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- Editor



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Benefits of Culture-based Fisheries

An initiative that could determine the cause of shell breakage in different species of mussels, one of the biggest challenges facing the shellfish aquaculture sector globally, is currently underway.



Dear Readers,

The July 2021 issue of *Aqua International* is in your hands.

In the **News section**, you may find news about –

A webinar held on "Hedging Price Volatility

of Feed Ingredients using Commodity Derivatives" by CLFMA of India in association with National Commodity and Derivatives Exchange (NCDEX). In the recent past, commodity prices have seen high volatility which has impacted the normal operations of business in the livestock industry.

In order to assess and discuss about benefits of Culture-based Fisheries (CBF) in improving nutritional security and income of rural farming and fishermen communities; present scenario of this prospectful technology; identify better planning, management practices and research needs for its development and capacity building, a webinar on 'Culture-based fisheries for rural development' was organized by Network for Aquaculture Centres in Asia-Pacific (NACA), Bangkok, Thailand on 31 May 2021. Dr V. V. Sugunan spoke on Culture-based Fisheries.

Skretting India launched the AquaCare range on 10 June 2021 which was attended and viewed by more than 260 people of their stakeholders, customers – dealers and farmers and others. It was well appreciated for the innovative approach in remaining connected during the current uncertain situations.

Shrimp stunning initiative wins animal welfare award. Hilton Seafood UK has received an award for trialling and adopting an electric stunner for farmed white leg shrimp, which delivers a more humane method of slaughter than immersion in ice slurry. Hilton Seafoods (HSF) is one of the largest distributors of fresh seafood in the UK and it supplies over 100 million Vannamei shrimp an year to Tesco. Shrimps are traditionally slaughtered using ice slurry but, in a bid to improve animal welfare, in June 2020 the company trialled an Optimar electrical stunner - which had been modified for use on shrimp - at a farm in Vietnam in collaboration with Amanda Seafood.

The search for a break through in mussel aquaculture. An initiative that could determine the cause of shell breakage in different species of mussels, one of the biggest challenges facing the shellfish aquaculture sector globally, is currently underway. The consortium – from the University of Stirling's Institute of Aquaculture, Fassfern Mussels, the Scottish Shellfish Marketing Group, the Fishmongers' Company, the Association of Scottish Shellfish Growers, and the Sustainable Aquaculture Innovation Centre (SAIC) – will examine a range of factors that could lead to weakness in mussels' shells.

The Farmers' Awareness Meeting on 'Balanced use of fertilizers in freshwater aquaculture' was organized jointly by ICAR-CIFA, Bhubaneswar and KVK, Dist. Khurdha, Odisha on 18 June 2021 in Virtual mode. In the beginning, Dr B. R. Pillai, Principal Scientist (PS) and Head, Aquaculture Production and Environment Division, CIFA spoke about importance and requirement of balanced fertilizer use in freshwater aquaculture practices by farmers and the ill effects of overfertilization and under-fertilization in fish culture ponds.

Fry of hybrid Koi in nature in South 24 Pgs, WB – a cause for concern. Native / indigenous Anabas testudineus or 'Desi Koi' is naturally-occurring, nutritious and high-valued food fish, cultured in 8 – 30 dec earthen ponds and recently in concrete tanks in semi-Biofloc system by small-to medium-scale fish farmers in WB villages. It attains 50 - 70 gm from 1 inch size in 135 - 150 days, 75 – 100 gm in 9 - 10 months, colour blackish green / faint green, snout 'V' shaped, mouth terminal.

The Soy Food Promotion and Welfare Association, an organisation representing soybean food processing industries, has urged Prime Minister Narendra Modi to allow the processing industry to import 50,000 tonnes of food specialty soyabeans from the US duty free.

Kochi based firm to promote Pokkali farming. To restore the past glory of Pokkali farming, organic cultivation of rice is being combined with aquaculture followed in the coastal areas of Kerala. Agronature, a Kochi based private *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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FOLLOW US: facebook.com/aquainternational.nrs twitter.com/nrspublications *Send a letter:* Letters to the Editor must include writer's full name, address and personal telephone and mobile numbers. Letters may be edited for the purposes of clarity and space. Letters should be addressed to the Editor:

AQUA INTERNATIONAL, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Masab Tank, Hyderabad - 500 004, T.S, India. Tel: +91 040 - 2330 3989, 96666 89554. Website: www.aquainternational.in company, has drawn up a plan to promote and sustain this unique traditional farming practice. Pokkali is an integrated rice-fish rotational complementary farming system in the saline backwaters of Alappuzha, Ernakulam and Thrissur.

APEDA holds meet to increase agri exports. The Agricultural and Processed Food Products Export Development Authority (APEDA) organised a virtual meeting with various stakeholders for formulating strategies as part of its efforts to further boost the country agricultural and processed food exports to the Gulf region.

Kochi-based fishing start-up launches digital 'Pond Diary'. Aquaconnect's app will help manage 44,000 shrimp, fish farmer's activities. Fish and shrimp farming startup Aquaconnect has launched "Pond Diary", a first of its kind feature to help farmers maintain a log of their activities on the Aquaconnect application. Artifical Intelligence and Machine Learning technologies will enable Aquaconnect to decode the collective intelligence and issue a mass advisory to all farmers.

