HydroMentia, Inc.

HMI Water Treatment Technologies
Harmony Creek Seafood

MISSION: HydroMentia, Inc. is an environmental management and aquaculture production company committed to the development of sustainable water treatment technologies which provide:

- Water resource management systems that contribute to the establishment and protection of a sustainable, functional environment.
- Fish production systems that provide food for human consumption in an environmentally sustainable manner.
- Achievement of desired and defined levels of profitability, as well as ensuring a fair return to the Company's investors.
- A working environment in which the Company's employees can achieve their individual objectives.
- Recognition of and contribution to the communities in which the Company operates.

VISION: Through the successful implementation of Aquatic Plant Based Water Treatment (APBWT) technology, to become the international leader in nutrient pollution control systems and environmentally sustainable food fish production.

HYDROMENTIA, INC. IS THE NATION'S LEADING DEVELOPER OF AQUATIC PLANT BASED WATER TREATMENT SYSTEMS (APBWT).

WITH RECENT IMPROVEMENTS TO BIOMASS MANAGEMENT, APBWT NOW SERVES AS THE LOW COST NUTRIENT POLLUTION CONTROL TECHNOLOGY.

APPLICATIONS INCLUDE NONPOINT SOURCE POLLUTION CONTROL, SURFACE WATER RESTORATION, WASTEWATER TREATMENT AND FISH PRODUCTION.

To demonstrate the innovative developments of APBWT, HydroMentia, Inc. showed its confidence in the technology by constructing the nation's largest, closed recirculating fish production facility in Okeechobee, Florida. Relying solely on the treatment capabilities of the APBWT technology, this zero-discharge operation has, since its construction in 1998, discharged no pollutants to surface waters - consuming only enough water to makeup for evaporation losses. Treating and recirculating 30 million gallons of water per day, this facility produces 1.5 million pounds of hybrid striped bass per year. The attributes of the system have brought praise from Florida's environmental management leaders during the critical drought of 2001, with the company being awarded a 2001 Leadership Award from the Council for Sustainable Florida.

The Company

A Commitment to Sustainability

In May 2001, HydroMentia received the Leadership Award from the Council for Sustainable Florida. To the founders and stockholders of HydroMentia, it was particularly gratifying to receive acknowledgment from Florida's leaders in business, government, and environmental management that a commitment to sustainability was not only appreciated but considered vital to the State's social and economic progress.

In Florida, as with many other regions, degradation and loss of critical resources threaten to impose serious social and economic impacts upon the State. For example, in the Orlando area, where the economy relies most significantly upon tourism, development, and clean industry, several of the largest and most important lakes, including Lake Apopka, Lake Griffin and Lake Jesup, have experienced such severe water quality degradation that property values are threatened and recreational use has been all but eliminated. In South Florida and the Keys, loss of Everglades habitat and disruption of water quality and the hydrologic balance threatens Florida Bay and several estuaries on both Florida's east and west coasts. Lake Okeechobee, which at 450,000 acres represents one of the nation's largest freshwater resources, has declined so severely that the major sports fishery has been seriously jeopardized and has further crippled an already challenged economy in many of the surrounding counties. Most recently, the nutrient pollution problem has manifested itself with widespread blooms of blue-green algae being implicated in health problems associated with drinking water resources.

These are serious problems that have gained the attention not only of Florida's environmental regulatory community but also the United States Environmental Protection Agency (EPA). In a continuing effort to implement the Clean Water Act, EPA, in coordination with the Florida Department of Environmental Protection (FDEP), recently began issuing Total Maximum Daily Loads (TMDLs) to critical surface waters. These TMDLs facilitate the setting of limits for nutrient loads to these surface waters and charge the states with responsibility for making concerted efforts to achieve these goals.

HydroMentia and Sustainability

- Economical recovery of nutrient pollutants and conversion to marketable feed products
- Long-term removal and recovery of nutrient pollutants
- Aquatic Plant Based Wastewater Treatment (APBWT) is a new technology to address new EPA TMDL standards for surface water resources
- APBWT-based fish production systems conserve water and eliminate pollutant discharges
- APBWT-based closed recirculating fish production systems eliminate fish escapement
- Aquaculture serves to reduce demands on native fisheries

SUSTAINABLE TECHNOLOGY

Meeting these new Federal limits will require sustainable technologies, meaning that the targeted nutrients and other pollutants listed in the TMDLs will need to be intercepted, removed and recycled so that there is a net removal and a sustained economically efficient disposal.

There is a saying that pollution is nothing more than a misplaced resource. Never has this been more applicable than with the most problematic of the nutrients considered in the development of TMDLs, that being phosphorus. The excess phosphorus that causes so much degradation of water quality by promoting excessive algae production and dramatic, deleterious ecological changes in native wetlands enters Lake Okeechobee at a rate nearly four times the TMDL limit. The only practical way to manage this excess on a long-term continuous basis is to transform it into a marketable product. This concept is the essence of sustainability, and it is the concept upon which HydroMentia was founded.

The Company's successful application of a technology that embraces this concept is why HydroMentia, after two and a half years of operation, was awarded the Leadership Award for a Sustainable Florida. In winning this award, HydroMentia was in distinguished company for other winners included Motorola, Inc; Montenay Power Corporation, a subsidiary of Vivendi; the City of Orlando; Gulf Power Company; The Florida Department of Environmental Protection; and Cargill Fertilizer, among others. This is an award given to established entities that have found sustainable practices to be contributory to their cost effectiveness and their efficiency of production.

