

Aqua International

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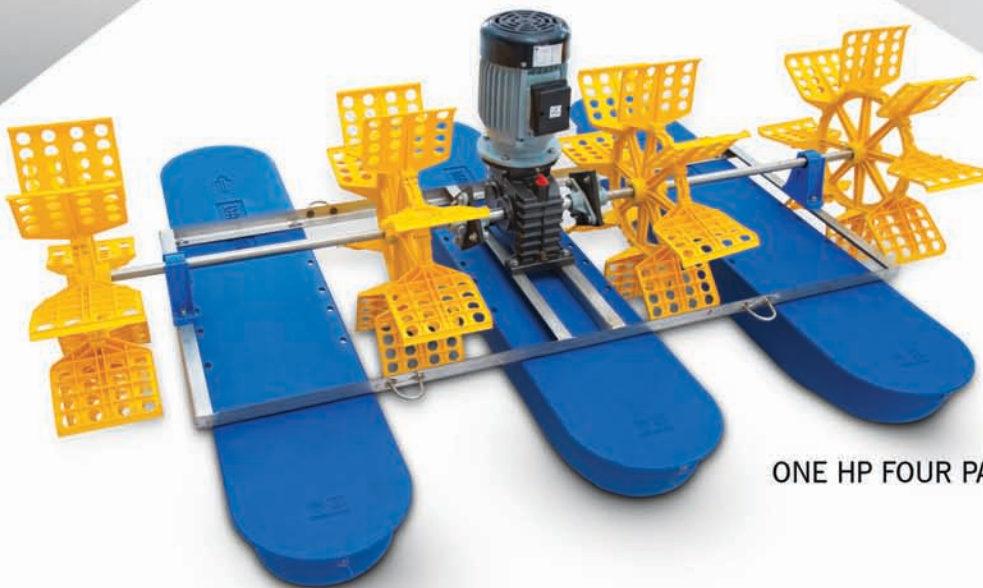
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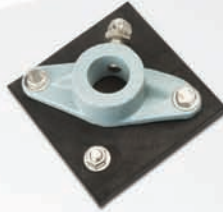
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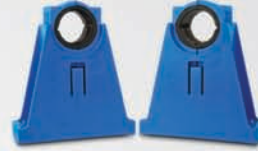
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- Nutreco has a strong focus to grow in the Indian sub-continent.
- Our ambition is to work at the forefront of science and technology by pioneering new, more sustainable and efficient ways to improve animal nutrition and health.

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- Editor

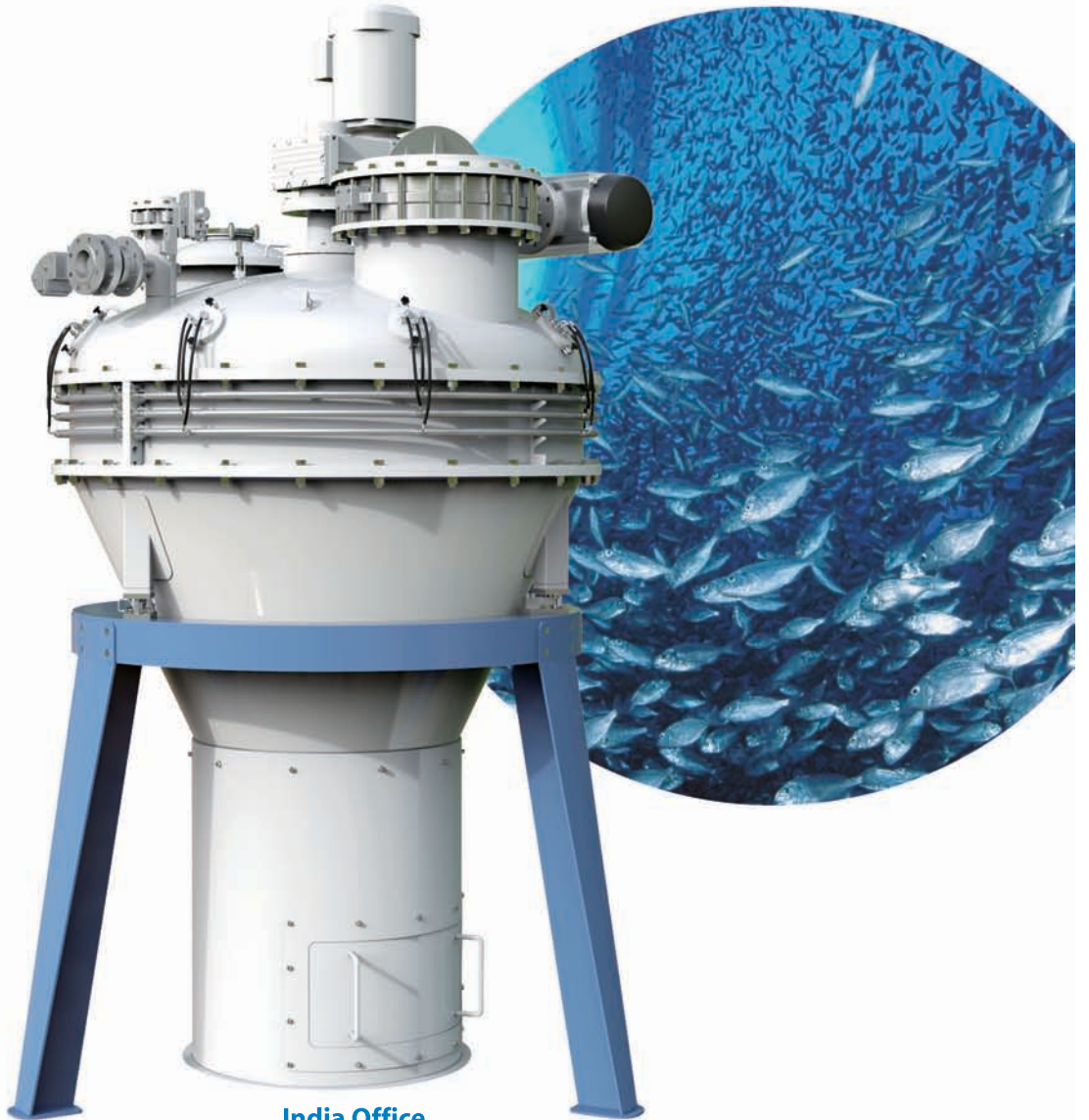


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The success of commercial shrimp industry depends mainly on the availability of healthy and quality Seedstock

A significant component of the fish and shrimp-based protein that humans consume, especially in first world countries, is now provided by these activities. Fluctuating environmental factors and operational challenges can significantly stress shrimp, impacting their overall well-being, immune response and growth. By understanding the root causes and implementing effective mitigation techniques, we can pave the way for sustainable and successful shrimp farming practices.



Dear Readers,

The May 2024 issue of Aqua International is in your hands. In the news section you may find news about ...

Alltech Agri-Food Outlook shares global feed production survey

data and influential trends in agriculture:

Data collected from 13th annual global feed survey estimates, world feed production remains steady with a slight decrease of 0.2% to 1.29 billion metric tons. Lower demand attributed in part to more efficient use of feed; poultry feed shows most significant growth.

U.S. Soy Sustainability Assurance Protocol Annual Report released

The Positive Momentum of Sustainable U.S. Soy, a comprehensive sustainability report on the 10-year history and growth of international U.S. Soy shipments verified by the SSAP. The SSAP is a tool that aggregates sustainability and conservation principles to verify sustainable soy production on U.S. soybean farms. It was created in 2014 to provide credible information and assurance to U.S. Soy customers that the soy they purchase is sustainably produced.

Nutreco, a global leader in animal and aqua nutrition

has two divisions – Trouw Nutrition which is in animal nutrition offering feed specialties, feed additives, premixes and smart blends for poultry, dairy & aquaculture and Skretting, the global aqua feed and nutrition leaders. The company said that they have both organic and inorganic growth plans for expansion of our footprints in South Asia. The

company would like to explore options to make inroads into the B2F segment of layer and dairy market that presents huge market potential. Simultaneously, being closer to customers in growth geographies and high potential areas will remain a priority.

Mr Ivo Lansbergen, President, ANH, DSM - Firmenich, said that their ambition is to work at the forefront of science and technology by pioneering new, more sustainable and efficient ways to improve animal nutrition and health. They are proud of their leading global network of scientists and engineers with a rich history of ground-breaking innovations. DSM started with the first synthesis of vitamins in 1934 and have ever since continued to deliver nutritional and health innovation to the market. These include feed and gut-health enzymes, mycotoxin deactivators and alternative solutions like algae-based omega-3 fatty acids and soon-to-come fermentation-based proteins.

Aquatic Life Institute is looking for progressive aquaculture producers to take part in a survey that will help to improve the welfare of farmed fish. Aqua Life Institute aims to improve the welfare of aquatic animals farmed for human consumption by refining the conditions in which animals are kept or captured in the seafood system and its supply chain.

Shrimp aquaculture in India is a highly dynamic and fast-growing activity dominated by the exotic pacific white shrimp introduced in 2009. The success of the commercial shrimp industry depends mainly on the availability of healthy and quality seed stock, and 276 shrimp hatcheries are involved in the production of specific pathogen free (SPF) *P. vannamei* seed stock and serving the shrimp aquaculture sector.

Contd on next page



Aqua International

Our Mission

Aqua International will strive to be the reliable source of information to aquaculture industry in India.

AI will give its opinion and suggest the industry what is needed in the interest of the stakeholders of the industry.

AI will strive to be The Forum to the Stakeholders of the industry for development and self-regulation.

AI will recognize the efforts and contribution of individuals, institutions and organizations for the development of aquaculture industry in the country through annual Awards presentation.

AI will strive to maintain quality and standards at all times.

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We have seen a significant growth of the shrimp industry over the last decade. Total imports in 2022 were 3,248,338 ton (Van der Pijl, 2023), with additional production in China estimated at 1,487,501 ton (Fu-Chi, 2023). China and Vietnam in Asia (945,791 ton) and the US (837,622 ton) absorbed most of the growth in shrimp production. Ecuador has seen a compound annual growth rate (CAGR) of 17% from 2012 to 2019 and a very significant CAGR of 25% from 2020 to Q2 2023. Reported production by the National Aquaculture Chamber in this country was 1,051,758 ton in 2022, with an expected 10% increase for 2023, equivalent to 1,158,460 ton. Similarly, the Indian Ministry of Commerce reported a CAGR of 19% from 2012 to 2019, reaching a peak of 734,160 tons.

Feed and excreta are the main source of waste and are also responsible for most of the environmental impact of aquaculture and water quality is a critical factor when culturing any aquatic organism. Water quality varies by species and must be monitored to ensure growth and survival. The quality of water in aquaculture production systems can significantly affect the organism's health and the costs associated.

Ahead of The Center for Responsible Seafood's Shrimp Summit, which is taking place in India in June, George Chamberlain reflects on the future of the industry and the recent allegations against some of the key players.

An increasing number of women farmers are now engaged in fish farming in the Indian state of Uttar Pradesh, thanks to a new initiative, according to Transform Rural India. A farmer associated with Urra Shobha Purva SHG in the Mihinpurva block of Bahraich, Uttar Pradesh, faced challenges in supplying sufficient food grains for her family due to seasonal flooding.

A new study at the Hebrew University of Jerusalem has concluded that a strain of disease-resistant carp has a higher chance of survival when infected with cyprinid herpes virus and is also less likely to pass on the disease than conventional strains.

The argulus infestation in fish ponds is very rampant across the country. Due to the parasitic diseases fish culture faces the biggest problem for its sustainability and the commercial expansion. The Argulosis disease causes almost 25% loss to farmers in the form diseases associated mortalities and reduce growth rate. The only immediate remedy is used by the farmers is the unregulated dumping of the insecticide and different drugs/ chemical in the culture water which may give temporary solution from the problem.

In the Articles section- Snail Management And Control In Aquaculture, authored by Dr.Sujani Gudipati said that in recent years, a critical need has been demonstrated for snail control due to the proliferation of a new trematode parasite that has been transmitted from pond to pond throughout the industry. In addition to fish and avian hosts, this trematode relies on snails within aquaculture ponds to complete its complex life cycle. With few legal options for preventing bird access to large aquaculture ponds, alternatives for snail control in this industry are limited to chemical treatments or biological controls.

Another Article Evidences of Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG) through trawl surveys from Off Cochin waters: Ms Sandhya, Mr Paras NathJha, Mr Mohammed Jabir K.K. & Mr Manju Lekshmi discussed that

Abandoned, lost or otherwise discarded fishing gear (ALDFG), is the most detrimental form of marine plastic pollution, causing significant adverse effects on target and non-target species, habitats, and human users in marine systems. ALDFG accounts for 70 percent all macro-plastic marine litter in the oceans (UNEP, 2016). Due to the escalated fishing activities in the last decade and the shift towards synthetic and more durable materials for fishing gear, it is likely that the quantity, distribution, and adverse effects of ALDFG have increased.

Another Article: **How to select superior quality shrimp Seed**, authored by Mr Ch. Lavanya and Ms T. Neeraja the quality of shrimp seeds are the key to the success of your cultivation efforts. As a consequence, selecting the proper one of good quality is critical for getting best profits. Seed selection, additionally referred to as breeding stock selection, is an important part of the cultivation of shrimps that influences the success and output. 70% of shrimp farming performance is dependent on the quality of the seed that we stock.

Another Article: **Stress Management in Shrimp Farming**, authored by Dr.Raghavendruru, Product Manager, Skretting India, over the last twenty years commercial aquaculture has experienced spectacular growth. A significant component of the fish and shrimp-based protein that humans consume, especially in first world countries, is now provided by these activities. Fluctuating environmental factors and operational challenges can significantly stress shrimp, impacting their overall well-being, immune response and growth. By understanding the root causes and implementing effective mitigation techniques, we can pave the way for sustainable and successful shrimp farming practices.

Results in Shrimp, Fish and Crab farming can be achieved as per specifications when the pond management guidelines are followed. Farmers and Integrators have to give sufficient time and attention to farm management and check the developments there to ensure results. When you invest your hard earned money into it, a little more care and attention can prevent losses and help in profitable farming all the time.

Readers are invited to send their views and comments on the news, special feature and articles published in the magazine which would be published under "Readers Column". Time to time, we shall try to update you on various aspects of Aquaculture sector. Keep reading the magazine Aqua International regularly and update yourself. Wish you all fruitful results in your efforts.

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2024 Alltech Agri-Food Outlook shares global feed production survey data and influential trends in agriculture

Data collected from 13th annual global feed survey estimates world feed production remains steady, with a slight decrease of 0.2% to 1.29 billion metric tons

Lower demand attributed in part to more efficient use of feed; poultry feed shows most significant growth.



The 2024 Alltech Agri-Food Outlook revealed global feed production survey data and trends.

LEXINGTON, Ky. – Global animal feed production remained steady in 2023 at 1.29 billion metric tons (BMT), a slight decrease of 2.6 million metric tons (MMT) — or 0.2% — from 2022's estimates, according to the 2024 Agri-Food Outlook, released today by Alltech. The annual survey, now in its 13th year, includes data from 142 countries and more than 27,000 feed mills.

The overall lower demand for feed was due, in part, to the more efficient use of feed made possible by intensive production systems that focus on

using animal nutrition, farm management and other technologies to lower feed intake while producing the same amount of protein, or more. A slowdown in the overall production of animal protein, in response to tight margins experienced by many feed and animal protein companies, also contributed to lower feed demand. Changing consumption patterns caused by inflation and dietary trends, higher production costs and geopolitical tensions also influenced feed production in 2023.

