

## Refereed Journal Publications

Use of Floating Bead Filters to Recondition Recirculating Waters in Warmwater Aquaculture Production Systems. Malone, R. F. and Beecher, L. E., Aquacultural Engineering, 22: 57-73, 2000

Modeling the Major Limitations on Nitrification in Floating-Bead Filters, W. J. Golz, K. A. Rusch, and R. F. Malone. Aquacultural Engineering, Vol. 20, pp. 43 - 61, 1999.

Nitrification Performance of a Bubble-washed Bead Filter for Combined Solids Removal and Biological Filtration in a Recirculating Aquaculture System, B. N. Sastry, A. A. DeLosReyes, Jr., K. A. Rusch, and R. F. Malone. Journal of Aquacultural Engineering, Vol. 19, pp. 105-117, 1999.

Evaluation of Airlift Pump Capabilities for Water Delivery, Aeration, and Degasification for Application to Recirculating Aquaculture Systems, J. C. Loyless and R. F. Malone. Aquacultural Engineering, Vol. 18, pp. 117 -133, 1998.

Generation and Management of Wastewater in an Alligator Farm, A. A. DeLosReyes, Jr., K. A. Rusch, and R. F. Malone. Journal of Applied Aquaculture, Vol. 8(2), pp. 27 - 38, 1998.

Performance of a Commercial Scale Recirculating Alligator Production System Employing a Paddle-Washed Floating Bead Filter. A. A. DeLosReyes, K.A. Rusch, and R. F. Malone. Aquacultural Engineering, Vol. 16, pp. 239-251, 1997.

Sludge Production and Management for Recirculating Aquacultural Systems, S. Chen, D. E. Coffin and R. F. Malone. Journal of World Aquacultural Systems, Vol. 28(4), pp. 303 -315, 1997.

A Sodium Bicarbonate Dosing Methodology for pH Management in Freshwater Recirculating Aquaculture Systems, J. C. Loyless and R. F. Malone. The Progressive Fish-Culturist, Vol. 59, pp. 198-205, 1997.

## Presented Papers

Evaluation of the Suta (Siphoning U-Tube Airlift) Pump to Achieve Required Water Flow Rates in Aquaculture Recirculating Systems, L. E. Beecher, J. Hird, and R. F. Malone. Aquaculture America '99 Book of Abstracts, January 27 - 30, 1999, Tampa, Florida.

Pushing it to the Limit: An Evaluation of Steady State Performance of a Recirculating System Using Airlift and Bead Filter Technology, L. E. Beecher and R. F. Malone. Aquaculture America '99 Book of Abstracts, January 27 - 30, 1999, Tampa, Florida.

Evaluating Performance of Floating Bead Filters in a Cold Water Marine Aquaculture System, T. Pflieger, L. E. Beecher, and R. F. Malone. Aquaculture America '99 Book of Abstracts,

January 27 - 30, 1999, Tampa, Florida.

Experiences with the Application of Airlift Technology in Bead Filter Recirculating Systems. L. Beecher, A. A. DeLosReyes, Jr., and R. F. Malone. Aquaculture '98 Book of Abstracts, February 15 - 19, 1998, Las Vegas, Nevada.

Guidelines for Comparison of Integrated Design Criteria Supporting Marine Fish Growout In High Density Recirculating Production Systems, R. F. Malone and A. A. DeLosReyes, Jr. Aquaculture '98 Book of Abstracts, February 15 - 19, 1998, Las Vegas, Nevada.

Use of High Frequency Washing and Modified Bead Shapes to Enhance Nitrification Capacities of Floating Bead Bioclarifiers, R. F. Malone, L. E. Beecher, and A. A. DeLosReyes, Jr. Aquaculture '98 Book of Abstracts, February 15 - 19, 1998, Las Vegas, Nevada.

Interim Design Criteria for Warm Water Recirculating Systems Employing Bead Filters and Blown Air. R. F. Malone and A. A. DeLosReyes, Jr. World Aquaculture '97 Book of Abstracts, February 19-23, 1997, Seattle, Washington.

Evaluation of an Air-Driven Recirculating System Employing a Bubble-Washed Bead Filter. L. E. Beecher, R. F. Malone, and A. A. DeLosReyes, Jr. World Aquaculture '97 Book of Abstracts, February 19-23, 1997, Seattle, Washington.