Since incorporation in 1996, all involved with the development and promotion of HydroMentia have worked at an intense pace to develop and implement an exciting and innovative approach to water resource management and aquaculture. What the founders of the company sought to create was a corporation that provides marketable goods and services in a manner compatible with identifiable trends in social and economic patterns along with an efficiency that permits the Company to enjoy a sound competitive advantage.

HydroMentia has built its business plan around the belief that sustainable technologies are beginning to predominate and will soon prevail in industry, in agriculture, and in environmental management. HydroMentia has taken the mandate for sustainability and developed a business strategy around a central technology based upon the cultivation and function of aquatic plants. We refer to this technology as Aquatic Plant Based Water Treatment Technology (APBWT).

While the use of aquatic plants for the removal of water pollutants is not a new technology, the comprehensive application of systems specifically designed to permit cultivation and management of aquatic plants in a manner that ensures sustainability represents a critical refinement. HydroMentia has taken the next step in bringing this technology to commercial status by embracing an agricultural perspective to cultivation of aquatic plants. This means that system operations must be effective, efficient, and sufficiently predictable. It also means the plants must be treated as a crop with a quantifiable value, not merely as a mechanism for treating water.

APBWT has in the past always been evaluated and applied from the perspective of the engineer whose goal is focused on water treatment. HydroMentia has added the farmer to the engineer's team, with the farmer seeking to optimize crop yield, to minimize costs for harvesting and processing, and to secure profitable markets for products generated within the APBWT system. Both perspectives are essential for successful operation and critical to sustainability.

Water Hyacinth System

The Technology

Aquatic Plant Based Water Treatment

HydroMentia's Aquatic Plant Based Water Treatment (APBWT) system is founded upon the integration of two aquatic plant based water treatment technologies. The first treatment unit involves the cultivation of the floating aquatic plant - the water hyacinth. The second treatment technology involves cultivation of attached algae along a sloped floway, also known as an Algal Turf Scrubber or ATS.

The water hyacinth technology has been extensively investigated over the past three decades and is used to a limited extent in practical applications throughout the world for water treatment and biomass production.

Photo upper right

Water hyacinth unit at Okeechobee, Florida fish production facility

The water hyacinth, when grown in highly nutritive waters, serves as a matrix for a complex and dynamic ecosystem. The hyacinths themselves, as the primary producers, are responsible for significant uptake of the plant nutrients, nitrogen and phosphorus. Research has shown that hyacinths, when grown in highly nutritive water, can produce ten tons of valuable plant protein per acre, per year, or about ten times more than one acre of a typical hay crop. Bacterial populations supported in the root mass serve to oxidize biologically degradable organic compounds and to oxidize reduced nitrogen forms. In the anoxic zones of the roots, denitrifying bacteria facilitate the conversion of oxidized inorganic nitrogen to gaseous molecular nitrogen which is lost to the atmosphere. Within the system, invertebrates such as amphipods, insect larvae, and molluscs serve to remove particulate matter from the water column. These organisms are in turn preyed upon by various vertebrate populations including fish, birds, amphibians, and reptiles. This diversity of life creates a complex food web which gives the hyacinth system its incredible efficiency and high productivity.

HydroMentia's leadership in hyacinth technology comes with its staff's nearly forty years combined experience in the design and operation of commercial water hyacinth systems, as well as several patents related to system design, application and crop management.

WATER HYACINTH TECHNOLOGY

- Investigations by NASA in the early 1970's demonstrated extensive treatment capabilities
- Projects in Texas, California and Florida resulted in commercial development of technology
- Staff currently with HydroMentia designed and operated the largest commercial application in the 1980's for the City of Orlando
- Water hyacinths shown to be valuable as a livestock feed ingredient, compost substrate and in the production of biogas
- Staff currently with HydroMentia developed and patented hyacinth crop harvest strategies resulting in low cost, efficient crop management

Algal Turf Scrubber

The Technology

Aquatic Plant Based Water Treatment

The ATS technology was developed by Dr. Walter Adey, Director of Marine Laboratories at the Smithsonian Institution. Dr. Adey developed the ATS while researching nutrient control technologies for oligotrophic or low nutrient systems at the Smithsonian.

Algal Turf Scrubber (ATS) at Okeechobee, Florida fish production facility

The ATS consists of a suitably sloped substrate, typically plastic geomembrane, overlain with an attachment grid, upon which nutrient enriched waters are discharged and an algal turf is cultured. The algal turf consists of dense mats of small anatomically simple algae less than several centimeters in height. Such turfs are effective at removing carbon dioxide, nutrients and a variety of pollutants found in natural or waste water. Wave surge motion is incorporated into the ATS to enhance the exchange of metabolites between algal cells and the water medium. Critical to the performance of the system, the cultured algae must be routinely harvested to avoid succession of the algal mat to macroalgae and macrophytes. Additionally, operating parameters such as flow rates, nutrient concentration, pH and harvest strategy can be manipulated to optimize the precipitation of phosphorous onto the algal cell wall, further enhancing phosphorus treatment capacity.

