

SPOTLIGHT

Healthy Fish & Shrimp



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Spotlight, brought to you by Cargill Aqua Nutrition, the global leader in feed for aquaculture, highlights some exciting developments with its EWOS brand feed. In this edition, we showcase our comprehensive portfolio of health feed for fish and shrimp farms. Developed by R&D scientists and technologists, the range meets evolving customer needs. Acknowledged as experts in our field, we have the people, capabilities and facilities to solve the challenges in the aquaculture feed industry. In doing so we work closely with fish farmers to help them deliver healthy seafood for today's demanding consumers.

We outline the work we are doing to develop new and improved products that help to tackle diseases and challenges in aquaculture, bringing nutritional and health benefits for stock and financial benefits for producers.

We also take a look at the new state of the art capabilities for research and development, acquired through the recently launched Cargill Innovation Centre in Colaco, Chile. This new facility will help us to work better with our customers in the aquaculture space, to ensure a sustainable future for fish farming.

The investment in the fish health center in Colaco also reinforces our commitment to building the best science knowledge base in the industry. As we like to say: "Knowledge makes the difference".

Cargill Aqua Nutrition (CQN) manufactures and distributes EWOS branded feed products. CQN combines 80 years' expertise of EWOS, with the solid global footprint and world-class raw materials and risk management capabilities of Cargill to secure healthy seafood for future generations. For more information about CQN and Cargill's animal nutrition footprint, visit: www.cargill.com/feed





EXECUTIVE SUMMARY

Cargill Aqua Nutrition has achieved a leading position in the development of health feeds for the aquaculture industry, in direct response to evolving market needs.

Each product has a weight of scientific research and development behind it, together with years of testing and evaluation. This means that the fish farmer can use EWOS feed, safe in the knowledge that it is backed up with solid documentation of efficacy, supported by on-farm validation.

We have introduced a portfolio of feeds to support fish immunity and help fish recovering from clinical symptoms of disease along with a highly palatable base pellet to support any medicinal treatments that may be required. These innovations have been well received by the market and have become important tools for fish farmers to use in combination with best husbandry practices.

In an exciting new move, we have also taken the first steps to providing health feeds for shrimp and other farmed fish species. Developed with industry, for industry, these new products are finding ready markets keen to benefit from their documented health benefits.

Our work does not stop there and we continue to work through open innovation with our range aquaculture partners both in industry and academia, to develop innovative products.

In October 2016, our brand-new, state-of-the-art USD 10.5 million Cargill Innovation Centre was officially launched in Colaco, Chile. In one facility, we have increased by 30%, the global capacity for fish health and nutrition research. This means that we have far greater capacity to undertake research and development, which will accelerate the development of new health feed solutions for the benefit of our customers, and for the wider fast-growing global aquaculture industry.

The Cargill Innovation Centre, Chile is one of three aqua innovation centres in Cargill. The record private investment put in to develop the facility, demonstrates Cargill's ongoing commitment to aquaculture feed research and development. It also confirms the EWOS brand as a provider of long-term feed solutions to combat ongoing challenges to the industry, with a firm focus on supporting the production of "Healthy Seafood for Future Generations".

CARGILL'S ROLE IN SUPPORTING HEALTHY FISH AND SHRIMP

Global aquaculture is big business, and farmed fish and shellfish volumes now exceed the wild catch each year. With only finite wild stocks available, this pattern is set to continue.

In addition, the general trend for seafood consumption is increasing on a global scale, driven in large part by the documented and perceived health benefits of including fish and shellfish in the diet.

This means that as demand continues to grow, far greater emphasis will be placed on providing fish and shellfish from aquaculture. Consequently, greater volumes of aquaculture feed will be required each year. This must meet our customers and global consumers' expectations of sustainability and environmental integrity, and provide for the nutritional needs of fish and shrimp.

But our feed does not just play a role in providing basic nutrition for aquaculture species; it can also strengthen the immune systems and overall health.

Providing fish with an optimum diet is a field in which EWOS has built up considerable experience.

"Proper fish nutrition is an excellent tool to help cope with challenges and specially with pathogens," said

Simon Wadsworth, Global Fish Health Manager for Cargill Aqua Nutrition (CQN).

"A fish consumes some 30,000 feed pellets over its lifetime and that means there are the same number of opportunities to provide targeted feed aimed at maintaining optimum health."

Unfortunately, the welfare of farmed fish is impacted by a complex plethora of health challenges, with constant threats from parasites and disease. Fish and shrimp farmers of every species are affected by these issues, which in turn impact on both the reputation and the economic viability of the global industry.

For example, in 2016 the global cost to the salmon industry of damage caused by sea lice alone, was estimated at **more than USD 500 million per annum**. Sea lice are also the main bottleneck for enabling the growth of salmon farming in certain geographies.

To maintain production, the aquaculture industry is on constant alert to keep their stocks healthy and

free from disease, but it seems that each time a vaccine or solution to one issue is found, another challenge is identified.

