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DEPARTMENT OF  
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BEFORE THE  
IDAHO DEPARTMENT OF WATER RESOURCES

IN THE MATTER OF DISTRIBUTION OF  
WATER TO WATER RIGHT NOS. 36-  
04103A, 36-04013B AND 36-7148 (Snake  
River Farm)

(Water District Nos. 130 and 140)

DIRECT TESTIMONY OF  
ANTHONIE M. SCHUUR

SUBMITTED ON BEHALF OF:

THE IDAHO GROUND WATER APPROPRIATOR'S INC.  
NORTH SNAKE GROUND WATER DISTRICT  
MAGIC VALLEY GROUND WATER DISTRICT

SEPTEMBER 11, 2009

1 Q STATE YOUR NAME, BUSINESS ADDRESS, AND POSITION.

2 A My name is Anthonie Michael Schuur. I am sole proprietor of my private consulting  
3 practice, Aquaculture Management Services, since 1988. My business address is 11583  
4 Valensin Road, Galt, California 95632. I was retained as an expert witness by Racine  
5 Olson Nye Budge & Bailey on behalf of Idaho Ground Water Appropriators, Inc., North  
6 Snake Ground Water District and Magic Valley Ground Water District.

7 Q WHAT IS YOUR AREA OF EXPERTISE?

8 A My training is in biology, economics, and engineering. My area of applied expertise is in  
9 the planning and economic analysis; engineering, design, and operation of aquaculture  
10 systems. I am a co-author of Bioeconomics of Aquaculture (Elsevier, 1982), a  
11 monograph about the economics of aquaculture systems, and authored journal papers on  
12 topics that are closely related to aquaculture system planning including hatchery logistics,  
13 bio-energetics, biosecurity, and financial analysis. For the past seven years I have served  
14 on the editorial board of the professional journal Aquacultural Engineering published by  
15 Elsevier.

16 Q PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL  
17 BACKGROUND

18  
19 A After attending UCLA for two years I served in the United States Marine Corps for three  
20 years. After my discharge, I attended the University of California, Irvine where I  
21 received a Bachelor of Science degree in Biological Science in 1969. I was then  
22 employed by Brown and Caldwell, Consulting Engineers as a water quality biologist. In  
23 1971, I was employed by the University of California, Davis as a Staff Research  
24 Associate and program manager for the marine aquaculture program.

25 I also attended graduate school in Agricultural Economics at UC Davis without  
26 completing a degree. In 1975, I was employed as a shrimp farm manager, constructing  
27 and operating a 300 hectare farm in Costa Rica. After returning to the United States in  
28 1978, I was employed by James M. Montgomery, Consulting Engineers as an Associate  
29 and then Supervising Aquaculture Scientist. There I provided technical advisory services  
30 and prepared numerous reports for domestic and international clients including state and  
31 local government agencies, the World Bank, the Asian Development Bank, and USAID.  
32 In 1984 I was employed by Agrifuture, Inc., an agriculture research and development  
33 company, as Vice-President for aquaculture operations where I managed two highly  
34 intensive fish farms and an oyster farm as well as providing consulting services to a  
35 shrimp farming venture in Panama.

36 Since 1988, I have conducted a private practice in aquaculture consulting. I have  
37 provided services to dozens of clients covering a wide variety of aquaculture planning  
38 and management advisory assignments in many locations in the United States and around  
39 the world. In five instances I have been retained as an expert witness in legal  
40 proceedings concerned with aquaculture topics. My current biographical summary which  
41 is attached hereto includes a description of the clients and projects that I have completed  
42 in private practice.

43 **Q WHAT IS THE PURPOSE OF YOUR EVALUATION?**

44 **A** I have been asked by Idaho Groundwater Appropriators, Inc. and North Snake River and  
45 Magic Valley Groundwater Districts to review the Over the Rim mitigation approach in  
46 the context of its implications to fish culture especially as it relates to replacing a flow  
47 deficit at Snake River Farm. More precisely, I refer to the approach as it is described by

48 the Order Approving Ground Water Districts' Replacement Plan for 2009 dated March  
49 26, 2009 (Order). The Over the Rim plan specifies the provision of 1.99 to 3.0 cfs flow  
50 on a continuous basis from several redundant wells located above the rim of the Snake  
51 River Canyon and then conveyed by a pipeline over the canyon rim to a location adjacent  
52 to the existing Snake River Farm spring so that it might be blended with existing water  
53 supply or further conveyed without mixing to individual trout culture raceways. The  
54 Order specifies several conditions including reliability, water temperature, and water  
55 quality that characterize the acceptability of the Over the Rim supply. My function is to  
56 determine that these conditions have been met and summarize the utility of the Over the  
57 Rim water supply for fish culture.

