

# New real-time monitoring technology assists hatcheries in successful productions

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The measurement of dissolved oxygen, temperature and other production attributes are an essential component of successful hatchery practices. Numerous studies and industry experts credit the monitoring of these attributes to growth, survival, feed efficiency, water chemistry requirements and the overall effect on hatchery production. What can be a manual process often limited by employee availability, accuracy and the ability to efficiently move from tank to tank or pond to pond is now being monitored remotely and in real-time.

The Aquasend Beacon™ collects and radio transmits water oxygen and temperature measurements for real-time water-quality management. The Beacon is solar powered, fouling resistant and designed to withstand the harshest of weather and farming environments. The innovative technology includes an optical oxygen sensor developed by Aquasend's parent organization, Precision Measurement Engineering, Inc. (PME).

The optical oxygen sensor contains an optode that measures lifetime-based luminescence quenching of a thin membrane. The sensing foil contains a coating that has a variable fluorescence that depends upon oxygen concentration in the surrounding water. The sensor can compute oxygen concentrations in mg/L.

The Beacon's optical oxygen sensor is factory calibrated to maintain accuracy for more than 12 months. Its LED lights correspond to prescribed water-quality levels and provide a visual notification of changing conditions. The sensors are integrated with a cloud-based data platform that allows farmers to receive preset alerts and alarms in real-time from any global location via GPS positioning, by phone, tablet or laptop.



## Three benefits of hatcheries implementing consistent monitoring methods

Development and testing of the Beacon has been an ongoing process dedicated to deployment and data collection in varying hatchery and farming environments. Throughout the testing, data collection and distribution process, three distinct benefits have been identified by farmers and industry experts.

### **Benefit one**

Collecting data to be used for consistent growth and using it daily, weekly and monthly to access and determine farm best practices. It is important to monitor oxygen and temperature continually and log data over time to determine optimum stocking rates, fish health and other feeding rates. The Beacon can protect against catastrophic low oxygen levels and chronic sub-optimum conditions that impact fish health and growth.

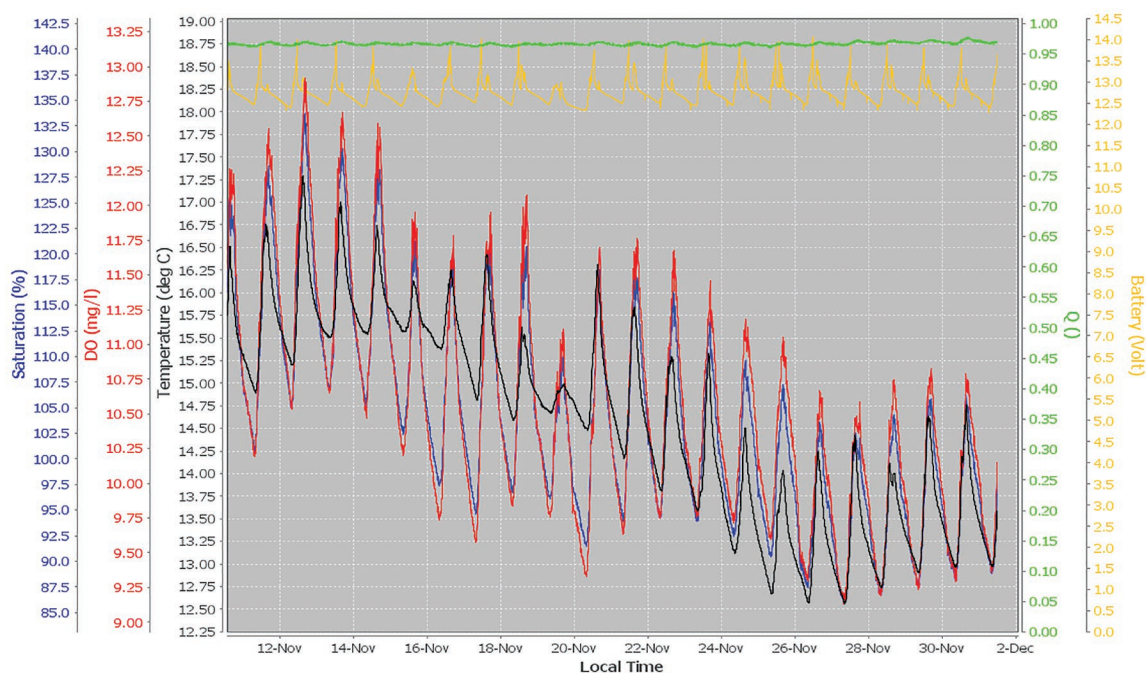


Figure 1. Overall trend data obtained while monitoring water temperatures and verifying the aeration system.

### **Benefit two**

Understand oxygen levels in ponds and tanks and the impacts of these levels on production numbers and successes. Typically, when oxygen depletes, farmers do not feed. Not feeding equals less growth and lower weights at harvest. By knowing the precise oxygen conditions, feeding rates can remain optimal and can ensure faster growth. By ensuring optimum conditions, survival rates or livability will increase. It is noted by farmers that when lost growth is averted, Beacon costs can be recouped in one season and potentially from one tank or pond. ROI is fast and can be calculated.

### **Benefit three**

Insurance for farmers and peace-of-mind to not lose crops. Crop insurance is expensive or simply not available for an aquaculture project. The Beacon alerts staff of lethal low oxygen conditions and prevents fish deaths.

