AN #: 17_004_14_001
Market: Aquaculture
Subcategory: Shellfish
Product: HI98196

Monitoring Water Quality in Pearl Farming

Description

For thousands of years, many cultures have recognized the beauty and value of pearls. Historically, pearls were gathered by searching various species of marine and freshwater bivalves. Natural pearls are extremely rare, found only once in every 2000 pearl oysters. In the early twentieth century, prompted by the high value and scarcity of natural pearls, Japanese researchers developed aquaculture methods that brought pearl production under the control of humans. These pearls, known as "cultured pearls," are typically larger and more consistent in size and color than natural pearls. To ensure that high quality pearls are produced, pearl farming techniques and practices are highly regulated.

Global climate change has significantly impacted pearl oyster farms. As atmospheric carbon dioxide levels increase, diffusion of carbon dioxide into ocean waters also increases, forming carbonic acid. The increase in acidity has been proven to inhibit shell growth in marine animals and is suspected to be the cause of reproductive disorders in fish. Over the past 300 millions years, the ocean's pH has remained constant at approximately pH 8.2. In just the last 200 years, the ocean's pH has dropped to pH 8.1. A decrease of 0.1 pH units is not as insignificant as it seems; since pH is based on a logarithmic scale, one pH unit represents a ten times change in hydrogen ion activity. In an ecosystem as sensitive as the ocean, a 0.1 pH unit change has drastic consequences. Small variations in the ocean's pH can vary at different points throughout the year due to seasonal upwelling and natural gradients. Oyster larval development is especially sensitive to these changes in pH, causing high larval mortality.

The increase in atmospheric temperature has also resulted in rising sea surface temperatures. Warmer waters in lagoons decrease the pearls' lustre and ultimate value. Additionally, parasites grow favorably in warm temperatures, causing additional stress on the oysters. Warming waters has also resulted in lower dissolved oxygen levels in ocean waters. As water temperatures rise, the solubility of dissolved gasses decreases. Lower available oxygen forces competition among lagoon organisms for oxygen to breathe. A constant supply of oxygen is important to the health of a pearl oyster in both the lagoon and during oyster transport.

Recommended levels of dissolved oxygen for pearl oysters in lagoons and transfer containers is above 5 mg/L. In order to ensure oxygen demand in lagoons isn't too high, guidelines for oyster spacing and depths are regulated to ensure that pearl oysters receive enough food and oxygen. During transport, because the volume of water and amount of available oxygen is low, these containers are frequently monitored and aerated to ensure adequate oxygen levels. Transport containers must also be closely monitored for organism death. If an organism perishes and is not removed from the container, the excess organic material will decompose, consuming oxygen and producing toxins that could harm the living oysters.

Application

A pearl farmer in the South Pacific contacted Hanna Instruments for a portable solution for monitoring the pH, temperature, and dissolved oxygen in their lagoons and transport containers. Hanna Instruments recommended the **HI98196** Portable pH/ORP, Dissolved Oxygen, and Temperature Meter. Since many factors affect dissolved oxygen readings such as atmospheric pressure, salinity, and temperature, the customer was pleased that the HI98196 featured a built-in barometer, manual salinity compensation, and automatic temperature compensation. The customer also appreciated the interval logging feature, which they utilized to monitor the change in oxygen levels and pH over time during farming and transportation. By monitoring pH at various locations over time, the customer was able to identify areas of their lagoon that were the least affected by seasonal pH variations, and therefore the best locations for oyster larval cultivation. The customer requested two custom cable lengths of 20 m and 40 m, and was grateful that Hanna was able to accommodate their request. This allowed them to get a complete profile of their water column quality. The IP67 waterproof rating of the meter made it durable for trips on the lagoon in all types of weather. The HI98196 was a perfect solution for the customer's pH, dissolved oxygen, and temperature monitoring needs.