Top 10 countries:

The top 10 feed-producing countries are China (262.71 MMT, +0.76%), the U.S. (238.09 MMT, 1.13%), Brazil (83.32 MMT, +1.84%), India (52.83 MMT, +13.43%), Mexico (40.42 MMT, +0.02%), Russia (35.46 MMT, +3.83%), Spain (27.53 MMT, -11.88%), Vietnam (24.15 MMT, -9.63%), Japan (23.94 MMT, -1.15%) and Türkiye (23.37 MMT, -11.48%). Together, the top 10 countries produced 63.1% of the world's feed production (same as in 2022), and almost half of the world's global feed production is concentrated

in four countries: China, the U.S., Brazil and India.

Notable species results and outlook:

- **Poultry** experienced an increase in broiler feed production (385.04 MMT, +13.10 MMT, +3.5%) and remained steady with a slight increase for layers (170.88 MMT, +0.01 MMT, 0%).
- **Broiler** feed now accounts for 29.9% of the total feed tonnage in the world thanks to a 3.5% increase in overall tonnage in 2023. While this growth was not uniform across all regions, the poultry sector is poised to keep holding strong in 2024 thanks to a combination of regional successes and global market dynamics. Some of the biggest factors that will contribute to the resilience of the broiler sector include reduced costs for inputs, such as feed and energy, and increases in margins and profitability.
- For **layers**, there are industry-wide efforts to optimize feed efficiency and to keep pace with changing dietary trends and new purchasing power. Some markets around the globe were significantly impacted by macroeconomic challenges and disease outbreaks, which can disrupt production cycles. Still, the general outlook for the layer industry remains positive thanks to its resilience in the face of difficult circumstances, when other protein sectors often struggle to adapt.



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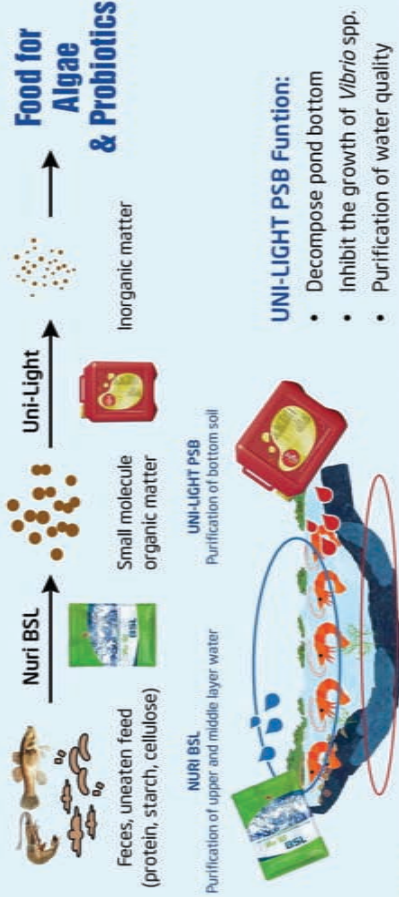
Bacillus spp. > 1 x 10¹¹ cfu/kg
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Every 7 - 10 days after stocking	300 g - 500 g	800 g - 1,000 g
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***Dosage can be adjusted according to the water conditions and practices.

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- The poultry sector is poised for continued strength, driven by a blend of regional successes and global market dynamics. The broiler forecast remains optimistic thanks to lower input costs, increased industrial margins and shifting consumer behaviors. For layers, challenges persist, but there are pockets of resilience and growth.
 - **The global pig feed** production sector faced many challenges in 2023, which led to an overall decrease in pig feed production of 1.23% (320.80 MMT, -4.01 MMT).
 - Latin America stood out as the only region that achieved an increase in pig feed production in 2023, while Europe, Asia-Pacific and North America — which have traditionally been the top pig feed-producing regions in the world — all faced challenges. African swine fever (ASF) continues to wreak havoc on pig production in China and Southeast Asia, where repopulation efforts are slowly proceeding.
 - The trends highlight the complex relationship between economic factors, supply dynamics and disease management in the global pig feed industry. Addressing these challenges will be crucial for sustaining animal agriculture and ensuring food security.
 - **Dairy feed** tonnage decreased by 2.3% (126.23 MMT, -2.28%), primarily due to the high cost of feed combined with low milk prices, which led farmers to make strategic adjustments that included reducing their cow numbers and/or relying more on non-commercial feed sources.
 - In Europe, dairy producers will continue to grapple with stricter environmental policies in the years ahead, and they will need to find new ways to continue growing.
 - Asia-Pacific managed to buck the downward trend and emerged as the only region that increased its dairy feed tonnage in 2023. This growth was fueled by a continued increase in the consumption of milk products there, as well as an expansion of feed production in co-operatives.
 - This shift reflects the delicate balance between economic factors and the need to sustain dairy production. Lower feed costs and higher milk prices would help right the ship.
 - **Beef feed** production decreased by 4.36% (117.49 MMT, -5.35 MMT) globally — the most pronounced downward change among all species sectors last year. Changes in cattle cycles in the United States and stricter sustainability policies in Europe had major impacts, with the Asia-Pacific beef sector notably surpassing Europe's in 2023.
 - The substantial decline in North America was the result of lingering droughts and high production costs, among other issues.
 - While the European and North American beef industries are expected to continue declining in 2024, growth is expected in China, Brazil and Australia — highlighting the complex dynamics and landscape of beef feed production around the world.
 - **The aquaculture sector** experienced a decline of 4.4% (52.09 MMT, -2.42 MMT).
 - This decline was driven in part by a significant drop in China's supply of aqua feed due to lower fish prices, which had a far-reaching impact.
 - Latin America grew by 0.27 MMT (3.87%). Despite adverse weather conditions in that region, the demand for aqua products is still strong in Latin America, which helped aqua producers there remain resilient.
 - **The global pet feed industry** continues to grow, albeit at a slower pace of 0.74% (34.96 MMT, +0.26 MMT) in 2023. Demand for high-quality pet products and services remains high from pet owners who want only the best for their animal companions.
 - The Latin American and North American markets were the primary drivers of this growth, with the pet food sector in North America surpassing Europe's this year.
 - Europe was the only market experiencing a decline in pet food production in 2023.
 - Supply-chain disruptions and inflationary pressures were the key factors contributing to this decrease.
 - **The equine feed** industry experienced a decrease of 3.9% (7.98 MMT, -0.32 MMT) in 2023.
 - The top challenges in the equine sector include high labor and material prices.
 - The top technologies impacting the sector are biosecurity, microchipping, genetics and nutritional solutions.
 - Survey respondents said the biggest opportunities for nutritional solutions are gut health management and feed efficiency.
 - Equine feed is expected to decrease both in price and in volume during the coming year.
- Notable regional results:**
- **North America** saw a decrease of 2.8 MMT (259.26 MMT, -1.1%), with beef feed tonnage down significantly. The pig and dairy sectors also slipped slightly, but the broiler, layer and pet sectors more than made up the difference. Feed tonnage in the broiler sector was up nearly 2.9%.
 - **Latin America** experienced growth in 2023 by 2.46 MMT (200.67 MMT, +1.24%). Despite high production costs, geopolitical tensions and changing consumer behavior due to economic reasons, the region continues to lead global growth, mainly because of its export-driven aquaculture, poultry and pork markets.



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- **Europe** continued its downward trend in feed production, with a decrease of 10.07 MMT (253.19 MMT, -3.82%) due to issues that included the invasion in Ukraine and the spread of animal diseases such as African swine fever (ASF) and avian influenza (AI).
- **Asia-Pacific** led feed production growth in 2023, with an increase of 6.54 MMT (475.33 MMT, +1.4%). Feed production growth in the region's ruminant sectors offset a setback in the aqua sector. The region is home to several of the top 10 feed-producing countries, including China, India, Vietnam and Japan.
- **Africa** experienced continued but slower growth with an increase of 1.95%, nearly 1 MMT to total 51.42 MMT.
- The **Middle East** saw

a slight decrease of 0.12 MMT (35.93 MMT, -0.32%).

- **Oceania** had the third-highest growth, 3.71% or 0.39 MMT to total 10.78 MMT.

Alltech works together with feed mills and industry and government entities around the world to compile data and insights to provide an assessment of feed production each year. Compound feed production and prices were collected by Alltech's global sales team and in partnership with local feed associations in the first quarter of 2024. These figures are estimates and are intended to serve as an information resource for industry stakeholders.

To access more data and insights from the 2024 Alltech Agri-Food Outlook, including an interactive global map, visit alltech.com/agri-food-outlook.

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About Alltech:
 Founded in 1980 by Irish entrepreneur and scientist Dr Pearse Lyons, Alltech delivers smarter, more sustainable solutions for agriculture. Our diverse portfolio of products and services improves the health and performance of plants and animals, resulting in better nutrition for all and a decreased environmental impact.

We are a global leader in the agriculture industry. Our team produces specialty ingredients, premix supplements, feed and biologicals, backed by science and an unparalleled platform of services.

Strengthened by more than 40 years of scientific research, we carry forward

a legacy of innovation and a unique culture that views challenges through an entrepreneurial lens. As a private, family-owned company, we adapt quickly to our customers' needs and focus on advanced innovation.

We believe agriculture has the greatest potential to shape the future of our planet. Our more than 5,000 talented team members worldwide share our purpose of **Working Together for a Planet of Plenty™**. Together, we can provide nutrition for all, revitalize local economies and replenish the planet's natural resources.

Headquartered just outside of Lexington, Kentucky, USA, Alltech serves customers in more than 120 countries, has five bioscience centers, and operates more than 80 manufacturing facilities across the globe.

U.S. Soy Sustainability Assurance Protocol Annual Report Released

ST. LOUIS, MO – April 2, 2024 - The U.S. Soy Sustainability Assurance Protocol (SSAP) has released *The Positive Momentum of Sustainable U.S. Soy*, a comprehensive sustainability report on the 10-year history and growth of international U.S. Soy shipments verified by the SSAP.

The SSAP is a tool that aggregates sustainability and conservation principles

to verify sustainable soy production on U.S. soybean farms. It was created in 2014 to provide credible information and assurance to U.S. Soy customers that the soy they purchase is sustainably produced.

"The U.S. Soy supply chain and its customers share a desire to understand one another and work together for sustainable solutions," said Jim Sutter, USSEC CEO.

"This communication and partnership is driving the ever-increasing demand and momentum for sustainable U.S. Soy."

In 2023, a record 44,480,427 metric tons – 70% of all U.S. Soy exports – were shipped with an SSAP certificate, a 56.44% increase in SSAP shipments over 2021. U.S. Soy's carbon footprint is the lowest in the world when factoring in cultivation impact and

land-use change versus other soy, plant proteins and vegetable oils.

Consumer-facing packaging labels verifying that products are made with "Sustainable U.S. Soy" (SUSS) or "Fed with Sustainable U.S. Soy" are also seeing an increase in use worldwide. More than 1,000 products in countries across the globe currently feature licensed SUSS labels.

"Sustainability is not just a trend but something that creates long-term value for companies," said Chulhoon Lee, Purchasing Manager for SajoDaerim Corporation in Seoul, Korea. "We

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know that using the “Sustainable U.S. Soy” logo is a great opportunity to demonstrate our commitment to sustainability.”

The 2023 SSAP report also highlights sustainability milestones achieved by U.S. soybean farmers, successful industry collaborations, and progress toward U.S. Soy’s 2025 sustainability goals*, which include:

- Reduction in land use impact by 10%
- Reduction in soil erosion by 25%
- Increased energy efficiency by 10%
- Reduction in total greenhouse gas emissions by 10%

*2025 sustainability goals use the year 2000 as a starting benchmark.

This press release was funded in part by the soy checkoff.

About the U.S. Soybean Export Council

The U.S. Soybean Export Council (USSEC) focuses on differentiating, building preference, and elevating market access for the use of U.S. Soy for human consumption, aquaculture, and livestock feed in 80+ countries internationally. USSEC members represent the soy supply chain including U.S. Soy farmers, processors, commodity shippers, merchandisers, allied agribusinesses, and agricultural organizations. USSEC is funded by the U.S. soybean checkoff, USDA Foreign Agricultural Service (FAS) matching funds, and industry.

Shrimp farming advances, challenges and opportunities



We have seen a significant growth of the shrimp industry over the last decade. Total imports in 2022 were 3,248,338 ton (Van der Pijl, 2023), with additional production in China estimated at 1,487,501 ton (Fu-Chi, 2023). China and Vietnam in Asia (945,791 ton) and the US (837,622 ton) absorbed most of the growth in shrimp production. Ecuador has seen a compound annual growth rate (CAGR) of 17% from 2012 to 2019 and a very significant CAGR of 25% from 2020 to Q2 2023. Reported production by the National Aquaculture Chamber (CNA) in this country was 1,051,758 ton in 2022, with an expected 10% increase for 2023, equivalent to 1,158,460 ton. Similarly, the Indian Ministry of Commerce reported a CAGR of 19% from 2012 to 2019, reaching a peak of 734,160 tons. This has since been reduced to an expected export volume of 632,802 tons for 2023

(Van der Pijl, 2023) due to market oversupply.

Boyd and McNevin (2018) reported that from a total of 2.4 million ha available for shrimp farming worldwide, 1 million had an annual production of less than 300 ton/ha (0.3 million ton), and 1.4 million ha produced >300 ton/ha/year, equivalent to 5.2 million ton, representing 94% of production output from only 58% of production area. Commercial farming technologies vary significantly between regions. For example, semi-intensive production in Ecuador result in annual yields between 1–5 ton/ha/year, while the intensive systems in India produce 5–10 ton/ha/year. Reports of 10–25 ton/ha/year are the norm for Thailand’s super-intensive systems, and 25–100 ton/ha/year would be expected in a hyper-intensive production systems elsewhere.

Currently, shrimp production faces several

problems that influence its development and consolidation worldwide. A Global Seafood Alliance 2022 survey to industry stakeholders mentions feed cost, market prices, diseases, and broodstock quality as the most relevant (Nikolik, 2022).

Feed Cost: Ingredients used for shrimp feed formulations have had marked increases in the past decade, with fishmeal and fish oil at average prices of US\$1496/ton and US\$2348/ton, respectively (BCRPData, 2023a, 2023b). The cancellation of the 2023 Peruvian anchovy fishery, to guarantee the sustainability of the biomass, has further reduced world fishmeal availability by 10% and fish oil by 30%, year-on-year (White, 2023) forcing prices up to \$2600/ton for fishmeal in China (LeBlanc, 2023), and \$6000/ton for fish oil (Miranda, 2023). Vegetable protein sources, such as soy and wheat meals, have also shown sharp increases in the last couple of years due to the Russia–Ukraine war and the extended droughts worldwide. After the collapse of the Black Sea Grain Deal in July 2023 (Wintour, 2023), wheat prices have risen another 8%. For an expected world shrimp production of 5.5 million ton, nearly 9 million tons of feed are necessary (at an average feed conversion ratio (FCR) of 1.6). Feed represents

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between 40%–65% of total shrimp production costs and the free on board price has risen 25% from early 2021. This has a significant impact on the economic viability of the industry.

Market Prices: Shrimp prices in Ecuador dropped from US\$5.80/kg to \$5.00/kg from January 2020 to January 2021, during the COVID-19 pandemic, before increasing to \$6.80/kg by November 2021, as the markets reopened post pandemic. Nevertheless, a steep decline to \$5/kg by July 2023 (Van der Pijl, 2023) has shown that oversupply and slow market demand have eliminated any expectations of a fast recovery. With the Organization for Economic Cooperation and Development Aquaculture (OECD) predicting a 9% decline in fish and seafood prices over the next decade (OECD/FAO, 2023), the economic outlook is for industry consolidation, needed value chain cost reductions and improved production efficiency.