As with the hyacinth treatment unit, HydroMentia's biomass management techniques allow cost effective and efficient management of the crop. Additionally, the company holds license rights to the use of harvested periphytic algae as a livestock feed ingredient and to the process for precipitating phosphorus onto algal cell walls.

Algal Turf Scrubber (ATS) Technology

- Developed by researchers at the Smithsonian Institution to facilitate coral cultivation in aquaria
- Attached algae offer high production rates in low nutrient environments and, therefore, are ideal for reducing phosphorus concentrations to very low levels
- Harvested algae is high in protein and has value as a livestock feed ingredient
- HydroMentia uses water surging to enhance algae production at its Okeechobee fish production facility
- The ATS compliments the hyacinth system by adding dissolved oxygen, stripping excess carbon dioxide, destroying pathogens, adjusting pH, and removing residual pollutants and nutrients to low levels.
- Automated harvest methods developed by HydroMentia result in low cost management of the algal crop

Synergistic Benefits of ATS/Water Hyacinth Treatment System

Together, these two technologies - water hyacinths and ATS - are synergistic and offer the following benefits that neither would offer in a singular application.

- The water hyacinth system offers a lower cost alternative for wholesale removal of nutrients down to certain limiting concentrations - usually about 1.50 mg/l for total nitrogen and 0.10 mg/l (100 ppb) for total phosphorus.
- The hyacinth lagoon system is generally less expensive to construct than the ATS and, therefore, is the logical front-end process.
- The water hyacinth system offers flow equalization and hydraulic retention, which permits consistent flow delivery to the ATS.
- Water hyacinths tend to increase dissolved carbon dioxide within the water and lowers dissolved oxygen.
- The ATS uses the carbon dioxide generated within the hyacinth pond to support algal photosynthesis. In turn, this photosynthesis contributes dissolved oxygen to the water, which renders the water more amenable to healthy aquatic ecosystems.
- The ATS has the capability of reducing nutrient levels to much lower levels than the water hyacinth system - less than 40 ppb for total phosphorous.
- The water hyacinth crop results in a high quality fiber, high protein product, which has been tested through feed trials by the University of Florida Veterinary School. Their study showed the product to be a suitable alfalfa substitute.
- The algae crop is a high mineral, high protein product suitable for supplementing protein in fish and livestock feeds. Algae are the natural feed of tilapia, a valuable aquaculture fish species.
- The integration of the two systems offer redundancy to help ensure desired performance during seasonal and operational fluctuations.
- The water hyacinth system has been shown to promote die-off of certain human pathogens. The ATS also promotes pathogen destruction with its shallow laminar flow which results in effective exposure to ultra-violet radiation.

The goal initially is to establish the following primary areas of application for the APBWT technology:

WATER TREATMENT SERVICES: Establish an industry around the removal and recovery of nutrient pollutants associated with degraded surface water bodies, with this industry supported by “pay for performance” contracts with public entities. Envisioned is a private-public arrangement with long-term obligations from an extensive customer base.

FISH PRODUCTION: Establish an aquaculture industry within Florida and other states and regions with similar climate that is compatible with sustainable practices and, therefore, could be readily permitted and assured of a long-term operational life and consistent performance.

HYACINTH CROP MANAGEMENT

A key component of the APBWT system is the continual harvesting of the hyacinth and algae crops.

In previous designs, efficient harvesting and processing of water hyacinths has been clumsy and expensive. This difficulty had always been an impediment to the advancement of the hyacinth technology. However, HydroMentia resolved these problems by designing the cultivation unit so that the transport of harvested plants was done in the same flume that carries the effluent. This permits harvesting around the pond periphery with relatively simple agricultural-type equipment. The harvested plants are conveyed by this flume to a centralized processing facility where a forage chopper reduces the plants into a homogenous material which is amenable to further processing, such as mechanical pressing, composting or drying. This proprietary crop management technique assures effective and low cost water treatment.

An example of these efficiencies is the Okeechobee Fish Production Facility where the harvest system permits the harvesting and chopping of water hyacinths at a rate of up to 10 - 20 wet tons or 0.5 - 1.0 dry ton per man-hour. During peak growth months, over 20 wet tons of hyacinths and 5 wet tons of algae are harvested daily.

As a livestock feed ingredient, the hyacinth biomass is valued at an estimated $115/dry ton. Consequently, at this rate of harvest, income from the sales of processed biomass more than pay for the cost to process, store, market, sell, and transport the plant biomass. Therefore, phosphorus is permanently removed from the treatment system without production of a residual destined for management as a waste product. The net result is a low cost, sustainable nutrient pollution control technology.

This level of efficient harvest and initial processing is critical to the viability of an APBWT system. As noted, it is this facet of system management that in the past has been inadequately addressed by the engineering community.

"This proprietary crop management technique assures effective and low cost water treatment"

ATS Crop Management

At the ATS, a similar crop management approach is applied. Standard four-wheel ATV's are used with either a modified plow or in tandem using a drag to move algae from the growing matrix into a receiving flume where the filamentous material is picked up by a automatic rake at a centralized harvesting station. This material is then conveyed to a bunker where it is available for further processing.

A crew of two persons with two ATV units can harvest approximately one acre of ATS in one hour, resulting in a harvest of about 5 wet tons or 0.5 dry tons. This material is about 30% protein on a dry weight basis, with a value of approximately $175/dry ton as a livestock feed ingredient.