CHALLENGES TO FISH AND SHRIMP HEALTH

One of the biggest challenges is that the number and type of fish health threats are both many and varied. Sea lice is often referred to as the main challenge for salmon farming, but there are also many other interrelated issues including, but not limited to, *Piscirickettsia salmonis* (SRS), Amoebic gill disease (AGD), Pancreatic Disease (PD), Heart and Skeletal Muscle Inflammation (HSMI) Cardio Myopathy Syndrome (CMS) and winter ulcers.

For the burgeoning global shrimp industry, three of the biggest challenges are EMS, White Spot and salinity stress.

But how do these issues affect the animals and the fish/shrimp farmer? And how can EWOS feed help them to cope with those challenges?

INNOVATIVE HEALTH FEED SOLUTIONS

Over the past 20 years EWOS has developed a notable range of feeds that help fish farmers with the important task of keeping their fish healthy. Designed and developed in conjunction with aquaculture producers, the health feed range includes well known product names such as BOOST, ROBUST, ALPHA and ADAPT.

With the benefit of this experience, we are now in an exciting phase of developing next generation products with increased efficacy and a broader

scope for application, to keep ahead of the game.

Medicated feed still plays an important part when fish succumb to health challenges and EWOS has formulated pellets that are suitable for incorporating medicines.

We are also working to develop oral delivery technologies that will improve the efficacy of medicines and antigens that are being delivered to the fish through their feed.

The table explores the key health challenges and the portfolio of health feed offerings from Cargill that are helping the global salmon industry to grow, reduce the costs incurred by fish farmers as a result of disease, and manage risks in the production cycle.



Health Challenges

Health Feed Offerings

GENERAL STRESS EVENTS

Throughout the production cycle, fish are exposed to various events that can compromise their health status and reduce the potential for efficient growth. In the UK and Norway mechanical treatment is often used to reduce the sea lice load on salmon. These methods include stressing and handling of the fish. During grading, vaccination and mechanical lice treatments, it is paramount to support the fish nutritionally, to ensure that any adverse effects are reduced to a minimum, so that the recovery process begins in earnest.

EWOS BOOST

BOOST is a functional feed comprising a unique source of nucleotides with a large spectrum of benefits. It supports the good functioning of the immune system and ensure that fish are better equipped to deal with any stress related event such as mechanical treatment, vaccination or grading. The benefits of using **BOOST** are broad and include:

- Improved tolerance to stress
- Improved vaccination success
- Maintenance of growth during stress conditions
- Enhanced resistance against infectious disease
- Improved resistance to sea lice
- Supports osmoregulation
- Promotes broodstock fecundity and egg quality

For optimal results EWOS BOOST should be fed 3-5 weeks pre and 3-5 weeks post any anticipated stress event.



Sea Lice

Sea lice, (*Lepeophtheirus salmonis* and *Caligus* spp) are a major problem for the global salmon farming industry and have a significant effect on many areas of production. The parasites attach to the skin of salmon and affect their immune system, causing stress and immunosuppression, which are exacerbated by chemical treatments.

The result is significant losses to the industry. In 2016, the economic impact was estimated to be around \$0.20 – \$0.30 per kg of salmon produced, **more than USD 500 million per annum.**

As well as the health and economic issues, critics of salmon farming believe that the growing use of chemicals to fight sea lice raises serious questions about the industry's environmental impact. The effect of sea lice on wild salmon is also reduced if sea lice numbers are kept to a minimum in farmed fish.

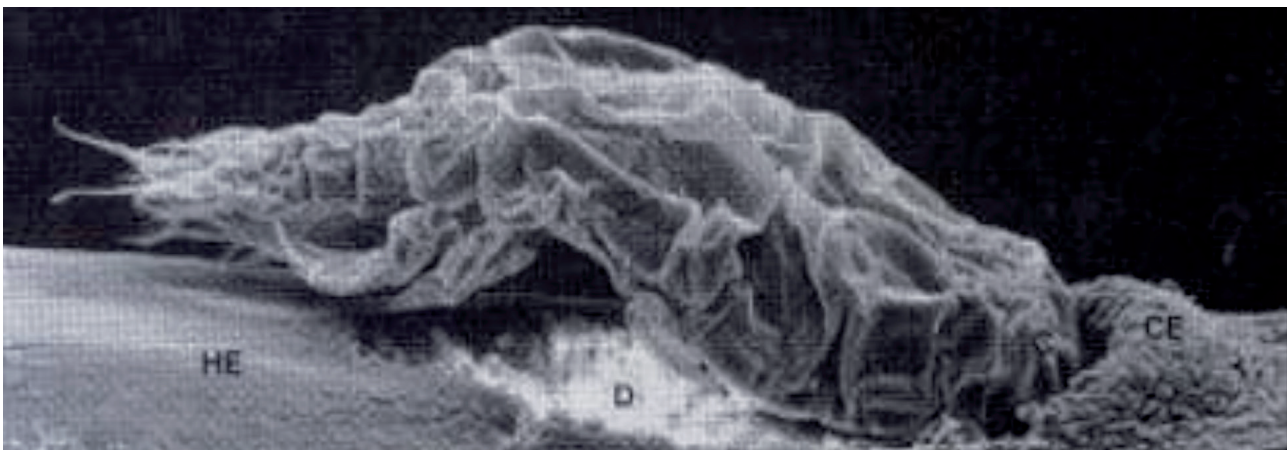
EWOS ROBUST

Since the launch of **ROBUST** in 2012, **ROBUST** has been an integral and established part of strategic Integrated Pest Management Programs for many sites and production areas. It is a nutritional solution which helps the fish to cope with challenges. The main benefits of using **ROBUST** include:

- Up to 30% less sea lice attachment
- Promotes enhanced fish health
- Strengthens and optimises immune response

When used strategically in a feeding programme, **ROBUST** reduces lice settlement while also supporting the fish immune system and supporting the wound healing process – reducing susceptibility to grazing damage from sea lice and the potential of associated viral and bacterial challenge such as those causing PD, HSMI, CMS, ISA and SRS.

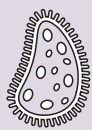
EWOS ROBUST should be pulse fed on a 3 week on, 3 week off basis with a focus on high risk periods such as spring settlement





Health Challenges

Health Feed Offerings



AGD & GILL HEALTH

Amoebic gill disease (AGD) is a potentially fatal disease for salmon, caused by the amoeba *Neoparamoeba perurans*, which colonises the gills of salmonids. The parasite triggers the epithelium to thicken, which reduces the ability of the fish to diffuse oxygen, or breathe.

At the same time, in part due to the gills being compromised, other opportunistic bacterial and viral pathogens may be present, which in turn can lead to wider gill health problems.

AGD has been reported around the globe, notably in the USA, Australia and Tasmania, New Zealand, France, Spain, Ireland, Scotland and Chile.

EWOS ROBUST

Trials have shown that the immunological effects on salmon caused by amoeba are similar to sea lice in terms of immune suppression. The immune suppression and immune diversion in the host when the sea lice is attached is already well understood but in trials at Cargill Innovation Center, **ROBUST** has been shown to be effective in optimising gill health as well as reducing sea lice attachment on Salmon. Recent results from In vivo tank trials demonstrated reduced gill damage, with the most pronounced effects being seen post hydrogen peroxide treatments.

EWOS ROBUST should be considered as part of an Integrated Pest Management Feeding Program as a cost effective means to nutritionally support the fish both against sea lice but also to reduce the impact of AGD and other gill health associated issues.



PD

Pancreatic Disease (PD) is caused by an alphavirus, known as Salmon Pancreas Disease Virus (SPDV). Infected fish suffer from severe damage to the pancreas, and infection in the heart and skeleton musculature. Vaccines have been developed for this disease, but their use varies from region to region. PD is causing heavy losses to the industry.

HSMI

Heart and Skeletal Muscle Inflammation (HSMI) is caused by piscine reovirus (PRV) and has been known to cause mortalities in farmed salmon in Norway, Scotland and Chile. HSMI is most common during the first year at sea, and can persist long after the initial diagnosis. There is wide variability in mortality from HSMI, which is often triggered by operational measures that have stressed the fish. Salmon that die from HSMI often have severe circulatory disorders.

CMS

Cardio Myopathy Syndrome, is caused by Piscine myocarditis virus (PMCV) and leads to a severe cardiac disease of farmed salmon. It is typically encountered in adult Atlantic salmon during their second year at sea. The virus can lead to severe changes in the heart muscle, and in pronounced cases, these changes can be so extensive that the heart wall cracks.

EWOS ALPHA

ALPHA is a specifically formulated diet offering a combined approach to nutritional management of fish which have to cope with affected by an outbreak of PD, CMS or HSMI challenges.

Scientists at Cargill Innovation Centre have documented that changes to protein ratios, amino acid and fatty acid profiles in feed formulations results in reduced impact on salmon health status and faster recovery from PD, CMS and HSMI in Atlantic salmon. As nucleotides become limiting during periods of stress or challenges, their inclusion in **ALPHA** feed assists salmon through recovery. Prebiotic is also included to promote a good functioning of the digestive tract, to support digestion process and help salmon to recover loss growth. The main benefits of using **ALPHA** include:

- Reduced impact on salmon health status
- Improved weight gain and growth
- Faster recovery from PD, CMS and HSMI

EWOS ALPHA should be used during both before and during challenging conditions. Feed **ALPHA** for a minimum of 12 weeks for PD challenged periods and longer for CMS and HSMI challenged periods.

Health Challenges

Health Feed Offerings

**Winter Ulcers**

The bacterium *Moritella viscosa* is regarded as the main causative agent of winter ulcers in salmonids. Fish grown in cold northern waters are particularly susceptible, and environmental factors such as temperature and salinity play a large part in influencing the ability of the bacteria to cause disease.

EWOS WINTER

Research shows that salmon are at risk of developing winter sores when water temperatures drop below 12°C. **WINTER** has been specifically formulated to enhance the immunity of salmon during periods of declining water temperatures. **WINTER** also provides extra micro-nutrients to build up a fish's stores of anti-oxidants, which enhance wound healing capabilities.