Disease: While all cultured species have had some impact from diseases, it is safe to say that shrimp has been affected the most. How much of an impact? Flegel et al. (2008) reported losses of around 22%/year, equivalent to US\$1 billion. More recently, Shinn et al. (2018) put that figure at US\$4 billion/year during 2009–2018, caused mainly by white spot syndrome virus (WSSV) and acute hepatopancreatic necrosis disease. Asche et al. (2021) modeled the impact of disease on shrimp concluding

“the presence of disease increases breakeven price significantly and thereby increases the probability of losing money as well as increase the risk.” The lack of a highly developed immune system in shrimp prevented development of the industry in Asia for a long time, as the reliance on wild *P. monodon* stocks created a vicious cycle of infection-antibiotic treatment-reinfection. The introduction of Specific Pathogen Free (SPF) white shrimp, *L. vannamei* (Alday-Sanz et al., 2018), and improved management, resulted in a dramatic increase in production from 2000.

Broodstock Quality: MacIntosh (2010) indicated that selective breeding for rapid growth based on SPF lines for white shrimp has been successful at improving survival, reducing FCRs and the fish in: fish out ratio, and shortening the grow out cycle, thus reducing energy demands and overall production costs. With this, a 44% reduction in culture time to 25 g (128–74 days), over 85% survival, 20% reduction in FCR (1.6–1.3), and 44 ton/ha/year over six generations were possible for white shrimp in Thailand. However, with the onset of diseases, selection strategies have changed. Farmers in Ecuador decided to use surviving individuals from WSSV-infected production ponds as breeders. Survival was their primary goal, with expectations of developing Specific Pathogen Tolerant (SPT) strains, which limit the effect of disease if it occurs (Alday-Sanz

et al., 2018). Expected challenges were that hatcheries could become a source of disease, and that tolerance would not transfer from generation to generation due to poor heritability. Nevertheless, the gamble paid off. With the incorporation of better management strategies, including automatic feeding and aeration, Ecuador is now the leading exporter of shrimp in the world. On the other hand, India which also expanded production significantly in the past few years is now dealing with an increase in crop failure rates which some attribute to a lack of robustness to changing environmental conditions of the new genetic strains in the pond (Kumar, 2022).

What are the opportunities to reduce production costs and improve production efficiency?

If we look at the feed costs, new manufacturing processes, like extrusion (Miranda, 2023), have shown clear benefits in FCR improvement and a reduction of residual organic matter in the ponds. This has taken hold in Ecuador, but not India, due to resistance by farmers to pay even more for the most expensive item in their production cost structure. Similarly, automatic feeding and aeration have shown its benefits for better-feed usage, but equipment and installation costs deter some producers from incorporating them. At present, around 17% of farm area in Ecuador uses automatic feeders and aeration, with expectations for the

country to increase exports significantly in the coming years, as more farming sectors incorporate better technologies (Yahira Piedrahita, “Will Ecuador continue to grow its shrimp production?” at the Global Shrimp Forum, 2023). Understanding carrying capacity in changing culture conditions (i.e., dry or wet seasons, El Niño Southern Oscillation (ENSO) events, or increased temperatures due to climate change) is essential to avoid past mistakes when deciding to increase stocking densities to improve yields. On the other hand, fishmeal and fish oil limitations present a major challenge for industry growth, as farmed crustaceans (shrimp, prawn, crayfish, and crab) are the top consumers of available fishmeal, with 30% (Johannessen, 2023). This means that new protein sources like insect meal (black soldier fly larvae), unicellular proteins (yeast, bacteria, fungi, and algae) and vegetables (Pea, Faba) (Geerts, 2023) will play a relevant role. However, volume and cost are still very much a limitation for these supplies. Similarly, as we consider the evolution of the industry from semi-intensive to more intensive systems in some regions (see Horton, 2022), and the incorporation of economically viable recirculatory aquaculture system (RAS) systems, molecular-assisted genetic selection for high growth strains, more adaptable to new protein use, will be needed.

The current geopolitical situation is also affecting

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Vitamin-B6	-	0.62 mg.
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the market. This will lead to consolidation and better vertical integration to reduce production costs, better managing the price downturn. Streamlined and continuous offer of high quality, traceable, shrimp from certified farms would reduce seasonal price variations and eventually lead to production contracts of insured crops. This will improve financial certainty for farmers. Certifiable, more controlled (intensive) production will also improve the narrative of the industry in terms of sustainability. This and the consumer shift to more nutritious and healthy products will encourage consumption (Bianchi et al., 2022; Gulmans, 2023), thus opening the door for an expected increase in production volume (i.e., from Ecuador or other areas). Hyper-intensive RAS production needs to complete its validation process, but when it does, will eventually contribute to a reduced carbon-footprint by establishing production areas near niche markets (live shrimp, head-on, never frozen shrimp, etc.)

As we intensify shrimp culture, continuous production becomes feasible in more regions. Better disease prevention and diagnostics are essential. The advent of genomics has made it possible to identify family traits and select for disease tolerance or resistance to specific pathogens (Kumar, 2022). At present, evidence of selection for WSSV tolerance shows promise, with some commercial genetic lines

offering organisms selected for both growth and disease tolerance. This was considered impossible by the industry 10 years ago. Quick-detection CRISPR-Cas 9 kits for multiple diseases will be essential on-site, to manage pathogens better (see Sullivan et al., 2019).

Improvements in breeding where selected lines are the result of natural mating and non-ablation of spawners, certified with improved disease challenges for early mortality syndrome climate and appropriate disease challenges for enterocytozoonhepatopenaei and WFD will contribute to improving genetic programs. These will continue to be based in SPF broodstock from a wide genetic pool nucleus, using molecular assisted selection for specific traits, like growth (MacIntosh, 2010), disease tolerance (Kumar, 2022), feed use efficiency (Dai et al., 2019) and physiological robustness (Villarreal-García, 2022). On the other hand, the development of new genetic lines for P. mondon will lead to the incorporation of a more consistent supply of larger sizes to the market (Van der Pijl, 2023).

Juarez et al. (2022) identify differences among production systems in terms of biosecurity, use of water, aeration and energy efficiency per ton of product. These differences are relevant for the way we deal with industry problems. Some hatcheries offer specific genetic lines for these production systems. In general, fast growing shrimp lines are

the best option in well-managed systems. For example, Fletcher (2023) quoted Robins MacIntosh (CEO Homegrown Shrimp) indicating that it is possible to produce 34-g white shrimp in 82 days, without a reduction in survival, using a RAS system. However, pond performance is an interaction between genetics, available feed quality and environment. When any of these three factors change, management has to adapt. Using a fast growth line means the expected weekly growth rate is higher requiring more feed. Boyd and Hanson (2010) indicated that only 10% of total oxygen is available for shrimp in biofloc systems. Faster shrimp growth results in a larger biomass that requires an increase in available oxygen levels in the pond to adjust the carrying capacity as the metabolic demands of shrimp increase (Villarreal et al., 2022; Villarreal-García, 2022). MacIntosh (2010) suggested that around 5.8 mg/L available oxygen in the pond contributes to keep shrimp healthy when they are metabolizing and growing at a faster rate (Fletcher, 2023).

As we move toward production systems that are more sustainable and efficient, a better understanding of shrimp biology and the dynamics of the interactions with the environment is needed. The shrimp industry is positioned to advance significantly in the coming years if it can integrate available knowledge to the industrial innovation process.

M V Koushik retires after leading the Avitech's sales team for over 25 years



After leading Avitech's growth and development for over 25 years, Mr Mahadev V. Koushik, President Sales, has sought retirement.

Mr M.V. Koushik has been at the helm of Avitech's sales function since 1998. He is, to a large extent, responsible for Avitech's transformation into leading premix/ feed additive supplier across India and several other geographies.

The high standards of professionalism that characterises the Avitech team is a direct result of Mr Koushik's relentless pursuit of excellence and his innate humility and integrity.

Whilst Mr Koushik will be missed at the company, he has graciously agreed to continue his association with the company as an advisor / consultant.

The organisation is indebted to Mr Koushik for his enormous contribution and wishes him the very best for the journey ahead, said a note from Avitech.

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Bacterial strains such as Bacillus Subtilis, Nitrobactor, Nitrasonomas, rapidly converts ammonia into Nitrates, Nitrites and finally non-toxic Nitrogen. Hydrogen Sulphide converts into Sulphates, Sulphites and finally non-toxic Sulphur, Methane into Non-toxic carbon. This conversion reduces the obnoxious gasses in the pond bottom. Reduction of this gasses improve the D.O. level in the water and bottom.



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Farmers sought for fish welfare initiative

Aquatic Life Institute (ALI) is looking for progressive aquaculture producers to take part in a survey that will help to improve the welfare of farmed fish.



CLFMA Managing Committee 2022-2024

Aqua Life Institute aims to improve the welfare of aquatic animals farmed for human consumption by refining the conditions in which animals are kept or captured in the seafood system and its supply chain.

The new initiative seeks to showcase the most welfare-conscious producers in the world and say that benefits of participating in the study include:

- Seafood certification/retailer promotion
- An exclusive presentation at the annual Aquatic Life Conference Trade show feature
- Media exposure
- Access to a multidisciplinary network of professionals
- Aquatic animal welfare resources
- Inclusion in its publications as a best practice example with a broad audience of policy-makers, industry, and NGOs

“Our intent is to promote

better cross-industry collaboration between academic institutions, advocacy organizations, and producer associations to inspire future research that addresses real-life challenges in aquatic animal farming. The information gathered will not only serve as progressive examples of improvements in farming of aquatic animals that can be replicated in various farms, but will also provide valuable guidance to aquaculture farmers, policymakers, and stakeholders, enabling them to continue enhancing animal welfare, productivity, sustainability, and environmental stewardship in aquaculture operations,” explained ALI in a statement.

ALI is specifically seeking information regarding industry best practices in global aquaculture as they relate to positive aquatic animal welfare for Atlantic salmon, rainbow trout, common carp, grass carp, Nile tilapia, European seabass, gilthead seabream, pangasius, >>

Timer-based power operated prototype Water Filtration System for Aquaculture



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Feed and excreta are the main source of waste and are also responsible for most of the environmental impact of aquaculture, and water quality is a critical factor when culturing any aquatic organism. Water quality varies by species and must be monitored to ensure growth and survival. The quality of water in aquaculture production systems can significantly affect the organism's health and the costs associated. Therefore,

>> turbot and Pacific whiteleg shrimp.

The organisation explains that they want to highlight practices that are not only beneficial to producers, but also to the animals themselves, accompanied by welfare indicators that are currently in use for the on-farm evaluation of these pillars and their effectiveness.

- Farm level environmental enrichment strategies
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removal of particles from water flow is important in aquaculture. Suspended solids, dissolved solids, and organic matter are removed from water by filtration of water through suitable media.

Salient features of the technology:

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optimisation and monitoring

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- Humane methods of stunning and slaughter.

Ali would like interested parties to fill in this spreadsheet. Questions, comments, and feedback can be directed to Tessa Gonzalez, senior researcher at Aquatic Life Institute (tessa@ali.fish).

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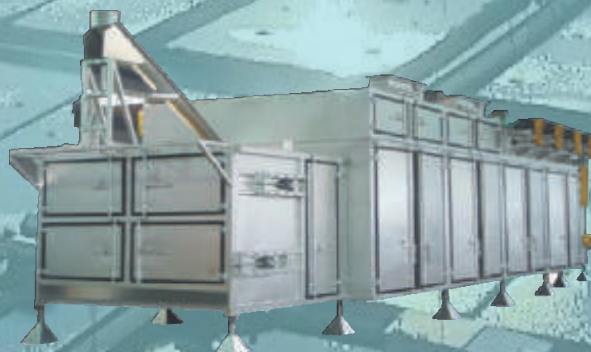
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Overview and methodology for examination of Pacific white shrimp mortalities



Indian shrimp hatcheries have experienced larval mortality in the zoea-2 stage, with molt deterioration and resulting in heavy mortality.

Shrimp aquaculture in India is a highly dynamic and fast-growing activity dominated by the exotic Pacific white shrimp (*Penaeus vannamei*), introduced in 2009. The success of the commercial shrimp industry depends mainly on the availability of healthy and quality seedstock, and 276 shrimp hatcheries are involved in the production of specific pathogen free (SPF) *P. vannamei* seedstock and serving the shrimp aquaculture sector.

Because of the constant demand of the growing aquaculture sector, intensive shrimp farming has improved substantially during the decade. This increasing trend of intensification and commercialization has exacerbated disease epizootics.

Diseases are significant challenges for shrimp larval breeding systems, particularly bacterial diseases such as luminescent bacterial

diseases that cause severe economic consequences for hatchery operations. Large-scale losses of eggs and larvae have been reported due to larval mycosis caused by *Legenidium* spp. and *Sirolopidium* spp. Larval fouling is caused by protozoans such as *Zoothamnium* and *Vorticella*, in addition to other diseases of viral and bacterial origin.

However, since introducing *Vannamei*, Indian shrimp hatcheries have experienced larval mortality in the zoea-2 stage, with molt deterioration and resulting in heavy mortality. In the case of *P. vannamei* shrimp larvae in Ecuador, Mexico and the United States, similar larval losses were recorded with the “zoea-2 syndrome” in 1993.

The occurrence of mortalities in zoal stages of *P. vannamei* frequently reported in Indian shrimp hatcheries provided us with the stimulus to investigate

the problem holistically, considering the possible participation of biotic and abiotic factors. This article is adapted from *Aqua Cultura* (Ecuador), #119, September 2017. We acknowledge Prof. Pushpa Viswanathan of the Electronic Microscopy Transmission Department of the Chennai Cancer

syndrome, is characterized by a reduction in the feeding rate of late zoea-1 and early zoea-2 larvae, due to the alteration in their metamorphosis followed by high mortalities. Microscopic studies revealed systemic abnormalities in affected larvae as well as pathological manifestations in the hepatopancreas and intestine. Microbiological detection revealed the predominance of *Vibrio alginolyticus* in most hatcheries (nine) affected by zoea-2 syndrome.



The study investigated mortalities of Pacific white shrimp during the zoea stages in 15 shrimp hatcheries located on the east coast of India.

Institute for his kind help and support in TEM studies, and also thank the shrimp hatcheries in Tamil Nadu and Andhra Pradesh for contributing samples and information for this study; and acknowledge the International Committee of Animal Registries (ICAR) of India for financial support to carry out this work.

We investigated mortalities of Pacific white shrimp (*Penaeus vannamei*), during the zoea stages in 15 shrimp hatcheries located on the east coast of India. This disease, commonly known as the zoea-2

Histological examination in the hepatopancreas and intestine revealed vacuolization, in addition to detachment of epithelial cells and disintegration of the peritrophic membrane of the intestinal epithelium. The OIE (World Organisation for Animal Health) polymerase chain reaction (PCR) protocols confirmed that the OIE-listed shrimp viral pathogens were absent in the affected larvae. Ultrastructural observation of the pathological manifestation in the hepatopancreas and intestines could not

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reveal the presence of pathogens. Data on water quality parameters were in the normal range and did not appear to influence the outbreak of zoea-2 syndrome in the nursery sites.

The feeding schemes (with microalgae *Skeletonema*, *Chaetoceros*, *Thalassia*) were uniform throughout the larval cycles, and it was also found that they were not associated with the zoea-2 syndrome.

Pathological manifestations of the hepatopancreas and intestine further indicated a deterioration of the digestion and absorption capacity, which resulted in delayed molting and the subsequent death of larvae in a gradual and progressive manner, with a cumulative mortality of 30 to 100 percent in the zoea-2 stage. It was also determined that the continuous storage of nauplii for three to four days within the same larval incubation unit exacerbated the incidence in the nine affected nurseries (OR-48, IC 2.5-932.9). The etiology (cause of disease) of the zoea syndrome may not be due to known infectious agents, an additional result from the interpretation of our studies.

Methodology: Sampling and microbiological exam

The study involved 15 commercial shrimp hatcheries along the eastern coast of India, including six from Tamil Nadu (Kancheepuram and Vilupuram districts) and nine from Andhra Pradesh (Nellore, Prakasham and East Godavari districts). Larval samples were collected under live conditions from larval cycles affected by zoea syndrome. Live zoeas were



Samples of shrimp larvae were collected from commercial hatcheries for several tests.

observed under optical microscopy and samples of larvae conserved in Davidson AFA fixative for histology. Zoeal samples were fixed in 2.5 percent glutaraldehyde and 0.1 M sodium cacodylate buffer for electron microscopic observations. The larvae were also conserved in 90 percent ethanol and RNAlater (Ambion) for the detection of pathogens by PCR analysis.

