VACUUM AIRLIFT

FISH HATCHERY GAS MANAGEMENT

A Case Study in Dissolved Gas Management

Situation

Maintaining high water quality is critical to the successful operation of a fish hatchery. To avoid pathogens, pollutants and other contaminants, water is generally sourced from deep wells. Unfortunately the high pressure in deep wells frequently leads to high levels or even supersaturation of undesirable dissolved gases. The presence of these gases can have detrimental effects on the delicate hatchlings. Supersaturated nitrogen can lead to Gas Bubble Disease which causes lesions, convulsions, blindness and death. High levels of carbon dioxide lead to reduced growth and high mortality. The toxicity of high levels of hydrogen sulfide also leads to high mortality. Other dissolved gases, such as VOCs, have a detrimiental effect on fish health. Conversely high levels of dissolved oxygen are required for the proper growth and health of the hatchlings. Poor dissolved gas management negatively impacts the return on investment by increasing the mortality rate and reducing the quality of the hatchlings.

Requirements

A western US fish hatchery utilizes mountain spring water at it's facility. The water contains high levels of nitrogen and carbon dioxide and less than optimal levels of dissolved oxygen. The hatchery investigated several approaches to address these issues. The cost / performance trade-off led to the selection of the Vacuum AirLift™ (VAL™) as their dissolved gas management solution.

Our Soution

The VAL™ provides a fully automatic, multi-functional solution to water treatment and management. The VAL™ utilizes a patented technology that provides water circulation, gas exchange and particulate extraction in a simple, reliable and energy efficient device.

The VAL™ continuously removes undesirable dissolved gases from hatchery water through fine bubble gas exchange and vacuum extraction. If left in the water stream these gases significantly decrease the survivability of the fish hatchlings and fingerlings. By injecting oxygen into the processed water stream, the dissolved oxygen level is raised to the level needed to ensure healthy and energetic fish fry.

VAL 600™ Treating
Hatchery Source Water

Results

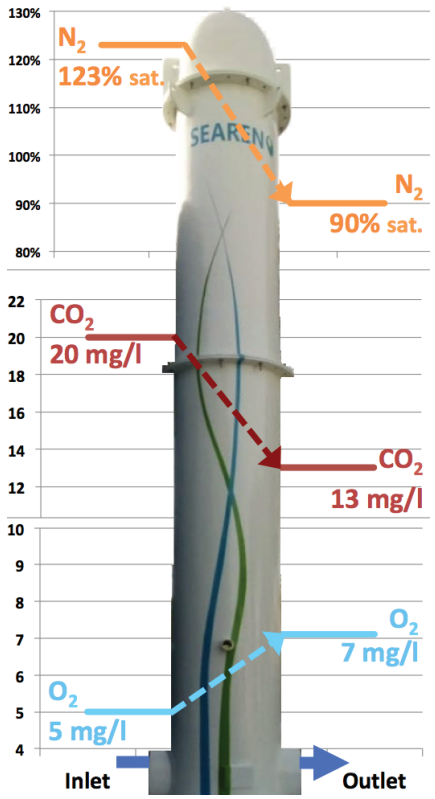
A Searen VAL 600™ was installed at the hatchery to treat the source water. The VAL™ processes the water at a flowrate of 450 gallons per minute. Pure oxygen is injected at the base of the VAL™ water at a flowrate of 4 liters per minute.

The hatchery measured dissolved nitrogen, carbon dioxide and oxygen levels across the VAL™. The test results are provided in the following table.

Parameter	Inlet	Outlet	Percent Change
Dissolved Nitrogen (% Saturation)	123	90.6	-26%
Dissolved Carbon Dioxide (ppm)	20	13	-35%
Dissolved Oxygen (mg/l)	5.25	7.06	+35%

The test results indicate that the VAL™ reduced the dissolved nitrogen and carbon dioxide by 26% and 35% respectively while the oxygen level was increased by 35%. These levels will have a dramatic effect on the surviveability and quality of the hatchery production. Those results are achieved in one pass, with the following specifications:

- The ratio of air to water is 1 to 4 (low thermal exchange)
- The stripped gasses are discharged outdoors (less indoor ventilation required)
- The energy consumption is as low as 10 watts per cubic meter of water treated
- As a result of the airlift, there is no head loss
- There is no packing media (no biofilm formation nor off-flavor produced by the system)
- There is no loss of efficiency over time
- One vacuum pump can serve multiple VAL™ units (yields higher energy efficiency and extremely low maintenance)



VAL 600™ single pass gas management performance

Model	Water Flowrate (gpm / m^3h^{-1})
VAL 400™	220 / 50
VAL 600™	600 / 135
VAL 900™	1,300 / 300
VAL 1200™	2,400 / 550
VAL 1400™	3,000 / 680
VAL 2000™	8,800 / 2,000

The airlift makes the VAL™ an efficient and effective water circulation device. Water circulation is accomplished with low pumping energy inherent in airlift operation. The VAL™ is available in a broad range of sizes allowing it to meet the water treatment requirements of any fish hatchery.

A number of benefits accrue as a result of this performance:

1. Lower CAPEX due to reduced equipment cost
2. Lower OPEX due to reduced power consumption
3. Increased reliability due to less complex equipment
4. Decreased carbon dioxide, nitrogen and other undesirable dissolved gas levels due to VAL™ vacuum extraction
5. Increased O_2 levels due to VAL™ aeration and direct oxygen injection
6. Faster growth and fewer mortalities due to improved fish health
7. Increased margin due to improved product quantity and quality

This installation validates the VAL™ as a highly effective tool in addressing dissolved gas management at hatcheries and other water treatment facilities.

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