By installing a reliable state-of-the-art monitoring system, test farms have indicated the following calculable results: labor is reduced, feed cost savings are realized, and fish growth and survival rates increase.

### **On-going research and development**

A literature review of hatchery-specific research confirmed that the percentage of dissolved oxygen

available is monitored from fertilization until the start of feeding and beyond. These studies, of varying species, identify the impact of dissolved oxygen levels in various research settings, from cold water recirculating aquaculture systems to low oxygen levels and the correlation to hypoxic stress and hatchery environments where dissolved oxygen levels were controlled to determine the effect of dissolved oxygen concentration on the development and survival of eggs and fry.

Using this research and countless interviews with farmers, industry professionals and through the deployment and data collection phase of the Beacon, farmers expressed the value of the data but indicated the solar-powered design of the Beacon to be prohibitive in covered hatchery environments. Using this information, the Aquasend team has developed a Beacon 2.0 design that is hard-wired and includes real-time data collection, alerts and access.

Currently deployed at a hatchery in California, USA, the Beacon 2.0 is performing to the standards of the Beacon. Beacon 2.0 can be used in both tanks and ponds where power is available. Product design parameters are currently being tested for mobility and readings can be collected from 8 feet from the water's edge or side of the tank.

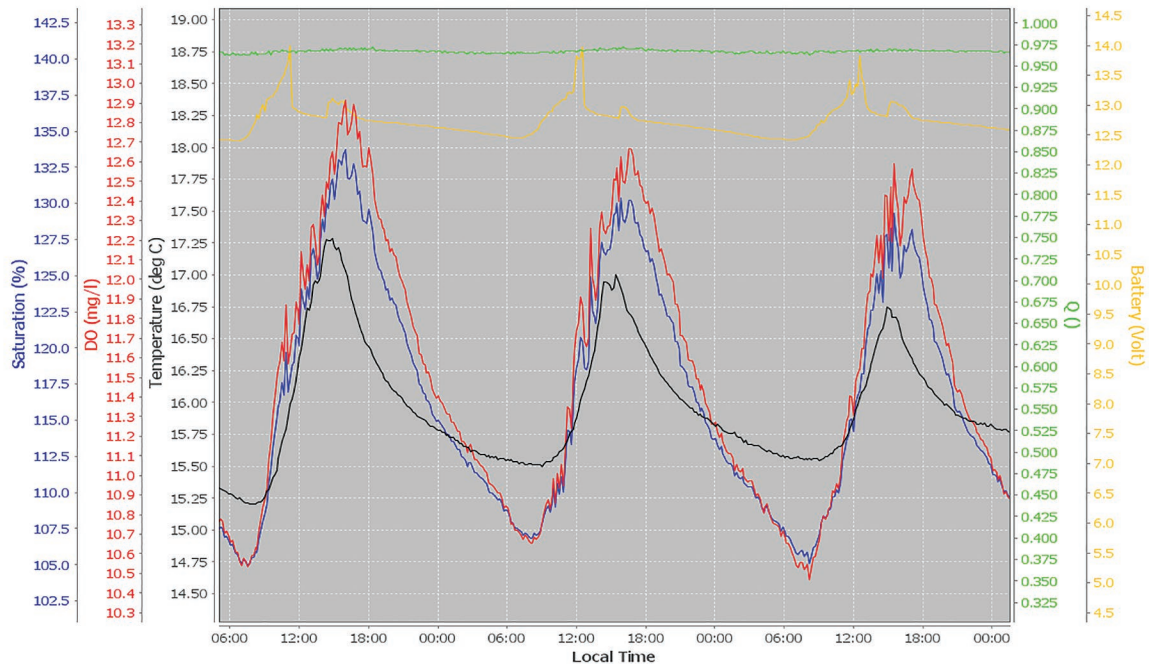


Figure 2. Hourly trend data obtained while monitoring water temperatures and verifying the aeration system.

### Data collection and interpretation made easy

Collected data can be accessed in varying intervals. Data in Figures 1 and 2 were collected from a test location with the long-term goal of monitoring water temperatures and verifying the aeration system was working properly. The farmer monitored each variable for eight to ten weeks prior to the introduction of hatchlings.

Figure 1 describes the long-term approach to data collection. This 20-day interval reveals a downward trend in water temperatures and dissolved oxygen that informed the farmer conditions would soon be adequate for the introduction of hatchlings.

Figure 2 describes an hourly, detailed view of each variables' daily cycle within the hatchery. This data was used by the farmer to determine the most efficient and effective feeding and aeration schedules for the hatchery. The real-time data also allows the farmer to gain immediate feedback on any changes that are made to operations.

Data can not only be viewed in real-time via the Aquasend dashboard but data can also be exported and sent to customers for detailed analysis and longitudinal insights.

### Conclusion

From instantaneous data to the ability to correlate collected data and make cost saving and revenue increasing decisions for your overall production process, the Aquasend Beacon™ is revolutionizing a hands-off approach to monitoring. This state-of-the-art technology provides much needed peace of mind, while simultaneously accessing multiple areas of the growing cycle where beneficial interventions and adjustments can be made. Consistent, real-time monitoring of dissolved oxygen and temperature, two major attributes, whose fluctuation can be costly, is a proven necessity.

*References available on request.*

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