A Model of Oxygen Demand in Recirculating Finfish-Culture Systems. W. Golz, K. A. Rusch, and R. F. Malone. World Aquaculture '97 Book of Abstracts, February 19-23, 1997, Seattle, Washington.

Developing Backwash Protocols for Floating-Bead Filters: A Model of Solids-Loading and Biofilm-Retention Effects on Nitrification, W. Golz, K. A. Rusch, and R. F. Malone, Proceedings: Successes and Failures in Commercial Recirculating Aquaculture, July 19-21, 1996, Roanoke, Virginia.

Energy Conservation and Environmental Improvement in an Intensive Recirculating Alligator Production System, A.A.D. Reyes, R.F. Malone, S. J. Langlinais, J. V. Huner, R. Soileau and K. A. Rusch, Proceedings: Successes and Failures in Commercial Recirculating Aquaculture, July 19-21, 1996, Roanoke, Virginia.

Design and Evaluation of A Commercial Scale Paddle-Washed Floating Bead Filter, A. A. DeLos Reyes, Jr., R. F. Malone, Proceedings: Successes and Failures in Commercial Recirculating Aquaculture, July 19-21, 1996, Roanoke, Virginia. Design

Backwash Frequency and Its Effect on Nitrification Efficiency in Floating Bead Filters. W. Golz, K. A. Rusch, and R.F. Malone. Aquaculture America '96, February 14 - 17, Arlington, Texas.

A Feasibility Study of Using Air-lift Pumps for Water Movement, Aeration and CO<sub>2</sub> Stripping in a Recirculating Aquaculture System. J. C. Loyless and R. F. Malone. Aquaculture America '96,

February 14 - 17, Arlington, Texas.

Digestion Characteristics and Treatment System Design of Aquacultural Sludge from Recirculating Systems. S. Chen, Z. Ning, and R. F. Malone. Aquaculture America '96, February 14 - 17, Arlington, Texas.

### **Published and Presented Papers**

Sizing and Management of Floating Bead Bioclarifiers. R. F. Malone, L. E. Beecher, and A. A. DeLosReyes, Jr. Proceedings of the Second International Conference on Recirculating Aquaculture, Virginia Polytechnic Institute and State University, Roanoke, Virginia, July 16 - 19, 1998.

Categories of Recirculating Aquaculture Systems. R. F. Malone and A. A. DeLosReyes, Jr. Aquacultural Engineering Society Proceedings, ISTA IV, Orlando, FL, November 9-12, 1997.

Design Rationale for an Air-driven Recirculating System Employing a Bubble-washed Bead Filter. A. A. DeLosReyes, Jr., L. E. Beecher, and R. F. Malone. Aquacultural Engineering Society Proceedings, ISTA IV, Orlando, FL, November 9-12, 1997.

Alternative Media for Enhanced Nitrification Rates in Propeller-washed Bead Filters. L. E. Beecher, A. A. DeLosReyes, Jr., D. G. Drennan, and R. F. Malone. Aquacultural Engineering Society Proceedings, ISTA IV, Orlando, FL, November 9-12, 1997.

Design and Evaluation of a Commercial Scale Paddle-washed Bead Filter. A. A. DeLosReyes, Jr. and R. F. Malone. Successes and Failures in Commercial Recirculating Aquaculture. pp. 183-195 In Aquacultural Engineering Society Proceedings, Vol. I, Roanoke, Virginia, July 19-21, 1996.

Developing Backwash Protocols for Floating Bead Filters: A Model of Solids-Loading and Biofilm-Retention Effects on Nitrification. W. Golz, K. A. Rusch, and R. F. Malone.

Successes and Failures in Commercial Recirculating Aquaculture. pp. 196-205 In Aquacultural Engineering Society Proceedings, Vol. I, Roanoke, Virginia, July 19-21, 1996.

Aquaculture Sludge Treatment Using an Anaerobic and Facultative Lagoon System. S. Chen, Z. Ning, and R. F. Malone. Successes and Failures in Commercial Recirculating Aquaculture. pp. 421-430 In Aquacultural Engineering Society Proceedings, Vol. II, Roanoke, Virginia, July 19-21, 1996.

Design of Recirculating Crawfish Systems Employing Expandable Granular Biofilters. R. F. Malone, K. A. Rusch, and J. M. Christensen. Successes and Failures in Commercial Recirculating Aquaculture. pp. 467-480 In Aquacultural Engineering Society Proceedings, Vol. II, Roanoke, Virginia, July 19-21, 1996.