58 **Q WHAT INFORMATION HAVE YOU REVIEWED TO FORM YOUR OPINION?**

59 Along with professional publications that I have referenced and relied on throughout my  
60 years of experience, I specifically reviewed information relating to the Over the Rim  
61 mitigation supply and plan. This includes the report prepared by SPF Water Engineering,  
62 Testimony by Terry Scanlan, report and information prepared by Raymond Eldridge,  
63 water quality data relating to the well field from which the mitigation water supply will  
64 be pumped, water quality sampling data and information.

65 **Q WHAT IS YOUR GENERAL APPRAISAL OF THE OVER THE RIM**  
66 **APPROACH WITH RESPECT TO FISH CULTURE?**

67  
68 **A** The Over the Rim approach offers a mitigation flow that is a proportional response to the  
69 mitigation need and that provides a water source that is likely to closely resemble the  
70 existing spring supply. In theory, pumping water from existing wells that are the very  
71 same ones that are identified as those depleting Snake River Farm spring flow is a direct  
72 solution. One should view the Over the Rim delivery as a direct diversion of aquifer

73 water from existing agriculture to use at Snake River Farm that is suitable for fish  
74 production and very similar to if not the very same water that emerges from the existing  
75 springs that supply Snake River Farm.

76 The Over the Rim mitigation supply satisfies many of the objections to previous  
77 proposals. From a fish culture perspective, the Over the Rim eliminates water quality  
78 concerns raised by Clear Springs Foods, Inc. regarding other prior below the rim  
79 solutions that have been proposed. The Over the Rim mitigation supply provides the full  
80 quantity of replacement water which also provides a mitigation flow that from a practical  
81 standpoint is nearly indistinguishable from Snake River Farm's existing spring supply for  
82 purposes of raising fish. See Terry Scanlan Testimony, Raymond Eldridge Testimony  
83 and related exhibits.

84 **Q WHAT OTHER ASPECTS OF THE OVER THE RIM MITIGATION SUPPLY**  
85 **NEED TO BE ADDRESSED?**

86  
87 **A** There are two aspects of the supply, constant water temperature and dissolved gas  
88 equilibrium.

89 Temperature is a key variable for fish culture. Because the source of supply for Snake  
90 River Farm and the Over the Rim mitigation supply is the same and has nearly the same  
91 temperature, the initial investigation focused on whether or not the pipeline might warm  
92 or cool water on its way to the Snake River Farm spring in a manner that might affect fish  
93 production. An analysis of this was completed by Dr. Brendecke and is included in his  
94 Direct Testimony. Dr. Brendecke's analysis indicates that there would not be a  
95 significant change in water temperature by delivery through the pipeline to Snake River  
96 Farm.

97

98 Q **DOES THE OVER THE RIM SYSTEM ADDRESS POTENTIAL GAS**  
99 **EQUILIBRIUM ISSUES?**

100  
101 A The proposed Over the Rim system design eliminates concerns relating to  
102 supersaturation (ie, when the total dissolved gas pressure exceeds 100% of the  
103 atmospheric pressure) by means described below and obviates the condition completely  
104 with a degassing facility that is contained in the testimony of Mr. Eldridge and **Exhibits**  
105 **2206, 2207 and 2208** that thoroughly aerates the water and ensures that TDG pressure is  
106 in atmospheric equilibrium.

107 Q **WHAT IS YOUR OPINION OF THE DESIGN AND RELIABILITY OF THE**  
108 **OVER THE RIM SYSTEM?**

109  
110 A I have reviewed the Over the Rim system design and especially the degassing and  
111 aeration system at the terminus of the pipeline. The well head and buried pipeline are  
112 configured to robustly prevent any physical or security breach. The pipeline itself is  
113 armored with a steel and concrete collar in the reach that descends, still buried, to the  
114 canyon floor. The pipeline connection from the canyon entry to the spring terminus is  
115 similarly protected. The pipe is regulated at a much lower pressure than would be the  
116 case due to the elevation changes in the system. Hydraulically, the entire pipeline is  
117 operated under positive pressure that precludes any possibility of air entrainment and is  
118 designed such that it is always full, free of any air pockets that might interrupt a  
119 continuous stream of water.