In the Articles section -- Article titled *Feed Handling and Storage*, written by A. Jemila Thangarani and other authors highlighted Feed storage is more important to extend their shelf life and improve durability. The general rule for preservation of dry feeds is to store them in a dry, well ventilated area that affords some protection from rapid changes in temperature. The key factors that affect any feed or commodity storage are its moisture content, relative humidity, and ambient temperature.

Article titled *Application of Monoclonal Antibodies in Aquaculture*, written by Anurag Semwal and other authors highlighted that in this article discussed about the Monoclonal antibodies (MAbs) are being utilized in pathogen classification, disease diagnosis, epidemiological investigation and improvement of vaccines. Monoclonal antibodies will bind to the specific target molecule, without any undesirable side effects. MAbs based ELISA have been used for studies of Vibrio anguillarum strains and for investigation of clinical cases of furunculosis (Aeromonas salmonicidae) and Enteric Red mouth (Yersinia ruckeri) in fish farms.

Article titled *Shrimp Hemocyte Iridescent Virus (SHIV): An Emerging Potential Threat to the Shrimp Aquaculture Industry,* written by David Waikhom and other authors highlighted that Shrimp hemocyte iridescent virus (SHIV) is a virus that causes disease in shrimps and prawns, and thusis considered an emerging potential threat to the shrimp aquaculture industry. SHIV/DIV1 was first reported in Zhejiang ProvinceChina2014, and so far, it is currently distributed only in China and Vietnam.

Another article titled *Seagrasses*, written by D.P. Rajesh and other authors highlighted Significance of marine seagrass ecosystem. Conservation and protection of Seagrass. Major threats to seagrass habitats.

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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CLFMA & NCDEX organise webinar on Hedging Price Volatility of Feed Ingredients using Commodity Derivatives

14 June 2021: CLFMA OF INDIA, the apex organization and the voice of the Country's dynamic livestock industry in association with National Commodity and Derivatives Exchange (NCDEX) organized Webinar on hedging price volatility in feed ingredients using commodity derivatives. In the recent past, commodity prices have seen high volatility which has impacted the normal operations of business. It was thus imperative to understand how to manage this risk using the derivatives platform. The webinar was chaired by the Chairman of CLFMA OF INDIA Mr Neeraj Srivastava. It included eminent panelists from the industry, Mr Kapil Dev, CBO NCDEX, Mr Sumit Gupta, Business head. South Asia and South EA, McDonald Pelz, Mr Rajjib Saha, Agri derivatives

Securing raw material purchases through far- month commodity futures contracts not only gives the protection from potential rise in prices at a later date but also raises the efficiency of capital through leveraged transactions Manager, ITC ABD Ltd, and Ms Rajini Panicker from Phillip Capital. All the panelists have an average experience of more than 15 years in the industry. The event was moderated by Dr Sujit Kulkarni, Managing Committee Member of Clfma of India and the vote of Thanks was given by Mr Suresh Deora, Hon Secretary of CLFMA OF INDIA.

Key objective of the Webinar was to discuss on anomalous rise in prices of Soybean seed and Soybean DOC and Corn which in turn enormous production cost leads to challenging circumstances for livelihood of livestock farmers of India. Webinar highlighted on the following topics:

- Hedging Practices in Global & Domestic Markets
- Price risk management using commodity derivative tools
- Hedging mechanism A Case Study



Dr Sujith Kulkarni, Moderator, MC Member, CLFMA

The Webinar started with a welcome address by Dr Sujit Kulkarni, who also moderated the sessions. Dr Sujit Kulkarni said that since last almost 3 to 4 months our industries have seen the volatility and the unusual spike particularly in Soyabean which led to increase in the feed cost.

Almost 80% price rise in Soyabean meal price was observed and there was a huge spike in soyabean seed also. So, CLFMA thought it prudent to support the Industry in this crucial time and hence arranged the webinar with NCDEX and invited the commodity market experts to deliberate the issue.



Neeraj Srivastava, Chairman, CLFMA

CLFMA OF INDIA Chairman Mr Neeraj Kumar Srivastava welcomed all. Mr Neeraj Srivastava, in his Welcome Note stated the objectives for the webinar, wherein he highlighted the importance of commodity price risk being a financial risk driven by commodity supply and demand fundamentals. The global commodity markets are facing high volatility due to the supply and demand gaps. It is important to manage this volatility using risk management tools like Futures and Options. The webinar was organized to understand the importance of these tools for effective price risk management and protecting the bottom lines of the business.



Kapil Dev, Chief Business Officer, NCDEX

Mr Kapil Dev was the first panelist to speak on the subject. He highlighted the fact that risk is something that is unknown and uncertain. There is health risk, life risk and wealth risk. While we insure ourselves against the life and health, wealth is something that is not insured. Volatility and uncertainty are always there in business largely driven by unknown and uncertain factors. He cited some of the recent examples, droughts, geopolitical events, biofuel push or logistical bumps like container shortages, Suez Canal blockage for recent volatility in the commodity prices. He explained that these can be effectively managed using the concept of Hedging.