EWOS WINTER should be fed in periods of declining water temperature in the range 12°C and below.

**SMOLTIFICATION AND SEA TRANSFER SALINITY STRESS**

Smoltification and sea transfer is a critical phase for salmon, when they undergo physiological changes in order to adapt to life at sea. In nature, the diet of a migrating smolt varies greatly between the river and the sea. This variation helps to open and close the smoltification window at the correct time, so it is important to mimic such changes in a commercial feed.

EWOS ADAPT

Scientists at Cargill Innovation Centre have discovered that by optimising the profile of long chain fatty acids within the diet, it can assist the 'opening' and 'closing' of the smolt window. The inclusion of nucleotides and extra vitamins has also been shown to bring positive effects during smoltification and transfer.

ADAPT has been designed to support the fish during smoltification. It comes in two formats:

- **ADAPT LIMNO** (ADAPT Parr in the UK) is specialized for the final part of a salmon's freshwater phase – Feed for the last 4–8 weeks in freshwater before sea transfer.
- **ADAPT MARINE** (ADAPT Smolt in the UK) is optimized for the first part of the seawater phase. Feed for up to 4–6 weeks post transfer, to provide a better start in the sea.

The two feeds used in combination help to make smoltification a less stressful event for farmed fish.





Health Challenges



SRS

Piscirickettsia salmonis (SRS), is a major issue for salmon farmers in Chile and is beginning to be a problem in Canada. This bacteria is **responsible for nearly 80 percent of salmon mortalities** and is the main reason for antibiotic use in aquaculture in Chile. Finding an alternative solution to antibiotics is a matter of great urgency for the future sustainability of the industry and in 2016 a vaccine was introduced.

Health Feed Offerings

EWOS BACTER

The **EWOS BACTER** is formulated with a particular nutrient profile and functional supplements designed and approved by Cargill Innovation Center under high quality standards. When used strategically as part of an Integrated Pest Management Program, this diet can be of great help for salmon to cope with pathogens such as SRS.

It is important to identify the most challenging periods so that fish immunity can be strengthened at this time. These periods of risk typically correspond to important changes during the cycle, such as fish handling, variations in mesh size, sudden changes in temperature or water quality conditions, particularly oxygen concentrations, or temporary or predictable periods of fasting.

EWOS BACTER is most effective when used for 3 to 4 weeks before the challenge, but can be fed for periods of up to 3 months if the risks are high.

MEDICINAL TREATMENTS

Treatments with medicine such as antibiotics or anti-sealice compounds remain an important option for famers. If the decision is taken to treat with a medicine, this treatment must be effective.

EWOS SYNERGY

SYNERGY is the base pellet for our medicated feed and is strengthened with functional components to promote health. The careful selection of highly palatable raw materials along with the inclusion, of nucleotides, immune modulators and vitamins is important for a successful treatment. The base pellet also has a reduced digestible energy level which ensures a better feed uptake by the fish.

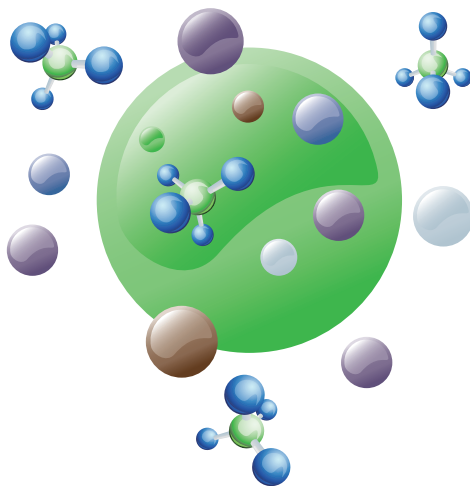
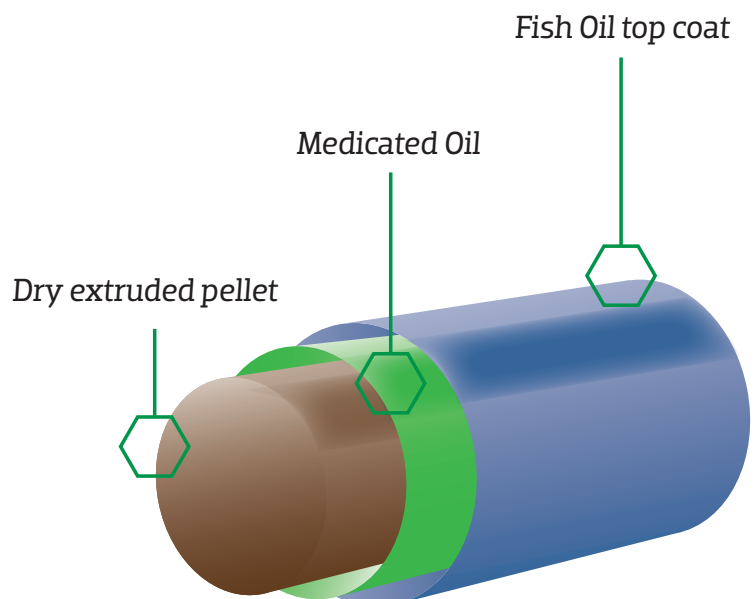


Figure 1
Medicines, prebiotics,
nucleotides and vitamins
are mixed with oil using a
unique vacuum technology





Health Challenges

Health Feed Offerings



EMS

Early Mortality Syndrome (EMS) or acute hepatopancreas necrosis disease (AHPND) continues to be a challenge for the global shrimp farming industry. It is caused by a bacterial agent, *Vibrio parahaemolyticus*, which is commonly found in seawater.

