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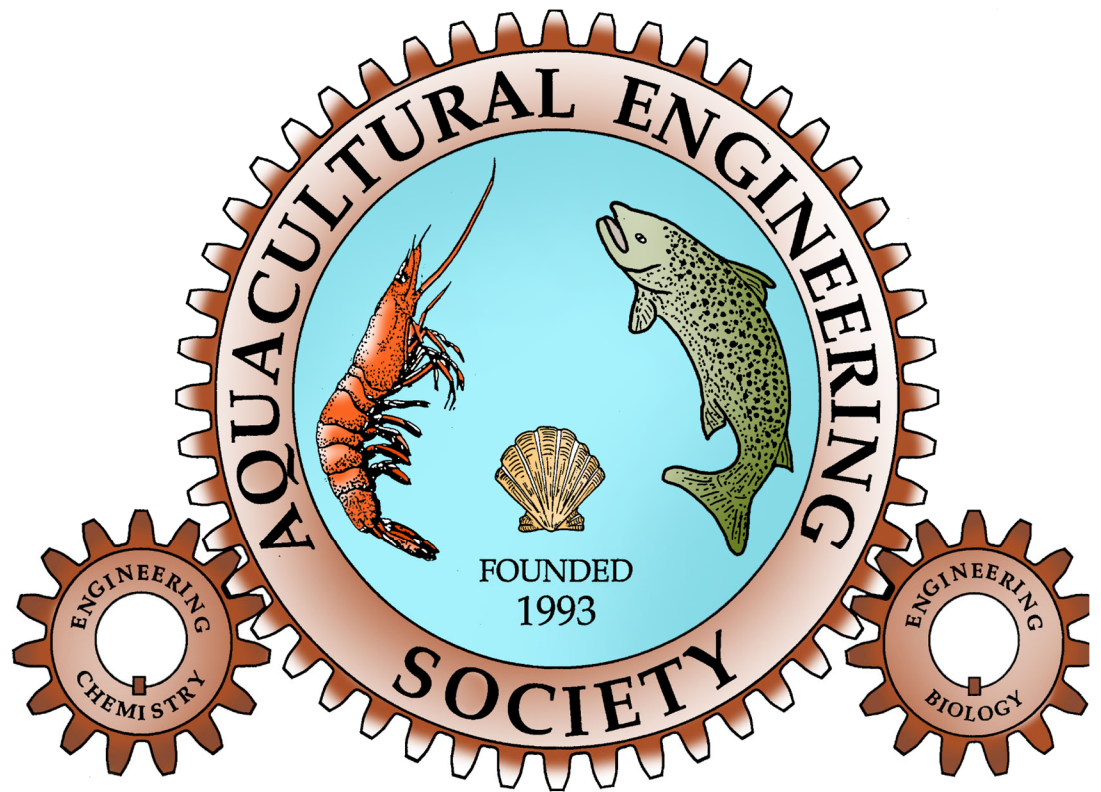
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Aquaculture 2025
Cornell Shortcourse



PRESIDENT'S LETTER

DEAR PAST, PRESENT, AND FUTURE AES MEMBERS,

My name is Michael Timmons, and I am the newly elected President of the Aquacultural Engineering Society (AES). The AES was established 30 years ago by a small group of individuals passionate about bringing engineering to aquaculture. At the time, aquaculture was starting to supply an increasing percentage of the consumer demand for global seafood. Back then, that number was less than 10%, and now aquaculture-produced products exceed 50% of the seafood supply to the market. Seafood demand continues to increase, and wild-caught seafood supply remains static, leaving aquaculture to make up for the increasing demand.

The AES is needed now more than ever, and the board of directors seeks to increase membership and engagement by providing value to society members. As the saying goes, *Show Me the Money*, or in this case, *Show Me the Value* before I invest any dollar/peso/yen/euro/dinar/CHF/yuan, so the AES is offering FREE membership for the remainder of 2024 and all of 2025.