Energy Conservation and Environmental Improvement in an Intensive Recirculating Alligator Production System. A. A. DeLosReyes, Jr., R. F. Malone, S. J. Langlinais, J. V. Huner, R. Soileau, and K. A. Rusch. Successes and Failures in Commercial Recirculating Aquaculture. pp. 494-507 In Aquacultural Engineering Society Proceedings, Vol. II, Roanoke, Virginia, July 19-21, 1996.

Clarification Abilities of Floating Bead Filters Used in Recirculating Aquaculture Systems, D. G. Drennan, II, W. Golz, H. Ahmed, and R. F. Malone, Aquaculture Engineering and Waste Management, pp. 256-267 In Proceedings from the Aquaculture Exposition VIII and Aquaculture Mid-Atlantic Conference, Washington, D.C., June 24-28, 1995.

Optimizing Nitrification in Bead Filters for Warmwater Recirculating Aquaculture Systems, R. F. Malone, B. S. Chitta, and D. G. Drennan, Techniques for Modern Aquaculture, pp. 315-325 In Proceeding of an Aquacultural Engineering Conference, Spokane, Washington, June 21-23, 1993.

Production, Characteristics, and Modeling of Aquacultural Sludge from a Recirculating Aquacultural System using a Expandable Granular Biofilter, S. Chen, D. E. Coffin, and R. F. Malone, Techniques for Modern Aquaculture, pp. 16-25 In Proceedings of an Aquacultural Engineering Conference, Spokane, Washington, June 21-23, 1993.

Slow Sand Filtration Techniques for the Containment of Non-Indigenous Species in Recirculating Aquaculture Effluents, D. G. Drennan, M. M. Rahman, and R. F. Malone, Techniques for Modern Aquaculture, pp. 335-344 In Proceedings of an Aquacultural Engineering Conference, Spokane, Washington, June 21-23, 1993.

Sludge Production from Recirculating Systems Employing Expandable Granular Biofilters, R. F. Malone, 21st U. S. Japan UJNR Aquaculture Meeting, Kyoto, Japan, November 26-December 3, 1992.

Water Quality Requirements and Environmental Impacts of Recirculating Aquaculture Systems, T. M. Losordo, R. F. Malone and S. Chen, In Proceedings of the United States National Oceanographic and Atmospheric Administration, Israel Oceanographic and Limnological Research Institute, Workshop on Mariculture and the Environment, June 9-10, 1992, Eilat, Israel.

Intensive Finfish Recirculating Systems Overview, D. E. Coffin, D. G. Drennan, and R. F. Malone, Presented at the 6th Annual Minnesota Aquaculture Conference, Duluth, Minnesota, March 6-7, 1992.

Biofiltration for Recirculating Finfish Culture Systems, D. E. Coffin, B. Chitta, and R. F. Malone, pp. 80-85 In Proceedings of the Louisiana Aquaculture Conference and Trade Show, Baton Rouge, Louisiana, January 30-31, 1992.

Design of Recirculating Systems for Intensive Tilapia Culture, D. G. Drennan, and R. F. Malone, pp. 85-94 In Proceedings of the Louisiana Aquaculture Conference and Trade Show, Baton

Rouge, Louisiana, January 30-31, 1992.

Biofiltration and Solids Capture with Low Density Bead Filters, R. F. Malone and D. E. Coffin, pp. 29-35, In A Workshop Proceedings on Design of High-Density Recirculating Aquaculture Systems, Baton Rouge, Louisiana, September 25-27, 1991.

Integrated Treatment with Expandable Granular Biofilters, Ronald F. Malone, presented at a Workshop on Design of High Density Recirculating Aquaculture Systems, Louisiana State University, Baton Rouge, Louisiana, September 25-27, 1991.

Suspended Solids Control in Recirculating Aquacultural Systems, S. Chen and R. F. Malone, Engineering Aspects of Intensive Aquaculture, pp. 170-186 In Proceedings from the Aquaculture Symposium, Cornell University, Ithaca, New York, 1991.

Low-Density Media Biofilter of Recirculating Finfish Systems, R. F. Malone, D. E. Coffin, and D. M. Wimberly, pp. 32-36 In Proceedings of the Louisiana Aquaculture Conference 1991, Baton Rouge, Louisiana, February 7-8, 1991.