Sumit Gupta, Business Head, South Asia & SE Asia, Mcdonald Pelz

Mr Sumit Gupta was the next panelist to talk on the subject. He further elaborated what Mr Kapil Dev had explained in his presentation. He explained the weather patterns in terms of El Nino and La



NEWS

Nina periods and how these largely impact production of Agriculture commodities globally. He mainly focused on Corn and Soybean as these are largely used raw materials as feed ingredients. World corn production should increase to meet the rising demand. Corn prices almost doubled over last year for US farmer while the Indian Corn markets didn't see this kind of rally, this price gap has made Indian corn attractive for exports. He also highlighted the domestic scenario where demand is driven by poultry and starch industry. There has been sharp increase in production and consumption domestically. For Soybean, he stressed on the fact that while the demand was increasing

" Corn and Soybean, as these are largely used raw materials as feed ingredients. World corn production should increase to meet the rising demand. **Corn prices almost** doubled over last *vear for US farmer* while the Indian Corn markets didn't see this kind of rally, this price gap has made Indian corn attractive for exports. He also highlighted the domestic scenario where demand is driven by poultry and starch industry "

the yield was constant. The demand for Soybean will continue to increase due to increasing awareness on food preferences and income growth. He mentioned that proper research and analysis of the commodity will help in taking informed price decisions.



Rajib Saha, Manager Derivatives Trading, ITC ABD Ltd

Mr Rajib Saha continued where Mr Sumit Gupta left his presentation and stressed more upon from a business perspective how these price volatilities impact the revenues of business. Corporates must have risk management policy to ensure that planned targets of annual sales, purchases and profitability numbers are attained to satisfy management and shareholders. It is all the more important for corporates who are into commodities as they have a number of risks including risk of change in government policies on tariffs, overseas trade, weather, currency or even hedge funds' strategies. Procurement via futures gives two- way protections, one is fixing the price and another is immunity from counterparty default. Futures also give price signals as they are reflective of what is going on in the markets both globally and domestically. He urged the participants to at least keep following the prices

of futures market to get an understanding of the market fundamentals.



Rajini Panicker, VP, Commodity Head-Phillip Capital India

Finally, Ms Rajini Panicker explained the role of a member in the ecosystem of Futures market. She highlighted how they work with various value chain participants to device customized strategies for them based on their raw material requirement. She also explained in detail the opportunity loss in Soybean if the market participants had hedged Soybean this year. This year being highly volatile, she explained the same for the last year as well, where if hedged the corporate would have saved about 4 - 6 % in their overall procurement costs. She summarized her presentation by saying Securing raw material purchases through farmonth commodity futures contracts not only gives the protection from potential rise in prices at a later date but also raises the efficiency of

There has been sharp increase in production and consumption domestically.

capital through leveraged transactions.

Webinar participants actively participated in Question and Answer session and Panelists answered their Questions satisfactorily.



Dr Suresh Deora, Hon. Secretary, CLFMA

Mr Suresh Deora, Hon. Secretary of Clfma of India concluded the webinar by thanking the panelists for their valuable inputs and the audience for participating and making the event a success. CLFMA OF INDIA will associate for more such programs for the benefit of the feed industry at large.

The event was attended by 270 participants and total registrations received were 317.

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Dr V. V. Sugunan speaks on Culture-based Fisheries in the webinar organized by NACA, Bangkok

31 May 2021, Bangkok: In order to assess and discuss about benefits of Culturebased fisheries (CBF) in improving nutritional security and income of rural farming and fishermen communities; present scenario of this prospectful technology; identify better planning, management practices and research needs for its development and capacity building, the Webinar on 'Culture-based fisheries for rural development' was organized by Network for Aquaculture Centres in Asia-Pacific (NACA), Bangkok, Thailand on 31 May 2021. Eminent invited scientists and experts from India, Bangladesh, Sri Lanka, Lao PDR, Thailand, Vietnam and China spoke on the subject. As the resource person from India, Dr V. V. Sugunan, Former ADG (Inland Fisheries), ICAR presented his deliberation on 'Development of CBF in India - opportunities and challenges'.

Dr Sugunan in his talk emphasized on concept of CBF as utilization of manageable existing inland lentic water resource {small reservoirs, beels, floodplain wetlands (FW)} and their natural productivity wherein fish fingerlings are stocked, cultured scientifically and adult ones produced. Natural inland waters can contribute substantially to fish production and these are managed on basis of CBF, which is intermediate to capture fishery and fish culture. In CBF, whole operation is based on captive fish stocks with a high degree of human control over water quality where fish harvest and production depends on artificial recruitment, whereas it is natural recruitment in capture fishery. Dr Sugunan discussed about avenues that lead to fish production, viz., capture fisheries, CBF, species and stock enhancements, capture-based aquaculture and aquaculture; resource opportunities, scope and water bodies suitable for CBF in India; total size and mode of management in different inland water resources for fish production and that small reservoirs (individual size less than 1000ha) and FW suitable for CBF and enhanced capture fisheries; total area of small reservoirs in different states of India; concept of FW and that known by different names (oxbow lakes, pats, chaurs, beels, mauns, baors); important river basins as potential FW resource for fish production and their area in Jammu & Kashmir, Uttar Pradesh (152000ha) and eastern and northeastern states; present and potential yield of fish productions (in kg/ha) from reservoirs and FW in India and yield opportunities in these sectors in Sri Lanka, Cuba and China.