Photo left

Dislodged algae filaments are moved into a conveyance flume and transported via water to a centralized harvesting station.

Photo left

Attached algae cultured on the ATS is severed during harvest and conveyed to an automated central harvesting station.

Plant Biomass Markets

Photo above

High protein filamentous algae produced on the algal turf scrubber in Okeechobee, Florida.

Experience has provided indication that a livestock feed is the most effective use of the material. The feed product could be either a dried product, which would offer the benefit of long-term storage capability and a nationwide market, or a pressed greenchop product at about 75% moisture to be used locally. The greenchop offers the advantage of lower production costs and lower capital investment for processing equipment. Other uses for the water hyacinth and algae products include soil amendments, compost and substrate for biogas production. In addition, further research into the nature and uses of extracts and fiber may allow identification of value-added products.

Presently at the Okeechobee fish production facility, the algae and hyacinth harvest primarily is being composted on site and is not being marketed or sold. However, a portion of the crop is being transported weekly for incorporation into local livestock diets. In the future, when large regional systems are in place, comprehensive crop sales programs will be instituted to market the feed product to local end-users and feed mills.

Both water hyacinths and periphytic algae have been used as livestock feed, although typically not on a commercial scale due to inadequate product supply. In support of these livestock feed experiences, a number of feed trials of dried water hyacinth have been conducted including one completed by the Florida Department of Agriculture and Consumer Services (FDACS) on dairy and beef cattle and one by the University of Florida School of Veterinary Medicine on rabbits. Both studies revealed that the product has value as a feed ingredient. Whereas the processed water hyacinth is similar in characteristic to alfalfa, the algae tend to be higher in protein (often over 30% on a dry weight basis) and lower in fiber. The protein content of water hyacinths depends upon the nitrogen level of the water in which it is grown. Typically levels range from 12% to 22% on a dry weight basis. An assessment of the value and market potential of the dried hyacinth product by HydroMentia revealed its worth at between $100 to $125/dry ton. The algae would have a higher value as a livestock feed, with the potential value approaching $300/ton as a direct fish feed substitute.

TMDL
Wastewater Treatment
Surface Water Restoration

Water Treatment Services

Market Opportunities

In promoting its APBWT technology, HydroMentia adopted a phased approach. The first phase was designed to demonstrate the effectiveness of the APBWT technology within a zero-discharge recirculating fish-based aquaculture facility. Today, the APBWT technology is marketed for a variety of applications, including both commercial aquaculture and water treatment programs, in which it serves as a new technology for meeting federally mandated TMDLs.

HydroMentia is developing the APBWT technology around the vision of long-term operational water treatment contracts in which HydroMentia will provide design and operational services. Public entities will be afforded the opportunity to enter into public-private partnerships for water treatment services where risk is shared with the private sector through "pay for performance" contracts.

Education is the first step towards realizing the potential of APBWT. Primary stakeholders must be made aware of APBWT and its numerous benefits that include cost, sustainability, unlimited system capacity and the potential for "pay for performance" contracts. The company is currently actively engaged in educating stakeholders including public entities such as Florida's Water Management Districts, the Florida Department of Environmental Protection (FDEP), the Florida Department of Agriculture and Consumer Services (FDACS), local governments, and federal agencies such as the Environmental Protection Agency (USEPA) and the Department of Agriculture (USDA). Soon the education process will expand to include both municipal and private clients such as dairy farmers, citrus producers and public and private stormwater utilities.

APBWT FOR SURFACE WATER RESTORATION
IMPLEMENTATION CONSIDERATIONS

- Potential customers include public entities such as a water management districts, stormwater utilities, specially created authorities, local government coalitions and the federal government.
- APBWT treatment facility would serve as a central component of a larger surface water reclamation program and could be publicly or privately capitalized.
- HydroMentia to provide customer a comprehensive package to include system design, construction, and operation.
- Facility can be operated under a long-term "pay for performance" contract. The performance standard would be $/pound of phosphorus removed or other quantifiable unit. This strategy protects public dollars, assuring money is expended only for performance.
- Biomass generated from facility to be processed, marketed, sold and distributed by the operator. Dependent upon nature of contract, fee reduction could be integrated into return from sales.

APBWT

Technology Advantages

Sustainability

Intensively managed aquatic plant systems capture nutrient pollutants and incorporate them into new plant growth that is harvested and processed into marketable end products. Nutrients of concern are thereby removed from the system, eliminating the potential risk of future release that exists with treatment systems where nutrients such as phosphorus are stored in sediments or plant tissue. As nutrients are continuously captured and removed from the system, the system's treatment capacity remains sustainable over an indefinite period of time.

Phosphorus Treatment Capabilities

Having evolved in low nutrient oligotrophic natural systems, periphytic algae have been shown to effectively reduce phosphorus concentrations to levels below 10 parts per billion.

System Cost Advantages

APBWT offers an innovative and unique approach to nutrient pollution control. No other technology has been shown to reduce nutrient pollutants to such low levels (10-30 ppb total phosphorus) while generating a marketable commodity. These goals are achieved while capital and operating costs are less than 20% of that estimated for systems of equivalent hydraulic capacity in the municipal water pollution control industry.