EMS outbreaks can occur within a few weeks to 60 days of stocking a newly prepared shrimp pond, **and mortality can exceed 70%.**

The disease was first identified in China in 2009, and spread to Vietnam, Malaysia and Thailand, causing annual losses of more than USD 5 billion in 2013.

SMARTSHIELD™

SmartShield™ is a holistic solution that integrates an on-farm risk assessment, nutritional solutions and specialized services, to help reduce the risk of Early Mortality Syndrome (EMS) and improve overall productivity and performance.

Our On-Farm Risk Assessment uses customized reports, including specific biosecurity and farm management recommendations to reduce the risk of disease.

Targeted Feed Solutions with advanced nutrition, includes a functional additives package delivered through a complete feeding program which improves growth performance and strengthen the shrimp's immunity.

The Technical Support Package includes on-site performance evaluation tools and rapid diagnostics in water quality and disease such as white spot, resulting in early detection and preventative recommendations, thereby saving the customer time and money.

When faced with an EMS attack, the **SMARTSHIELD™** program has been shown to better equip the farm and animals, resulting in stronger, better performing shrimp, bigger production yields and an overall increase in productivity. For example, our customer field trials have shown average increases in growth rate of 13%, which in turn shortens the growth cycle and give average increases in yield of 59%.



SALINITY STRESS

Stress is a medical term meaning disruption of equilibrium or balance of the normal physiology of the organism (homeostasis) by various stressful stimuli; physical, perceptive or physiological. Stress evolves from activation (alarm) via resistance (depletion of reservoirs) to exhaustion (immune system collapse). To avoid stress is decisive within all aquaculture operations.

Shrimp are produced in hatcheries and are shipped at post larvae (PL) stage to growout ponds, which may have different conditions of salinity and temperature from those experienced in the hatchery. The resulting stress to shrimp can cause severe losses and it is usual for a stress test to be performed to identify when a batch of shrimp is ready to be moved.

360 PROTECTOR

Whitespot and Salinity Stress

Introduced in 2011, and as a result of collaboration with the National University of Mexico (UNAM), **360 PROTECTOR** was been shown to support the immune system and enhance the chances of survival when the shrimp were undergoing period of stress.

Salinity stress is a condition that can cause stress in animals, and **360 Protector** is a nutritional solution for this type of metabolic condition and is suitable for use in both low salt water systems and high-salinity systems.

These nutritional solutions are focused on supporting the shrimp during the osmoregulatory process.



HEALTHY PIPELINE OF NEW PRODUCTS, SERVICES AND SOLUTIONS



"Our table shows just how far we have come in innovating feed solutions that help our customers to keep their fish stocks healthy" said Ian Carr, Strategic Marketing Director for Cargill Aquaculture Nutrition. "Our solutions for salmon farming are already very well established and we have an exciting pipeline of second generation products that will further increase the efficacy of reducing sealice settlement and help fish that are challenged by gill amoebiasis, for example. But what's even more exciting is that we are already making terrific progress in transferring the technology behind those products to the benefit of shrimp farmers and other aquaculturists."

Our SmartShield™ offering for shrimp farmers combines advanced health feed with husbandry advice and diagnostic services to help manage the impacts of EMS. The offering was introduced in 2015 and already knowledge and experience from EWOS is being applied to enable the development of an even more effective second generation offering. We expect to expand the availability of SmartShield™ throughout Central America, Mexico, Thailand, China, Vietnam and the US, as well as Ecuador and India.

In addition to this we are looking at how we might add technical services such as diagnostic and assessment tools into the package for fish farmers and are currently working on some exciting concepts.

Oral Delivery Technology

Cargill Innovation Center has been working since 2012 on the development of oral delivery technologies to improve the delivery of medicines and vaccines that we deliver to fish through their feed. An increase in the absorption of antibiotic has been achieved in fish receiving microencapsulated antibiotic in the feed. See Figure 2.

In trials, salmon challenged with SRS that were treated with this new technology achieved an increase in survival of 54% compared to fish treated with a standard antibiotic in the feed. Similar advances were achieved with the microencapsulation of vaccines against IPN and PD for Atlantic salmon. The microencapsulated vaccines increased the presence of

antigens in target organs, producing a higher immune response against the pathogens.

Further developments will include an oral vaccine against SRS to complement the health feeds currently produced by Cargill. EWOS SYNERGY feed will soon include the concept of oral delivery of medicines and vaccines, to meet customer needs.