In India, out of total, area of small reservoirs and FW suitable for CBF is 13,00,000ha and 1,50,000ha respectively. As advantages of CBF, Dr Sugunan explained that it is essentially stocking recapture system, can have better control over fish stock, less resource intensive, water use is non-consumptive, simple and sustainable technology that contributes to poverty alleviation of rural communities. Yield (kg/ha) rises from different open systems of fish production (more sustainable) to closed systems of aquaculture, from extensive to hyperintensive ones. Stocking provides benefits of production in CBF and that is shared by large group of fishers (is more inclusive) whereas in aquaculture, return on investment is for an individual or small group. Total 165000 tonnes of fish may be produced (additional production) from Indian reservoirs and FW through CBF. But concept of CBF is not clear among stakeholders at different levels in India. According to Dr Sugunan,

other challenges include poor documentation and reporting of fish production from CBF; varying jurisdiction and ownership of these water bodies; very complex and varied tenure right systems across different Indian states. He discussed about contribution of CBF in Indian inland fisheries development since recent past, in national schemes Blue Revolution (BR) and Pradhan Mantri Matsya Sampada Yojana (PMMSY); comparison of percentage contribution of inland culture and marine capture sectors in overall quantity of fish production and its growth in India from 1950-51 till 2018-19 graphically and further about achieving the targeted production of 200 lakh tonnes in 2023-24; increasing demand for fish in India in years 2000-01, 2010-11, 2018-19, 2020-21, 2023-24. Contribution of capture fishery, CBF and enhancement fishery in combination in total fish production in India had been 8 lakh tonnes in 2009-10, 9 lakh tonnes in 2018-19, and has been projected and estimated to be 10 lakh tonnes in 2020-21 and 27 lakh tonnes in 2023-24. In the end, Dr Sugunan

In the end, Dr Sugunan justifiably mentioned that CBF can contribute to meet the BR and PMMSY targets in India in years to come by producing and adding a substantial quantity of fish sustainably and equitably. It was very informative and News communicator Subrato Ghosh was registered participant in this Webinar.



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Skretting India Introduces AquaCare: to safeguard water quality for aquaculture productivity

- Skretting expands scope beyond shrimp and fish feed to a range of water quality improvement products
- Easy-to-use products improve water quality which can also lead to improved results

10 June 2021: Skretting India proudly launched the AquaCare range on 10 June 2021 with a grand virtual launch event which was attended and viewed by more than 260 people. The launch, which was a huge success, was attended by our customers – dealers and farmers, and agua industry leaders. It was well appreciated by all for the innovative approach in remaining connected during the current uncertain situations.

As a key part of our ongoing commitment to improve the sustainability of the industry in India, Skretting India has extended its scope beyond the supply of sophisticated and sustainable feeds by creating a new global product line – AquaCare



Dr Saurabh Shekhar giving an overview of Skretting India

- specifically focused on providing practical solutions to improve water quality for shrimp and fish farming systems.The launch of new product line reflects our commitment to India and South Asia markets. India with its fastgrowing urban population and continuously evolving aquaculture industry present huge market opportunities.

Speaking about the launch **Dr Saurabh Shekhar,**

Revolutionizing Aqua and Animal Nutrition

Dr. Saurabh Shekhar, General Manager – Nutreco South Asia



have a successful culture." While the aquaculture industry in India has significantly grown over the last decade, the producers face a growing challenge in terms of access to safe and clean water. With AquaCare products, we aim to address these challenges faced by our customers by improving culture productivity and efficiency.

Improving quality, improving efficiency with new water care portfolio

General Manager - Nutreco

we have been catering the

Indian market through our

range of high-quality feed,

we also understand that

challenges in aquaculture

extend beyond feed. Our

objective in India is to

become an integrated

solution provider for our

customers and with the

launch of Aquacare – our

water care portfolio, helps

us in achieving this. Water

quality and management

is an extremely important

Aquacare we will be able

to extend our expertise

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that with our innovative,

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to support the growth and

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guidance, our farmers can

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on field for practical

this area. We are confident

aspect of aquaculture, with

South Asia says, "While



AquaCare Control Probiotic AquaCare Control is a probiotic solution, its formulation is designed to improve water quality, support growth and feed conversion ratio for shrimp and fish. It is a combination of synergetic beneficial bacteria and micronutrients on a carbon rich carrier. It works preventatively, with the objective to load the water in pond farming systems with beneficial bacteria that prevent the same space from being occupied by potentially harmful bacteria. These bacteria are specifically selected to provide an effective and versatile solution for water bioremediation in all aquaculture conditions.

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Dr Arjen Roem presents AquaCare in India

changing environmental conditions. This practical, cost-effective solution ensures that pond systems have a stable, nutrientrich water that is also ionically balanced, thereby



AquaCare Mineral Balance

providing the platform necessary to optimise species' growth and health.

During the presentation Dr Arjen Roem, Strategic Marketing Director-Skretting Asia said, "Water is aquaculture's greatest ally. It is also a very complicated and volatile element, requiring great care and attention. By addressing imbalances, the long-term future of the industry can be assured. AquaCare is a key part of our ongoing commitment to improve the sustainability of the industry."

AQUA care











Grand Launch

- It begins with water
- AquaCare Control
- AquaCare Mineral Balance

It begins with water

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Lagoon fish are also the backbone of Lakshadweep's famous sustainable and indigenous tuna fishery industry.

Prices of different Shrimp & Fishes in India

| S. No. | Name of the Fish | In Indian Rupees per Kg |
|-----------|--------------------|-------------------------|
| 1 | Black Tiger Shrimp | 290 |
| 2 | Vannamei Shrimp | 450 |
| 3 | Tilapia Fish | 200 |
| 4 | Pungasius | 55 |
| 5 | Mud Crab | 500 |

| Raw Material price | | | |
|--------------------|-------------------------|-------------------------|--|
| S. No. | Name of Raw Material | In Indian Rupees per Kg | |
| 1 | Soyabean | 40 | |

Source: India Mart



People throng the Musharabad fish market on the occasion of Mrigashira Karte, in Hyderabad on 8 June 2021. The day marks the start of monsoon season and eating fish on the day is considered good by the locals.