120 The pipeline discharges directly into the headwork of the degassing column and is sealed  
121 from any possibility of contamination. Multiple columns provide ample aeration capacity  
122 and scope for additional future flow. (See **Exhibits 2206, 2207 and 2208**) Water is  
123 dispersed into the columns by splash plates that distribute water evenly over the entire

124 surface area of the columns. The column length and total volume provides more than  
125 sufficient capacity for the degassing operation.

126 Having designed and reviewed numerous aquaculture facilities during my career, I have  
127 never seen a higher level of reliability engineered into a fish culture system.

128 **Q IF THE OVER THE RIM SYSTEM IS IMPLEMENTED, HOW DO YOU**  
129 **EXPECT IT TO PERFORM AND, MORE SPECIFICALLY, HOW WILL IT**  
130 **AFFECT SNAKE RIVER FARM PRODUCTION AND OPERATIONS?**

131  
132 **A** At the most fundamental level, an individual fish in the culture system should experience  
133 no change as a result of the additional water supply added by the Over the Rim system.

134 The Over the Rim system will deliver incremental water at a high quality and at a  
135 temperature indistinguishable from the Snake River Farm spring source. Quantitatively  
136 and qualitatively, for culture purposes, the Over the Rim water source is for all practical  
137 purposes an identical replacement of the deficit flow.

# Anthony M. Schuur

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## BIOGRAPHICAL SUMMARY

- Personal:** Born Whittier, California August 12, 1945
- Languages:** English, Spanish
- Education:** B.S. Biological Science, University of California, Irvine, 1969;  
Graduate Studies in Agricultural Economics, University of California,  
Davis.
- Employment Summary:**
- 1988 to present, **Aquaculture Management Services**  
Principal Aquaculture Consultant
  
  - 1994 to 1997, **Altrix International/Jamaica Flour Mills Investments**  
Project Development Manager  
Project Manager, Altrix Panama shrimp farm expansion  
Project Manager, Hellshire Hatchery design and construction
  
  - 1984 to 1988, **Agrifuture Inc.**  
Vice President, Director, Agrifuture, Inc.  
Vice President, Tomales Shellfish Farms, Inc.  
Vice President, Aquafuture, Inc.  
Consultant to the World Bank (Indonesia)
  
  - 1978 to 1984, **James M. Montgomery Consulting Engineers, Inc.**  
Supervising Aquaculture Scientist  
Senior Aquaculture Scientist
  
  - 1976 to 1978, **Maricultura, S.A.**, Costa Rica  
Production Manager  
Assistant Operations Manager
  
  - 1972 to 1976, **University of California, Davis**  
Postgraduate Research Economist, Department of Agricultural Economics  
Program Manager, Aquaculture Development Program  
Staff Research Associate
  
  - 1970 to 1972 **Brown and Caldwell, Consulting Engineers**  
Water Quality Biologist
  
  - 1965 to 1967 **United States Marine Corps**  
Sergeant, communications specialist



### **Specific Experience Areas:**

- Development, economic analysis, and design of aquaculture projects in public and private sectors. Preparation of commercial fish and shrimp farm studies for clients in Panama, Guatemala, Jamaica, Honduras, Nicaragua, Colombia, Venezuela, Ecuador, Mexico, Trinidad, India, Malaysia, Sri Lanka, Bangladesh, and Indonesia
- Operational management of commercial shrimp, shellfish, and finfish production programs.
- Preparation of business plans and financial projections for commercial aquaculture ventures.
- Preparation of bioengineering criteria and design studies and for commercial intensive and semi-intensive aquaculture production systems.
- Mathematical modeling of bioengineering systems.
- Preparation of rural development project plans in Africa, Asia, and Latin America.
- Instruction in bioenergetics and bioengineering (Associate Instructor, Aquaculture Department, Harbor Branch Oceanographic Institution)
- Project management including construction of water systems, supervision of civil works including pump stations, water control structures, and ponds.

