

## CONTENTS:

- **President's Message**
- **Article:**
  - RAS Workshop in Finland
- **In Memory of Mel Steffens**
- **Upcoming Events**
  - 2012 Aquaculture America meeting in Las Vegas
  - 9th ICRA in Roanoke



Photo: Tom Waldrop, Production Manager, at the Freshwater Institute picking Atlantic salmon eggs (Courtesy: Kata Rishel)

## President's Message

by Asbjorn Bergheim

Dear All,

A summer season characterized by wet, unsettled - and occasionally even dangerous - weather in parts of both North America and Europe is left behind and we are facing winter. Also in Australia, the climatic instability has hit hard where prawn farms were almost totally devastated in tropical-subtropical Queensland last February, and where bushfires almost wiped out trout farms two years ago in north-eastern Victoria (Hatchery International). The ongoing change of climatic conditions is considered a substantial challenge for the established aquaculture industry in many regions.

The impact factor of our journal, Aquacultural Engineering, was slightly up last year. Six bimonthly issues were published in 2011.

At a seminar held in Stavanger, Norway 15 August focusing on RAS for production of salmon, Dr. Brian Vinci was one of the keynote speakers presenting: 'Identifying criteria to optimize the performance, health, and consumer value of Atlantic salmon grown to food-size in closed-containment systems'. Such results attracted high interest among the audience mainly without former knowledge about intensive production of big salmon in freshwater and not least,

on-growing in landbased systems. After Stavanger, Dr Brian visited Trondheim and attended the European Aquaculture Society's conference.

Central members of AES also played an important role at the European Aquaculture Society's Upscaling Aquaculture Systems conference in Trondheim 17 - 18 August, where Dr. Jean-Paul Blancheton moderated and Dr. Steven Summerfelt gave a keynote talk at the session on Landbased Systems.

A brief presentation of the advantages of becoming a member of AES was presented for some 50 delegates at the seminar in Stavanger and was also presented at the 1st RAS Workshop organized by the Nordic Network on Recirculating Aquaculture Systems ([www.NordicRAS.net](http://www.NordicRAS.net)) 5 - 6 October in Helsinki. Our organization is obviously closely connected to this newly established Nordic network. Generally, there seems to be considerable interest to become AES members, not least among people planning to construct RAS based farms for production of trout and salmon smolt.

The BOD members voted yes to sponsor half of the registration fee for 20 students at the workshop in Helsinki in October with a maximum cost of USD 1340.00. Some 150 attendees from Scandinavia and other parts of Europe turned up at

the workshop in Scandinavia. Chief editor of Aquacultural Engineering, Dr. Jaap van Rijn, has kindly offered the lecturers to submit manuscripts to a special issue of the journal based on the presentations at the workshop.

Dr. Barnaby Watten has been an excellent Chairman of the AES best paper review process for several years. He reported earlier this summer that he has to decline to coordinate the process this year due to a new position as Lab Director of the USGS Conte Anadromous Fish Laboratory in Turner Falls, Massachusetts. We congratulate you, Barnaby, on your new position and welcome Dr. German Merino as new Chairman of the review process! German has kindly accepted to continue this position when he leaves his duties as Past President at Aquaculture America 2012. The review process of the articles published last year is now well under way.

Our organisation prepares for three sessions at Aquaculture America 2012 to be held in Las Vegas, February 29 - 2 March 2.

Dr. Yoram Avnimelech will chair a Biofloc session jointly with Dr. David Kuhn, Dr. Gregory Boardman another session titled 'Management of Effluent from Flow-through Systems' and Dr. Chanchal Kumar Muherjee will be chair of a third

## Article

### Successful workshop on RAS in Helsinki, Finland

Asbjørn Bergheim, Jouni Vielma, Helgi Thorarensen, Torsten Wik and Per Bovbjerg Pedersen



The 1st workshop on Recirculating Aquaculture Systems (RAS) organized by the Nordic Network on Recirculating Aquaculture Systems ([www.NordicRAS.net](http://www.NordicRAS.net)) was held in Helsinki, Finland on October 5-6, 2011. Anne Johanne Dalsgaard (DTU Aqua, Denmark) led the organization committee for the Nordic Network on Recirculating Aquaculture Systems.

