

Application of Aanderaa AquaOptode in Urban Aquaculture Shrimp Farming

Food security is a worrying issue faced by most country's governments worldwide, particularly as human population growth, and its concomitant food demands, just surpassed 8 billion people. To make matters worse, climate change-induced erratic weather patterns and unsustainable farm practices have exacerbated problems in global food supplies. Many countries have begun to diversify food security both through international trade policy as well as technology. Similarly, offshore, marine food supply has been declining due to unsustainable fishing practices and coastal pollution. Although designated "no fishing" marine park sanctuaries have allowed some marine habitats to slowly recover, the demand for seafood continues to increase, and thus urban aquaculture has stepped in to help support this demand for seafood, both locally and globally.

Vertical Oceans, an aquaculture startup company, embraces the vision of vertical urban aquaculture. They are developing and growing sustainable shrimp in huge "aqua towers", which can be located inside cities, potentially in facilities that resemble downtown skyscrapers. The towers can incubate shrimp without chemicals or antibiotics, and the shrimp can be grown anytime of the year, regardless of season. So far, the startup has delivered harvests from its initial proof-of-concept facility and has recently expanded into a new facility on the main island of Singapore, where it will develop its technologies to full scale.

Their objective in Singapore is to demonstrate that the core biological concept of their technology works, and that it can produce a product suitable for even the fanciest of fine-dining restaurants.

Dissolved Oxygen (DO) plays an important role in aquaculture production, especially in shrimp farming. Failure in responding to low DO levels can quickly result in heavy losses in shrimp yield. Therefore, it is essential to adopt continuous DO and temperature monitoring to ensure levels are maintained at optimal conditions (see Figure 1).



Figure 1: Aanderaa AquaOptode 4531 deployed in shrimp tank for continuous dissolved oxygen and temperature measurements.

Xylem Water Solutions Singapore Pte Ltd has worked with Vertical Oceans from the beginning at their proof of concept facility in St. John's Island (see Figures 2 & 3). They tested a number of different DO sensors, comparing performance and accuracy, but ultimately Xylem's **Aanderaa Aquaoptode** emerged as the preferred DO sensor to be used in the expanded facility on mainland Singapore (see Figure 1). Aanderaa's Aquaoptode 4531 is an optical DO smart sensor, which measures temperature and DO levels based on the luminescence quenching principle. The fluorescent indicator is a special Platinum Porphyrin complex embedded in a gas permeable foil that is exposed to the surrounding water. This sensing foil is mounted on a Sapphire glass window providing optical sampling from inside a water-tight housing. Unlike other optical DO sensors which requires the change of membrane caps annually, the sensing foil only needs to be replaced if it is physically damaged.

The Aquaoptode undergoes a 40-point calibration in 0 - 120% air saturation, and water temperature ranging from 1°C to 30°C. This allows long term stability and low drift measurements. Stability in measurements means low risk in activating false alarms which are often seen in galvanic DO sensors. The cleaning frequency of these sensors has been reduced significantly compared to other sensors, and requires only **one in air adjustment per year**, thus reducing operational costs and labor and time investment.



Figure 2: During the selection for suitable dissolved oxygen and temperature sensor, Aanderaa **4835 Optode** and **4319 Conductivity** sensor connected with **Smartguard** were deployed and tested in the Vertical Oceans' facility.



Figure 3: Proof-of-concept facility in St. John's Island, Singapore.

Aanderaa Data Instruments AS

Sanddalsringen 5b
P.O. Box 103 Midtun
5843 Bergen, Norway

+47 55 60 48 00
aanderaa.info@xylem.com
Aanderaa.com