### **Publications:**

Co-author of Bioeconomics of Aquaculture, a monograph. Author or co-author of the following academic papers and more than 60 technical reports, system designs, and financial plans:

Schuur, A.M., Allen, P.G., and Botsford, L.W. 1974. An analysis of three facilities for the commercial production of *Homarus americanus*. American Society of Agricultural Engineers. Paper No. 74-5517.

Shleser, R.A., and Schuur, A.M. 1975. Utilization of power plant thermal effluent for mariculture. In: Water Management by the Electrical Power Industry. Water Resources Symposium. 8:307-312. Center for Research in Water Resources.

Botsford, L. W., Raush, H.E., Schuur, A.M. and Shleser, R.A. 1975. An economically optimum aquaculture facility. Proceedings of the World Mariculture Society, 6:407-420.

Schuur, A.M., Fisher, W.S., Van Olst, J., Carlberg, J., Shleser, R.A., and Ford, R. 1976. Hatchery Methods for the Production of Juvenile Lobsters (Homarus americanus). University of California Sea Grant Program. Publication 48.

Wickham, D.E., Shleser, R.A., and Schuur, A.M. 1976. Observations on the inshore population of Dungeness Crab, *Cancer magister*, in Bodega Bay. California Fish and Game, 62(1): 89-92.

Allen, P.G., L.W. Botsford, A.M. Schuur, and W.E. Johnston, 1984. Bioeconomics of Aquaculture, A Systems Approach. Elsevier, New York, 386 pp.

Schuur, A.M. 1991. A bioenergetic model for application to intensive fish culture system management. Fisheries Bioengineering Symposium, American Fisheries Society Symposium 10: 393-401.

Rolland Laramore, S. Allen, P.Hitchens, X. Romero, and A. Schuur. 2000. Artificial induction of active accommodation for white spot syndrome virus (WSSV) in *Penaeus vannamei* with tolerine products. Presented at 4th Congreso Centroamericano de Acuicultura, June 2000.

Schuur, A.M. 2003. Evaluation of biosecurity applications for intensive shrimp farming. Aquacultural Engineering 28 (1-2): 3-20.

#### **Organizations:**

California Aquaculture Association, President, 1988, Chairman of the Board, 1989; National Aquaculture Association, founding Director, 1990, Newsletter Editor, 1991; Editorial Board, Aquacultural Engineering, 1998-present; member World Aquaculture Society, Florida Aquaculture Association and Aquacultural Engineering Society.

#### **Contact Information:**

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Aquaculture Management Services  
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## NARRATIVE SUMMARY

Anthonie M. Schuur

Mr. Schuur is a professional aquaculture scientist with over 30 years of experience in aquaculture both as an operational manager and as a consultant. He has direct experience as the manager of commercial fin-fish, shrimp, and bivalve production facilities encompassing both intensive and extensive production methods. His consulting experience includes 7 years as a Supervising Environmental Scientist with James M. Montgomery Consulting Engineers and 15 years as an independent consultant specializing in services to commercial aquaculture clients. The scope of his consulting includes bioengineering studies, facility planning and design, operational advisory services, expert testimony, marketing development, and financial analysis.

He is a co-author of *Bioeconomics of Aquaculture*, a monograph describing the interrelationships between the biological, engineering, and economic aspects of aquaculture production. His scientific publications often emphasize the field of bioenergetics that underlies many of the criteria for aquaculture production facilities. He has conducted several seminars demonstrating the use of bioenergetics models for aquaculture systems management at national aquaculture technical meetings and at the University of California, Davis.

He has completed several comprehensive planning studies that include conceptual development, facility engineering, capital cost assessment, and analysis of projected financial performance. Under contract to the International Finance Corporation of the World Bank, he prepared an extensive shrimp farming feasibility study for a 6,000-acre site in Nicaragua. The study included an integrated plan for a shrimp farming industry complex including a hatchery, a shrimp farm capable of five million pounds of output per year, and a processing facility. In 1997, he completed an assignment as the project manager of a shrimp farm and hatchery complex in Panama and Jamaica. The Panama farm expansion involved construction of 300 hectares of new ponds, renovation of 100 hectares, construction of a 12 cum/sec pump station, and other ancillary structures. The Jamaica hatchery has the capacity to produce approximately 30 million shrimp post-larvae per month. In 1999, he prepared a comprehensive planning study for a shrimp-farming venture in Venezuela comprising more than 5,000 acres. Like many of the planning and design studies he has prepared, the project report served as the business plan for the venture, providing the vehicle for financing and implementing the project.