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The search for a break through in Mussel Aquaculture

extreme cases, it can

prevent farmers from

completely shut down.

The researchers will

molecular tools and

combine cutting-edge

biomaterial testing during

on the results of the initial

the project. Depending

phase of the study, the

project could develop a

molecular tool that will

assess juvenile mussels for

shell strength, a location

screening system for

mussel farms, or a new

process for harvesting.

Dr Stefano Carboni from

Institute of Aquaculture

said: "We are aiming to

understand what causes

the sector. Our project

will help producers to

is genetic, influenced

by local environmental

understand whether the

strength of mussels' shells

conditions, the harvesting

process itself plays a part,

or it is a combination of all

these factors. Whatever

the causes, we can help

farmers avoid growing

mussels for years only to

realise there is a problem at

a large problem for

the University of Stirling's

harvesting or cause sites to

24 June 2021: An initiative that could determine the cause of shell breakage in different species of mussels, one of the biggest challenges facing the shellfish aquaculture sector globally, is currently underway.

The consortium – from the University of Stirling's Institute of Aquaculture, Fassfern Mussels, the Scottish Shellfish Marketing Group, The Fishmongers' Company, the Association of Scottish Shellfish Growers, and the Sustainable Aquaculture Innovation Centre (SAIC) – will examine a range of factors that could lead to weakness in mussels' shells.

Trialling different conditions among different species at two Scottish sites, the researchers will aim to determine whether shell strength is related to mussels' genetics; environmental conditions, such as the salinity of local water or the harvesting process itself.

Salinity, for instance, can affect the mineral properties of water and, in cases where it is too low, could compromise shell strength. Certain species of mussels – and hybrids there of – are also suspected to have weaker shells to begin with; specifically, bay mussels (Mytilus trossulus). In Scotland, shell breakage

causes mussels to be unusable and is estimated to cost the sector around 2 percent of its average annual output, as well as associated costs. In



Blue mussels

the last moment.

"Once we have determined the variables, we can start to develop remedies – that might be screening for salinity conditions or a tool that predicts the percentage of mussels that will develop broken shells. From there, we can protect jobs, create new products, and develop a more efficient and sustainable sector."

Heather Jones, CEO of SAIC, said: "The mussel sector is a growing part of Scotland's aquaculture landscape, providing sustainable jobs in rural and remote communities. Shell breakage is among the biggest challenges to its growth and tools that can better inform how the sector grows mussels, selects sites, and undertakes harvesting will be invaluable in supporting development. It is a great example of how organisations with a common interest in shellfish can collaborate to develop new technologies and methods that could make a real difference to the sector."

Dr Nick Lake, CEO of the Association of Scottish Shellfish Growers, added: "The wild blue mussel is a valuable natural resource within Scotland, which in recent years has supported the development of a dedicated cultivation industry. While around 8,000 tonnes are currently cultivated, plans are in place to increase this to around 20,000 tonnes, creating significant additional employment.

"To ensure we have a sustainable basis upon which to develop, there is a requirement to understand the detailed biology of the natural populations and environmental conditions allowing the shellfish to thrive. By harnessing the advanced scientific techniques available through the Stirling University research group, we hope to rapidly unlock the answers to some of the fundamental questions regarding the selection of natural blue mussel stocks which are optimal for cultivation in Scotland."

Dr Stefano Carboni from the University of Stirling's Institute of Aquaculture said: "We are aiming to understand what causes a large problem for the sector. Our project will help producers to understand whether the strength of mussels' shells is genetic, influenced by local environmental conditions, the harvesting process itself plays a part, or it is a combination of all these factors. Whatever the causes, we can help farmers avoid growing mussels for years only to realise there is a problem at the last moment.

NEWS

females of Vietnamese

Fry of hybrid Koi in nature in South 24 Pgs, WB – A cause for concern

Kolkata: Native / indigenous Anabas testudineus or 'Desi Koi' is naturally-occurring, nutritious and high-valued food fish, cultured in 8 – 30 dec earthen ponds and recently in concrete tanks in semi-Biofloc system by small-to medium-scale fish farmers in WB villages. It attains 50 - 70 gm from 1 inch size in 135 - 150 days, 75 - 100 gm in 9 - 10 months, colour blackish green / faint green, snout 'V' shaped, mouth terminal. The Vietnamese A. testudineus or 'Bangladeshi Koi', fast-growing but not as good as former, cultured in few districts of WB, attains 100 - 120 gm in 90 days, 275 gm in 7 – 8 months and 15 – 20 % fishes weigh 350 gm. Black circular blotch present near caudal fin origin, black mole on operculum edge, colour greenish red, snout not 'V', somewhat 'U' shaped.

As both fishes exhibit 'climbing' behaviour, in order to breed / spawn, with onset of monsoon or after heavy shower (rain), native Koi 50 – 90 gm of both sex migrate from one culture pond or normal pond to nearby small seasonal pond with submerged weeds, paddy fields (with embankments on all sides) with minm 8 - 10 inch of rainwater stagnation or above, depressed temporary lowland, shallow canals; breeding season is June - August. For native and Vietnamese A. testudineus monoculture ponds in villages, split bamboo-



Growing hybrid fry of A. testudineus

nylon net fences erected on all sides upto 50 – 60 cm height to prevent escape, but accidental / unintentional release from some ponds occur during heavy rain through torn fence net. This is problematic and poses concern in case of Vietnamese A. testudineus, which is exotic. During August - October, native Koi seed collectors conventionally place indigenous 'Baanser ghuni' at mouth of outlets of those nursery grounds and capture 1 - 4 gm fry (30 - 45 days old; 1.0 - 1.5 inch) produced due to natural breeding. Growout Desi Koi farmers buy it for stocking from local collectors (a) Rs 2 - 3/-/piece.