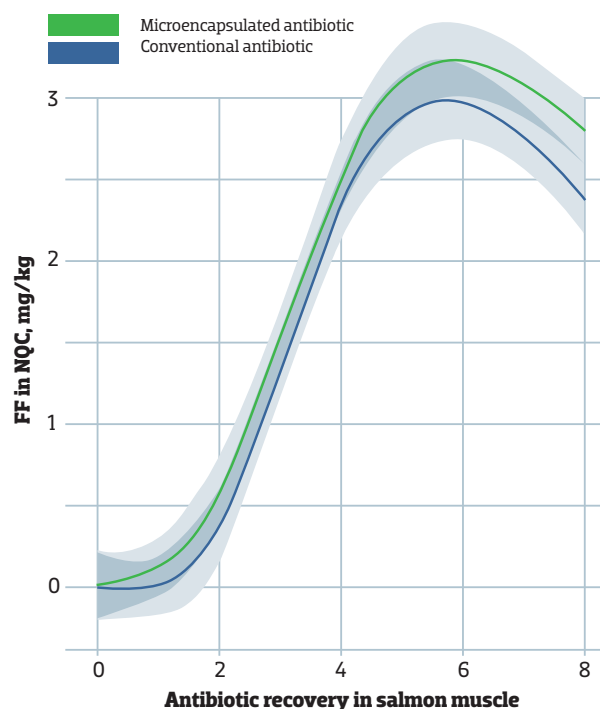


Figure 2. The chart shows modelled antibiotic and microencapsulated antibiotic concentrations in salmon muscle during trials. Lines represent the mean value and shadow areas are the confidence intervals (95%). There is a higher amount of active ingredient measured in the fish fed with microencapsulated antibiotic, which results in more effective treatment of disease.

INVESTMENT IN NEW CAPABILITIES

Cargill Aqua Nutrition (CQN) supports growth in sustainable aquaculture by helping to combat the challenges that threaten growth today. The opening of our new Innovation Centre in Colaco, Chile, in October 2016, marked a significant milestone in helping to address global fish health issues.

Our new centre is one of the world's largest and most important research centres of its kind and **we are proud that this facility has added a significant 30% global capacity for fish health research.**

The Cargill Innovation Centre is the result of a \$10.5 million investment, which is the most important private investment ever made in fish health R&D in the world. It will focus on developing our knowledge of nutrition & health, which in turn will give our scientists a greater understanding of how feed ingredients play such a vital part in fish health and in tertiary prevention of disease.

"This is a really exciting development and will serve as a research hub for more than 30 internationally-renowned experts who will focus on developing functional fish diets and studying diseases that affect farmed fish and shrimp around the world," said Simon Wadsworth.

"The Cargill Innovation Centre will enable us to expand our research capability 4-5 fold and accelerate our product development programs. This means that we can dig much deeper

into the primary diseases and combat the risks they create for salmon producers, as well as applying our findings across multiple species of fish."

In the initial stages, our scientists are particularly tasked with creating tools and additional controls to fight the major challenges from sea lice, SRS and AGD. This work is especially important to support the growth of the Chilean salmon farming industry, but is equally applicable to the global industry.

"We aim to find new solutions within a time frame of 2-3 years, and believe this is entirely feasible," said Simon Wadsworth.

Senior Scientist Ragna Heggebo is excited by the opportunities that the Cargill Innovation Centre affords the industry.

"The new center will make our work more efficient. In the past, sea trials were not always possible and our own challenge facilities were fully booked, so extra tank space to undertake extensive trials is very welcome," she said.

The impressive facilities and capabilities of the Cargill Innovation Centre mean that we are ready to seek solutions to new health challenges as and when they arise. We are also preparing for faster development of new health feed products to assist with those challenges.

Cargill Innovation Centre will enable scientists to screen new ingredients and feed additives, as well as vaccines and medicines that can be applied through feed to solve fish health challenges.

"We do not work alone, but in close collaboration with customers and key stakeholders in the fish health space, including pharmaceutical companies, universities and other research institutes. All of these working relationships will be strengthened by our increased capacity for research," said Simon Wadsworth.

In developing new feed solutions CQN must also take into account the different rules and regulations in each country to ensure compliance.



REASONS TO PARTNER WITH CQN TO SUPPORT HEALTHY FISH

The EWOS brand is already well established and respected in the market. This is in part due to the proven performance of our products, and in part due to the wealth of scientific and technical knowledge used in their development and production, along with background documentation to back them up.

Innovations from our new Cargill Innovation Centre can only help to strengthen our position as the leading provider of high-quality fish feed products. CQN's scientists and consultants will continue to work closely with customers to create innovative solutions that address their business needs and help to achieve maximum results.

Cargill is renowned for its commitment to R&D to help optimise fish health and growth, and to find solutions to emerging challenges. Its promise to aquaculture customers is to maintain that commitment with the EWOS brand.

Cargill is renowned for its commitment to R&D to help optimise fish health and growth.