Board of Directors

Michael Timmons

President

Steven Hall

1st Vice President

Germán Merino

2nd Vice President

Tim Pfeiffer

Secretary/Treasurer

Dave Brune

Director (US-based)

Jaime Garcia

Director (International)

Marlon Greensword

Director (US-based)

Farshad Sishehchian

Director (International)

Joseph Tetreault

Director (US-based)

Brian Vinci

Director (US-based)

STAFF

John Colt

Administrative Assistant

During this period, we will demonstrate the value of the AES to you through professional networking, educational webinars, special conference sessions, and discounted offerings to various goods and services, particularly from our commercial sponsors.

To provide maximum value and show that the AES is a dynamic organization whose purpose is to serve its members, please provide us with input on how to do that, and we will do our best to meet your needs. As a start, the AES is offering the following in 2025:

- Free society membership
- Access to all society webinars at no cost
- Online subscription to Elsevier's Aquacultural Engineering journal for only \$75 (* previously \$170 *)
- Hardcopy subscription to Elsevier's Aquacultural Engineering journal for only \$100 (* previously \$195 *)

Please use the following links to join or renew your AES membership and take advantage of the discounted subscriptions:

Join—<https://www.aesweb.org/members/join>

Renew—https://www.aesweb.org/member_renewals

Also attached is a flyer for special conference sessions the AES organized for Aquaculture 2025 (March 6-10, 2025, New Orleans, LA, USA). These special sessions are FREE to all who attend Aquaculture 2025, and AES members receive discounted registration for being members of an associate sponsor organization (* \$95 discount *).

I look forward to welcoming back previous members and seeing many new members join with this new initiative.

Happy fishing!!

Michael "Yellow Book" Timmons

Email mbt3@cornell.edu

FINANCIAL REPORT

AS OF DECEMBER 31, 2023

Form 990-EZ **Short Form** **Return of Organization Exempt From Income Tax** **2023** **Open to Public Inspection**

OMB No. 1545-0047

Under section 501(c), 527, or 4947(a)(1) of the Internal Revenue Code (except private foundations)
Do not enter social security numbers on this form, as it may be made public.
Go to www.irs.gov/Form990EZ for instructions and the latest information.

Department of the Treasury
Internal Revenue Service

A For the 2023 calendar year, or tax year beginning **2023**, and ending **2023**

B Check if applicable:
 Address change
 Name change
 Initial return
 Final return/terminated
 Amended return
 Application pending

C Name of organization
AQUACULTURAL ENGINEERING SOCIETY INC
Number and street (or P.O. box if mail is not delivered to street address) Room/suite
660 32ND AVE SW
City or town, state or province, country, and ZIP or foreign postal code
VERO BEACH, FL 32968

D Employer identification number
16-1434475

E Telephone number
(772) 321-5529

F Group Exemption Number

G Accounting Method: Cash Accrual Other (specify):

H Check if the organization is not required to attach Schedule B (Form 990).

J Tax-exempt status (check only one): 501(c)(3) 501(c)(6) (insert no.) 4947(a)(1) or 527

K Form of organization: Corporation Trust Association Other

L Add lines 8a, 8c, and 7b to line 9 to determine gross receipts. If gross receipts are \$200,000 or more, or if total assets (Part II, column (B)) are \$500,000 or more, file Form 990 instead of Form 990-EZ.

Part I Revenue, Expenses, and Changes in Net Assets or Fund Balances (see the instructions for Part I)
Check if the organization used Schedule O to respond to any question in this Part I