The workshop was a success both in context and number of participants. The Nordic Network, being the formal organizers, originally aimed for some 60 participants. We ended up with 126 participants from 13 European countries (Denmark, Finland, France, Germany, Iceland, Israel, Latvia, Lithuania, Norway, Sweden, the Netherlands, the Russian Federation, and the United Kingdom).

There were 37 speakers at the workshop who, like the audience in general, represented many experiences and approaches to the subject. RAS farmers, RAS entrepreneurs, feed companies, and researchers made contributions in separate sessions, creating an interesting mix of industry and research experiences. The setup was consistent with one of the major aims of the workshop: bringing

researchers and industrial partners with an interest in RAS together, and creating an opportunity for exchanging practical experiences and scientific knowledge on the newest developments in RAS.

The presentations were sectioned in four overall themes: 1) RAS in practice; 2) Feed, nutrition and waste characterization; 3) Water quality in RAS; and 4) Waste management and diseases in RAS. Following an opening keynote from Jean Paul Blancheton (IFREMER, France), each theme was introduced by different keynote speakers, all well known to AES: Alexander Brinker (Fishery Research Station Baden-Württemberg, Germany), Ep Eding (Wageningen University, the Netherlands) and Jaap van Rijn (the Hebrew University of Jerusalem, Israel).

The workshop program, book of abstracts, and some of the presentations can be found at: <http://www.nordicras.net/Network-events/Workshop-2011.aspx>. Based on presentations and thanks to positive response by potential authors, the plan is to publish manuscripts based on some of the workshop presentations in a special issue of *Aquacultural Engineering* during 2012.

The Nordic Network on RAS was formally founded in April 2011 with representatives from Denmark, Norway, Sweden, Finland, and Iceland. The steering committee consists of: Jouni Vielma (Senior Research Scientist, Finnish Game and Fisheries Research Institute, Finland), Helgi Thorarensen (Professor, Holar University College, Iceland), Asbjørn Bergheim (Senior Research Scientist, International Research Institute of Stavanger AS (IRIS), Norway), Torsten Wik (Associated Professor, Chalmers University of Technology, Sweden), and Per Bovbjerg Pedersen (Head of Section, DTU Aqua, Denmark).

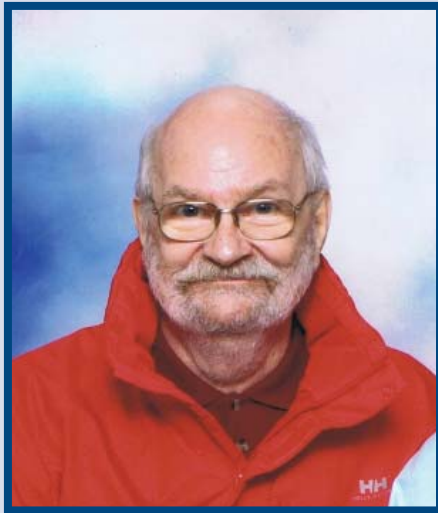
The Nordic Network on Recirculating Aquaculture Systems and the workshop in Helsinki are financially supported by the Nordic Council of Ministers, having sustainable development of aquaculture in the Nordic region as a focus area. Consistent with this, RAS technology is considered an important element in future aquaculture development, facilitating the rearing of fish under controlled conditions with minimum environmental impact. Currently, the Danish production of trout, increasing salmon smolt production in Norway, and diversification into new species are three major categories of RAS production in the region.