During the microbiological examination, samples of 0.5-gram larvae were collected and placed in sterile phosphate buffered saline (PBS) solution, homogenized and inoculated on thiosulfate bile salt sucrose (TCBS) agar and Zobell marine agar (ZMA). The total plate count (TPC) was performed by means of 10-fold serial plate dilution plates in duplicate on ZMA. Plates were incubated at 30 ± 1 degrees-C and observed after 24 hours. Based on phenotypic characteristics, pure cultures of the dominant heterotrophic bacterial flora were identified.

DNA extraction, RNA extraction and cDNA synthesis

Genomic DNA was extracted from larval samples, as described

in the experiment by Rajendran et al. (2016). Larval samples were homogenized and digested for 10 minutes at 95 degrees-C in 500 μ l of lysis buffer (50 mM Tris, 1 mM methylenediaminetetraacetic acid (EDTA), 500 mM NaCl 1 percent SDS) and 0.1 mg Proteinase K. The mixture was centrifuged at 12,000 rpm for 10 minutes at 4 degrees-C. After centrifugation, the supernatant was carefully collected, and two volumes of ethanol were added and maintained at minus-20 degrees-C for one hour. The mixture was then centrifuged at 12,000 rpm for 10 minutes at 4 degrees-C. The DNA sediment was washed with 70 percent cold ethanol, air dried, re-suspended in nuclease-free water and stored at minus-20 degrees-C. RNA was extracted from larval samples using TRIzol™ Reagent following the manufacturer's protocol. The amount and quality of the extracted RNA were evaluated using a nano spectrophotometer and stored at minus-80 degrees-C. Reverse transcription was carried out using the iScript cDNA synthesis kit in 10 μ l reactions, according to the manufacturer's instructions

and the cDNA was stored at minus-20 degrees-C until further use.

Detection of viral pathogens

Nucleic acids were used for the detection of viral pathogens, extracted from samples of larvae by PCR. For the detection of White Spot Syndrome Virus (WSSV), we used a nested PCR protocol.

Other DNA and RNA viruses – namely, hypodermic and hematopoietic infectious necrosis (IHHNV), baculovirus monodon (MBV), hepatopancreatic virus (HPV), yellowhead virus (YHV), Taura syndrome virus (TSV) and Infectious myonecrosis (IMNV) – were detected by the PCR tests recommended by the OIE. Covert mortality syndrome virus (CMNV) was tested by a nested RT PCR protocol, described by Zhang et al. (2014). PCR was carried out in a thermocycler. An aliquot of the amplified PCR product was resolved on 2.0 percent agarose-Tris-acetate-EDTA (TAE) gels stained with 0.5 μ g/mL of ethidium bromide, and the amplified DNA along with a marker of 100 bp DNA was visualized under UV illumination using a gel documentation system (Bio-Rad Laboratories, USA).

Light microscopy exam

The larval samples collected under live conditions of normal and affected larval cycles were observed under light microscopy. For histology, the zoeal samples were fixed in the Davidson AFA fixative for 48 hours and processed using routine histological techniques. The zoeal samples were dehydrated through graded alcohols (70, 90 and 100 percent, respectively)

each for 60 minutes. After dehydration, the tissues were cleared twice with xylene for 60 minutes, further infiltrated with paraffin wax for 2 hours and then blocks were prepared using Leica EG 1160 tissue. Tissue sections 4-5 μm thick were obtained on clean microscopic slides of paraffin blocks using a Leica RM 2145 microtome, and the sections subsequently treated by hematoxylin and eosin staining using standard procedure. The stained tissue sections were mounted on DPX and observed under a microscope.

Electron transmission microscope

The larval samples were fixed in 2.5 percent glutaraldehyde in 0.1 M sodium cacodylate buffer (pH 7.3) for 8 hours at 8 degrees-C, fixed in 0.1 percent osmium tetroxide prepared, using the same buffer at 8 degrees-C for 2 hours and processed according to the protocols of Naveenkumar et al. (2013). Sections were examined using a JEM 1400 Transmission Electron Microscope at an accelerated 80 kV voltage and photomicrographs were taken at the Cancer Research Institute (WIA) Adyar, Chennai.

Statistical and epidemiological analyses

The odds coefficient, which measures the strength of the association between disease and exposure to a risk factor, was estimated using the Epi Info™ 7.1.2 single table analysis at a 95 percent confidence level, by approximation of the Taylor series, and two p-values using the Fisher exact test.

Why abuse allegations should cause a rethink for the Indian shrimp sector

Ahead of The Center for Responsible Seafood's Shrimp Summit, which is taking place in India in June, George Chamberlain reflects on the future of the industry and the recent allegations against some of the key players.the next research stage.



George Chamberlain walking beside a smallholder's shrimp pond in India with teams from AquaExchange and The Nature Conservancy

What are the main insights into the state of the shrimp sector that you've picked up of late?

Media coverage of alleged labour abuses in India has highlighted the need to openly address the issues, identify any shortcomings, and improve assurances. As with most issues, this is likely driven by rare exceptions from mainstream processing. Nonetheless, it's important to provide a forum for stakeholders to openly review it, identify any

areas for improvement, and implement corrective actions and assurances.

Digital technology is enabling previously unforeseen advances for smallholders, including accurate estimation of shrimp biomass using smart-phone assisted evaluation of check trays in ponds. This, coupled with the estimation of shrimp size, enables estimates of real-time crop value, which reduces risk and enables insurance and financing

of smallholders. This is a scalable shift that one could easily see spreading throughout Asia.

Access to rich datasets from digital apps, in turn, enables enrollment in improver programmes leading to certification. The Centre for Responsible Seafood (TCRS) is working closely with AquaExchange in India and Tomota in Vietnam to develop an improver database, with support from The Nature Conservancy (TNC) through

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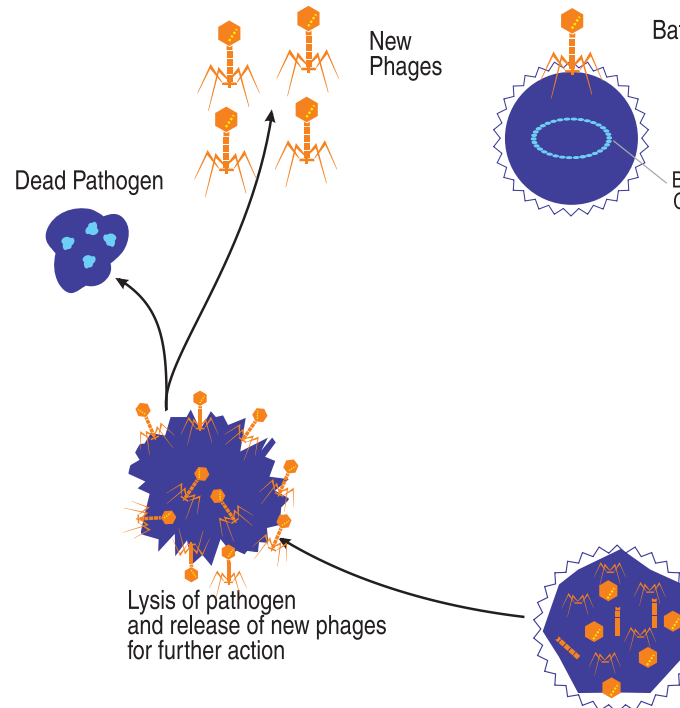
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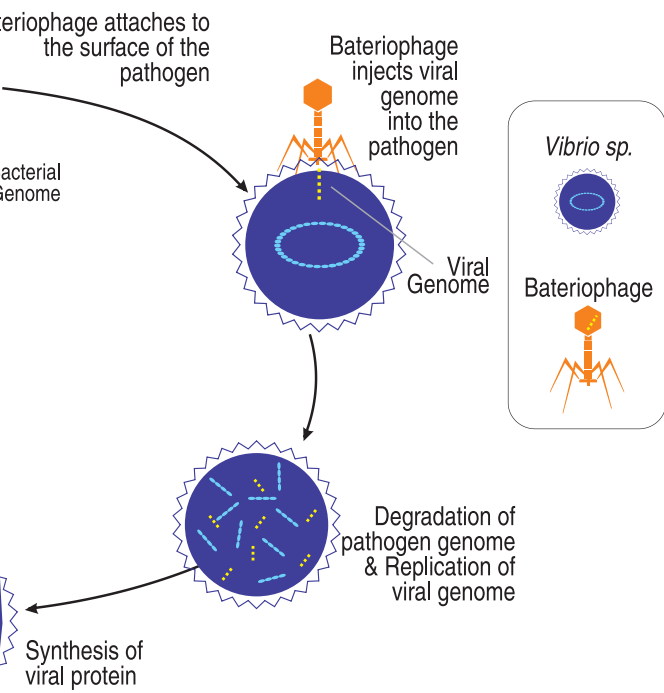
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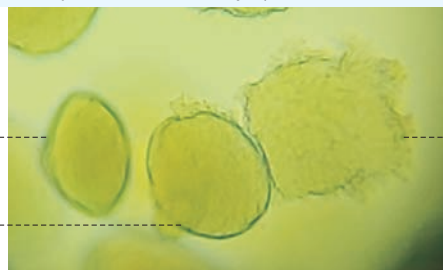
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Stages of *Vibrio sp.* colonies infected with Bacteriophages & Progressive Lysis observed on an Agar plate, under Stereo Microscope

Colony 1 in Stage 1:
 Intact Colony may be infected or yet to get infected.

Colony 2 in Stage 2:
 Phage infected Colony showing Partial lysis.



Colony 3 in Stage 3:
 Phage infected Colony Completely lysed, cell contents with multiplied phages spreads out in search of their host.

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George Chamberlain presenting a posthumous Lifetime Achievement Award to Dr Fujinaga the 2023 Shrimp Summit.

Dr Fujinaga is widely seen as the father of shrimp farming

a grant from the Walmart Foundation.

There are high hopes for unified global shrimp marketing led by the newly formed Global Shrimp Council to increase shrimp consumption and lift prices.

There is a tight interconnection between shrimp breeding and disease management and a growing recognition of the need for more sentinel testing of breeding families in the actual production environment to assure that appropriate families are selected with increasing tolerance of local pathogens.

Short on time? Watch this summary video.

Are there any rays of hope, despite all the challenges?

An overarching theme of the [TCRS] Shrimp Summit will be identifying best practices around the world that are leading to improved efficiency, sustainability, and cost. As outlined above, there are many opportunities to improve at each level of the production chain.

Can you tell me a bit more

about the summit and what you aim to achieve with it?

TCRS launched the first Shrimp Summit in July 2023, in Ho Chi Minh City. It attracted 300 in-person delegates, and 350 virtual attendees. Networking was enhanced with a tasting of shrimp from around the world and a dinner cruise on the Mekong River. We organised a pre-conference bus tour to the super-intensive Minh Phu farm and a two-day post-conference charter-flight tour to Ca Mau, where we visited a shrimp hatchery, processing plants, organic shrimp farms in the mangroves, mangrove restoration area, and a shrimp waste upcycling facility.

A post-conference poll of delegates indicated that 96 percent wanted to repeat the event this year. So, we're in the process of planning a second Shrimp Summit in Chennai, India on 27-29 June.

What are the topics you're most excited about?

There are lots of interesting and impactful sessions lined up, including:

- Global production and markets
- Expanding the market
- Improver programmes for smallholder farms
- The rise of digital technology
- Sustainable feeds
- Breeding and disease management
- Innovation

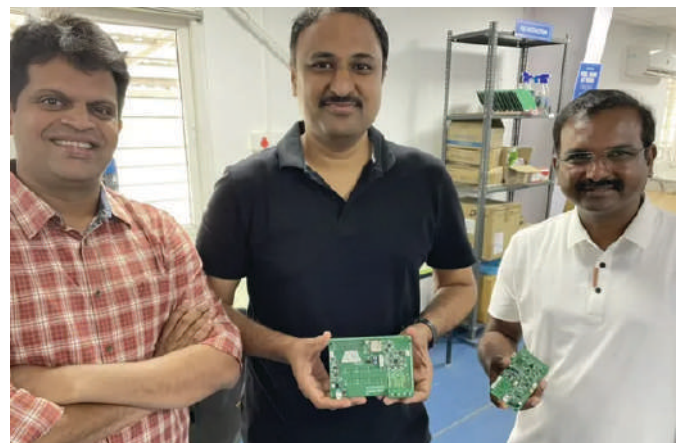
We select the venues based on where the action is. Vietnam was exciting because of its progress on both super-intensive tank farms (as exemplified in the pre-conference tour to the huge Minh Phu Loc Anh farm) and unfed organic farms in harmony with mangrove forests in Ca Mau.

India is exciting because of its remarkable growth and reliance on smallholder farms and its very recent game-changing shift toward digital technology.

Indonesia might be next, because it's another Asian powerhouse with many fascinating developments, and it's driven by smallholder farms who might benefit from the TCRS improver programme.

How has the transition from GSA to TCRS been treating you?

I retired from the Global Seafood Alliance (GSA) after 25 years as president



The founders of AquaExchange: Hemasundar Dhavili, Pavan Kosaraju and Kiran Kumar

The trio are holding circuit boards that they've designed for their digital equipment for smallholder farms

- And a special session on alleged labour abuses in Indian processing

How do you select the venues and where next?

at the end of 2022. I've devoted my time to TCRS since then. It's been a fun ride. TCRS is a small non-profit with no full-time staff (including me).

The tiny team means that we can move fast in our decision making and implementation. It feels like a startup. I enjoy that.

How and why was TCRS formed?

In 2003, GSA applied for a grant from a philanthropic foundation to improve shrimp farming practices in Asia. Our proposal won the competitive grant process, but we subsequently discovered that GSA was not eligible to receive foundation funds since it is incorporated as a non-profit trade association. The GSA board felt that research and education were important components of the sustainability mission. In 2009, it took steps to form an independent charitable organisation called the Responsible Aquaculture Foundation (RAF) with its own governance structure and board of directors.

Initially, RAF pursued grant funding from the World Bank to conduct a series of case studies on aquaculture disease management. The first was in Chile with infectious salmon anaemia, the second in Vietnam with early mortality syndrome, and the third in Mozambique and Madagascar on white spot syndrome virus. It subsequently conducted projects on food safety, social accountability, and animal welfare. To help disseminate its findings, it developed 25 online courses on disease management, water quality, social accountability, food safety, and animal welfare. Another 5-10 courses will be released soon.

Nearly the entirety of

funds from each grant was devoted to executing the projects, leaving little funding to support administrative costs. For 10 years, RAF relied on GSA for office space, book-keeping, taxes, IT systems, and project management.

As I approached my retirement from GSA, it occurred to me that I might lend a hand to RAF in helping it grow and achieve independence. The RAF board invited me to assume the role of president. We decided to change the name of the organisation to The Center for Responsible Seafood (TCRS) to reflect the organisation's interest in pursuing a broader scope that included all seafood – farmed and wild catch. Within a few months, we established an office, hired an administrative team, pursued several grants, and started several new projects.

So, in answer to your question, GSA helped found TCRS, provided its first home, and assisted with financial support. TCRS could never have gotten to his point without GSA support. Now, TCRS is an independent organisation with its own office and staff and an exciting mission and programme.

What are GSA's and TCRS's greatest achievement in the shrimp sector to date?

GSA can be proud to have helped the shrimp sector navigate many issues over the years including mangroves, antibiotics, food safety, antidumping, social issues and animal welfare. The BAP certification programme has become an

important tool for retailers to gain assurances of best practices throughout the supply chain. Of course, this job is never done, and the system must be continually reviewed and improved to navigate the challenges of climate change, etc.