Sludge Management for Recirculating Aquaculture Systems, S. Chen, D. E. Coffin, and R. F. Malone, pp. 36-43 In A Workshop Proceedings on Design of High-Density Recirculating Aquaculture Systems, Baton Rouge, Louisiana, September 25-27, 1991.

### **Conference and Workshop Presentations (not published)**

Evaluation of the SUTA (Siphoning U-Tube Airlift) Pump to Achieve Required Water Flow Rates in Aquaculture Recirculating Systems, Aquaculture America '99, Tampa, Florida, January 27-30, 1999.

Developments in Recirculating Systems. R. F. Malone. Invited Speaker, '98 European Aquaculture Society Conference, Bordeaux, France, October 7 - 10, 1998.

Overview of Recirculating Technologies (invited speaker), R. F. Malone, 1996 Florida Aquaculture Association Meeting, St. Petersburg, Florida.

Biological and Mechanical Filtration (invited speaker), R. F. Malone, 1996 Water Garden Gems Expo, San Antonio, Texas.

Backwash Frequency and Its Effect on Nitrification Efficiency in Floating Bead Filters. W. Golz, K. A. Rusch, and R.F. Malone. Aquaculture America, 1996.

A Feasibility Study of Using Air-lift Pumps for Water Movement, Aeration and CO<sub>2</sub> Stripping in a Recirculating Aquaculture System. J.C. Loyless and R.F. Malone. Aquaculture America, 1996.

Ammonia Production and Organic Decay in Aquacultural Sludge, L. Wang, R. F. Malone, B. N. Sastry, and D. G. Drennan, II. Presented at Aquaculture '95 special session "Recent Advances

in Aquacultural Engineering, San Diego, CA. February 1-4, 1995.

Particle Size Transformation in Recirculating Aquacultural Systems. S. Chen, D. Drennan, and R. F. Malone, Aquaculture '95, San Diego, California, February 1-4, 1995.

Determination of BOD Decay Constant and Total Ammonia Variation of Aquacultural Sludge. L. Wang and R. F. Malone. Aquaculture '95, San Diego, California, February 1-4, 1995.

Role of In-Situ Nitrification in Design of Recirculating Systems. R. I. Mia, D. G. Drennan II, and R. F. Malone. Aquaculture '95, San Diego, California, February 1-4, 1995.

Use of Alternative Filter Media for Increased Nitrification in Traditional Bead Filter Configurations. B. Sastry, D. G. Drennan II, and R. F. Malone. Aquaculture '95, San Diego, California, February 1-4, 1995.

Analysis of Particle Size Removal in Recirculating Systems Using Bead Filters. H. U. Ahmed, D. G. Drennan II, R. F. Malone, and S. Chen. Aquaculture '95, San Diego, California, February 1-4, 1995.

Evaluation of Prototype Commercial Scale Paddle Washed Filters. D. G. Drennan II and R. F. Malone. Aquaculture '95, San Diego, California, February 1-4, 1995.

Partical Size Transformation in Recirculating Aquacultural Systems. Shulin Chen,\* Douglas Drennan, Ronald Malone. Aquaculture 95.

Determination of BOD Decay Constant and Ammonia Variation of Aquacultural Sludge. Lihua Wang, Ronald F. Malone. Aquaculture 95.

Role of Nitrification In-Situ Nitrification in Design of Recirculating Systems. Riazul I. Mia, Douglas G. Drennan II\*, Ronald F. Malone. Aquaculture 95.

Analysis of Particle Size Removal in Recirculating Systems Using Bead Filters. Helal U Ahmed, Douglas G. Drennan I, Ronald F. Malone\*, Shulin Chen. Aquaculture 95.

Evaluation of Prototype Commercial Scale Paddle Washed Filters. Douglas G. Drennan II\*, Ronald F. Malone. Aquaculture 95.

Simplified Sizing Procedures for the Bead Filters Used in High Density Aquaculture Recirculating Systems, R. F. Malone, D. G. Rennin II, and R. MIA. Joint Sessions of the Bioengineering Section of the American Fisheries Society and the Aquacultural Engineering Society, Halifax, Nova Scotia, August 21-25, 1994.

Suspended Particle Removal by Granular Filtration and Sedimentation, S. Chen, D. G. Drennan II, and R. F. Malone. Joint Sessions of the Bioengineering Section of the American Fisheries

Society and the Aquacultural Engineering Society, Halifax, Nova Scotia, August 21-25, 1994.