The Nordic Network on Recirculating Aquaculture Systems is a lasting network, and everybody with an interest in RAS is most welcome to join (please refer to our website: [www.NordicRAS.net](http://www.NordicRAS.net)). It is our hope and plan that the workshop will be a recurrent event, taking place every other year, alternating with the International Conference on Recirculating Aquaculture and AES Issues Forum in Roanoke, US (AES supported the registration fee for attending students). We were therefore very pleased that the interest in the 1st workshop was overwhelmingly positive, promising well for the future of this Northern European initiative. In our view, arousing and supporting RAS interests and cooperation regionally will provide a broader base for future cooperation and possibilities within RAS development for the benefit of sustainable aquaculture.



## In Memory of Mel Steffens

1936-2011



Mel Steffens, 75, passed away very peacefully on November 1st, 2011 in Greece, while fulfilling his lifelong dream of visiting ancient Greek theatres. The funeral service and burial were in Athens, Greece on November 4th, 2011.

Mel was a long-time member of the Aquacultural Engineering Society and has been a friend to many of our members. Mel worked in the architectural field for over 50 years including more than 30 years as Manager of Architectural firms. Mel

had over 200 schools, several University additions, hospital renovations, theatres, sports fields and buildings as well as residential and commercial buildings to his credit. In 1978 Mel offered his services as a consultant and formed Coseco Limited. In his later years he designed many reuse and recirculating aquaculture hatcheries, always with the intent that the next project be better than the one before and had several aquaculture projects underway at the time of his death. Over the years he was involved in building code, construction insurance and specification upgrading and was called upon as an expert in construction disputes. He was known for his formidable memory, attention to detail and curiosity. He loved to tell a story to illustrate a point.

Over the years he participated in many community volunteer activities. In his early years he enjoyed car racing and was instrumental in the formation of the Saskatoon Car Club and was a keen competitive sailor. Mel served on the local Planning Advisory Committee for seven years.

He is survived by his wife, Joan McDonnell of New Brunswick, son Daryl and daughters Denise, Vanessa and Margo, seven grandchildren and 3 great grandchildren, brothers Victor (Shari) and Robert, and sister Ruth (Jack), nephews and nieces. All of British Columbia.

In Lieu of flowers donations can be made to The Heart and Stroke Foundation of New Brunswick, 5th Floor, 133 Prince William Street, Saint John, New Brunswick E2L 2B5.

## President's Message

session, "Engineering Aspects to Cage Mariculture". We are most grateful for your efforts. Additionally, 1st VP Dr. Ed Aneshansley is in the process of putting together a producer's session on Aquaponics.

I think the AES had a great year in 2011. Thanks to all of you that contributed.

Asbjorn Bergheim

Senior Researcher, Dr. scient,  
IRIS-International Research Institute of Stavanger AS  
P.O. Box 8046  
N-4068 Stavanger, Norway  
Phone: +47 51875000  
Fax: +47 51875200  
Email: Asbjorn.Bergheim@iris.no



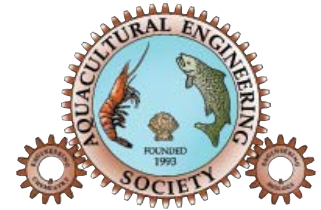
## AES Board of Directors 2011

Name	City, State, Country	Position	Term	Engineering Status	E-mail Address
German Merino	Coquimbo, Chile	Past President	2008-2011	INT-ENGR	gmerino@unc.cl
Asbjorn Bergheim	Stavanger, Norway	President	2009-2012	INT-ENGR	asbjorn.bergheim@iris.no
Ed Aneshansley	Beverly, MA	Vice-President	2010-2013	ENGR	eda@aquaticesco.com
Brian Vinci	Shepherdstown, WV	2nd Vice-President	2009-2011	ENGR	b.vinci@freshwaterinstitute.org
Tim Pfeiffer	Fort Pierce, FL	Secretary/Treasurer	2006-	ENGR	Timothy.Pfeiffer@ars.usda.gov tjpfeif@comcast.net
Alexander Brinker	Langenargen, Germany	Director	2010-2012	INT-ENGR	Alexander.Brinker@lazbw.bwl.de
George Flick	Blacksburg, VA	Director	2010-2012	NON-ENGR	flickg@vt.edu
Matt Smith	Fort Myers, FL	Director	2010-2012	ENGR	mattsmith@biofilters.com
Greg Boardman	Blacksburg, VA	Director	2011-2013	ENGR	gboard@vt.edu
David Kuhn	Blacksburg, VA	Director	2011-2013	ENGR	davekuhn@vt.edu
Marc Verdegem	Wageningen, Netherlands	Director	2011-2013	INT-ENGR	marc.verdegem@wur.nl
Rafael Morey	Osorno, Chile	Director	2011-2013	INT-ENGR	rafael.morey@oceca.cl