TCRS is a young organisation that's just getting started, but I think that it can serve a significant role in the "pre-certification" arena, especially with Improver programmes for smallholder farms. It's also working in the innovation space with optimisation of intensive shrimp tank designs and in the area of novel feed ingredients, both in collaboration with TNC.

How do you see the role of TCRS evolving in terms of your involvement with shrimp?

As TCRS builds its improver programmes for smallholders in collaboration with digital solution providers, I see

it developing an industry-wide database which will enable hundreds of thousands of previously unreachable small farms to enter the sustainability journey and ultimately become certified. The rich dataset will provide an unprecedented landscape view of feed and energy efficiency and of carry capacity on a landscape basis.

1. If you could solve three issues in shrimp aquaculture what would they be?
2. Openly address with alleged labour abuses and restore confidence in farmed shrimp.
3. Assist small holders in improving their efficiency, profitability and sustainability.
4. Improve disease tolerance in Asian shrimp farming by capitalising more on sentinel testing of breeding families in the production environment.

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Aquaculture initiative ramps up incomes for female farmers in Uttar Pradesh

An increasing number of women farmers are now engaged in fish farming in the Indian state of Uttar Pradesh, thanks to a new initiative, according to Transform Rural India.



A group of people attending one of TRI's Aqua Schools

Shail Kumari, a farmer associated with Urra Shobha Purva SHG in the Mihinpurva block of Bahraich, Uttar Pradesh, faced challenges in supplying sufficient food grains for her family due to seasonal flooding.

Upon discovering fish farming through Transform Rural India's Aqua School, Kumari decided to excavate a fish pond in her one bigha land, investing Rs 10,000 with support from the village organisation, while TRI provided fish seed and bird nets. Kumari earned a profit of Rs. 5,000 from her rice production and a total income of Rs. 40,000 from fish farming. Additionally, fish farming reduced pests in the rice crop and eliminated the need for extra fertilisers. Currently, Shail Kumari plans to expand fish farming across her entire field in the future.

According to TRI, many other women farmers

in the rural villages of UP are efficiently integrating fish farming into their conventional crop cultivation thanks to the Aqua Schools initiative. Through the initiative, TRI's main goal is to revolutionise fish farming practices, enhance productivity within the region, and promote aquaculture. It also includes comprehensive capacity-building programmes, where women farmers receive ponds and technical support from TRI facilitators. Subsequent training equips them with the necessary skills in fisheries management.

TRI says that nearly 100 women farmers have already benefited from the project and the programme will be further extended to more villages soon.

"As part of the initiative, we're providing assistance for services such as water testing, the supply of fish food, marketing support,

and helping construct artificial ponds for demonstration purposes. The Aqua Schools are part of TRI's commitment to bringing multidimensional transformation to rural communities. We don't just help villagers find innovative livelihood opportunities, we also train them in maintaining and marketing their product or service as well as market and delivery support," says Gaurav Misra, TRI's operations director.

The collaboration between TRI and local farmers not only enhances fish production but also significantly contributes to the socioeconomic empowerment of women in the region, enabling them to embrace innovative techniques in fish farming. For example, Ram Rani, a farmer associated with Gram Panchayat Urna Gulra SHG, has repurposed unused land near her house for

the biofloc model in fish farming. The expenses incurred for creating a 25x25 foot pond on the vacant land were Rs 5,000 for digging, Rs 50 for lime, Rs 300 for cow dung manure, and Rs 1,500 for khali (mustard cake). Fish seeds for the pond were provided by TRI.

"Now, our pond holds 50-60 kg of fish, which is estimated to be worth at least Rs 15,000. Currently, we are considering further expansion," says Rani.

Beyond traditional fish farming, the Aqua Schools also encourage farmers to adopt integrated farming practices, incorporating the cultivation of makhana, chestnut, or lotus, alongside poultry and duck farming as pond-based activities. Furthermore, the borders of the ponds are utilised for growing seasonal vegetables and flowers, contributing to sustainable income generation.

"We had support for both agriculture and fish farming, and when we sell the produce or enjoy it at home, it is very nutritious and everyone stays healthy in the family, too," says Manju Devi, who benefitted from an Aqua School set up around her village in Gangapur.

Shail Kumari, a resident of Sohapur, asserts the same.

"We reared fish through this initiative and also produced food. When we farmed the fish, we made use of some as food for our family, and we were able to sell the rest. The best part is that we were able to grow both food and fish through this support," she says.

Breeding produces a breakthrough in common carp production

A new study at the Hebrew University of Jerusalem has concluded that a strain of disease-resistant carp has a higher chance of survival when infected with cyprinid herpes virus and is also less likely to pass on the disease than conventional strains.



Breeding programmes can help make common carp more resistant to pathogens such as cyprinid herpes virus

The study, led by Prof Lior David, investigated the infectivity of disease-resistant and susceptible fish by examining their roles as shedders (infecting) and cohabitants (infected) in various combinations. The study focused on common carp; a species that's widely cultivated in aquaculture.

Infectious diseases pose significant challenges to the health and welfare of both humans and animals. While breeding genetically resistant animals is a sustainable solution for healthy food production, providing unique research opportunities, the relationship between resistance and infectivity remains poorly understood.

The study revealed that fish resistant to cyprinid herpes virus exhibited lower viral loads in their spleens and demonstrated higher survival rates compared to susceptible fish. Susceptible fish infected by resistant counterparts experienced reduced mortality rates compared to those infected by other susceptible fish. Additionally, tanks housing resistant fish exhibited decreased viral levels in the water, leading to lower infection of other fish within the tank.

Prof Lior David, the lead researcher of the study, commented in a press release: "The study provides experimental evidence that resistance to

cyprinid herpes virus type 3 reduces infectivity, due to a host mechanism that restricts viral replication and pathogen shedding. This not only benefits aquaculture production but also contributes to reducing virus propagation and disease spread in natural water bodies."

These results demonstrate that disease-resistant fish

not only survive better but also reduce the infection rate in others. This has significant implications for aquaculture production and disease epidemiology. The study highlights the importance of breeding disease-resistant animals for sustainable food production and animal welfare.

CIFE-ARGUNIL



CIFE-ARGUNIL: The argulus infestation in fish ponds is very rampant across the country. Due to the parasitic diseases fish culture faces the biggest problem for its sustainability and the commercial expansion. The Argulosis disease causes almost 25% loss to farmers in the form of diseases associated mortalities and reduced growth rate. The only immediate remedy used by farmers is the unregulated dumping of insecticide and different drugs/chemicals in the culture water, which may give a temporary solution to the problem. On the other hand, this leads to a series of other problems such as environmental hazards, impact on other organisms, and reduction of growth rate in

fish and higher upgraded residue in fish tissue with potential health hazards to humans. ICAR-CIFE has tested the feed mix with the pharmaceutical and higher upgraded residue in fish tissue with potential health hazards to humans. ICAR-CIFE has tested the feed mix with the pharmaceutical and nutraceutical components which include the regulated and monitored dose of the pharmaceuticals for growth restoration and better productive performance.

Advantages: The product practices the treatment of Argulus infection and makes the fish harvest superior in terms of absence of lesions on the body, healing of the lesions (Argulus spot) and secondary infections, good color and appearance, better overall health and condition factor of fish.

Nutreco has a strong focus to grow in the Indian sub-continent

- Dr Saurabh Shekhar, Managing Director - Nutreco South Asia



Dr Saurabh Shekhar,
Managing Director - Nutreco South Asia

We have both organic and inorganic growth plans for expansion of our footprints in South Asia. We would like to explore options to make inroads into the B2F segment of layer and dairy market that presents huge market potential, said Dr Saurabh Shekhar, Managing Director - Nutreco South Asia covering both the divisions – Trouw Nutrition and Skretting in an interview by M.A. Nazeer, Editor, Poultry Fortune. Excerpts:

125 years of rich history, SHV is a family of companies active in energy distribution, cash-and-carry wholesale, heavy lifting and transport activities, industrial services, animal nutrition and aquafeed, providing private equity, testing, inspection and certification (TIC) and exploration, development and production of oil and gas through its eight companies. SHV employs more than 60,000 people with presence in more than 70 countries.

Poultry Fortune: Global Head Quarters and Indian Head Quarter?
Dr Saurabh: Nutreco has its headquarters in Amersfoort, The Netherlands. The headquarter is shared with Trouw Nutrition in The Netherlands. Skretting started with Salmon sp. before it became the global leader across species in aquaculture and continues with its headquarters in Stavanger, Norway.

Poultry Fortune: Tell us about your poultry nutrition and healthcare company?

Dr Saurabh Shekhar: We are Nutreco, the global leader in animal and aqua nutrition. It has two divisions – **Trouw Nutrition** which is in animal nutrition offering feed specialties, feed additives, premixes and smart blends for poultry, dairy and aquaculture; and **Skretting**, the global aqua feed and nutrition leaders. Our purpose is Feeding the Future that motivates us to pursue sustainable development in animal protein sector through innovative solutions. With more than 11,000 employees globally and > 100 production plants in 37 countries, we are proud to say that we produce 9.4 m MT of animal products annually.

In India, we have a subsidiary of Nutreco with headquarters in Hyderabad,

Telangana, catering to the entire South Asia.

Poultry Fortune: Promoters of Nutreco?

Dr Saurabh: Nutreco is a subsidiary of **SHV Holdings N.V.**, a family-owned multinational with net sales of €23 billion in 2023. With more than

Poultry Fortune: Where do you have your production units situated?

Dr Saurabh: In India, we have invested into two production units within a short duration of 5 years. In 2020, we commercially launched our state-of-the-art production facility for premixes and specialized feed additives for



Trouw Nutrition Experimental Feed Plant, Spain



The Bubble - Skretting, Norway



Team - Trouw Nutrition India at Factory site

Trouw Nutrition at Jadcherla, about 70 kms from Hyderabad, Telangana. Subsequently, we built our first feed factory for Skretting as our commitment to Indian sub-continent at Mangrol, about 60 kms from Surat, Gujarat.

Poultry Fortune: Key persons of the company with designation and contact details in India?

Dr Saurabh: We currently employ more than 200 people and the South Asian unit is led by Dr Saurabh Shekhar – MD, Nutreco South Asia. We can be reached at customercareindia@trouwnutrition.com for queries related to Trouw Nutrition and at india@skretting.com for queries related to Skretting.

Poultry Fortune: Category of products being manufactured / marketed? Names of products ?

Dr Saurabh: As earlier mentioned, we

provide solutions and services across species and life stages. **Trouw Nutrition** has been serving feed millers, integrators and farmers for more than 90 years with a focus on Feed-Farm-Health to bring improvement in animal productivity and profitability. We have a programme or solution-based approach that focuses on the following 5 innovation pillars:

1. **Early Life Nutrition:** Maximizing the genetic potential of production animals by investing in the young animal and pre-parturition period is essential to enable farmers to gain maximum production results. Products like **ChickCare** and **PullyCare** for broiler and layer, and **Sprayfo** are part of our Life Start solutions to set performance for life.
2. **Healthy Life:** We want to empower our customers to reduce reliance on non-sustainable solutions like

antimicrobials to be better prepared for the future challenges. A core part is to ensuring healthy animal throughout life cycle. We work on feed management solutions like **trace mineral nutrition** – next generation minerals **Intellibond** (Hydroxy Trace Minerals), **Optimin** (Organic Trace Minerals) and **IntelliOpt** (IntelliOpt + Intellibond) are developed to ensure better bioavailability of minerals and optimize mineral availability as per animal's nutritional requirement. Our **Trouw Premixes** are also formulated as per customer requirement with support from our experts while ensuring homogenous, superior quality premixes that provide consistent results. Besides feed management, to ensure healthy life, we also provide solutions for health and farm management through products like **Selacid GG** and **Selko**



Skretting India Factory Launch



On farm customer support by Skretting team



Dr Saurabh Shekhar

pH that are formulated to ensure better gut health and control microbes that negatively impact bird health.

3. Feed Safety & Quality: Feed and food safety is critical to ensuring sustainable development. Through a range of products like **Toxo-MX, Toxo, and Toxo-XL** we ensure management of growing mycotoxin challenges as the raw material quality remains uncertain. Our moisture management and mould control solution brand **Fylax** is available in both liquid and powder form with different specs to cater to the wider requirements of different customer segments. An important part to ensuring feed safety is advanced

diagnostic solutions like **Mycomaster**, a rapid analysis tool that measures all 6 major mycotoxins.

4. Sustainable Precision Farming: We also aim to deliver integrated, data-driven solutions, services and platforms to our customers to provide them the right insights and support decision-making for business success. Under **NutriOpt**, our suite of integrated digital solutions we provide feed and mycotoxin analysis, nutritional insights, feeding programs, and optimization models. We also bring solutions like **NutriOpt On-site Advisor (NOA)** for quick on-site assessment of raw materials and finished feed.

Recent launch of product:

We also continuously look for breakthrough solutions through our discovery branch, NutEx (Nutreco Exploration). As a result of the R&D, we recently launched a new line of product under phylogenics, **Fytera**, that unlocks the real value of plants to support animal performance.

Skretting pioneering Aqua Nutrition space:

Skretting, has been pioneering the aqua nutrition space with extensive R&D and innovation – an expertise that is developed over the past 125 years. Skretting provides solution across life stages with focus on Nutrition – Farm – Health. We cater to the below categories:

1. Life start solutions: We continuously innovate to bring new generation marine hatchery diets like **Elevia, PL and White Tiger** which ensure better larva health and robustness while managing the pond environment. We also have solutions for fish segment under **Gemma and Micro** brands. To ensure a healthy broodstock, **Vitalis** is designed to ensure higher nauplii production and manage disease risks. **Ori**, artemia enrichment diet, is formulated with highly balanced nutritional components to allow optimal uptake, encapsulation and retention.



SK AI research station Chile

2. **Nursery solutions:** Survival and growth is critical at nursery stages. **Lorica**, our nursery diet, has immuno stimulants to ensure nutritional requirements are fulfilled with better survival and growth.
3. **Grower diets:** Diets that fulfill the nutritional requirements of shrimp and fish need to be based on their physiology, raw material nutrient profiling, feeding habits and frequency. An in-depth study of these criteria led to development of the concept of Optiline – optimum nutrition lines – under which we produce **Gamma** for *L. vannamei*, **Kuroline** for *P. monodon*, and **Stella** for Sea Bass and Murrel.
4. **Water treatment:** Pond ecosystem can be very complex and challenging but with right solutions it is controllable. Our range of probiotics – **AquaCare Control and Eliminator**– help to manage the pond microbes and ensure beneficial bacteria while managing the sludge formed during culture. **AquaCare 3D** is a powerful disinfectant that provide triple protection against bacteria, virus and fungi.
5. **Health supplement:** To better support our farmer’s production and profitability, we introduced health supplements last year for better gut health – **Santron**, and to manage the stressful conditions – **Relaxx**.
6. **Precision nutrition:** We realise the importance of technology in bringing maximum benefits to



Bird's eye view of Skretting India facility

the farmers. **Skretting 360+** is our unique proposition based on three pillars of precision nutrition, farm management and technical support that empowers farmers to achieve better growth at optimised costs on their farms.

With Skretting too, we innovate and perform R&D to bring breakthrough solutions and recently launched our prime functional feed, **Armis** that builds up resilience of shrimp to manage disease challenges and related stressors.

Poultry Fortune: Results of R & D? Collaborate with institutions: **Dr Saurabh:** As a research-driven organisation, we conduct research at our research units as well as collaborate with research institutions worldwide for local validations. We have 16 research and laboratory units worldwide 6 research facilities for Trouw Nutrition to conduct research trials for poultry, dairy, calves, swine and ingredients, supported by our central laboratory Master Lab;

7 research stations under Skretting’s Aquaculture Research Centre (ARC) to conduct research on 9 key species including shrimp. We invest more than approx. **€35 million** annually into R&D. This significant investment underscores our commitment to innovation and ensuring that our nutritional solutions remain at the forefront of scientific advancement, continuously addressing the evolving needs of our customers and industries and achieve our purpose of Feeding the Future.