1 Contributions, gifts, grants, and similar amounts received	1	
2 Program service revenue including government fees and contracts	2	
3 Membership dues and assessments	3	12,785
4 Investment income	4	5
5a Gross amount from sale of assets other than inventory	5a	
b Less: cost or other basis and sales expenses	5b	
c Gain or (loss) from sale of assets other than inventory (subtract line 5b from line 5a)	5c	
6 Gaming and fundraising events:		
a Gross income from gaming (attach Schedule G if greater than \$15,000)	6a	
b Gross income from fundraising events (not including \$ of contributions from fundraising events reported on line 1) (attach Schedule G if the sum of such gross income and contributions exceeds \$15,000)	6b	
c Less: direct expenses from gaming and fundraising events	6c	
d Net income or (loss) from gaming and fundraising events (add lines 6a and 6b and subtract line 6c)	6d	
7a Gross sales of inventory, less returns and allowances	7a	
b Less: cost of goods sold	7b	
c Gross profit or (loss) from sales of inventory (subtract line 7b from line 7a)	7c	
8 Other revenue (describe in Schedule O)	8	
9 Total revenue. Add lines 1, 2, 3, 4, 5b, 6d, 7c, and 8.	9	12,790
10 Grants and similar amounts paid (list in Schedule O)	10	
11 Benefits paid to or for members	11	
12 Salaries, other compensation, and employee benefits	12	
13 Professional fees and other payments to independent contractors	13	
14 Occupancy, rent, utilities, and maintenance	14	6,093
15 Printing, publications, postage, and shipping	15	
16 Other expenses (describe in Schedule O)	16	1,185
17 Total expenses. Add lines 10 through 16.	17	7,278
18 Excess or (deficit) for the year (subtract line 17 from line 9)	18	5,512
19 Net assets or fund balances at beginning of year (from line 27, column (A)) (must agree with end-of-year figure reported on prior year's return)	19	64,556
20 Other changes in net assets or fund balances (explain in Schedule O)	20	
21 Net assets or fund balances at end of year. Combine lines 18 through 20.	21	70,068

For Paperwork Reduction Act Notice, see the separate instructions. Form 990-EZ (2023)

Form 990-EZ (2023) **AQUACULTURAL ENGINEERING SOCIETY INC** 16-1434475 Page 2

Part II Balance Sheets (see the instructions for Part II)
Check if the organization used Schedule O to respond to any question in this Part II

	(A) Beginning of year	(B) End of year
22 Cash, savings, and investments	64,556	70,068
23 Land and buildings	0	0
24 Other assets (describe in Schedule O)	0	0
25 Total assets	64,556	70,068
26 Total liabilities (describe in Schedule O)	0	0
27 Net assets or fund balances (line 27 of column (B) must agree with line 21).	64,556	70,068

Part III Statement of Program Service Accomplishments (see the instructions for Part III)
Check if the organization used Schedule O to respond to any question in this Part III

What is the organization's primary exempt purpose? **OFFER TECHNICAL EXPERTISE AND DISCUSSION**

Describe the organization's program service accomplishments for each of its three largest program services, as measured by expenses. In a clear and concise manner, describe the services provided, the number of persons benefited, and other relevant information for each program title.

28 SPONSOR CONFERENCE SESSIONS, OFFER TECHNICAL EXPERTISE AND DISCOUNT OF THE SOCIETY'S TRADE JOURNAL TO MEMBERS

(Grants \$) If this amount includes foreign grants, check here **28a**

29

(Grants \$) If this amount includes foreign grants, check here **29a**

30

(Grants \$) If this amount includes foreign grants, check here **30a**

31 Other program services (describe in Schedule O) (Grants \$) If this amount includes foreign grants, check here **31a**

32 Total program service expenses (add lines 28a through 31a) **32**

Part IV List of Officers, Directors, Trustees, and Key Employees (list each one even if not compensated—see the instructions for Part IV)
Check if the organization used Schedule O to respond to any question in this Part IV

(a) Name and title	(b) Average hours per week devoted to organization	(c) Reportable compensation (Form W-2/1099-MISC/1099-NEC) (if not paid, enter 0-0)	(d) Health benefits, contributions to employee benefit plans, and deferred compensation	(e) Estimated amount of other compensation
TIM PFEIFFER, PH.D., PH.D. SECRETARY TREASURER	1.00	0	0	0
MADDI BADIOLA, PH.D., PH.D. PAST PRESIDENT	1.00	0	0	0
DAVID J BRUNE, PH.D., PH.D., P.E. DIRECTOR	1.00	0	0	0
MARION GREENSWORD, PH.D. DIRECTOR	1.00	0	0	0
GERMAN M MERINO PH.D. DIRECTOR	1.00	0	0	0
GARY MILLER, PH.D. DIRECTOR	1.00	0	0	0
FARSHAD SISHERCHIAN, PH.D. DIRECTOR	1.00	0	0	0
MARK SORINSEN PRESIDENT	1.00	0	0	0
JEFF TETREAULT VICE PRESIDENT	1.00	0	0	0