# Upcoming Events



AES Sessions at  
**Aquaculture America 2012**  
February 29th - March 2nd, Las Vegas, NV



## ENGINEERING ASPECTS TO CAGE MARICULTURE

Moderator: CK Mukherjee  
Wednesday, February 29, 2:00 pm- 5:30pm, Champagne 2

**UNOFFICIAL PROGRAM - PLEASE CHECK PRESENTATION SCHEDULE IN THE SHOW DIRECTORY THAT IS DISTRIBUTED AT THE CONFERENCE.**

### Presenter/Title

**Nhu Van Can**

MARINE FISH FARMING IN VIETNAM: PRESENT STATUS, CHALLENGES AND INTRODUCTION OF THE SUBMERSIBLE CAGES FOR OFFSHORE CULTURE

**N Vishwanath**

A REVIEW OF PROGRESS IN THE FIELD OFFSHORE CAGE FOR MARICULTURE IN INDIA

**Judson DeCew**

DEVELOPMENT AND FIELD TRIALS OF A SUBMERSIBLE NET PEN USING ANTI-FOULING NETTING

**Andrew Drach**

EXPERIMENTAL STUDIES OF BIOFOULING RESISTANCE AND MATERIAL LOSS RATES OF COPPER ALLOYS SUITABLE FOR MARINE AQUACULTURE

**Judson DeCew**

ACOUSTIC MEASUREMENTS OF FISH CAGE DEFORMATION UNDER CURRENTS

**Barbaros Celikkol**

AQUACULTURE MOORINGS: THE DESIGN, DEPLOYMENT, UTILIZATION AND RECOVERY OF AN OFFSHORE SYSTEM FOR FIN-FISH AQUACULTURE

**David W. Fredriksson**

THE DEVELOPMENT OF AQUACULTURE NET MODELING TECHNIQUES USING FINITE ELEMENT MODELS LABORATORY TESTS

**Chun-Woo Lee**

DESIGN AND SIMULATION OF FISH CAGE SYSTEMS USING NUMERICAL METHODS

**DSM Dyneema**

SHARK RESISTANT CONTAINMENT NETTING FOR WARM WATER OFFSHORE AQUACULTURE

**Hakeem A. Fashina-Bombata**

DEVELOPMENT OF LOW COST CAGE SYSTEMS FOR DEVELOPING COUNTRIES: THE LAGOS STATE, NIGERIA EXPERIMENT

## BIOFLOC CULTURE SYSTEMS

Moderators: Yoram Avnimelech  
Thursday, March 1, 8:30am - 12:30pm

**UNOFFICIAL PROGRAM - PLEASE CHECK PRESENTATION SCHEDULE IN THE SHOW DIRECTORY THAT IS DISTRIBUTED AT THE CONFERENCE.**

### Presenter/Title

**David Kuhn**

REVIEW OF BIOFLOC TECHNOLOGY OPTIONS FOR SHRIMP CULTURE: BENEFITS, BURDENS, AND NUTRITIONAL CONSIDERATIONS

**Nyan Taw**

RECENT DEVELOPMENTS IN BIOFLOC TECHNOLOGY IN SHRIMP CULTURES AND ITS ECONOMICS

**Tzachi Samocha**

PERFORMANCE OF *LITOPENAEUS VANNAMEI* IN SUPER-INTENSIVE LIMITED-DISCHARGE RACEWAYS WITH FOAM FRACTIONATION AND DISSOLVED OXYGEN MONITORING SYSTEMS AS MANAGEMENT TOOLS