We have over 200 collaborations with research institutions worldwide. In India, we have established collaborations with leading institutions like Bangalore Veterinary College, Ludhiana Veterinary College among others. We also have tie-up with known research centres like AgriVet as per the strategic requirements.

Poultry Fortune: How is the progress and development after setting up factory in India?



Nutreco South Asia team

Dr Saurabh: We pride ourselves in being a customer-centric organization and the objective of setting up the factories in India was to come closer to our customers addressing challenges related to logistics and turn around time. We have been able to successfully meet the challenges while also providing more customized solutions esp. with our factory for Trouw Nutrition. Overall, our progress and development in India is in line with our strategic plan. This success is largely attributed to the unwavering support of our customers and farmers, whose feedback and collaboration have been invaluable in shaping our journey and achievements.

Poultry Fortune: The companies you have acquired in recent times. What is the present status?

Dr Saurabh: We take a very systematic and conscious approach to investments through NuFrontiers, the investment arm of Nutreco. We look for companies that align with our purpose of Feeding the Future via digital interventions or by bringing efficiencies and advancements into animal and aqua nutrition. In India, we have invested into two companies - **Eruvaka**, is an Internet of Things (IoT) based organization that aims to improve efficiency in aquaculture. We have also invested in **Stellapps**, another IoT organization that works in the entire dairy value chain.

Poultry Fortune: How is your sales & Technical Service network in India?

Dr Saurabh: Our sales and technical service network is spread across India with the focus on production hubs. Our sales team is equipped with right services to provide on-field solutions to customers. Technical team includes subject-matter specialists – veterinarians and fishery graduates – who have rich experience in their respective sectors and constantly support farmers to manage the various conditions on field for better productivity and profitability.

Poultry Fortune: How many dealers and distributors you have in the country?

Dr Saurabh: Our business partners (dealers and distributors) are one of the most important stakeholders for us and we have developed a robust network of dealers and distributors across the country. We currently have

over 20 distributors network for Trouw Nutrition and more than 140 authorized dealers for Skretting.

Poultry Fortune: How is the acceptance level of your products from the customers? What are the best aspects for the benefit of your customers / integrators / breeders etc ?

Dr Saurabh: We have been fortunate to have received the trust of our customers who have seen the results from our high-quality products. While we entered the Indian market at a later stage, but have been able to create significant brand presence in a short duration. We believe our USP lies in bringing innovative yet practical solutions that cater to current challenges while also ensuring sustainable growth. We do not work in silos but bring integrated approach to ensure right solution and service while also involving in knowledge sharing to bring latest information to our customers.

Poultry Fortune: There are comments that healthcare companies are using harmful chemicals and antibiotics in their products, which is harmful to chicken & egg consumers? What do you say on it?

Dr Saurabh: Misinformation and misrepresentation are the biggest cause of concern in today's fast paced

digitally connected world. We advocate safe chicken and egg consumption as protein demand continues to rise and animal protein is going to play a critical role in fulfilling this demand. Animal protein is also widely known for its high bioavailability and health benefits.

Poultry Fortune: What are your future plans and targets?

Dr Saurabh: We have both organic and inorganic growth plans for expansion of our footprints in South Asia. We would like to explore options to make inroads into the B2F segment of layer and dairy market that presents huge market potential. Simultaneously, being closer to customers in growth geographies and high potential areas will remain a priority.

Poultry Fortune: Message to targeted customers and other stakeholders in the industry?

Dr Saurabh: We would like to thank our customers, business partners and stakeholders for their support and look forward to receiving the same in coming years as we grow mutually. We remain open for feedback and listening to our stakeholders and aim to continue bringing quality products and services to support Indian livestock and aquaculture industry.

Read

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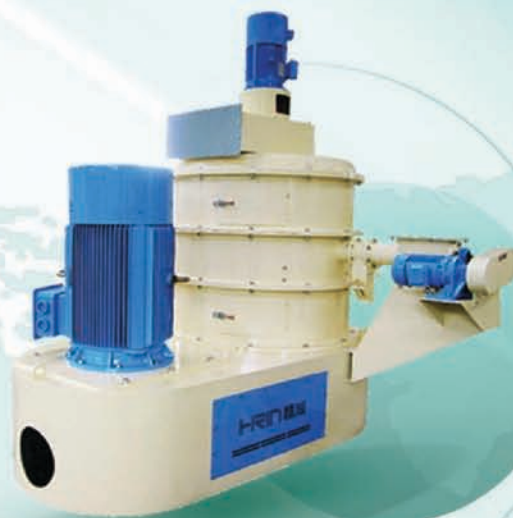
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Our ambition is to work at the forefront of science and technology by pioneering new, more sustainable and efficient ways to improve animal nutrition and health

- Ivo Lansbergen, President, ANH, **DSM – Firmenich**

*We started with the first synthesis of vitamins in 1934 and have ever since continued to deliver nutritional and health innovation to the market. These include feed and gut-health enzymes, mycotoxin deactivators, and alternative solutions like algae-based omega-3 fatty acids and soon-to-come fermentation-based proteins, said Mr Ivo Lansbergen, President of Animal Nutrition & Health at **dsm-firmenich** in an interview to Aqua International Editor M. A. Nazeer.*

Excerpts:



**Ivo Lansbergen, President
– Animal Nutrition and Health, DSM - Firmenich**

Aqua International: How is your visit to India ?

Ivo Lansbergen: I concluded my 10-day tour of Asia with a visit to India from 14 to 16 April 2024. The tour, which began in China and continued through the Philippines and Singapore, was designed to strengthen customer relations, visit the Jadcherla plant near Hyderabad and engage with stakeholders to deepen his understanding of the Asian market.

AI: What are the developments you are making in India with regard to production facilities, supply and the people ?

Ivo Lansbergen: Future plan for India. One of the key aspects of ANH is to expand beyond traditional blending operations and move into the

production of feed additives. This strategic shift will not only support domestic demand but also enable the company to export these additives to international markets. By establishing in-house manufacturing capabilities for feed additives, the company aims to diversify its product portfolio, strengthen its supply chain, and open up new revenue streams through global exports. This approach underscores the company's commitment to innovation and growth while providing a competitive edge in the animal nutrition industry.

AI: Some time back you announced a new company: DSM-Firmenich and separating out Animal Nutrition

and Health from DSM-Firmenich Group. Could you elaborate on it ?

Ivo Lansbergen: DSM-Firmenich announced on February 15 a plan to separate out the Animal Nutrition & Health (ANH) business from the Group. ANH is driven by different dynamics to the rest of the Group, which has become even more apparent with the unprecedented challenges in the vitamins market.

dsm-firmenich believes that the full potential of the ANH business could be best realized through a different ownership structure for which all potential separation options will be considered. The Company would expect to be in a position to separate the business in the course of 2025.

ANH is a world-leading business with the most complete ingredients portfolio ideally positioned to support a growing population through more sustainable animal farming. ANH, a world-leading company in vitamins and top 3 in performance solutions, delivered more than €3 billion in revenues with approximately 6,000 employees and is headquartered in Switzerland. It helps its customers to deliver healthy animal proteins efficiently and sustainably whilst harnessing the power of data to make animal farming practices more sustainable, productive, and transparent. The business has a unique premix network across the world that helps deliver global products with local solutions and benefits from precision services capability.

We have an amazing team within ANH that has built a global leader with scale, a unique portfolio and unrivalled innovation capabilities to help our customers tackle some of the most challenging food security issues and with a strategy that is strongly focused on Making Animal Farming Sustainable. It is an exciting prospect for our world class team to pursue our ANH strategy.

ANH has an amazing team with unrivalled capabilities in manufacturing, technology, and innovation to help its customers tackle some of the most challenging food security issues. .

AI: What kind of products you manufacture for poultry and aquaculture sectors ?

Ivo: ANH is the world's leading innovation partner and offers the broadest portfolio of vital nutrients, enzymes, and eubiotics for animal nutrition and health solutions. In three business lines, we offer Essential Products, Performance Solutions and Precision Services.

- **Essential Products:** Our high quality vitamins, premixes and carotenoids are fundamental for the growth and development of farm animals.
- **Performance Solutions:** Our broad portfolio of feed and gut health enzymes, mycotoxin deactivators and Eubiotics create value for farmers whilst meeting environmental and animal health challenges.



M.A. Nazeer, Editor, Aqua International with Ivo Lansbergen, President – Animal Nutrition and Health, DSM - Firmenich during the later's visit in Hyderabad, India

- **Precision services:** Our precision services use diagnostics and Life Cycle Assessment and provide data-based personalized recommendations to unlock sustainability-related opportunities and improve animals' health, productivity and welfare.

With feed additives, premixes, and digital services, we improve the health and performance of livestock. We help farmers and the entire value chain to improve animal health, performance and quality of their products. But we don't stop there. We support farmers in the transition to a more sustainable production of animal source foods and drive efficiency. Whether it's neutralizing harmful toxins in feed grain, reducing emissions and feed cost or providing new alternative solutions to reduce the reliance on natural resources. And yes, we also help to improve the quality of dairy, eggs, fish and meat to reduce food loss and waste.

AI: DSM has acquired Biomin and Romer Labs ? What is the status of DSM after this acquisition ? Have you also acquired any other companies ?

Ivo: Over the last 20 years, ANH has strategically acquired a number of companies and developed the broadest portfolio in Animal Nutrition & Health, Recent acquisitions and successful integrations include companies like Biomin, Romer Lab, Midori and Prodap, Pradact and Adare

AI: How many production facilities do you have in India and globally ?

Ivo: India -1 in Jadcharla, Hyderabad

and we are setting up a new plant adjacent to it which will be ready by August / September. ANH operates globally with a unique global network of manufacturing, premix and R&D facilities. In India we are based in Jadcherla. and are investing in a new facilities in adjacent to our existing facility.

AI: What is the sales and service network you have in India ?

Ivo: We are present in every state in India.

AI: What is the size of Nutritional products market in value globally ? What is your share in it ?

Ivo: The global Feed Additives market in 2023 was estimated €13 bn (Amino Acids, Vitamins, Carotenoids, Feed Enzymes, Eubiotics, Minerals & Chelates, Nutritional Lipids).

ANH is a global leader in with an important market share in vitamins & premixes and a top 3 company in the growth segment of performance solutions.

AI: What do say on usage of Antibiotics as Growth promoters in Poultry and Livestock sector ?

Ivo: Antimicrobial resistance is flagged as one of the major issues for humanity. Unless tackled, it will become the single leading cause of death worldwide by 2050.

Watch our video on Antimicrobial resistance: https://www.youtube.com/watch?v=gr_reSTPH9Y

The good news is that the prevalence of antimicrobial resistance is reversible and goes down again with the avoidance of the use of antibiotics. To preserve the medicinal value of antibiotics, their application in farming should be limited to therapeutic use or disease prevention if needed.

Health through optimum nutrition, precision analytics and feed additives can all contribute to reducing the need for antibiotics in livestock. Science-based solutions from ANH along with biosecurity and veterinary services are proven to work in commercial settings to keep animals healthy, support farm profitability and enhance the sustainable production of safe, nutritious food.

Watch our video on Antimicrobial resistance: https://www.youtube.com/watch?v=gr_reSTPH9Y

AI: What kind of trends do you expect in future in technology development in Animal Nutrition & Healthcare products manufacturing ?

Ivo: ANH addresses significant trends that influence the health of people and of the planet by two principal areas of engagement: enabling the sustainable production of animal protein and protecting food security.

Enabling the sustainable production of animal protein

Animal-based proteins are highly nutritious and form a key part of a balanced, healthy diet. Their consumption is also central to many cultures, and animal-source foods and other animal-source products play an important socio-economic role in those cultures. However, livestock production comes at a cost. This cost is increasingly evident. Rising demand for animal protein is driving up greenhouse gas (GHG) emissions and piling pressure on natural resources. In some cases, this pressure has already transgressed accepted planetary boundaries, including the Earth's tolerance thresholds in terms of GHG emissions, biochemical flows, water quality and quantity, land use, and biodiversity.

The agrifood sector is one of the major contributors to global GHG emissions, and almost a third of wild fisheries are overexploited. The sustainability of animal protein production is now front and center in the minds of many, with widespread calls for change from the value chain, policy makers and associated stakeholders.

The world's population is projected to reach 9.7 billion by 2050. At the same time, demand for healthier, balanced, and more nutrient-dense diets is increasing – driven not only by the growth of the world's population but also by changing health awareness and consumer expectations. The possibilities created by a growing range of plant-based alternatives to protein will go some way to filling this gap, although for many in the world these are less accessible and affordable than animal proteins. Demand for animal-source

Puneet Pokhriyal working to strengthen DSM India

Mumbai: Animal Nutrition and Health has been made into three categories globally like Essential products such as vitamins and minerals, Feed additives and Precision services to ensure effective results in production in animal and livestock sector, said Mr Puneet Pokhriyal, Director, West APAC, ANH, DSM.



Puneet Pokhriyal, Director, West APAC, ANH, DSM

DSM Nutritional Products has come with a unique product like Verax, which is the world's first blood-based early warning system for critical decision making. This first-of-its-kind technology provides customized nutritional solutions based on your specific results related to peer reviewed research as well as actual in-field results.

Talking to Poultry Fortune Editor, Mr Puneet said that Verax is a data-driven, decision-making tool that helps veterinarians, nutritionists and operations make better decisions about their animals' health. Blood biomarkers are at the heart of our platform and they

foods is therefore still expected to grow as many populations need to raise their animal protein intake to attain a level of balanced, healthy nutrition. Enabling sustainable animal production is therefore of paramount importance.

AI: Which are the top 5 ANH products manufacturers globally ?

Ivo: ANH offers the broadest portfolio of feed additives, premixes and precision services. Here some examples of our global brands: Rovimix, OVN, Ronozyme, Poultrystar, Micofix, Biomin, Crina, Veramaris, Sustell.

AI: What are your future plans and targets internationally and in India ?

Ivo: We help farmers and the entire value chain to make nutrient-rich

are the gold standard for early detection of hidden performance issues.

After joining DSM Nutritional Products India, Mr Puneet Pokhriyal met the key stakeholders in Poultry as well as Aquaculture sectors in India to understand the needs of these sectors and working to strengthen

DSM India and to perform to the expectations of the customers.

Vitamins, Minerals and Feed additives play crucial role to ensure quality of production in Shrimp culture and Poultry sectors, and these inputs help in a great way in export oriented shrimp farming, he stated.

DSM Nutritional Products India Pvt Ltd appointed Mr Ashwin Rajaram as its General Manager for India. Dr Pradip Naik is the Technical Manager for Poultry. Mr Deepak Mukhija is the Business Head for Poultry ANH as well as vitamins & premixes business.

dairy, eggs, fish and meat more sustainable and affordable for a growing world population to thrive.

Our ambition is to work at the forefront of science and technology by pioneering new, more sustainable and efficient ways to improve animal nutrition and health. We are proud of our leading global network of scientists and engineers with a rich history of ground-breaking innovations. We started with the first synthesis of vitamins in 1934 and have ever since continued to deliver nutritional and health innovation to the market. These include feed and gut-health enzymes, mycotoxin deactivators, and alternative solutions like algae-based omega-3 fatty acids and soon-to-come fermentation-based proteins.