STRONG BACK UP

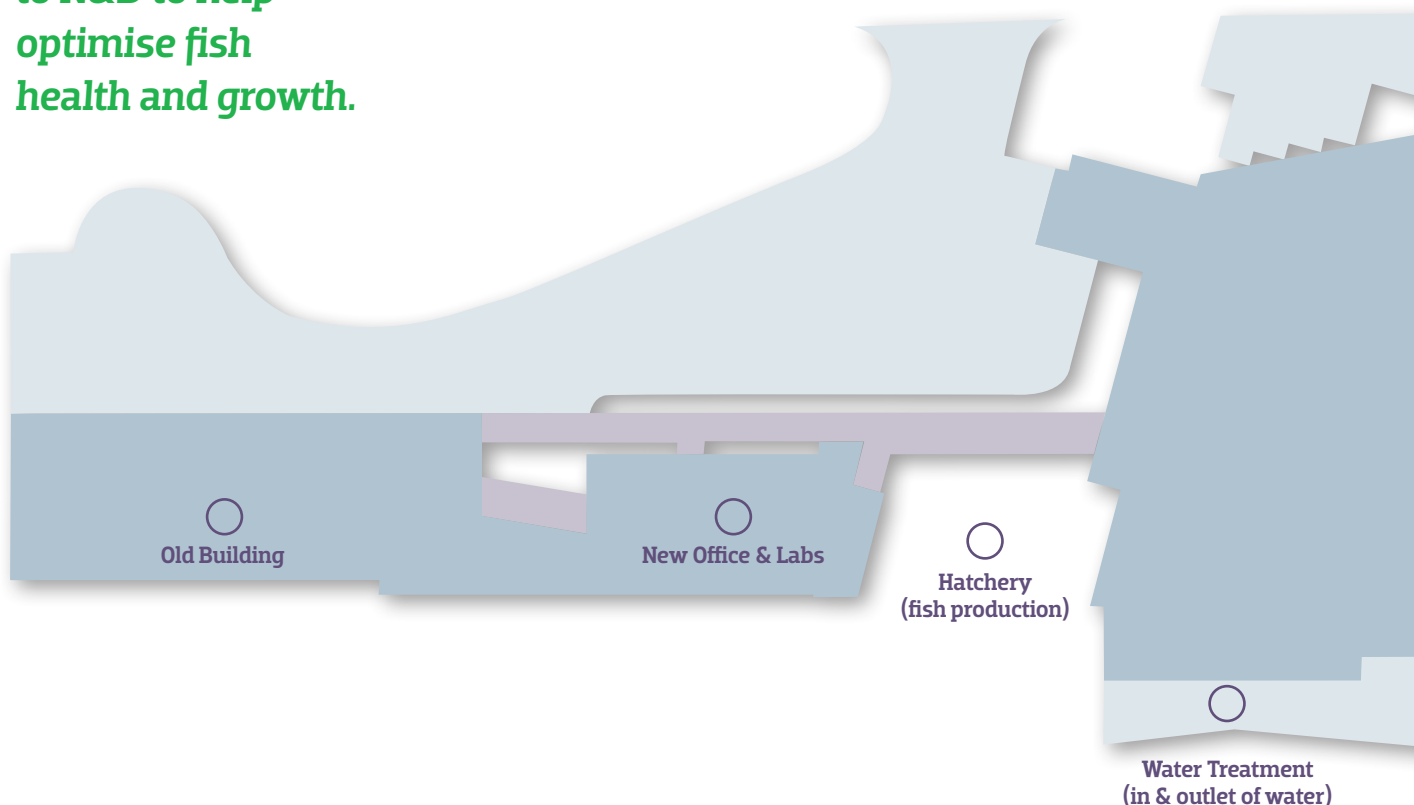
"For fish farmers, one of the most important features of our service is support from the account management team on the ground, who are the public face of CQN and the EWOS brand. They use the knowledge of our scientists and product formulators, along with our advanced computer programs, to ensure that each farmer is using the best product at the right time for their fish health, growth and budget," said Ragna Heggebo.

One innovation of which CQN is proud is its newly-established technology team, which is playing an important

role as the link between industry and R&D.

Cold Water Technology Lead Louise Buttle explained that the team's task is two-fold.

"We focus very much on customer needs, helping to translate them into scientific research, disseminating the results back to the field, and helping to turn them into new products and solutions," she said.





SUPPORTING SUSTAINABILITY

The investment at Colaco, fits with the now accepted need within the market to reduce the use of chemicals and medicine treatments.

Along with this, there is a continued focus on welfare, as well as health, given that farming methods are evolving on production sites.