EEA Form 990-EZ (2023)

MEMBERSHIP REPORT

AS OF DECEMBER 6, 2024

	#
Members	95
Membership + Online Journal Subscription	8
Membership + Hardcopy Journal Subscription	9
Lifetime Members	7
Corporate Supporters	1
Student Members	32
Total	152

MEMBERSHIP IS UP 200% AND STILL GOING...

MASS BALANCES REVISITED (PART 1)

EXCERPT FROM TIMMONS & VINCI (2022). RECIRCULATING AQUACULTURE SYSTEMS (5TH ED).

Water flow is the mechanism by which oxygen is transported into a fish culture vessel, and the waste products being generated within are removed. The design of a recirculating aquaculture system (RAS) should ensure that the important parameters affecting water quality and fish productivity, e.g., oxygen, ammonia, carbon dioxide, and suspended solids are properly balanced. This requires calculating the value of each of these parameters independently to determine the thresholds for each. Then, having done the necessary calculations, the system must be operated at the lowest flow rate possible while still maintaining a particular parameter at its design value, e.g., ammonia. Obviously, the minimum flow rate possible while maintaining one particular parameter may be too low for maintaining another. The same mass balance approach can be utilized on any variable affecting water quality. It simply comes down to balancing the transport in, the production of a particular parameter within the culture tank, and the transport out. In word equation form, engineers like to say:

$$\text{Transport in of "x"} + \text{production of "x"} = \text{transport out of "x"} \quad (3.1)$$

The production or **P term** can be the production of oxygen, ammonia, suspended solids, or CO₂. Note that the production term can be negative, meaning consumption of a certain component, e.g., oxygen. Figure 3.1 depicts a mass balance for the general case where part of the flow is recirculated, and part of the flow is flow-through.

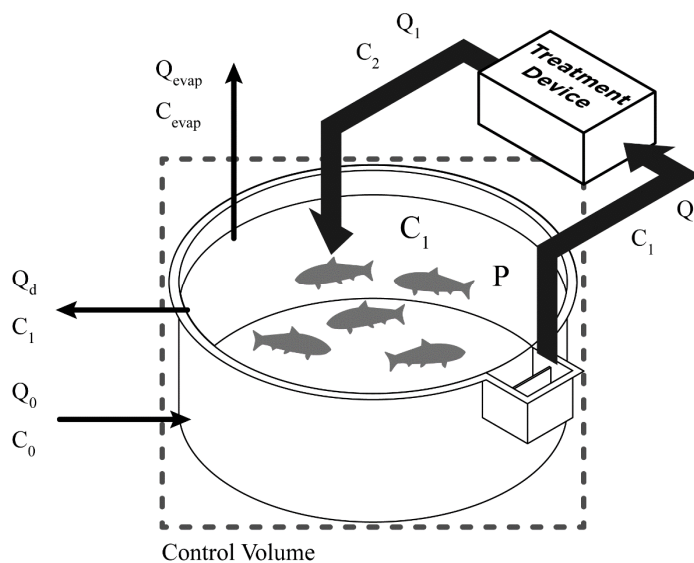


Figure 3.1 General mass balance on a fish culture tank. Treatment occurs exterior to the tank. (Q is water flow; C is concentration)

We are assuming a completely well-mixed tank and that the tank has reached a non-changing condition, i.e., equilibrium, with respect to time or steady-state conditions. The box outside the fish tank represents some treatment device or process that changes the concentration of the noted parameter “x”. (Note: several treatment devices could be each treating a different water quality variable.)