Vietnamese A. testudineus farmers in WB procure its fry stages from Naihati fish seed market and hatchery owners which are induced-bred seeds. There was no report from Desi Koi culturists in ponds and semi-Biofloc systems in Dist. South 24 Parganas, WB about occurrence of hybrid Koi fry (cross between native A. testudineus and Vietnamese A. testudineus) in nature in same or nearby villages, until recently on

11 February 2021, News communicator Subrato Ghosh got informed from Sri Shiblal Maity at Vill. PaschimJota, GP Kankondighi, PS Roydighi, Block Mathurapur-II in this district during on-site conversation about fry of hybrid Koi produced in nature. Sri Maity, MA, aged 32, introduced semi-Biofloc system of Desi Koi culture in concrete tank in this GP since end of 2019. He bought naturally-bred fry 1.0 - 1.5 gm (20 – 25 mm size), some fishes reached 100 – 150 gm in 3 - 4 months which didn't exhibited true body features of native A. testudineus completely. He strongly realized occurrence of only 200 nos of pure variety of native species in every 500 nos of Koi fry bought and stocked, rest belongs to hybrid variety.

There is increasing trend of pond farming of Vietnamese A. testudineus in this GP and is quite possible that some matured ones escaped through net screen and entered into water-logged paddy fields during heavy rain; normally only gravid

Koi move out from pond. During this time, some matured males and females of Desi Koi escape from culture ponds, which also live in normal seasonal village ponds naturally. A. testudineus of one paddy field during monsoon and post-monsoon got mixed with another field in this GP, finally led to mixing of matured adults of both native and Vietnamese varieties of A. testudineus in particular (same) region and production of such 'Doaansla' seeds (in local dialect) or hybrid Koi fry, Sri Maity opined. Hybrid A. testudineus fry, trapped in 50% or above in quantity in device of Koi seed collectors in addition to native Koi fry, had black spots at caudal peduncle and operculum; body colour resembled that of Vietnamese variety and shape of native variety. Both News communicator and Sri Maity feel that it is an issue as presence of Vietnamese Koi in nature may lead to marked depletion of naturally-occurring native A. testudineus seeds in Kankondighi GP in near future and increase availability of seeds of the hybrid variety, which is strictly unwanted.



Marginal areas of paddy plots as repository of Koi seeds

Awareness Programme on Balanced Use of Fertilizers in Freshwater Aquaculture

18 June 2021: The Farmers' Awareness Meeting on 'Balanced use of fertilizers in freshwater aquaculture' was organized jointly by ICAR-CIFA, Bhubaneswar and KVK, Dist. Khurdha, Odisha on 18 June 2021 in Virtual mode. In the beginning, Dr B. R. Pillai, Principal Scientist (PS) and Head, Aquaculture Production and Environment Division, CIFA spoke about importance and requirement of balanced fertilizer use in freshwater aquaculture practices by farmers and the ill effects of overfertilization and underfertilization in fish culture ponds.

Dr S. K. Swain, Director, CIFA mentioned in his speech that we should think about use of balanced fertilization in fish pond ecosystem and this programme, which coincides with celebration of 75 years of Indian independence, is aimed at awareness and knowledge sharing about better use of balanced fertilizers. Inorganic-type soil fertilizers used to cause phytoplankton growth and subsequently zooplankton production which is fish food; many fish farmers often use soil fertilizers in excess that may lead to dissolved oxygen depletion. Use of organic fertilizers makes fish and other crops more tasty, can be applied in larger quantity, results in greater fish production, fish flesh is

completely safe for human consumption. It contains low concentration of nitrogen (N), phosphorus (P) and potassium (K). Dr Swain emphasized on combined application (appln) of organic and inorganic fertilizers, determination of optimum fertilization rate, plankton turbidity / transparency estimation using Secchi disc, judicious use of inorganic fertilizers (should be done after testing pond soil and water parameters), knowing organic load in pond ecosystem. Chief Guest of this Meeting revered Swami Shivakarananda Maharaj, Principal, Samaj Sevak Sikshan Mandir, Ramkrishna Mission at Belur Math, WB spoke about essentiality of organic fertilization in ponds, organic fertilizer produced at Belur Math and has demonstration plot, more awareness training required on it and it may be helpful as remedy of severe cyclone 'Yash'affected freshwater fish culture ponds in coastal Blocks of WB where saline water has intruded. Tablesize major carps of Andhra Pradesh are nowadays less preferred in comparison to local carps produced in WB. Dr P. P. Chakrabarti, PS, RRC of CIFA at Rahara gave a PP Presentation on