**Andrew Ray**

COMPARING CHEMOAUTOTROPHIC-BASED SYSTEMS AND THE USE OF THREE CARBOHYDRATES TO PROMOTE HETEROTROPHIC-BASED BIOFLOC SHRIMP *LITOPENAEUS VANNAMEI* CULTURE SYSTEMS

**Jack Crockett**

PRELIMINARY OBSERVATIONS ON MANAGEMENT STRATEGIES TO CONTROL BIOFLOC PRODUCTION IN ZERO TO LIMITED WATER EXCHANGE SHALLOW WATER INDOOR NURSERY SYSTEMS

### BREAK

**Kevin K. Schrader**

DEVELOPMENT OF PHYTOPLANKTON COMMUNITIES AND COMMON OFF-FLAVORS IN A BIOFLOC TECHNOLOGY SYSTEM USED TO CULTURE CHANNEL CATFISH *ICTALURUS PUNCTATUS*

**Bartholomew Green**

DENSITY-YIELD RELATIONSHIP FOR CHANNEL CATFISH REARED IN A BIOFLOC TECHNOLOGY SYSTEM

**Timothy Morris**

PERFORMANCE OF THE PACIFIC WHITE SHRIMP *LITOPENAEUS VANNAMEI* IN BIOFLOC-DOMINATED ZERO-EXCHANGE RACEWAYS USING A NON-VENTURI AIR INJECTION SYSTEM FOR AERATION, MIXING, AND FOAM FRACTIONATION

**John Leffler**

IMPACT OF REUSED WATER FROM SUPERINTENSIVE, MINIMAL-EXCHANGE, BIOFLOC SYSTEMS ON THE PRODUCTION OF PACIFIC WHITE SHRIMP *LITOPENAEUS VANNAMEI*

**Yoram Avnimelech**

USING NATURAL CARBON AND NITROGEN ISOTOPES TO DETERMINE BIOFLOC HARVESTING BY FISH AND SHRIMP IN PONDS

DISCUSSION FORUM Introduction: How intensive is profitable?

**Jeffrey Brunson**

PRODUCTION AND ECONOMIC COMPARISON OF *LITOPENAEUS VANNAMEI* RAISED IN BIOFLOC UNDER FULL LIGHT GREENHOUSE ENVIRONMENT VERSUS INDOOR, LOW-LIGHT CONDITIONS IN AN INSULATED BUILDING

**Terry Hanson**

ECONOMIC ANALYSIS OF TWO ZERO-EXCHANGE BIOFLOC DOMINATED SUPER-INTENSIVE PRODUCTION SYSTEMS FOR THE PACIFIC WHITE SHRIMP

## MANAGEMENT OF EFFLUENT WATERS FROM FLOW-THROUGH AQUACULTURAL SYSTEMS

Moderator: Gregory Boardman  
Thursday, March 1, 2:00 pm- 5:00 pm, Champagne 2

UNOFFICIAL PROGRAM - PLEASE CHECK PRESENTATION SCHEDULE IN THE SHOW DIRECTORY THAT IS DISTRIBUTED AT THE CONFERENCE.

### Presenter/Title

**A. Brinker and J. Unger**

FUNCTIONAL FEEDS OFR MAXIMIZING REMOVAL OF SOLIDS IN AQUACULTURAL OPERATIONS

**A. Bergheim, A. Josang, O. Alvestad and F. Mathisen**

YEAR ROUND SAMPLING OF EFFLUENT TREATMENT EFFICIENCY IN A FLOW THROUGH SMOLT FARM

**G. Boardman and R. Doheny**

EVALUATION OF PRETREATMENTS AND CONSTRUCTED WETLANDS FOR THE TREATMENT OF FLOW-THROUGH AQUACULTURAL EFFLUENTS

**T. Guerdat and T. Losordo**

USING A TWO-STAGE CONSTRUCTED TREATMENT WETLAND TO TREAT MARINE RECIRCULATING AQUACULTURE WASTEWATER

**B. Klim, T. Samocha, V. Uddameri and K. Jones**

PERFORMANCE OF A SUB-SURFACE FLOW CONSTRUCTED WETLAND PLANTED WITH THE HALOPHYTE *SALICORNIA BIGELOVII* IN THE TREATMENT OF SHRIMP MARICULTURE EFFLEUNT