Returning to our word equation, Eq. 3.1 and Fig. 3.1, the mass balance equation can be applied assuming steady state conditions:

$$Q_1 C_2 + Q_0 C_0 + P = Q_d C_1 + Q_1 C_1 + Q_{\text{evap}} C_{\text{evap}} \quad (3.2)$$

Transport is the key term in these calculations, and it is defined as the product of flow and concentration. For example, the remainder of oxygen transport into the tank minus the allowable minimum level of oxygen departing the tank defines the oxygen available for fish growth.

Returning to the general mass balance Eq. 3.2, the simplest RAS case is where all water flow is recirculated, and there is no discharge. In this situation, the Q₀ terms in Eq. 3.2 drop out Q_{in} = Q_{out} have:

$$\begin{aligned} Q_1 C_2 + P &= + Q_1 C_1 & (3.5) \\ Q_1 (C_2 - C_1) &= - P \end{aligned}$$

MEET THE BOARD OF DIRECTORS

Michael Timmons, President

Dr. Michael Timmons has worked in aquacultural engineering for 35 years as a researcher, teacher, and extension specialist. He was one of the founders of the Aquacultural Engineering Society and has served in all officer positions, including President. Dr. Timmons was a J. Thomas Clark Professorship of Entrepreneurship and Personal Enterprise (1999-2006) at Cornell University, where he is now a Graduate Professor in the Department of Biological and Environmental Engineering and the Field of Global Development. Email: mbt3@cornell.edu

Steven Hall, 1st Vice President

Steven Hall is William White Distinguished Professor and Director of the Marine Aquaculture Research Center in the Department of Biological and Agricultural Engineering at North Carolina State University. He is Past President of the Aquacultural Engineering Society; NC Association of Cooperative Extension Specialists; and Fellow of the American Scientific Affiliation. He is a co-editor of the journal *Aquacultural Engineering*. Email: shall5@ncsu.edu

Germán Merino, 2nd Vice President

Dr. Germán E. Merino has been a Professor of the Faculty de Ciencias del Mar of the Universidad Católica del Norte since 1995. His profession is Aquaculture Engineering obtained at the Universidad Católica del Norte in 1995, and he holds the academic degree of PhD in Engineering in Agricultural and Biological Systems obtained at the University of California at Davis in 2004. In 2010, he served as AES President, and since then, several times as an AES BOD member. In 2012, he started a family business based on a bio-integrated production of fish and vegetables with freshwater recirculation and powered with renewable energies. His academic and professional activities allowed him to develop a national and international network called SIBIOLATPlus (www.redsibiolat.cl). Email: gmerino@ucn.cl

Tim Pfeiffer, Secretary/Treasurer

Dr. Tim Pfeiffer has worked in aquacultural engineering for over 20 years as a Research Scientist with the USDA Agricultural Research Service National Aquaculture Program in AR, FL, and MS. Dr. Pfeiffer also spent time as a Water Resource Technical Advisor for the USDA Foreign Agricultural Service in Afghanistan and with USAID in Egypt as an Irrigation Specialist. He has been a member of the Aquacultural Engineering Society for more than 20 years and a Board member and officer for over a decade. Email: tim.pfeiffer@usda.gov

Dave Brune, Director (US-based)

David E. Brune is a professor of bioprocess and bioenergy engineering within the Division of Plant Science and Technology at the University of Missouri-Columbia. He is a founding member of the Aquacultural Engineering Society and Past President. He has been involved in aquacultural engineering for over 45 years, researching agriculture and aquaculture water treatment and developing integrated water use systems. His current research targets the development of cost-effective, zero-discharge aquaculture. He has designed and installed prototype recirculating aquaculture systems (on a private farm) and is developing a “standard operating procedure” to be provided to farmers in the Midwestern U.S. Email: bruned@missouri.edu

Jaime Garcia, Director (International)

