MOLEAER
ADVANCING NANOBUBBLE TECHNOLOGY

SALMON: MOLEAER NANOBUBBLE TECHNOLOGY REDUCES OPERATING COSTS AND IMPROVES FISH HEALTH IN COIPUE FLOW THROUGH FISH FARM IN CHILE

Client Case Study: Coipue Hatchery

Location:	Unit Type:	Installation:	Species:	Results:
Acuícola Nalcahue, Chile	**Trinity 500, 113 m^3/hr**	**September 1-30, 2022**	**Coho Salmon**	• **41% savings in oxygenation operating costs** • **4.5% reduction in water consumption** • **4.2% reduction in FCR** • **19.5% increase in SGR**

Nanobubble technology has been shown to improve flow through aquaculture systems by reducing water, oxygen and energy consumption and improving the health and growth of fish. Prior to upgrading the Coipue hatchery's oxygen system, a one-month study was conducted at the facility in Acuícola Nalcahue, Chile using Moleaer's nanobubble technology to evaluate if oxygen nanobubbles in a salmon flow-through system could:

- Reduce the overall use of water and oxygen
- Reduce energy usage by the oxygenation system
- Provide a stable oxygen level and >70% saturation at the outlet of tanks
- Have a positive impact on fish growth and production

Moleaer's Trinity 500 nanobubble generator was installed inline, replacing two 110 m^3/hr cones in the flow-through system. The facility consisted of 22 total tanks with 3 independent lines, 2 cones per line. The trial was conducted on one of the lines. The tanks with existing cones were used as the control group. The Trinity 500 had a flow rate of 113 m^3/hr with an average oxygen injection volume of 60 SLPM.

This section of the hatchery had a total volume of 1760 m^3 in each set of 11 tanks. The average fish weight was 17-117 grams with 454,000 salmon in the ponds and total biomass of around 33,000 kg.

Moleaer's patented nanobubble technology delivers two major benefits: highly efficient gas transfer and nanobubble generation at a relative low energy consumption. It's the unique benefits of the nanobubbles that deliver critical improvements to water quality, pathogen control, biofilm removal and fish health without the use of chemicals. Coupled with simple installation, the system can be easily retrofitted into any facility to help optimize oxygen utilization and lower operating costs.

Over the course of the evaluation, the Trinity nanobubble generator data was compared to the two existing cones. The results showed monthly savings of around $1,025, a 41% reduction, in operational costs as compared to the two cones for oxygen and energy consumption. The total oxygen consumption decreased from 5.4 m^3/hr with the two cones to 3.6 m^3/hr with the Trinity. Additionally, energy consumption was reduced from 15 kW/h to 7.5 kW/h, a 50% reduction in cost. Further, water consumption was also reduced by 114 m^3/hr or 4.5% of the total flow by eliminating a pump from the operation.

OPERATIONAL COST COMPARISON

Cones (two)	Value (US$)	Usage / hr	US$ / hr	Total US$ / Day
O_2 Consumption	$0.33	5.40 m^3	$1.78	$42.77
Energy Consumption	$0.11	14.91 kw/hr	$1.64	$39.37
		Total Cost / Day		$82.14
		Total Cost / Month		$2,505.32

Trinity 500 NBG	Value (US$)	Usage / hr	US$ / hr	Total US$ / Day
O_2 Consumption	$0.33	3.64 m^3	$1.20	$28.86
Energy Consumption	$0.11	7.46 kw/h	$0.82	$19.69
		Total Cost / Day		$48.54
		Total Cost / Month		$1,480.56

Percentage Savings	**40.90%**
ROI	**Less Than 2 Years**

MOLEAER
ADVANCING NANOBUBBLE TECHNOLOGY

SALMON: MOLEAER NANOBUBBLE TECHNOLOGY REDUCES OPERATING COSTS AND IMPROVES FISH HEALTH IN COIPUE FLOW THROUGH FISH FARM IN CHILE

ACHIEVED LARGER FISH IN LESS TIME WITH NANOBUBBLES

FCR: Feed Conversion Factor
SFR: Specific Feed Rate
SGR: Specific Growth Rate

	FCR	SFR	SGR (Days Fed)
Trinity 500 (odd)	0.92	2.78	3.62
2 cones (even)	0.96	2.95	3.03
RESULTS of Trinity 500	-4.2% ↓	-5.7% ↓	19.5% ↑

Fish feed conversion factor (FCR), specific feed rate (SFR), and specific growth rate (SGR) were also compared. The Trinity nanobubble generator improved each of these leading to decreased FCR by 4.2%, and SFR by 5.7%. The SGR increased by 19.5%.

These parameters indicate an increase in the efficiency of the transformation of feed into meat and decrease in the daily ration delivered, while obtaining a smolt size in less time, shortening the time to transfer the fish into the sea.

These indicate that the system's ability to maintain consistent and optimal DO levels had a positive impact on fish growth. They were able to produce larger fish in less time, with less food, by creating a better growth environment with nanobubble technology. It's possible for the grower to start another cycle of fish sooner, which could result in higher production rates over a longer span of time, in addition to saving fixed and variable costs.

The results of this trial demonstrate that Moleaer's nanobubble technology improves the efficiency and sustainability of flow-through systems while also reducing oxygen consumption and operational costs, and improving fish growth rates. Broad implementation of nanobubble technology into all forms of production systems would help aquaculture farmers reduce operating costs, conserve resources and increase the profitability of their companies. In parallel, nanobubbles help reduce the negative environmental impacts of pharmaceuticals, maintain high-quality growing water, reduce the use of chemicals to control microorganisms and biofilm, improve animal welfare and lead to better land-based fish quality.

Acuícola Nalcahue was so pleased with the results of Moleaer's systems, they purchased six additional nanobubble generators to replace 12 cones and six pumps. By replacing their lower-performing equipment, Acuícola Nalcahue will save around $73,000 annually, helping to improve the profitability and sustainability of their salmon farming operation.

Learn more about how nanobubbles improve aquaculture.
Visit our website: www.moleaer.com/industries/aquaculture