**J. Gonzalez-Hermoso, C. Paniagua-Chavez and M. Segovia**

BIOREMEDIATION OF AQUACULTURE EFFLUENTS USING TWO DIFFERETN TROPHICS SYSTEMS

**J. Ebeling, P. Hightower, E. Kopache, D. Drennan and R. Blaylock**

MARINE AQUACULTURE WASTE MANAGEMENT DEMONSTRATION SYSTEM USING GEOTEXTILE BAGS

**M. Schumann and A. Brinker**

DIETARY MANIPULATION OF FAECAL DENSITY IN AQUACULTURE SYSTEMS- PREDICTING EFFECTS ON SOLID REMOVAL EFFICIENCY

**C. Flora and R. Kroger**

MITIGATING AQUACULTURE EFFLUENT IN A DRAINAGE DITCH SYSTEM THROUGH THE USE OF LOW-GRADE WEIRS

**R. Johnson and M. Sugie**

APPLICATION OF 100 NM NANO-BUBBLES TO WATER TREATMENT FOR AQUACULTURE, CAFOs ANIMAL DRINKING WATER, FARM EFFLUENT, INDUSTRIAL EFFLUENT AND RECREATIONAL WATERS.

## AQUAPONICS: APPLIED RECIRCULATION AQUACULTURE TECHNOLOGY

Moderators: Ed Aneshansley  
Friday, March 2, 8:30am - 12:30pm

UNOFFICIAL PROGRAM - PLEASE CHECK PRESENTATION SCHEDULE IN THE SHOW DIRECTORY THAT IS DISTRIBUTED AT THE CONFERENCE.

### Presenter / Title

**Rick Jones.** INTRODUCTION TO AQUAPONICS

**Sylvia Bernstein.** BEGINNER AND HOBBYIST'S GUIDE TO AQUAPONICS

**Charlie Schultz.** PRODUCERS GUIDE TO AQUAPONICS

**JD Dixon.** PRODUCERS CASE STUDY

**Gina Cavaliero.** PRODUCER CASE STUDY

**Jason Danaher.** RESEARCH IN AQUAPONICS

**Rick Jones.** AQUAPONIC SYSTEM DESIGN

**Sylvia Bernstein.** AQUAPONICS AT HOME AND IN THE COMMUNITY

**Charlie Schultz.** AQUAPONICS APPLIED AT THE UNIVERSITY OF THE VIRGIN ISLANDS

**JD Dixon.** AQUAPONICS: NUTRIENT MASS BALANCE AND SPECIES SELECTION

*PLAN NOW TO ATTEND IN 2012*

**Aquacultural Engineering Society  
ISSUES FORUM**

*August 23, 2012*

---

**9TH INTERNATIONAL CONFERENCE ON  
RECIRCULATING AQUACULTURE**

*August 24-26, 2012*

---

*The Hotel Roanoke & Conference Center  
Roanoke, Virginia, USA*

**Find more information and register at:**

[www.recircaqua.com](http://www.recircaqua.com)

*Questions? Contact Us!*

E-mail: [aquaconf@gmail.com](mailto:aquaconf@gmail.com)