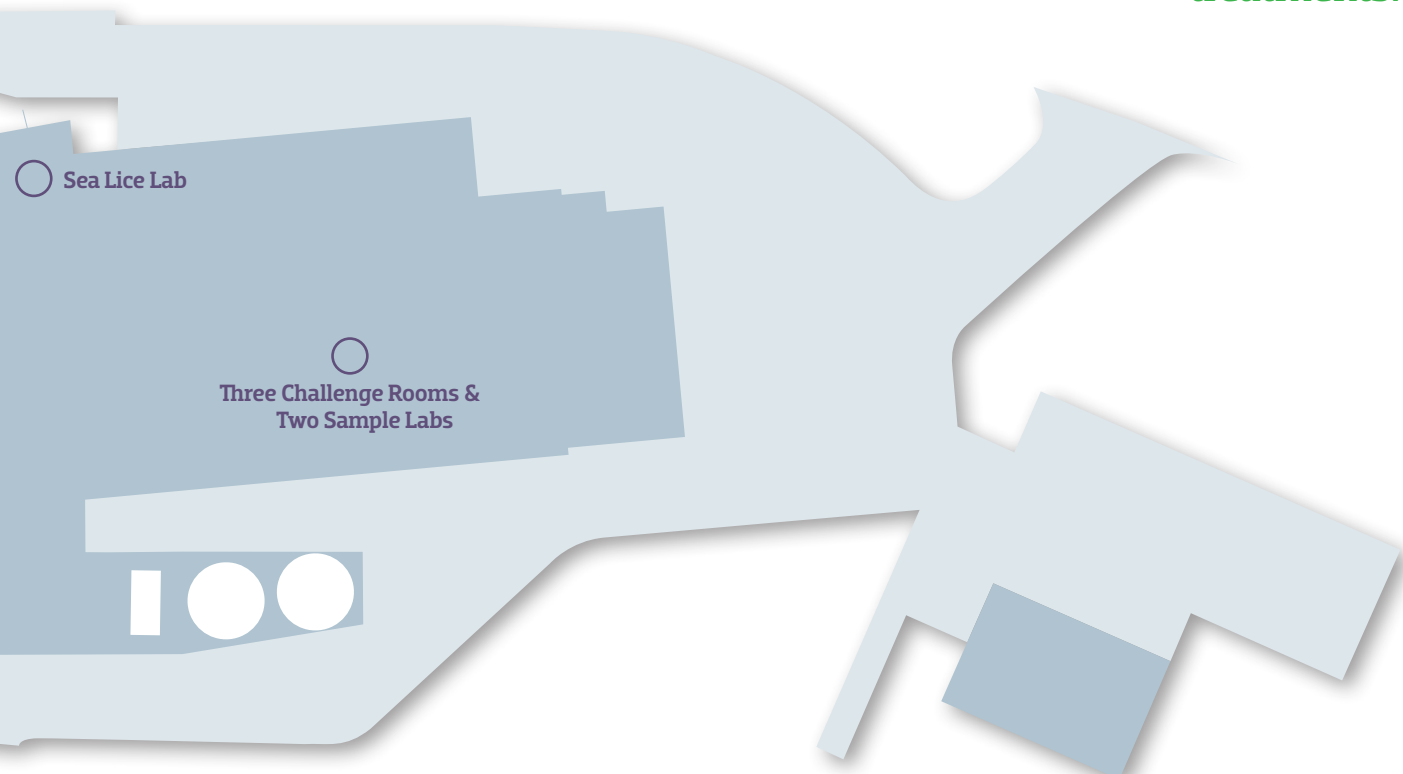
By having more capacity and increased capabilities, we can be recognised as a partner to support fish welfare and health.

This also brings benefits to the farmer. For Example:

- Higher capacity and scope to introduce diets that will support the growth of the salmon industry.
- Improving efficacy of health feeds to be included as part of an integrated pest management plan.
- Development of an oral vaccine against SRS to further complement the health diets already available from CQN.
- Improved micro-encapsulation to enhance the uptake of medicines and results in a more effective treatment of disease.

By being better positioned to introduce holistic feed solutions to promote the health of farmed salmon, CQN can strengthen the perception of salmon as a safe and healthy product that can supply more protein to a growing world population.

The investment at Colaco, fits with the now accepted need within the market to reduce the use of chemicals and medicine treatments.



CARGILL INNOVATION CENTRE – COLACO

Cargill's ongoing commitment to aquaculture feed research and development

A global presence strengthens the focus on developing nutritional solutions for salmon, shrimp and tilapia.

Furthermore, other developments in new regions such as the new shrimp feed mill in Guayaquil, Ecuador, which is due to begin producing feed during early 2018 and with an investment of USD 30 million, demonstrates that Cargill continues not only to have strong visions for global growth, but also strives to improve productivity, manage risk and support reputation in the market.



Salmon



Shrimp



Other



Research



Aqua Feed Mill



Combined Feed Mill



OUTLOOK FOR THE FUTURE

The future for our fish farming customers will be a greater focus on using feed as part of an integrated pest management plan, with a greater number of compounds available to tackle different health issues.

Working in conjunction with academic and industry partners in Canada, Norway, Scotland and the US, CQN and Cargill Innovation Centre is undertaking important research on many different aspects of fish health.

For example, we are currently undertaking research into co-infection, looking for example at how parasitic infestations go hand in hand with bacterial disease, and have received a GAPP grant from Canada for some of this work. The aim is to formulate better feeds to help maintain fish health and to give them additional support when subject to challenges.

Our enhanced ability to develop new compounds and introduce these into our feed products means that CQN and the EWOS brand will continue to be the best choice for fish farmers.



ACKNOWLEDGEMENTS

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EWOS



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