Passive wetland treatment systems currently serve as the only technology employed on a large scale to achieve new low-level phosphorus TMDL standards. However, a number of major challenges confront passive wetland systems including: (1) long-term effectiveness (sustainability without management), (2) large land area requirements, (3) overall system costs when land acquisitions costs are included and (4) impacts to communities when land is taken off the local tax roll and out of productive use. APBWT systems address these challenges.

Minimal Land Requirements

APBWT systems treat on a sustainable basis an equal or greater volume of nutrients than conventional stormwater treatment areas (STA) while requiring 5-10% of the land area. Used in combination with STAs, APBWT enhances the biological diversity of the fauna and flora of the wetland system through reduced nutrient loads and extends the life of the STA as a diverse wetland.

Environmentally Beneficial End Products

Harvested plant biomass can be converted into livestock feed, soil amendments, biogas and other marketable environmentally friendly products. Environmental concerns associated with the management of sludge generated in chemical treatment facilities are eliminated.

Commercial Success

Over the past two decades, managed aquatic plant systems have been successfully operated for nutrient pollution control in commercial scale domestic wastewater treatment applications in California, Alabama and throughout Florida. The APBWT currently serves as the sole water treatment technology employed at one of the world's largest closed recirculating aquaculture facilities located in Okeechobee, Florida.

Recycling and Exporting Nutrients

By recycling nutrients into marketable end products, use of the plant biomass as livestock feed and soil amendment may decrease regional fertilizer demands, thereby reducing incoming nutrient loads to the region. In nutrient poor regions of the world, valuable nutrients can be captured and recycled back to the environment.

Two System Redundancy

The combination of water hyacinth systems with ATS offers significant advantages, which would not be available with just a single aquatic plant or conventional physical-chemical-biological systems. The most obvious of these advantages is redundancy, which provides greater system reliability and the ability to manage high volume waste streams with low levels of nutrients.

Research Proven

For nearly three decades, researchers at the Smithsonian Institute have researched and developed methods for optimizing nutrient uptake using algal turf systems. More research has been performed on the control and utilization of water hyacinth than perhaps any other aquatic plant. In the 1987 book titled Water Hyacinth, Gopal provides a comprehensive bibliography of 2700 references for hyacinth research through the mid-1980's.

Unlimited Facility Capacity

APBWT patented systems can be constructed to accommodate flows from several thousand gallons per day to over 100 million gallons per day.