Phone: (540) 553-1455

## AES Newsletter Sponsors

<p>Water Management Technologies, Inc. P.O. Box 66125 Baton Rouge, LA 70896 Ph: (225) 755-0026 Fax: (225) 755-0995 Email: info@w-m-t.com Web: www.w-m-t.com</p>	<p>Aquaculture Systems Technologies, LLC P.O. Box 15827 New Orleans, LA 70175 Ph: (800) 939-3659 Fax: (504) 837-5585 Email: info@BeadFilters.com Web: www.BeadFilters.com</p>
<p>YSI, Inc. 1725 Brannum Lane Yellow Springs, OH 45387 Ph: (800) 897-4151 (US only) Ph: (937) 767-7241 Fax: (937) 767-9353 Email: environmental@ysi.com Web: www.yysi.com</p>	<p>Inter Aqua Advance Sortevj 40 DK-8543 Hornslet, Denmark Ph: +45 8880-9998 Fax: +45 8880-9988 Email: Interaqua@interaqua.dk Web: www.interaqua.dk</p>
<p>PR Aqua 1635 Harold Road Nanaimo, BC V9X 1T4 Canada Ph: (250) 714-0141 or toll free (866) 714-0141 Fx: (250) 714-0171 Email: info@praqua.com Web: www.praqua.com</p>	<p>Waterlife Design Group A Division of Aquatic Habitats, Inc. 2395 Apopka Blvd. Apopka, FL 32703 Ph: (407) 472-0525 Fax: (407) 886-1304 Email: Info@WaterlifeDesign.com Web: www.WaterlifeDesign.com Web: www.AquaticEco.com</p>
<p>L.S. Enterprises P.O. Box 51033 Fort Myers, Florida 33994 USA Ph: (239) 543-1258 Fx: (239) 543-7308 Email: info@biofilters.com Web: www.biofilters.com</p>	<p>Aquatic Eco-Systems, Inc. 2395 Apopka Blvd. Apopka, FL 32703 Ph: (407) 886-3939 Fax: (407) 886-0800 Email: AES@AquaticEco.com Web: www.AquaticEco.com</p>

The AES is looking for sponsors within the aquaculture industry to support the cost of producing the AES News. The sponsors listed above have donated generously to support the AES in 2010-2011.



## A.E.S. Information

The AES News is printed quarterly by the Aquacultural Engineering Society. You can receive the AES News by joining the Aquacultural Engineering Society. If you would like to discuss the contents of the AES News, or if you would like to contribute information to the AES News, please contact the editor.

Steven Summerfelt, Ph.D., P.E.  
The Conservation Fund Freshwater Institute  
1098 Turner Road  
Shepherdstown, WV 25443-4228 USA  
Ph. 304-870-2211  
Fax: 304-870-2208  
email: s.summerfelt@freshwaterinstitute.org

## AES Member Registration

Name \_\_\_\_\_ Company \_\_\_\_\_  
Street Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_ Country \_\_\_\_\_  
Phone \_\_\_\_\_ Fax \_\_\_\_\_  
Email \_\_\_\_\_

- 2012 Annual Membership.** Includes: \$30
- One year subscription to the AES quarterly newsletter AES News (Volume 15)
  - AES Member Directory for 2012

\* NOTE: Student membership is free with a letter from advisor

### Options (additional cost to the \$30 annual membership dues):

- Print subscription to Elsevier's journal Aquacultural Engineering (Volumes 46 & 47). \$80
- Standard one year subscription of the print journal
- Online subscription to Elsevier's journal Aquacultural Engineering (Volumes 46 & 47). \$60
- Web-based access through ScienceDirect (www.sciencedirect.com)

Total \_\_\_\_\_

## PAYMENT

- Check enclosed (Made payable to Aquacultural Engineering Society in US Funds)
- Charge:     Visa             MasterCard             American Express             Discover

Credit Card # \_\_\_\_\_ Expiration Date: \_\_\_\_\_ Security # (3-4 digits): \_\_\_\_\_

Name on Card: \_\_\_\_\_ Signature: \_\_\_\_\_

Please send this form and payment to: Aquacultural Engineering Society, c/o Terry Rakestraw, Rm 25-A, Food Science and Technology Bldg (0418)  
Virginia Tech, Blacksburg, VA 24061, USA, Fax: (540) 231-9293