Commercial Testing of a Prototype 200 ft<sup>3</sup> Bead Filter. D. G. Drennan II, R. F. Malone. Joint Sessions of the Bioengineering Section of the American Fisheries Society and the Aquacultural Engineering Society, Halifax, Nova Scotia, August 21-25, 1994.

Suspended Solids Removal Mechanisms during Granule Filtration, Chen, S., Ahmed H., Drennan, D. and Malone, R.F., Paper presented at American Fisheries Society Annual Meeting, August 20-24, 1994, Halifax, N.S., Canada.

Limitation and Design Implication of Fixed Film Processes for Nitrification in Aquaculture Applications, Chen, S., Wang, G.-T. and Malone, R.F., Paper presented at World Aquaculture'94, World Aquaculture Society, New Orleans, Louisiana, January 14-18, 1994.

Biofiltration and Solids Capture Using Expandable Granular Biofilters, K. A. Rusch, D. G. Drennan II and R. F. Malone, Joint Meeting of the South Atlantic Aquaculture and U.S. Chapter of the World Aquaculture Societies, Hilton Head, South Carolina, January 27-30, 1993.

Biofiltration and Solids Removal in Recirculating Aquaculture Systems, D. G. Drennan, and R. F. Malone, presented at Louisiana Aquaculture Conference, Baton Rouge, Louisiana, February 18-19, 1993.

Biofiltration and Solids Removal in Recirculating Aquaculture Systems, R. F. Malone, and D. G. Drennan, presented at Western Regional Aquaculture Expo, Reno, Nevada, February 16-19, 1993.

Biofiltration and Solids Capture Using Expandable Granular Bead Filters, D. G. Drennan and R. F. Malone, presented at 1993 Joint South Atlantic Regional Aquaculture/U. S. Chapter of World Aquaculture Society Conference and Trade Show, Hilton Head Island, South Carolina, January 27-30, 1993.

The Application of Recirculating Technologies to Alligator Culture, D. G. Drennan and R. F. Malone, presented at the Aquaculture Expo VI, New Orleans, Louisiana, January 6-10, 1993.

Treatment Options for Recirculating Production Systems, R. F. Malone, presented at the Aquaculture Expo VI, New Orleans, Louisiana, January 6-10, 1993.

Aquacultural Sludge Production, Characteristics, and Production Simulation. S. Chen, R. F. Malone, and D. E. Coffin. Proceedings: International Conference of Engineering Techniques for Modern Aquaculture. Spokane, Washington. June 20-23, 1993. (American Society of Agricultural Engineers. Page 16-25)

Water Quality Requirements and Environmental Impacts of Recirculating Aquaculture Systems. T. M. Losordo, R. F. Malone and S. Chen. Proceedings: United States National Oceanographic

and Atmospheric Administration/Israel Oceanographic and Limnological Research Institute. Workshop on Mariculture and the Environment. Eilat, Israel. June 9-10, 1992.

Recirculating System Technology Status and Prognosis, R. F. Malone, presented at a Quarterly Program Coordination Meeting Cooperative Extension, Baton Rouge, Louisiana, June 11, 1992.

Recirculation System Technology Status and Prognosis, R. F. Malone, presented at the Aquaculture '92 Conference and Exposition, Orlando, Florida, May 21-25, 1992.

Recirculating Catfish System - The Greenville Experience: Problems and Solutions, D. G. Drennan, and R. F. Malone, presented at the Aquaculture '92 Conference and Exposition, Orlando, Florida, May 21-25, 1992.

Waste Management for Recirculating Aquacultural Systems, S. Chen and R. F. Malone, presented at Aquaculture Expo V, New Orleans, January 12-16, 1992.

Biological Filtration Technology, R. F. Malone, Recirculating Aquaculture Systems Short course, Greenwood, Mississippi, February 6, 1992.

Biofiltration Options, R. F. Malone, Recirculating Aquaculture Systems Short course, Greenwood, Mississippi, February 6, 1992.

Waste Management in Intensive Recirculating Aquaculture System, R. F. Malone and S. Chen, presented at the Aquaculture Expo V, New Orleans, Louisiana, January 12-16, 1992.

Recirculating Technology: Update, D. G. Drennan and R. F. Malone, Quarterly Program Coordination Meeting-Sea Grant Marine Advisory Program, Baton Rouge, Louisiana, October 24-25, 1991.