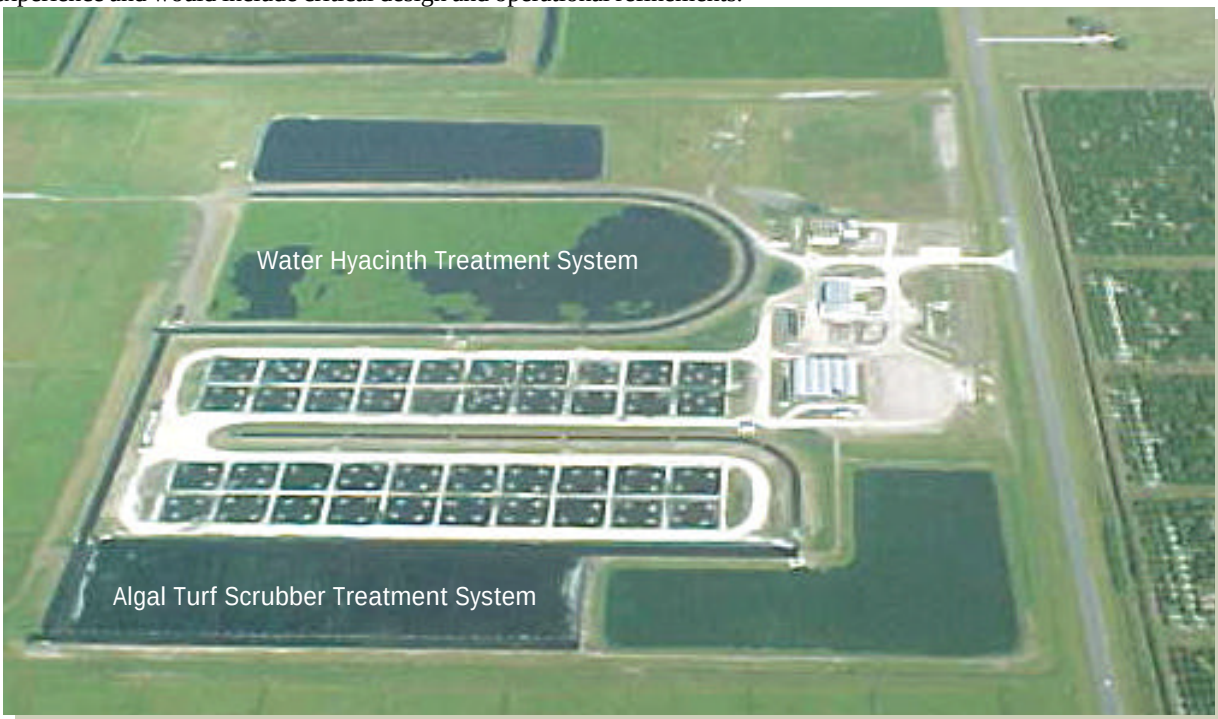
Okeechobee, Florida
Case History

Fish Production

The First Commercial Application of APBWT

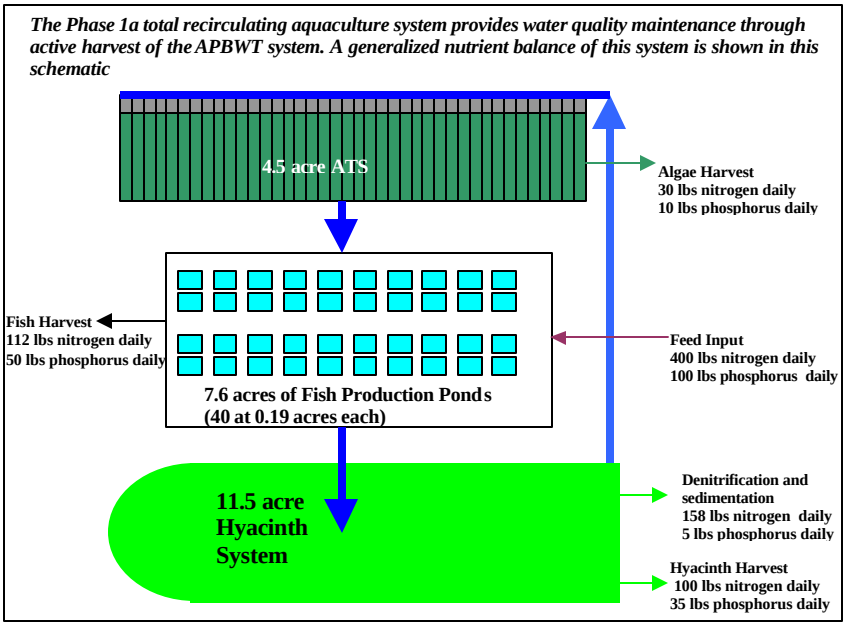
By the first quarter of 1998, HydroMentia had selected a site for its first demonstration of the APBWT technology. The application would be a zero-discharge fish production facility located in Okeechobee County, Florida. This site was selected because of its agricultural-based economy, its ideal climate, its proximity to the Florida Turnpike and I-95, and the fact that the region is plagued with serious water quality problems, primarily associated with Lake Okeechobee and the Everglades to the South. It is, therefore a targeted region for the marketing effort associated with the second phase of business development.

By the summer of 1998, the facility design was complete and permits had been obtained from the South Florida Water Management District (SFWMD), the Florida Department of Environmental Protection (FDEP) and the Florida Department of Agriculture and Consumer Services (FDACS). At this time a decision was made to build the facility with half of its planned total capacity - Phase 1a - with the intent that a smaller investment was justified until design and operational refinements could be made. The facility Phase 1b expansion would therefore benefit from the Phase 1a experience and would include critical design and operational refinements.



The construction of the Okeechobee Fish Production Facility was initiated in July of 1998. By November 1998, fingerlings were brought into the facility. At that time two species were targeted - tilapia and hybrid striped bass. Tilapia were selected because of their fast rate of growth and because there was a sizable market for live tilapia in the United States and Canada. Hybrid striped bass were selected because of the high price they demanded in the market, and the fact that the identifiable market was sizable, stable and expanding. Facility construction was completed in May 1999.

In November of 1999 the facility began generating sales. By late 2000 it became evident that though the facility design allowed for the efficient production of both species, hybrid striped bass provided a greater return. By the beginning of 2001, the facility was totally committed to hybrid striped bass production.



The success of the Okeechobee facility is attributable to the ability of the APBWT system to maintain water quality. Every day nearly 9,000 pounds of pelletized feed are delivered to a fish stock of about 900,000 pounds. Without an ability to remove the pollutants associated with such a massive loading, water quality would quickly deteriorate. However, the facility is sustained by APBWT technology consisting of an 11.5 acre water hyacinth system followed by a 4.5 acre ATS, which together remove about 288 pounds of nitrogen and 50 pounds of phosphorus every day. This removal permits maintenance of desirable water quality conditions while recirculating about 30 million gallons of water daily with zero water discharge.

FISH PRODUCTION OKEECHOBEE, FLORIDA

- Production of 1.5 million pounds of hybrid striped bass annually
- Harmony Creek brand recognized as among the best in the industry
- Standing crop of 900,000 pounds of fish consume approximately 9,000 pounds of high protein feed daily
- State-of-the-art AKVAsmart centralized feeding system ensures effective use of feed
- Packaging on-site in USDA approved facility
- System water volume of over 40 million gallons with recirculating rate of about 30 million gallons daily with zero discharge
- Daily harvest of 15-20 wet tons of water hyacinth and 2-5 wet tons of algae removes excess system nutrients and organic compounds

Photo left

Forty 1/4 acre production ponds provide required growing conditions for the fish stock at the Okeechobee facility.

Photo right

An AKVAsmart automatic feeding system at the Okeechobee fish production facility. This is the first land-based application of this technology in the U.S.

Hybrid Striped Bass
Tilapia

Sturgeon
Other Species

Fish Production

Market Opportunities

Decreasing Production Costs and Unrestricted Growth

It is obvious those aquaculture companies that produce fish for market at the lowest cost experience a competitive advantage. When combined with high quality marketing, sales, processing and distribution, these companies typically gain market leader status. However, in order to maintain the market leader position in a rapidly expanding marketplace, a company must sustain its position as a low cost producer while expanding production capacity. This requires continued access to adequate resources for growth.