Jaime Garcia obtained his degree in Aquaculture Engineering from Universidad Católica del Norte in Chile. He has been working in the aquaculture industry for over 10 years, where he has been lucky enough to have worked with salt and freshwater finfish species, mollusks, micro- and macro-algae, crustaceans, and even in pearl farming. Jaime has also supported aquaculture research in university facilities and industrial production fish farming in sea sites and hatcheries. He is now dedicated primarily to designing large-scale (>5,000 ton) recirculating aquaculture systems (RAS) and supporting fish farms for clients in North America. Email: jaime.garcia009@gmail.com

Marlon Greensword, Director (US-based)

Dr. Marlon Greensword is a STEM Educator in Mansfield, TX. As such, he introduced and launched inaugural aquaponics programs and provides aquaponics education to public high school students in Texas. He is an experienced engineering designer specializing in water filtration systems, with proven results in designing bioreactors and water quality control. He is a published researcher in aquacultural engineering with extensive training in wastewater management and environmental toxicology. Greensword obtained a Ph.D. in Engineering Science from Louisiana State University (LSU) in December 2017. His dissertation, *Rice Hull Bioreactor for Recirculating Aquaculture*, examines green alternative filtration media for recirculating systems. Greensword has M.S. degrees in Civil & Environmental Engineering and in Industrial Engineering & Construction Management from LSU. Email: mgreensword00@gmail.com

MEET THE BOARD OF DIRECTORS

Farshad Shishehchian, Director (International)

Dr Farshad is the President & CEO of Blue Aqua International Group of companies, a one-stop solution provider for the aquaculture industry with a global presence in 14 countries. He is also the Founder and President of the Asian Aquaculture Network (AAN), a not-for-profit organization dedicated to informing and inspiring new generations by sharing knowledge, education initiatives, and resources for the ecological sustainability of aquaculture in the Asia Pacific region. He was also the President of the World Aquaculture Society (WAS), Asia Pacific Chapter (2013-2016), collecting an extensive network of over 25 years in the world's top aquaculture-producing countries. Email: farshad.shishehchian@blueaquaint.com

Joe Tetreault, Director (US-based)

Joe Tetreault is a Research Scientist at Harrisburg University in Harrisburg, PA, USA. He earned his Master of Science in 2020 from the University of New Hampshire. Primary research interests include aquaculture waste valorization through anaerobic digestion, standardization in aquaponic systems for improved scalability and fish production, and regenerative life support system design. He manages a pilot-scale research farm incorporating recirculating aquaculture, hydroponic, and aquaponic systems. He has helped lead and collaborate on projects funded by the United States Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA). Email: JTetreault@harrisburgu.edu

Brian Vinci, Director (US-based)

As Director and Research Engineer at The Conservation Fund's Freshwater Institute in Shepherdstown, WV, Dr. Brian Vinci leads cutting-edge research on water treatment and reuse technologies for aquaculture systems. His work has significantly contributed to the field, evidenced by his co-authorship of the text "Recirculating Aquaculture (5th edition)" and over 40 other publications, including peer-reviewed journal articles, book chapters, and proceedings articles. He is a licensed professional engineer in New York, Pennsylvania, and Mississippi and has held leadership positions in professional engineering societies throughout his career. Email: bvinci@conservationfund.org

BECOME A CORPORATE SUPPORTER

Any member of the AES can become a Corporate Supporter by paying an additional annual fee of \$100. As a supporter, you have the following additional benefits to your AES membership:

- Listing your company as a supporter in the AES newsletter
- Posting your company as a supporter on the AES website
- Posting job openings on the AES website
- Additional employees can join the AES for half off

Thanks to our Corporate Supporters!



