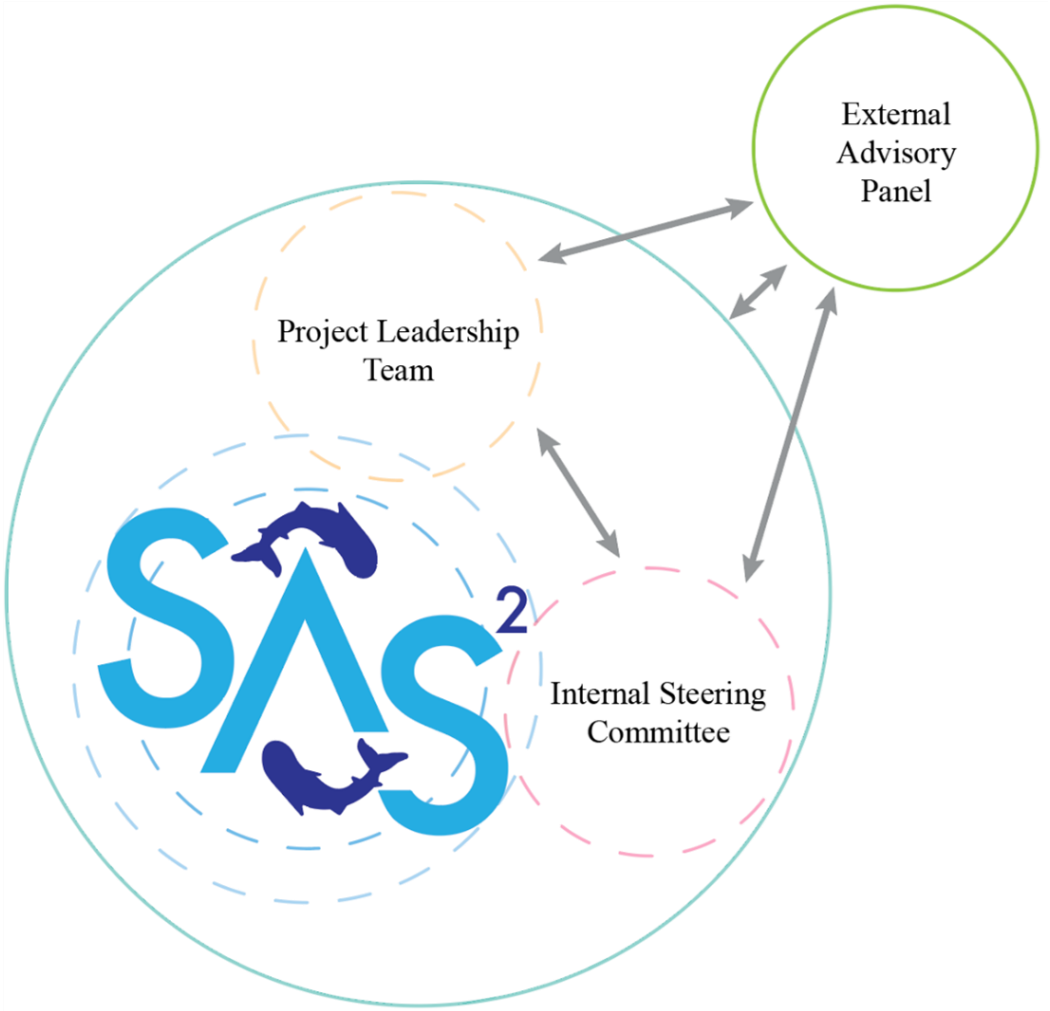
Continuation of Engagement with Newly Funded USDA Project

New Project Based On

- Known Priorities
- Existing Partners
- New Industry Collaborations

Extension

- 6 Objectives
- 7 Individuals
- 2 Industry Collaborators



Our Network Welcomes Questions and Insights

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Institute of Marine and Environmental Technology
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Project Coordinator: John Stubblefield
Institute of Marine and Environmental Technology
stubble@umbc.edu