RRC of CIFA at Rahara gave a PP Presentation on 'Nutrient management in nursery, rearing and culture ponds'. Highlighting the importance of fish and fish

farming in human health, nutrition and income generation, Dr Chakrabarti spoke about the need of empowering fish farmers with the knowledge of proper manuring and fertilization in fish ponds for better fish productivity, treated domestic waste water for fish farming as a technology developed by CIFA. He discussed in detail about types of fish ponds; steps in nursery pond management; pond bottom preparation; pond soil fertility will be lost forever if insecticides used to kill predatory fishes; balanced fertilization of urea @ 100kg/ha and bleaching powder @ 175kg/ ha on 2nd day for killing fishes; appln of cow dung in 50cm water level during pond preparation and depth increased to 1mt or above after a week which leads to huge zooplankton population; beneficial use of mixture of cowdung, mustard oil cake (MOC), yeast powder and molasses in semi-decomposed state at every ten days interval; rates of basal and intermittent fertilization with GNOC / MOC, cow dung and SSP in nursery ponds for continuous plankton production; proper time and rates of two fertilization in rearing ponds to enhance fish production; culture in growout ponds by stocking stunted / over-wintered carp fingerlings (80-90gm); fertilization schedule, rates of appln and requirements

of SSP, urea, lime and cowdung in one-year pond culture. Appln of cowdung will not lead to ammonia formation if done at proper dose.

Dr S. Adhikari, PS and incharge, Rahara Centre of CIFA gave a presentation on 'Balanced fertilization for aquaculture fish ponds'. He mentioned that banned CuSO4 can't be used for pond algae eradication; gill clogging in table-size carps occurs if excess KMnO4 applied during harvesting; too much organic carbon harmful for giant prawn culture; pond fertilization rate should be fixed after soil testing: maintenance and care of pond health (soil-water) is equally important like fish health for sustained fish production; emergence of multi-nutrient deficiencies in soil in several areas observed as a result of continuous soil nutrient mining every year as against lesser external supplementation and low addition of organic manures and micronutrients.

Dr Adhikari discussed about rates and proper time of appln of cowdung (in presence and absence of mohua oil cake), lime and mixture of MOC, cowdung and poultry manure in nursery ponds and their beneficial effects; appln of N, P and K in proper ratio and the compounds involved (forms of appln) for different kinds of pond soils; rates of appln of cowdung, biogas slurry and poultry droppings in rearing and stocking ponds and detailed dosages of N, P and K in ponds in form of different compounds; rate of appln of N, P and cowdung (kg/

ha/yr) in conditions of low, medium and high nutrient content of soils; fortnightly appln rates and composition of mixture of MOC, GNOC, mineral-mix, black molasses and yeast for plankton production; total requirement of cowdung, urea and SSP in ten-months culture in 1ha pond; biofertilization and importance of Azolla culture; dosage of lime at different pH values and conditions of pond soil; values of important desirable pond water physicochemical parameters; case studies on increase and improvement in

pond water productivity and fish production by following recommended management practice in comparison to normal fish farmers' practice; yield and water productivity (in kg/ha-mm) for four cultivated crops, i.e., major carps, Pangas catfish, rice and wheat. Above 100 fish farmers were registered participants in this very informative online programme; queries on field-related problems faced by farmers were addressed by eminent speakers. News communicator Subrato Ghosh also participated in it.

seafood in the UK and it supplies over 100 million Vannamei shrimp a year to Tesco. Shrimps are traditionally slaughtered using ice slurry but, in a bid to improve animal welfare, in June 2020 the company trialled an Optimar electrical stunner - which had been modified for use on shrimp - at a farm in Vietnam in collaboration with Amanda Seafood.

It was the first large-scale electrical stunning system used for shrimp globally and was able to process 10 tonnes of shrimp an hour. Following successful results, and a review of the outcomes by external animal welfare experts, Tesco approved the use of electrical stunning of P.vannamei in July 2020. Since then, approximately 80 percent of the P. vannamei supplied to Tesco through HSF have

Shrimp Stunning Initiative wins Animal

Welfare Award

Using an electric stunner is deemed more humane than immersing shrimp in ice slurry, which is the conventional method for shrimp slaughter

24 June 2021, United Kingdom: Hilton Seafood UK has received an award for trialling and adopting an electric stunner for farmed white leg shrimp, which delivers a more humane method of slaughter than immersion in ice slurry. The company was the winner of the best innovation category of Compassion in World Farming's Good Farm Animal Welfare Awards, which were presented on 24 June 2021.

Hilton Seafoods (HSF) is one of the largest distributors of fresh been electrically stunned. The ambition is to achieve 100 percent electric stun for P.vannamei in the HSF supply chain.

According to Compassion in World Farming, in addition to the welfare benefits it provides, which includes less handling and lower crowding times for the shrimp, the method was shown to stun more quickly than immersion in ice slurry, and provide a more effective and consistent stun, which reduces labour during harvest, while not being detrimental to product quality.

The system, which has been approved and rolled out across the Hilton/Tesco supply chain, will benefit more than 100 million animals in its first year.

"Hilton Seafoods UK take fish and crustacean welfare extremely seriously and actively seek out improved welfare methods and the latest research on welfare and animal handling," said William Davies, fisheries, aquaculture and supply chain manager at Hilton Seafood UK.

"Working with our supplier partners we are very happy with the performance of the shrimp stunner, enabling both improved welfare at harvest and a harvest efficiency benefit for the farmer. Awareness of crustacean sentience is growing, and the implementation of the farmed shrimp stunner adds to the existing electrical stunning we have in all the wild caught crab and lobster we purchase."

Dr Tracey Jones, director of food business at Compassion in World Farming, said: "The sentience of crustaceans is often overlooked and in the absence of any legislation or standards, this electric stunner for shrimp, pioneered by Hilton Seafood, has the potential to benefit billions of animals if adopted more widely across the industry."