He has also prepared plans and system designs for several intensive fin-fish farming ventures including the facilities employed by The Fishery near Sacramento, California. The intensive facility, used for the production of sturgeon caviar, is the first dedicated caviar production venture; it produces several tons of select caviar annually. He has also prepared similar designs for intensive culture of several kinds of fish including catfish, tilapia, and striped bass.

Due to his specialization in aquaculture economics and the financial assessment of aquaculture ventures, Mr. Schuur has served several institutional clients requiring appraisals for aquaculture facilities. On five occasions, he prepared expert opinions for submission in court proceedings. His expert testimony was used to ascertain asset values and other financial issues. Mr. Schuur has also assisted lending institutions and development agencies in assessing loans for proposed aquaculture projects.

Mr. Schuur has served as a technical and management advisory resource to many commercial aquaculture production clients such as The Fishery, Shrimp Culture Inc., Sierra AquaFarms, SeaChick of Mississippi, Solar AquaFarms (Chiquita Brands), Grupo Granjas Marinas de San Bernardo, Altrix International, Jamaica Flour Mills (ADM) and Bluepoints Company, Inc. Services for these clients span a diversity of species and culture system approaches.

As an independent consultant, Mr. Schuur provides planning and bioengineering professional services to private, corporate, and public clients and serves on the editorial board of the journal, [Aquacultural Engineering](#).

**ANTHONIE M. SCHUUR**  
*Aquaculture Management Services*  
**REPRESENTATIVE CLIENT LISTING (1989-2008)**

client	scope of work
<b>Shrimp Culture, Inc.</b> Dr. William MacGrath	Farm feasibility studies in the Dominican Republic and Nicaragua (with IFC), shrimp hatchery facility engineering projects
<b>The Fish Factory</b> Dr. John Colt	Aquaculture Plan for the State of Minnesota, bioengineering studies
<b>Economic Development Bank for Puerto Rico</b>	Aquaculture project loan assessment
<b>The Fishery</b> Mr. Ken Beer	Intensive culture system design, pond system design, computer accounting systems
<b>SDZ Land Co.</b> Mr. Steven Zuckerman	Expert witness in legal case involving aquaculture feasibility issue
<b>SeaChick (Mississippi)</b> Mr. Don Robohm	Production management advisory service for intensive fish farming
<b>JMM Consulting Engineers</b> Mr. William Madden	Bioengineering consultant, international project development advisory services
<b>Solar Aquafarms, Inc.</b> Mr. Steven Serfling	Site selection studies, bioengineering studies
<b>California Prison Industry Authority</b>	Site feasibility studies and aquaculture project planning
<b>California Sturgeon Growers Association</b>	Executive Secretary, marketing, distribution, and product promotion
<b>Seafood Industries</b> Mr. Paul Jackson	Intensive fish culture system planning and design
<b>Sierra Aquafarms</b> Mr. Lennart Thornros	Technical advisory services, renovation of water recirculation system and oxygen injection system
<b>Commonwealth Development Corp.</b> Mr. Patrick Blow	Technical assessment and feasibility appraisal of multi-species aquaculture production complex in Belize
<b>Bronson, Bronson, &amp; McKinnon</b> Mr. Robert N. Phillips	Expert testimony related to valuation of aquaculture facility in Hawaii