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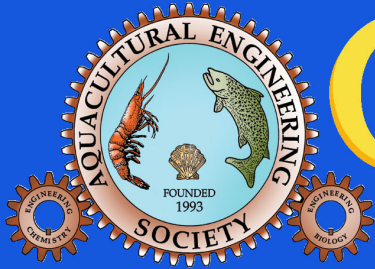
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New Orleans, LA • March 6-10, 2025



@ AQUACULTURE 2025

SPECIAL WORKSHOP

RAS FUNDAMENTALS

Topic	Speaker	Affiliation
Elements of Today's RAS (Intro)	Bert Wecker	Oceanloop (Germany)
RAS Design: Mass Balances	Mike Timmons	Cornell University (USA)
Fish Tank Design & Selection	Ed Aneshansley	EdA Aquatics (USA)
Solids Control	German Merino	University Catholica Norte (Chile)
Oxygenation	David Kuhn	Virginia Tech (USA)
Carbon Dioxide Control	Brian Vinci	Freshwater Institute (USA)
Biofiltration	Sharada Navada	NTNU (Norway)
Denitrification	Snir Azaria	Inland Ocean (Israel)
Ozonation	Katie Spiliotopoulou	OxyGuard International A/S (Denmark)
Heating and Chilling	Devin Murray	Delta Hydronics (USA)
Piping Design	Carlos Espinal	Landing Aqua (the Netherlands)

ADVANCES IN RAS

Presentation Title	Speaker
Olive Flounder Performance in RAS	Andrew Ray
Spawning and Early Life Cycle for Striped Bass in RAS	Steve Hall
Indoor Land-Based Shrimp Farming: An Alternative to Pond Farming	Bert Wecker
Algae-based RAS for Shrimp	Matt Ellis
FiletCam 2.0: AI Tool for Fillet Quality and Defect Assessment	Rakesh Ranjan
Anaerobic Digestion of RAS Waste: Status and Developments	Abhinav Choudhury
Investigating RAS Water Disinfection with Low-Dose Peracetic Acid	Chris Good
Sources of Off-flavor Production in RAS	John Davidson
Objective Evaluation of Off-Flavor Mitigation Technologies	Matthew Stromberg
Engineered-Airlift Pumps Can Improve Sustainable Operation of RAS	Josh Rosettani
iMCR: A new Paradigm in RAS Design	Mike Timmons
Evaluation of a Novel Water Treatment Technology for BOD, TSS and Phosphorous Removal	German Merino



Cornell **CALS**
College of Agriculture and Life Sciences

Life. Changing.

Cornell University 26th Annual Short Course

Recirculating Aquaculture Hydroponics Aquaponics January 13-16 *and* January 30, 2025

The course is a unique, knowledge-filled opportunity to access expertise from world leaders in Recirculating Aquaculture Systems (RAS), Controlled Environment Agriculture (CEA), hydroponics, aquaponics, fish physiology, business dynamics, and industry trends.

This virtual course will be held in 5 sessions from 3:15 pm to 6:15 pm EST daily on Monday – January 13, 2025 through Thursday – January 16, 2025
New for 2025 - Post Course Discussion/Q&A Session on January 30th

Cornell Experts – Cornell Expertise

Dr. Michael Timmons – Aquaculture Systems - Dr. Timmons has worked in aquacultural engineering for over 26 years as a researcher, teacher, and extension specialist. Dr. Timmons is highly sought after for his design, construction, and operational knowledge. Dr. Timmons is the lead author of the seminal book on RAS: *Recirculating Aquaculture (5th edition)*.

Dr. Neil Mattson – Hydroponic/Aquaponic Production - Dr. Mattson is one of the nation's leaders in CEA and is known for providing producers with relevant, research-based information for the production of high-quality CEA crops.

Dr. Eugene Won – Fish Health - Dr. Won has extensive experience with RAS and is the academic coordinator for Shoals Marine Lab. Dr. Won teaches Fish Physiology and works closely with stakeholders and government agencies to promote the growth of the domestic aquaculture industry.

Aquaculture Engineering Society Member Registration (Use Registration Code AES25)

AES Member Rate: \$299 per attendee; \$149 for each additional attendee who registers as part of the initial registration. Primary registrant receives a pdf version of Recirculating Aquaculture (5th Edition).

For full information and to register: <https://cals.cornell.edu/aquaponics-short-course>