‘At the core of our business, we are driven by a commitment to our customers, a focus on sustainability and a dedication to innovation in precision nutrition for animals’

- Ivo Lansbergen, President, ANH and Member of the Group Executive Committee, DSM – Firmenich

Mr Ivo Lansbergen, President, Animal Nutrition & Health and Member of the Group Executive Committee, DSM – Firmenich addressing Indian poultry media at Hyderabad on 16 April 2024 said that Animal Nutrition & Health (ANH) is a business unit within DSM-Firmenich, a globally recognized leader in the field of animal nutrition and health products with the most complete ingredients portfolio ideally positioned to support a growing population through more sustainable animal farming. Headquartered in Switzerland, last year ANH delivered more than €3 billion in revenues with approximately 6,000 employees. It helps its customers to deliver healthy animal proteins efficiently and sustainably whilst harnessing the power of data to make animal farming practices more sustainable, productive and transparent. The business has a unique premix network across the world that helps deliver global products with local solutions and benefits from precision services capability.

DSM-firmenich announced on February 15 the initiation of a process to carve-out and separate out the Animal Nutrition & Health business from the Group. ANH is driven by different dynamics to the rest of the Group, which has become even more apparent with the unprecedented challenges in the vitamins market. The Company believes that the full potential of the ANH business could be best realized through a different ownership structure for which all potential separation options will be considered. The Company would



Mr Ivo Lansbergen, President - Animal Nutrition and Health, DSM - Firmenich addressing media at Hyderabad, India on 16 April 2024

expect to be in a position to separate the business in the course of 2025, he stated.

Mr Ivo Lansbergen stated that the carve-out process will have no impact

on our daily business. Serving the needs of our customers always has priority for ANH: Customers can expect the highest standards of service and dedication from us. We continue to innovate and create solutions with Vitamins, Performance Solutions & Precision Services.

Ivo Lansbergen joined DSM in 1997 and held several positions across the company’s various business units before being appointed to lead the Animal Nutrition & Health (ANH) business unit in 2019. He transformed the organization, reinforcing its position as a customer-focused partner in the development of feed ingredients for the global food supply chain. Supported by complementary acquisitions, Ivo strengthened the business’s expertise and reputation as a leading provider of solutions for farm productivity and sustainability throughout the value chain, including



From left: Puneet Pokhriyal, Deepak mukhija, Ivo Lensbergen, D. S. Subramaniam, K. Venkat Reddy, Achyuth Iyengar and Dr Sudeshna Ray

as a pioneer in the fast-emerging area of technology-driven precision nutrition and health. Ivo is an experienced global executive, having worked in science-based industries across Europe and Asia during his career. He holds a master's in Chemical Engineering from the University of Enschede, the Netherlands.

Ivo Lansbergen concluded his 10-day tour of Asia with a visit to India from 14 to 16 April 2024. The tour, which began in China and continued through the Philippines and Singapore, was designed to strengthen customer relations, visit the Jadcherla plant near Hyderabad and engage with stakeholders to deepen his understanding of the Asian market.

Asia: A key Growth market

Lansbergen believes Asia represents a significant growth opportunity. He noted that Asia and Latin America (LATAM) will drive much of the industry's expansion in the coming years.

Focus on China and Beyond

Lansbergen highlighted the uncertainty surrounding China's pork market, which has experienced a dip in demand for feed additives due to low pork prices. Despite this, he anticipates that demand for additives would increase later in the year as the pork market recovers.

Poultry and Shrimp critical species for Asian market

Additionally, Lansbergen sees poultry and shrimp as critical species for

the Asian market, with beef facing challenges due to its higher cost and a shift towards more affordable proteins.

Looking Ahead

Ivo Lansbergen's visit to Asia underscores his commitment to understanding the unique dynamics of the region's animal nutrition market. As the industry navigates its current challenges, Lansbergen remains optimistic about the future, confident that the recovery in vitamin and amino acid prices and the anticipated increase in demand will drive growth in the coming years.

Here's an expanded summary incorporating your focus on customers, sustainability and innovation, with the broader perspective on the company's operations and values.

Our Commitment to Customers, Sustainability and Innovation in Animal Nutrition

At the core of our business, we are driven by a commitment to our customers, a focus on sustainability and a dedication to innovation in precision nutrition for animals. Our vision encompasses more than just providing high-quality products; it includes a holistic approach to creating affordable protein, supporting healthy incomes for farmers and maintaining a healthy ecosystem—all without compromising the environment.

Customer-Centric Approach

We put our customers at the heart of

everything we do, ensuring that their needs are met with precision and reliability. We make it possible, she told.

We have customers in our heart, the sustainability in our DNA, and we drive innovation and precision nutrition for animals. We have one of the broadest portfolio including mycotoxin risk management, vitamins, feed additives and precision services making us successful. We diagnose and provide solutions.

We create affordable protein and healthy income for farmers—sustainably and not on the expense of the environment. We provide solutions to improve the quality of protein and enhance feed efficiency, while reducing emissions and our reliance on natural resources.

Sustainability should be long-lived and is a much broader term encompassing not only the environment but also affordability.

Challenges and Opportunities

The separation process will require time as it involves scarping out legal entities, assets and plants, ANH specific market dynamics such as Avian influenza, Swine Fever, fluctuating vitamin and feed prices and consumer trends impact the animal nutrition sector differently than other segments within DSM-Firmenich. The separation is designed to make the business more agile and focused on the specific customer needs of the animal nutrition market.



DSM India and Asian team with Ivo Lansbergen, President, DSM – Firmenich during his visit to the production facilities at Jadcherla.

The Future of Animal Nutrition

ANH is embracing innovation and technology to help farmers optimize their operations through digital tools and data analysis. Digital precision services are already launched in selective markets and is expected to expand to India, where digital development is progressing but may take longer to catch up with countries like the USA and Brazil.

India: A Key Market for ANH

With the global animal nutrition industry under going significant changes, is focusing on India as a vital part of its growth strategy. The following are key factors that underline India's importance and the company's plans for this market.

Strong Economic Growth and Increasing Demand

India's economy is expanding rapidly with a GDP growth rate projected at 7% in 2024. This strong economic backdrop creates a fertile ground for growth in the animal nutrition sector. As disposable incomes rise, so does the demand for lean animal proteins, driving increased consumption in segments like poultry, seafood and lean meats.

Success in the Poultry segment

The company's operations in India have already shown promising results, with a noticeable increase in market share, especially in the poultry segment. This success is attributed to the rising demand for chicken and other poultry products along with milk, driven by India's growing middle class and changing dietary preferences.

New Solutions for Aqua segment

In addition to poultry, the company is planning to introduce new solutions in the aqua segment. This strategic move to offer innovative feed and nutrition solutions for aquaculture, the company aims to capitalize on this growing trend.

Precision Service Solutions and Technology

The company is bringing precision service solutions like Verax to its Indian customers. These digital tools are designed to help farmers optimize their farm operations through data analysis and precision feeding, resulting in higher yields and lower costs. While digital technology adoption in India may be slower compared to the USA and Brazil, there is significant potential for growth as digital infrastructure improves.

Expansion and Investment

To meet the growing demand in India, the company is investing in a new plant adjacent to its existing facility in Jadcherla, Hyderabad. Production at this new plant is expected to begin in August 2024, with a substantial capital expenditure investment. This expansion indicates the company's commitment to serving the Indian market and its confidence in the region's growth prospects.

Record Production Capacity

In March 2024, the company's production capacity in India hit an all-time high, reflecting the trust and confidence customers have in its products and services. This record production capacity aligns with the company's broader

strategy to meet the increasing demand for animal nutrition solutions in India and ensure a stable supply chain.

Future plan for India

One of the key aspects of the future plan for the company is to expand beyond traditional blending operations and move into the production of feed additives. This strategic shift will not only support domestic demand but also enable the company to export these additives to international markets. By establishing in-house manufacturing capabilities for feed additives, the company aims to diversify its product portfolio, strengthen its supply chain, and open up new revenue streams through global exports. This approach underscores the company's commitment to innovation and growth while providing a competitive edge in the animal nutrition industry.

"We are here to grow in India" Ivo shared

India's growth story is an essential part of ANH's. With a robust economy, increasing demand for lean animal protein and successful expansion into the poultry and aqua segments, the company is well-positioned to continue its growth in this dynamic market. Through strategic investments, digital technology and innovative solutions, precision services, performance solution and sustainability, the company aims to contribute to India's evolving animal nutrition landscape.

AVAILABLE FROM OUR READY STOCKS

AVAILABLE FROM OUR READY STOCKS:

- SPIRULINA POWDER SPRAY DRIED, CHOLESTROL
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Snail Management and Control in Aquaculture...

Snail Cap to pack up Aquatic Snails

Dr Sujani Gudipati, Head R & D, Advance Aqua Bio Technologies India Private Limited
Email: dr.vasu@aabtgroup.com

In recent years, a critical need has been demonstrated for snail control due to the proliferation of a new trematode parasite that has been transmitted from pond to pond throughout the industry. In addition to fish and avian hosts, this trematode relies on snails within aquaculture ponds to complete its complex life cycle.

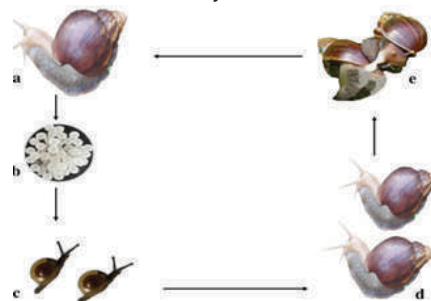
With few legal options for preventing bird access to large aquaculture ponds, alternatives for snail control in this industry are limited to chemical treatments or biological controls. Chemical treatments in production ponds present a number of problems for producers: high cost for repeated treatments, potential ecological impacts, and potential physiological stress on fish in the ponds.

Significant ecological threat to aquatic systems, Snails are invertebrate animals of the class Gastropoda found in freshwater and other aquatic habitats around the world. Approximately 5000 species of snails are found to inhabit different habitats worldwide. Snails receive considerable attention as they are

Snails proliferate very fast and so do the problems they cause in aquaculture, right from competition for feed, space and living to they acting as disease vectors. In recent years instances of snails outraging the cultured species, in production has been observed. Combating this expanse is the need of the hour. Chemical control has its negative impacts on the animal and the environment too. So resorting to alternate treatments seems viable. Advance Aqua Bio Technologies - Snail Cap as a sure option for this.

intermediate hosts that can cause diseases. Snails are one of the most invasive species that proliferate very fast, control of the same is the need of the hour, since the snails seem to be mainly carriers of parasites apart from causing other problems of competition for oxygen, space and nutrition in the pond. In small numbers these are treated as good invitees but when their number explodes they become a menace. They increase the bioload cause ammonia and nitrite spikes leading to

oxygen depletion, their high growth and reproductive rate also increases the water turbidity.



Life cycle of an aquatic snail *



Snails attached to substrata, turbidity*



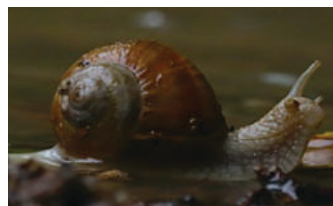
Snail laying eggs in the water body*



Parasite infected snail, carrier snail*

SNAILS IN AQUACULTURE

Focus is mainly on snail species belonging to genera Biomphalaria, Bulinus and Lymnaea which are known to serve as intermediate hosts. Majority pertaining to the subclass Pulmonata which can be grouped under Planorbidae, Lymnaeidae, Physidae and Ancylidae and those of the family Ampullaridae.



Different types of snails in aquatic waters*

Note : above image source the internet

SNAIL CAP ...

ADVANCE AQUA'S EXCLUSIVE & SPECIAL

A proprietary conjugation formulation of herbals, organic and inorganic inclusions developed for the control and eradication of the invasive Snail problem.

Effective against all life history stages of the Snail like Egg, Larvae and the adult.

SNAIL CAP'S HERBAL MOLLUSCICIDES

A polyherbal combination (Annona, Nerium, Cedrus, Pongamia, Azardarictha) with Alkaloids, Saponins, Quercetin, Ursolic acid, Myricetin etc., interfere and inhibit every metabolic activity of the snail.

SNAIL CAP'S INORGANIC MOLLUSCICIDES

The Haemocyanin proteins contain 2 copper atoms, this makes the snail very sensitive to the ingestion of additional quantities of copper. Too much copper prevents oxygen from moving around their bodies and eventually they die.

Acts as Snail's Kryptonite by dehydrating its slimy exterior, it draws out the water from their body by Osmosis leading to dehydration death.

SNAIL CAP'S ORGANIC MOLLUSCICIDE

A deterrent and demineralizer, progressively decreases calcium of the shell, acts as a potential molluscicide.

SNAIL CAP'S SPECIAL INCLUSION

On coming in contact with this, the snails begin to produce significant mucus secretion, this also dissolves the calcium carbonate in the shell, both leading to dehydration and desiccation eventually leading to death of the snail. This would even work on buried snails too. This when coupled with high temperature increased the toxicity further.

MECHANISM OF SNAIL CAP'S MOLLUSCICIDAL ACTION

Molluscicides are biocides developed specifically for destroying molluscs (Snails, Slugs).

Work by causing stress, reduce the normal water flow, dehydrate, this results in other disturbances in metabolism and physiological functions. Cause toxic reactions to occur at the gill membrane. The irritant effect causes the snails to excrete large amounts of mucus which results in dessication and death. The toxicity as a nerve poison prevents the snail from crawling away from poison.

Mortality is caused by the disruption of the DNA and protein structures, finally resulting in their non functioning. The mechanism of action is believed to target specific physiological processes like electron transport, nitrogen fixation. I

Salt absorbs water from molluscs which dehydrates and kills them. Lime also functions in the same way.

CONCLUSION

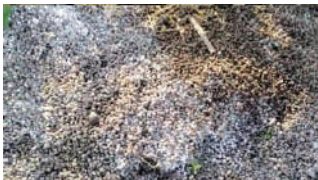
Aquatic snails are often considered undesirable in aquaculture due to their intermediary role and tendency to transmit parasitic Trematodes, since these compete for food space. There remains a need for an effective approach to control snails. There is therefore a clear need to control the proliferation and spread of these pests in ecologically and economically sustainable ways.

These details clearly indicate that Snail Cap can be used as a promising molluscicide against all the life history stages of Snail. More selective working and less harmful to the aquatic ecosystem.

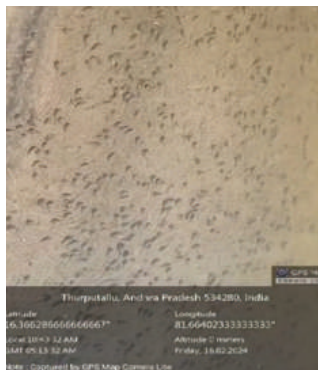
Note: * Image courtesy – internet.

FIELD TRIALS ON SNAIL CAPS'S EFFECIENCY

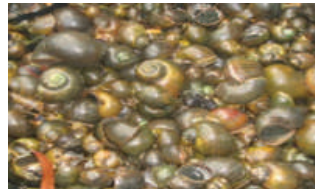
Snail cap has proved its efficiency both in fresh water and across varied salinity ranges and temperatures. Snail cap during its working has practically unharmed the cultured species, eradicated all stages of the snails life history, it has also bettered the FCR, disease resistance and most importantly reduced the production losses and expenditure.



Field trial in Eluru region, Andhra Pradesh with 100% efficiency



Field trial in Brackish water shrimp farm in Repalle region, Andhra Pradesh



Dead Snail egg mass



Dead Snails, all stages of life cycle, netted

Field trial at Balasore, Odisha

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Evidences of Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG) through trawl surveys from Off Cochin waters

Sandhya K.M., Paras Nath Jha, Mohammed Jabir K.K. & ManjuLekshmi N.