HydroMentia believes it is well positioned to become a future market leader as a food fish producer due to the potential for significantly decreasing production costs and the unlimited growth potential associated with systems incorporating the APBWT treatment system.

The water treatment technology employed by HydroMentia represents what the company believes to be the lowest cost wastewater treatment alternative for aquaculture effluents. **Exclusive of pumping costs, water treatment operating costs at the Okeechobee facility represent less than 3% of the fish production cost**.

In addition to the low cost of operation, the APBWT technology eliminates nitrates and other compounds that often buildup within recirculating systems. The net result is that treated aquaculture effluent may be either returned to the fish farm, operating the facility as a 100% closed system, or the effluent may be treated to levels at which the release is not deleterious to the receiving water. In either system, expansion of the fish production facility can normally continue unimpeded by environmental regulations.

Fish Escapement

As a closed recirculating system, concern over fish escapement is eliminated. This offers the potential for both reducing losses and expanding the types of fish cultured to include non-native species and genetically modified fish. To feed the world's burgeoning population, many agriculture experts agree that genetically modified food products are necessary and will become commonplace. Today, genetically modified grains are prevalent in consumer foodstuffs processed from United States-produced grain products; meanwhile, pharmaceutical corporations specializing in agricultural production in the United States and Europe widely publicize the future of genetically modified grains. In the near future, the United States Food and Drug Administration (FDA) may approve genetically modified fish for human consumption. The race will then begin for market dominance in culturing genetically modified fish that can be grown to market size in a fraction of the time and, therefore, at a fraction of the cost.

Future market leaders of fish products will likely employ closed recirculating systems that eliminate escapement concerns, thereby enhancing existing fish production techniques including net pens and flow-through systems. Enhanced fish growth rates will significantly reduce fish production costs in closed recirculating systems, thereby making them cost competitive with net pen and flow-through production technologies.

Internal Feed Production Capabilities

Nutrient wastes generated from fish or other sources are converted to plant biomass within the water hyacinth and algal turf scrubber treatment systems. Feed trials with tilapia at the Okeechobee facility demonstrated that fish cultured exclusively on periphytic algae produced within the ATS water treatment systems gained weight and remained healthy throughout the trial. In excess of 15,000 pounds of tilapia fed exclusively algae were then packaged and sold and well received by the market. Additional trials and nutritional studies are required, but the potential exists to produce tilapia at production costs lower than that of foreign producers.

Fish Production

Technology Advantages

Low Cost Treatment Technology

- APBWT serves as an agriculture-based water treatment technology employing conventional agricultural technologies including crop management, harvesting and processing.
- Low labor costs due to agriculture-based technology. Simple tasks required of operators.
- APBWT technology nutrient not hydraulic limited, therefore treatment cost does not increase exponentially as hydraulic load increases. This allows fish production at lower densities than recirculating aquaculture systems applying conventional water treatment technologies.

Total Nitrogen Control

- Technology allows for both nitrification and denitrification, thereby eliminating the buildup of nitrate typical of closed recirculating aquaculture operations.

Unrestricted Growth Potential

- Non-polluting, land-based system design with fish escapement eliminated. Local communities support clean aquaculture technology and resulting creation of jobs and benefits to local economy.

Fish Escapement Concerns Eliminated

- Land-based total recirculating aquaculture eliminates escapement concerns allowing for culture of a wide variety of species to potentially include genetically modified species.

Freshwater or Saltwater Systems

- Water treatment capabilities for both freshwater and saltwater systems.

Outdoor Production Systems

- Cultured in outdoor earthen ponds, the system benefits from both low cost construction and oxygen systems (paddlewheels).
- Fish cultured in outdoor clear water (no phytoplankton blooms) display increased coloration, hence greater market appeal.
- Production of oxygen by the ATS reduces energy demands for maintaining dissolved oxygen levels.

Feed Production Potential

- Periphytic algae produced within the ATS may be utilized as a food source for species such as tilapia.

Quality Control

- APBWT limits the presence of phytoplankton within the fish production ponds, thereby controlling earthy off-flavor typical of extensive pond systems.

"Additional trials and nutritional studies are required, but the potential exists to produce tilapia at production costs less than that of foreign producers."

Harmony Creek Seafood

www.harmonycreekseafood.com

Since entering the market in early 2000, the company quickly established a reputation for superior quality product. The product characteristic that has forged this superior standard is the brilliant sheen of the fish which is a direct result of being cultured in high quality water in an outdoor facility. Hybrid striped bass produced in indoor recirculating systems and outdoor extensive pond systems with heavy phytoplankton blooms are shaded from the sun. The result is that fish cultured by these methods lack the brilliance of the contrasting lateral lines of the wild striped bass. Cultured in shallow outdoor ponds that are flushed four to six times per day, striped bass produced in the HydroMentia facility exhibit brilliant contrasting coloration that enhances brand positioning and visually demonstrates product quality.

Total annual fish sales presently are targeted at nearly 1.5 million pounds. Fish are sold in the round, ranging in size from less than one pound to over two pounds. To assure superior quality, the product is packaged on site in a state-of-the-art facility meeting stringent Hazard Analysis Critical Control Plan (HACCP) guidelines. While hybrid striped bass are better known in mid-Atlantic, northern U.S. and Canadian markets, HydroMentia is rapidly developing a reliable market for the Harmony Creek brand in Florida.