Current Status of Research on Automatic Soft-shell Crawfish Separator. R. F. Malone and S. Chen. Proceedings: Louisiana Aquacultural Conference. P27-31. 1991.

Expandable Media Biofiltration System for Recirculation in an Aquaculture System, R. F. Malone, Water Environment and Technology A Technical Conference of the Louisiana Water Pollution Control Association, Baton Rouge, Louisiana, September 17-18, 1991.

Low Density Biomedial Filtration of a Commercial Recirculating Soft Crawfish Production Facility, R. F. Malone, J. E. Robin, and D. E. Coffin, World Aquaculture '91, San Juan, Puerto Rico, June 16-20, 1991.

Effect of Backflushing Frequency on Carrying Capacity of Upflow Low-Density Media Biofilters, D. E. Coffin, J. E. Robin, and R. F. Malone, World Aquaculture '91, San Juan, Puerto Rico, June 16-20, 1991.

Sludge Management for Recirculating Aquacultural Systems, S. Chen and R. F. Malone,

presented at the Workshop on Design of High Density Recirculating Aquacultural Systems, Louisiana State University, Baton Rouge, Louisiana, September 25-27, 1991.

Granular Expendable Biofilter for Recirculating Aquacultural Systems, R. F. Malone, S. Chen, and D. Coffin, presented at the Workshop on Design of High Density Recirculating Aquacultural Systems, Louisiana State University, Baton Rouge, Louisiana, September 25-27, 1991.

Suspended Solids Control in Recirculating Aquaculture Systems, Aquaculture Symposium, Engineering Aspects of Intensive Aquaculture, Ithaca, New York, April 4-6, 1991.

Biological Filtration Options for Recirculating Finfish Production Systems, (Invited Speaker) R. F. Malone. Presented at Texas Aquaculture Conference, Houston, TX, January 9-11, 1991.

Biofiltration of Recirculating Systems, R. F. Malone. Presented at Fish Farming Expo IV, New Orleans, LA, December 12-16, 1990.

Water Filtration for Recirculation of Water Treatment Systems (Aquaculture with Traditional Applications), R. F. Malone. Presented at 1990 Fall Technical Conference, Louisiana Water Pollution Control Association, November 13-14, 1990.

Biological Filtration Technology, R. F. Malone. Presented at North Carolina Aquaculture Development Conference, Raleigh, North Carolina, October 30-31, 1990.

Closed Recirculating Systems, R. F. Malone. Presented at the Committee on the Assessment of Technology and Opportunities for Marine Aquaculture in the U. S., Fourth Meeting, Hilton Head, South Carolina, August 6-8, 1990.

Solids Control and Nitrification by Expandable Media Filters, R. F. Malone, D. Wimberly and K. A. Rusch, at 1990 World Aquaculture Conference, Halifax, Canada, June 10-14, 1990.

## **Technical Reports**

Using the Bead Filter in Your Koi Pond: A Comprehensive Guide to Water Quality Management, R. F. Malone and K. A. Rusch, Louisiana Sea Grant College Program. 1997.

## **Miscellaneous**

Floating Media Hourglass Biofilter, Canada Patent No. 7989-005, September 8, 1998.

Air-Charged Backwashing Bioclarifier, U. S. Patent No. 5,770,080, June 23, 1998.

Floating Media Biofilter, U.S. Patent No. 5,445,740, August 29, 1995.

Floating Media Hourglass Biofilter, R. F. Malone, U. S. Patent No., 5,232,586, August 3, 1993.

Floating Media Biofilter, R. F. Malone, U. S. Patent No. 5,126,042, June 30, 1992.

### **Recent and Ongoing Research**

An Integrated Closed Recirculating Greenhouse Pond Module for the Production of Brackish Water Species with Emphasis on Red Drum *Sciaenops Ocellatus*; Board of Regents, with Charles Weirich, (1998-2001, \$ 189,167).

Impact of Interstitial Turbulence Induced by Porosity and Fluxrate Variations on the Biofiltration Performance of Floating Bead Filters; Louisiana Sea Grant College Program (1998 -2000, \$ 165,598).

Establishment of National Guidelines for Classification and Competitive Evaluation of Integrated Marine Recirculating Aquaculture System Design; Louisiana Sea Grant College Program, with Aurelio A. DeLosReyes (1998, total \$ 12,336).

Cost Minimization of Recirculating Finnish Production Systems by Integrated Use of Airlift Pumps and Expandable Granular Biofilters, Louisiana Sea Grant College Program (1994 -1996, \$ 124,824).