**Representative Client Listing (continued)**

<b>client</b>	<b>scope of work</b>
<b>Pesca Nova S.A.</b> Mr. Roberto Ehrens	Intensive aquaculture system planning for site in Colima, Mexico
<b>JMM Consulting Engineers</b> Mr. William Madden	International Group, project development and proposal preparation, Pakistan
<b>Southern California Edison Co.</b> Mr. Joe Kelly	Aquaculture project development and financial assessment connected with power plant effluent.
<b>KAD Partners</b> Mr. Phillip Wilson	Technical advisory services, financial analysis, and masterplan preparation connected with Kona Ocean Center
<b>WESCO</b> Mr. Scott Cressi	Development of aquaculture options for reclamation of open pit mining operation.
<b>Southern California Edison Co.</b> Ms. Barbara Oldaker	Bioengineering and design consultant for marine biology laboratory and aquarium exhibit
<b>Ponce Marine Farm</b> Mr. Gil Kendrick	Technical consulting services and financial analysis for Puerto Rico shrimp farm venture
<b>Law Offices of Reinwald O'Connor</b> Mr. Jerry Guben	Court appointed expert for appraisal of aquaculture facility value in bankruptcy proceeding
<b>Agro Productos S.A.</b> Mr. Roberto Ehrens	Planning and engineering design of commercial fish culture facility in central Mexico
<b>Montgomery Watson Engineers</b> Mr. John Knoll	Development of computerized database for tracking of documents related to litigation for the City of Los Angeles
<b>Jamaica Flour Mills</b> Mr. John Ruland	Appraisal level design and feasibility of Jamaica hatchery project in association with Shrimp Culture Inc.
<b>Pine Mountain Club</b> Mr. Lee Benevides	Preparation of lake management plan recommendations for aquatic weed control and fishery enhancement
<b>Pacific Sea Farms, Inc.</b> Mr. Amund Utne	Assessment of groundwater resources for aquaculture facilities; Oahu, Hawaii
<b>Altrix International</b> Mr. Joe Thaggard	Preparation of appraisal level design and feasibility study of integrated shrimp farming complex; Aguadulce, Panama
<b>Altrix Seafoods/Hellshire Hatcheries</b> Mr. John Ruland	Design and construction management of a 500 hectare shrimp farm expansion in Panama and a 400 metric ton shrimp hatchery in Jamaica.

**Representative Client Listing (continued)**

<b>client</b>	<b>scope of work</b>
<b>Granjas Marinas de San Bernardo</b> Mr. James Heerin	Development of environmental criteria for a sustainable shrimp farming industry in Honduras.
<b>S&amp;S Industries, Ltd.</b>	Engineering design review of pipeline and pumping station for shrimp farm seawater supply system; Madras, India
<b>ShrimpCulture, Inc. (2)</b> Mr. Ralph Parkman	Preparation of engineering design and feasibility studies for shrimp farm ventures in Mexico and Venezuela
<b>Shrimp Culture Technologies, Inc.</b> Mr. Jim Norris	Preparation of design studies for shrimp breeding facilities in Florida
<b>West Bay Law Inc.</b> Mr. Paul Wartelle	Expert testimony regarding animal rights issues involved in the sale of live finfish
<b>First Republic Corporation of America</b> Mr. Jonathan Rosen	On-going technical advisory services connected with operation of two shrimp farms in Ecuador
<b>The Fishery (2)</b> Mr. Ken Beer	Design studies and facility planning for a commercial sturgeon caviar production facility
<b>Mr. John Harvin</b>	Design study and financial analysis for intensive shrimp farming ventures in Central Florida.
<b>Sturgeon AquaFarms</b> Mr. Mark Zaslovsky	Appraisal design study and financial analysis of a venture to produce Russian sturgeon and caviar in Florida.
<b>Central American Bank for Economic Integration (CABEL)</b>	Loan monitoring and supervision for aquaculture projects in Central America.
<b>Harbor Branch Oceanographic Institution</b> Mr. Joe Mountain	Preparation of appraisal level design study for intensive environmentally controlled shrimp production in Florida.
<b>Aquanetics, Inc.</b> Mr. Sam Courtland	Design of biofiltration and other treatment equipment, technical assistance to clients.
<b>Sweetwater Shrimp Company</b> Mr Steve Geigy	Design of inland shrimp farm in Florida, including a recirculating pond system.
<b>Indian River Aquaculture, LLC</b> Mr. Don Schumman	Design of biofiltration and other treatment equipment, technical assistance to clients.
<b>SeaArk International</b> Mr. Dick Monroe	Design and implantation of high intensity shrimp rearing systems and shrimp hatchery in commercial pilot facility in South Africa
<b>The Fishery</b> Mr. Ken Beer	Planning and design of commercial intensive fish farming facilities for catfish, sturgeon, and other species