Photo above

Hybrid striped bass with brilliant sheen typical of APBWT-based systems

Photo below

Packaging fish in the state-of-the-art facility in Okeechobee, Florida

The People

HydroMentia, Inc.

Founder…….. Whitfield M. Palmer, Jr.

Whit Palmer's leadership and focus on sustainable fundamentals provides the foundation for the company.

"Committed to making a difference"

HydroMentia, Inc., a Florida corporation, was formed in 1996. Its two principal founders are the Panoz group of Braselton, Georgia, and the Palmer group of Ocala, Florida. These two groups provided initial start-up funds as well as the exclusive proprietary licenses of the two biological systems--Algal Turf Scrubber (ATS) and Water Hyacinth System.

The Palmer group is headed by Whitfield M. Palmer, Jr. who has been active in mining and real estate in Florida. Mr. Palmer, a third generation Floridian, is also involved in numerous business, political, educational and philanthropic activities, principally in Florida. The Palmer group supplied the proprietary rights to the Water Hyacinth System. Mr. Palmer serves as President and Chairman of the Board of Directors.

The Panoz group is headed by Donald E. Panoz who was the founder of both Mylan Drugs and Elan Pharmaceuticals of Ireland. Mr. Panoz is also active in real estate development in the United States, as well as the Panoz Motor Group. The Panoz group supplied the proprietary rights to the Algal Turf Scrubber (ATS) that had its origin in the Smithsonian Institution. Mr. Panoz also serves as a Director of the Company.

Key management personnel include E. Allen Stewart, III, Chief Operating Officer and a Director of the Company. Mr. Stewart, a biologist and a professional engineer, is recognized as the leading developer of managed aquatic plant based water treatment systems. Mark J. Zivojnovich serves as the Vice President of Marketing and Sales. Combined Messrs. Stewart and Zivojnovich have nearly 40 years experience in the design, development and management of commercial aquatic plant based water treatment systems. Management also includes other biologists, aquaculturists and limnologists.

Other members of the Board of Directors include:

Walter Hamilton Adey, Ph.D. . . . Dr. Adey has degrees from MIT and the University of Michigan. He is presently serving as Director of Marine Systems Laboratory, Museum of Natural History, Smithsonian Institution. He is widely published and well known in the field of Marine Biology. For more than two decades, Dr. Adey had been the leading researcher investigating the use of algal turf scrubbers for nutrient pollution control. In 1982 Dr. Adey was awarded Patent No. 4,333,263 that served as the foundation for algal turf scrubber technology.

J. Allison DeFoor, II . . . Mr. DeFoor is a graduate of Stetson Law School. As a member of Governor's Growth Study Commission, South Florida Ecosystem Restoration Task Force and Governor's Commission for Sustainable Florida, he has taken a leadership role in negotiating programs for Everglades Restoration.

Louis E. Fischer . . . Mr. Fischer, a graduate of Brown University, has been actively involved in leading several major development companies and organizations. He was responsible for one of the first major wetland mitigation projects in Florida.

Richard D. Purgason . . . Mr. Purgason, a chemical engineer previously active in the aquaculture industry, provides experience in the day-to-day operation of a tilapia farm using the ATS technology. Mr. Purgason has operated several commercial-scale systems and, based on developments from these projects, has obtained numerous product, method and equipment patents relating to the use of ATS technology. In addition to being a member of the Board of Directors, he also serves as Vice President.

Kenneth R. Tefertiller, Ph.D. . . . Dr. Tefertiller, an agricultural economist, has degrees from Oklahoma State University and the University of Illinois. He served for seventeen years at the University of Florida as Vice President of its Institute of Food and Agricultural Sciences and recently retired as a professor of its Department of Food and Resource Economics.

Michael W. Wilkinson . . . Mr. Wilkinson is currently President of MFM Industries, Inc. and a Certified Public Accountant in Florida.

E. T. (Travis) York, Ph.D. . . . Dr. York received degrees from Auburn University and Cornell University. He presently serves as Chancellor Emeritus of the State University System of Florida. Dr. York has had a distinguished career in Agriculture Education and has served on numerous boards of both non-profit and commercial ventures. He received an honorary degree from Ohio State University for his work concerning world hunger and has been the recipient of many other honors for his contributions to the development of agricultural and food systems worldwide. Most recently, in recognition for his efforts in combating world hunger, the Biographical Centre in Cambridge, England, has named Dr. York the "International Scientist of the Year" for 2001.

FOR THREE DECADES, THE HARVESTING AND PROCESSING OF AQUATIC PLANTS USED FOR WATER TREATMENT HAVE BEEN CLUMSY AND EXPENSIVE.

THIS DIFFICULTY HAS REMAINED THE SINGLE GREATEST IMPEDIMENT TO THE ADVANCEMENT OF AQUATIC PLANT BASED WATER TREATMENT SYSTEMS (APBWT).

DISCOVER INSIDE HOW HYDROMENTIA HAS RESOLVED THESE PROBLEMS THROUGH DEVELOPMENT OF AN EFFICIENT CULTIVATION AND PROCESSING SYSTEM THAT MAKES APBWT SYSTEMS THE LOW COST ALTERNATIVE FOR NUTRIENT POLLUTION CONTROL.