Energy Conservation in Intensive Alligator Producing Systems Using Expandable Granular Biofilter (EGB) and Recirculation Technologies; Louisiana Department of Natural Resources, (1994-1997, \$ 388,582).

Characterization, Treatment and Disposal of Aquacultural Sludge; United States Department of Agriculture, with S. Chen (1993-1995, \$ 55,718).

Manipulation of Feed Ingredient Particle Size as a Means to Improve Catfish Waste Management, United States Department of Agriculture, with Shulin Chen and Robert Reigh (1993-1995, \$ 48,624).

Size Distribution, Environmental Impact and Removal Efficiency of Suspended Particles in High Density Aquacultural Systems; Louisiana Sea Grant College Program (1993 - 1995).

Design and Evaluation of a Commercial Scale Propellor-Washed Bead Filter; National Coastal Resources Research and Development Institute (1993 - 1995, \$138,092).

Computer Aided Sizing of Biofiltration Systems; Louisiana Sea Grant College Program (1993-1994, \$2,000).

Development and Testing of a Commercial Scale Recirculating Aquaculture System; United States Department of Agriculture, with Dudley Culley (1993-1994, \$ 38,115).

Development and Testing of a Commercial Scale Recirculating Aquaculture System; Louisiana Sea Grant College Program (1992 - 1994, \$ 38,115).

Integrated Intensive Recirculating Tilapia Production System with Expandable Granular Media Biofiltration; Louisiana Sea Grant College Program (1992 - 1994, \$ 115,130).

Installation and Evaluation of Alligator Farm EGB Biological Filter; Louisiana Department of Agriculture (1992-1993, \$6,166).

Optimization of Biological Filtration in Recirculating Finfish Culture Systems by Minimizing Solids Time, Louisiana Sea Grant College Program (1991-1993, \$ 55,539).

Optimization of High Density Recirculating Aquaculture Production Units: Phase I: State-of-the-Art Design; Louisiana Sea Grant College Program, United States Department of Agriculture, United States Department of Wildlife and Fisheries, and the National Sea Grant College Program (1991-1993, \$ 35,604).

Optimization of Biological Filtration for High Density Recirculating Aquaculture Production Units, Louisiana Sea Grant College Program (1990-1991, \$ 5,000).

### **Pending Research**

Treatment of Effluent Water from a Marine Recirculating Greenhouse Pond System with Emphasis on Salt Conservation and Phosphorus Control; National Sea Grant College Program, (2000 - 2001, \$ 76,000). Submitted April 5, 1999.

Impact Gas to Liquid Ratios on the Pumping and Gas Transfer Characteristics of Siphoning U-Tube Airlifts (SUTA) Applied at Differing Salinities; National Sea Grant College Program, ( 2000 - 2001, \$ 86,000). Submitted April 5, 1999.

Use of Emerging Marine Recirculating Technologies to Establish Commercial Production of High-Value Marine Species; National Sea Grant College Program, (with Charles R. Weirich as Principle Investigator, 2000 - 2001, \$ 120,000). Submitted April 5, 1999.

Evaluation of Diets and Water Filtration for Culture of Juvenile Nassau Groupers; National Sea Grant College Program, (with John Tucker as Principle Investigator, 2000 - 2001, \$ 68,867). Submitted April 5, 1999.

Passive Treatment of Heavy Metals from Elevated Roadway Runoff over Coastal Waterways using Floating Sorptive Bead Clarification Technology; City/ Parish of East Baton Rouge, Department of Public Works, (with John Sansalone as Principle Investigator, (2000 - 2001, \$ 90,000). Submitted March 30, 1999.

Integration of Technology to Effectuate Reliable Production of Estuarine Marine Fingerlings Represented by Red Drum; Louisiana Sea Grant College Program, (2000 -2001, \$ 80,742).

Submitted March 30, 1999.

Development of Sludge Management Strategies that Will Encourage Denitrification to Reduce Chemical Costs and Extend Water Reuse in Closed Recirculating Marine Aquaculture Systems; Louisiana Sea Grant College Program, (2000 - 2001, \$ 76,618). Submitted March 30, 1999.

Application of Floating Bead Bioclarification Principles to Economically Treat Domestic Waste Streams in Coastal Communities; National Sea Grant College Program, (2000 - 2002, \$ 145,000). Submitted March 26, 1999.