ICAR-Central Institute of Fisheries Technology, Cochin, Kerala. | Email: sandhyafrm@gmail.com

Abandoned, lost or otherwise discarded fishing gear (ALDFG), is the most detrimental form of marine plastic pollution, causing significant adverse effects on target and non-target species, habitats, and human users in marine systems. ALDFG accounts for 70 percent all macro-plastic marine litter in the oceans (UNEP, 2016). Due to the escalated fishing activities in the last decade and the shift towards synthetic and more durable materials for fishing gear, it is likely that the quantity, distribution, and adverse effects of ALDFG have increased. Top of Form

Impacts of ALDFG include injuries to marine animals through entanglements and ingestions leading to their mortality referred to as *ghost fishing*. Damages to habitat, navigational hazards, are other impacts due to ALDFG. Passive gears such as gill nets, traps and lines are more likely to become ALDFG and causes ghost fishing because once lost, they will continue to ghost-fish effectively for a substantial period of time. Despite the growing international focus on the issue of ALDFG (FAO, 2019), there remains limited understanding of the extent of the problem. (Macfadyen *et al.*, 2009; Gilman *et al.*, 2016).

Locating ALDFG is crucial for comprehending the fate and

- ▶ Abandoned, lost or otherwise discarded fishing gear (ALDFG), is the most detrimental form of marine plastic pollution, causing significant adverse effects on target and non-target species, habitats, and human users in marine systems
- ▶ Locating ALDFG is crucial for comprehending the fate and transport of lost fishing gear and facilitating its removal from marine waters
- ▶ A total of 13.57kg of lost gears/accessories were retrieved through 13 trawling operations at depth range of 33-34m from onboard ICAR-CIFT Research vessel from Off Cochin waters
- ▶ Polyamide monofilament lines (45.5%) were the major component of ALDFG followed by squid jigs (27%) based on frequency of occurrence whereas quantity wise trawl pieces (59.85%) contributed the major part of ALDFG
- ▶ The baseline data obtained in the present study will be useful for monitoring ALDFG and identifying hotspot areas of gear loss

transport of lost fishing gear and facilitating its removal from marine waters. This action helps to eliminate the harmful impacts on species and habitats associated with such discarded gear. There is currently little knowledge about the geographical distribution of ALDFG, which is mainly due to the absence of any system of reporting of gear loss incidents and lack of efforts in undertaking long term studies. Substantial data on ALDFG has arisen from retrieval endeavors conducted globally, particularly in recent years. However,

a significant portion of these efforts, along with the resulting data, is yet to be published, and in many cases, the work is still ongoing. Such baseline information will provide valuable insights to the extent and distribution of ALDFG, aiding in the identification of hotspot areas where gear losses are concentrated. Scientific methods adopted for retrieval of ALDFG includes underwater diving surveys, use of grapnel devices and trawl surveys.






Retrieval attempts conducted by

ICAR-CIFT at Enayam coast of Tamil Nadu through scuba diving surveys located about 33kg of lost gears (Thomas *et al.*, 2019). Present study is undertaken for evidences of ALDFG through trawl (HDPE shrimp trawl, 41m) survey at a depth range of 33-34m from onboard ICAR-CIFT Research vessel MATSYAKUMARI -II from Off Cochin waters (09° 54.11'N 075° 59.75'E, 09° 52.98'N 076° 02.78'E, 09° 54.33'N 076° 01.48'E). A total of 13.57kg of lost gears/accessories were retrieved through 13 trawling operations during October 2022 to December 2022. Five types of lost gears/accessories were retrieved including polyamide monofilament lines, squid jigs, trawl pieces, polyamide multifilament gillnet panel and HDPE floats. Polyamide

monofilament lines (45.5%) were the major component of ALDFG followed by squid jigs (27%) based on frequency of occurrence whereas quantity wise trawl pieces (59.85%) contributed the major part of ALDFG. Details of recovered ALDFG are given in table 1. All the retrieved nets appeared not to be new, but it was not possible to identify whether they were lost or discarded. In most of the recovered lines, hooks were present except in one occasion during which a longline with several branchlines were obtained, but all of them were without hooks suggesting possibility of discarded lines after removal of hooks. Remnants of fishes/shellfishes were not observed in the retrieved gears.

The baseline data obtained in the present study will be useful for monitoring ALDFG and identifying hotspot areas of gear loss. Generation of a certain amount of ALDFG is unavoidable and hence some management strategies need to be put forward in this regard to avoid those occurrences such as implementing incentives for gear retrievals, targeted removal of ALDFG in hotspot locations, and education for vessel operators on lost gear impacts and gear avoidance techniques. Future studies are required towards innovative modifications to fishing gear that will effectively disarm lost gear for reducing further impacts in ecosystem.

Table 1: Type of ALDFG materials retrieved from trawl survey

Type of ALDFG	Material/Dimensions	Weight (g)
Trawl net piece 	HDPE, multifilament twisted twine, Mesh diameter 2-2.5mm Cod end mesh size 30mm	6330
Gillnet panel 	PA multifilament (6X3 ply) Mesh size 110mm, Mesh depth 60 meshes	1460
Lines 	PA monofilament, Diameters- 0.6,0.7,0.8, 0.9mm	2420
Squid jigs 	Plastic jig (length-7.85cm, 8.6 cm, 5.2cm) and lead jig (length-17cm)	338
Float 	Apple shaped float, HDPE ,90x65mm	27.6

*References can be provided on request

How to select superior quality shrimp seed

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Introduction

The quality of shrimp seeds are the key to the success of your cultivation efforts. As a consequence, selecting the proper one of good quality is critical for getting best profits. Seed selection, additionally referred to as breeding stock selection, is an important part of the cultivation of shrimps that influences the success and output. 70% of shrimp farming performance is dependent on the quality of the seed that we stock. There are several tests are carried out to assess the quality of shrimp seed. Among them are post larvae quality, the hatchery's origin and reputation, visual and stress evaluation, and other disease detection tests. The list of parameters for selection of shrimp seed mentioned in Table 1 (Kumaran *et al.*, 2016). Don't select the shrimp seeds transported from one farm to another because such shrimp seeds are likely to suffer secondary infection, which may cause decreased survival rate.

Criteria for seed selection

1. Identical Seed Size

The first credit of high-quality seed selection is its uniform size. This non-uniform size expresses that the seed grows appropriately and has the same nutritional requirements.



Source of image: IndiaMart

Furthermore, the equal size of seeds helps to reduce cannibalism and food rivalry among them (Fortuna).

2. Seed is not physically disabled

Healthy seed should have fully formed limbs. The swimming legs are completely intact, from the non-curved tail to the perfectly developed eyes and eye stalks. Preferably stock PL 13 (4+ rostral spines) Clean and complete body appendages without any fouling or necrosis. Healthy hepatopancreas with fine lipid droplet and no infections.

3. Seed with Absolute filled gut

If the shrimp seed is healthy then it has a full gut, indicating that it is

feeding properly. On the other side, seed with an empty stomach state may indicate that the seed lacks hunger or is under stress. A 8 mm-10 mm shrimp seed's digestive tract should be thick and black and 20%-30% of shrimp seeds produce faeces in water. If there is food in the stomach but no faeces in the digestive system, then seeds are likely to be affected by changes in water quality and maybe contaminated with illness (Yang and Lachans, 2019).

4. Stress test of seed

The shrimp seeds move very actively if they are healthy and which is done by activity testing. This is because

the shrimp seeds are sensitive to external stimuli. This will be estimated by two ways i.e. salinity stress test and formalin test (Kumaran et al., 2016).

Salinity stress test: Collect about 100 PL in a beaker with animals from a tank having the optimum salinity. Pour equal quantity of freshwater and wait for half an hour. If you find any mortality, reject the animals from that tank.

Formalin stress test: Collect 100 PL of shrimp seed from the selected tank and put them in 100 ppm formalin

water and wait for an hour. If more than 90% of the seed survive, select that batch.

5. Disease free seed

Disease outbreaks caused by viruses and bacteria have disrupted the culture productions. So seed health status is needed to protect farmers from losses. Typically, a Polymerase Chain Reaction (PCR) test is conducted using an extremely careful population sampling process to verify whether it is actually disease-free. Seed should be checked for presence of WSSV, EHP.

Microbiological test also should be conducted to know the vibrio bacteria in hepatopancreas.

6. Shrimp vitality

Another important factor in determining the quality of shrimp seeds is vitality. For this test, collect shrimp seed in a water bucket. Then shake the water bucket to make the water swirl. Good seeds will separate soon after being gathered in the centre and then lie on the wall of the water bucket after overcoming the resistance to water flow (Yang and Lachans, 2019).

Table 1: The parameters should look while selecting, shrimp seeds

S.No	Parameter	Standard
1	Colour	light to dark brown
2	Activity	Very active
3	Feeding behaviour	Readily accept and eat feed
4	Gut	Full gut and with a tail muscle to hind gut ratio (MGR) of 4:1 or more
5	Hepatopancreas	Developed in at least 90% of the sample given and full with oil globules.
6	Rostral spines	More than 5 should be observed
7	Body Length	12 mm and above
8	Size variation	Less than 10%
9	Appendages	Intact without any deformity
10	PCR screening for viral and bacterial diseases	Negative
11	Pigmentation	Chromatophores well defined and located along the mid-ventral line
12	Stress test with survival	100% for salinity reduction and above 90% for formalin test.
13	PL stage	PL12 and above. Adequate gill development will not be there in small sized PL.
14	WSSV, EHP	Absent based on Realtime PCR-test
15	Necrosis	Absent
16	Fouling	Clean without any fouling organism

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Stress Management in Shrimp Farming

Dr Raghavendrudu, Product Manager, Skretting India

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Over the last twenty years commercial aquaculture has experienced spectacular growth. A significant component of the fish and shrimp-based protein that humans consume, especially in first world countries, is now provided by these activities.

Fluctuating environmental factors and operational challenges can significantly stress shrimp, impacting their overall well-being, immune response and growth. By understanding the root causes and implementing effective mitigation techniques, we can pave the way for sustainable and successful shrimp farming practices.

Stress is “a measurable alteration of a physiological steady state that is induced by an environmental change and that renders the individual more vulnerable to further environmental change.” Essentially anything, whether it is external or internal that disturbs the “normal” physiological balance can be stress.

Stress is a normal and natural phenomenon, and it is impossible for life to exist without it. Signs of stress can be overt, such as sluggishness, lack of feeding activity, slow growth, molting difficulties, hyperactivity, death, or hidden until animals become ill. The action of stressors on shrimp is varied and not widely studied. One consistent feature seems to be an elevation in blood glucose levels.

What are stressors?

Stressors are how animals become stressed. Many stressors have been identified that impact aquaculture operations. Some of these can be easily and cost effectively controlled, and others cannot at any cost.

Stressors in aquaculture:

- 1) Ammonia
- 2) Density
- 3) Dissolved oxygen
- 4) Heavy metals
- 5) Salinity fluctuations
- 6) Nitrate
- 7) pH fluctuations
- 8) Nutrition
- 9) Pesticide
- 10) Turbidity
- 11) Diseases
- 12) Temperature fluctuations
- 13) Handling

Factors affecting stress in shrimps

1. Environmental Factors

Fluctuations in water quality parameters, temperature, and inconsistent oxygen levels are key environmental factors that contribute to stress in shrimp. By ensuring timely and accurate measurement of these parameters, along with responsive management practices, farmers can significantly reduce shrimp stress. This in turn mitigates the symptoms often observed, such as slow growth, reduced feed conversion ratio (FCR), increased mortality, and susceptibility to disease. Maintain min water level 1.4 mt to maintain water holding capacity.

2. Handling and transportation

Operations such as juvenile transportation and pond transfers are when shrimp are particularly susceptible to increased stress levels. Adhering to best practices in transportation methods and pond design for shrimp transfer can help reduce these stress events, ultimately contributing to the shrimp's overall health and strength. By focusing on these critical periods, farmers can better ensure the vitality and robustness of their shrimp populations.

3. Overstocking

Understanding your pond's carrying capacity is critical to avoiding overstocking, determined by factors like pond type and infrastructure. Awareness of infrastructure limitations is key to reducing stress and improving shrimp survival rates.

How to control stress in shrimp farming

1. Immune Response

Managing stress effectively can have a significant positive impact on the shrimp's immune system. Stress often leads to the suppression of the immune system, making shrimp more vulnerable to diseases. When stress is minimized, the immune system can function at its best, allowing the shrimp to fight off diseases more efficiently.

2. Decreasing Susceptibility to Pathogens

Stressors like overcrowding, poor

Holistic Approach to Shrimp Health Management



New generation hatchery diet Inspired by Nature



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water quality, or insufficient oxygen levels can compromise the protective barriers of shrimp, making them more susceptible to pathogens. Effective stress management creates an environment where these barriers are strong, reducing the likelihood of pathogen entry and subsequent disease.

3. Nutrition

This is a complex issue as most dietary nutrient requirements are determined in the laboratory under stringent conditions that have nothing to do with the stressful world of the shrimp farm. Certainly, if deficiency symptoms are present below a certain level a nutrient, then the diet in the field must have at least these levels. Though higher levels may be required depending upon the cultural conditions. It is known that shrimp consume an average of around 60% of the feed that they are fed during their life cycles in a pond, with the amount likely varying with respect to the size of the animal, the size of the ponds, the densities of the animals in the ponds and the feeding strategy.

4. Optimal Energy Use

Under stress, shrimp tend to use more energy for survival responses (like rapid swimming or jumping), which takes away from the energy that could be used for growth. Effective stress management ensures that the energy is optimally distributed towards growth, moulting, and reproductive processes. This can be achieved by maintaining ideal water conditions, providing high-quality feed, and implementing proper aeration systems to ensure sufficient oxygen levels.

Stress Control Solutions

- Maintaining water quality
- Optimum stocking density
- Control Ammonia and Nitrate
- Maintain Biosecurity to reduce the Disease Outbreak
- Beta Glucans
- Vitamin C and E supplementation
- Chelated Trace minerals
- Probiotics supplementation

Nutritional solutions for optimum shrimp health and manage stress:

Optimum shrimp health starts with ensuring healthy larvae. A stable microdiet that delivers right nutrition while maintaining the pond ecosystem is required for good larvae development. Skretting's new generation shrimp hatchery diet, **Elevia**, is one such solution that is Inspired by Nature to improve FCR, feed consumption and post larva robustness. Similarly, solutions like **Lorica** are the right inclusions for nursery diet as immunostimulants present in the feed help to ensure higher survival rate and better growth.

During culture, it is necessary to ensure diets that fulfill the nutritional requirement of shrimp physiology. Skretting's shrimp grower diets, **Gamma** for *L. vannamei* and **Kuroline** for *P. monodon* have been developed after extensive research into shrimp physiology, eating habits and requirements. With higher digestible marine protein and phospholipids, they ensure a balanced diet for robust shrimp culture.

As diseases become prevalent and the culture become more susceptible to disease challenges like EHP, the level of stress also increases significantly under disease conditions. In these circumstances, feeding a functional feed like **Armis**, Skretting's latest innovation to build shrimp resilience, ensures healthy gut management and effective management of EHP and related stressors.

Health supplements like **Relaxx** that contains phyto-biotics, micro

minerals, vitamins and antioxidants are also designed to manage the various stress factors during culture.

Summary

The key to the management of stress in farmed fish and shrimp is avoidance through the use of right animal husbandry techniques, optimization of animal genetic tolerances, appropriate nutritional and feeding strategies and the selective use of biologically active compounds to promote heightened immunity during times of stress.

About Skretting

Skretting is a global leader in providing innovative and sustainable nutritional solutions and services for the aquaculture industry working closely with shrimp and fish farmers. Our purpose is 'Feeding the Future'. Skretting has 30 production facilities in 18 countries on five continents and manufactures and delivers high-quality feeds from hatching to harvest for more than 60 species. The total annual production volume of feed is more than 3 million tonnes. It is headquartered in Stavanger; Norway and it employs 4,000 employees. Its team of more than 140 employees is dedicated to Innovation that works on the core competencies of nutrition, feed production and health for aquaculture. In India, we have head office in Hyderabad and our manufacturing footprint in Surat, Gujarat.

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

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- Enhance non-specific immunity and reduce mortality.
- Regulate intestinal flora, reduce the risk of pathogens infection.



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