

The benefits of aeration and oxygenation to aquaculturists



There are a number of challenges that the aquaculture industry faces every day - from the impacts of rising sea temperatures to algae blooms and jellyfish blooms to name only a few. Left unchecked, the impact can be detrimental.

Compressed air can be used to mitigate these challenges, thereby contributing to more sustainable and environmental aquaculture practices.

When it comes to fish farming - such as farming salmon - once upon a time, you would only need a net, feed, and fish to stock. But a number of factors such as warming sea temperatures and the more frequent occurrence of algae blooms and jellyfish blooms, have created a demand for more sophisticated farming techniques.

Aquaculturists in New Zealand are of course well aware of the impacts that such factors can cause, from thermal stratification to eutrophic conditions to name only a few. And, unmanaged the result can be catastrophic causing mass mortalities.



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As the world's fastest growing primary industry, and a significant and growing industry in New Zealand, the question becomes how can the aquaculture industry mitigate these challenges?

Meeting the challenges of modern salmon farming: Sea Pen Aeration (SPA)

Sea pens are commonly used to farm salmon, however many farmers have yet to realise the benefits that upwelling systems - or aeration systems can garner.

Aerating sea pens in near shore aquaculture - or Sea Pen Aeration (SPA) - is a relatively new technique to the industry, although already well adopted in countries like Canada and Chile.

SPA is a process whereby compressed air is blown into the pens through diffusers. As bubbles rise to the surface, a gas exchange takes place between the water and the gases in the bubbles. This raises the oxygen levels in the water. But, even more importantly, it creates an artificial upwelling. This forces oxygen-rich and cold water from deeper down in the water column to rise up into the pens.

The benefits of SPA include:

- **Mitigate the impact of thermal stratification:** The upwelling effect allows the SPA system to draw cooler water up from the depths and into the pens. This mitigates the impact of thermal stratification, common in static water particularly in warmer months.
- **Increase the oxygen content in the pens:** Cold water can hold more oxygen, and of course salmon require cold oxygenated water to thrive and survive. More oxygen also means better digestion of feed. This means less feed is required per kg of growth, lowering the feed conversion ratio (FCR) for the farmer. This brings a cost saving as less feed is required, and as the highest cost in aquaculture production, that's a real winner!
- **Mitigate the harmful effects of algae and strong sea lice infections:** The artificial upwelling created by SPA forces the water at the surface to flow outwards. This prevents algae and other harmful organisms occurring in the top layer of the sea from entering the sea pens. This includes the planktonic copepodite stages of sea lice, the infectious life stage that can't swim against the current. As the water is pushed out of the pen thanks to the upwelling effect, SPA can also weaken sea lice infections.



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- **Improve salmon quality*:** The aeration process also creates a current in the water for the salmon to swim against. It is suspected* - but not yet fully proven - that this impacts the quality of the final fish, making the flesh less fatty.
- **Can be used with a Bubble Curtain for total coverage of the entire water column:** Another benefit of SPA is that it can be combined with a Bubble Curtain. An upwelling system can only stop protists (e.g. algae), parasites (such as sea lice) and predators (such as jellyfish) on the top layer of the pens due to the water movement. This means that only algae in the photic zone as well as sea lice in the copepodite stages will be pushed out. To protect the entire water column, you would also have a bubble curtain, and they can easily be combined with an SPA system. This is also beneficial as it is believed that a bubble curtain stops fresh water from entering. But a water exchange is necessary in order to bring new, oxygen-rich water into the pen. By combining an aeration system with a bubble curtain, you get the best of both worlds - you keep the oxygen levels up (with the aeration system) while also providing protection (with the bubble curtain).

Production Optimisation - the next frontier: Sen Pen Oxygenation (SPO)

Early adopters are now also realising the potential to use compressors in combination with PSA or VSA Oxygen systems to additionally oxygenate the water in order to optimise production. Here, systems are built that can be used for creating an upwelling with a compressor fed SPA system or in combination with an oxygen producing device to inject pure oxygen at a purity of 93%.

Conclusion

Pneumatic feeding using low pressure compressed air has already revolutionised the intensification of salmon farming as we know it today. With applications like SPA and SPO now on the rise, compressed air is set to become especially beneficial in the development of more sustainable and environmental aquaculture practices.

Why choose HPC KAESER for your aquaculture air compressor solutions?

HPC Kaeser offers a compressor configuration which delivers even greater reliability under the harsh conditions that go hand-in-hand with aquaculture applications.

This, in combination with increased compressor service life, means that plant hire companies and fish farmers alike can enjoy the significant advantages that HPC KAESER compressed air solutions have to offer.



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