Kochi-based firm to promote Pokkali farming

Agronature to combine organic rice farming with aquaculture



Kochi, 28 June 2021: To restore the past glory of Pokkali farming, organic cultivation of rice is being combined with aquaculture followed in the coastal areas of Kerala. Agronature, a Kochibased private company, has drawn up a plan to promote and sustain this unique traditional farming practice.

Pokkali is an intergrated rice-fish rotational complementary farming system in the saline backwaters of Alappuzha, Ernakulam and Thrissur. The rice varieties are salttolerant and adapted to submergence.

The company has been partnering with Palliyakkal Service Cooperatives Bank, at Ezhikkara, a prominent Pokkali rice growing region near Kochi, since 2017 to support the efforts of Pokkali farmers and extend its reach in Kerala and across India.

GI tag

Brand Pokkali has bagged geo-graphical indication tag. Agronature intends to address the challenges faced by Pokkali farming such as low output, high production cost, absence of mechanisation and low value addition.

"Pokkali farming is more than preserving a farming heritage; it holds the clue to a sustainable and secure food future for India. It is of great interest to the responsible tourism community," said Ranjit Rajendran, co-founder Agronature.

Conserving this traditional variety also forms the basis for the efforts to address climate change-related issues such as sea level rise and saline water intrusion, he added.

Features

The core features of the plan are fully mechanised and equipped trial farm for the benefit of academics, farmers and tourists, seed bank of high quality indigenous seeds by dedicating 200 hectares of paddy field in Ezhikkara for it, along with a seed testing laboratory. The company aims to apply technology-based solutions for on-farm problems, especially related to farm operations to be conducted in standing water.

Agronature supports >>

PM urged to allow food specialty soyabean imports duty-free

Chennai, 20 June 2021: The Soy Food Promotion and Welfare Association, an organisation representing soybean food processing industries, has urged Prime Minister Narendra Modi to allow the processing industry to import 50,000 tonnes of food specialty soyabeans from the US duty free.

'Zero' duty

In his plea to the Prime Minister, K. Sarat Chandra Kumar, President, Soy Food Promotion and Welfare Association, said the beans could be allowed into the country at "zero" duty under tariff rate quota since food specialty soyabeans are not grown in the country.

Soyabean is not a staple food in India, hence, the requirement to process and serve the best optimal quality to customers is paramount. Though soya food companies have improved quality, "due to a lack of affordable, highquality raw ingredients, we feel challenged for new growth opportunities", he said.

Kumar said that inconsistent and inferior raw soyabean quality is the leading cause of dissatisfied consumers wanting better taste, texture and flavour profiles.

"Indian soybeans are oiland meal-centric, suitable

>>

Palliyakkal Service Cooperative Bank by working alongside 4,074 farmers. The bank pays higher MSP rates to



Soyabean

for animal utilisation. There are no food specialty soybeans grown in the country; thus the supply of the same does not exist. While all Indian beans are non-GM, they are also treated as commodity beans regardless of the end use, be it in the food or feed industry," he said.

When soyabeans are needed for food applications, Indian producers grade and select the best beans from the general lots and sell them at a premium price, he said.

But they do not qualify to satisfy the specialty food characteristics and do not match up with the quality standards and expectations for producing retail-end products. As a result, many food processors are now forced to shut down, the soy food promotion body chief said.

According to Sumit Agarwal, Vice President of the Association, due to the lack of suitable food grade specialty soyabeans, food processors are constrained. "This is limiting the business opportunities, job creation, and revenue generation," he said.

farmers. In 2021, when MSP was Rs 28, the bank paid Rs 55 per kg, according to a report published in The Hindu Business Line.

Kochi-based fishing start-up launches digital 'Pond Diary'

Aquaconnect's app will help manage 44,000 shrimp, fish farmer's activities



Kochi, 30 June 2021: Fish and shrimp farming startup Aquaconnect has launched "Pond Diary", a first of its kind feature to help farmers maintain a log of their activities on the Aquaconnect application.

Artifical Intelligence and Machine Learning technologies will enable Aquaconnect to decode the collective intelligence and issue a mass advisory to all farmers.

A simple innovation coupled with a smart chatbot will enable 44,000 famers to manage their farms better.

The *Pond Diary* feature captures famers' culture production data starting from seeds stocked, water quality reports, daily feed quantity, weekly growth, animal signs, expense bills, farm infrastructure details, licence, government records and more. Pond Diary is the first step towards capturing pond production data in a simple way and bringing precision in aqua farming with collective intelligence.

"Aqua Farmers are deprived of simple technology tools that can make a big impact on their productivity and efficiency. We are very confident about the launch of the new feature, and it helps in solving the woes of the farmers which result in low productivity. We will encourage farmers to adopt the tool and educate them digitally. And we shall be having manual remote intervention in the form of an integrated chatbot,"said Rajamanohar Somasundaram, Founder and CEO, Aquaconnect.

The data-driven approach

The data-driven approach helps farmers to adopt sustainable farming practices in every culture operation and improves productivity and better disease management with higher profits. Through this automated advisory, farmers are able to access technical advisory for their pond instantly and more conveniently, which further reduces dependency on technicians for any farm support, he said.

The company will also introduce interactivity, notification reminders and collaboration to its new feature in the next three months. The data will also help farmers to access formal finance from banks, have better risk mitigation with insurance and access to market linkage for their harvest produce, says a report in The Hindu Business Line.

APEDA holds meet to increase agri exports

New Delhi, 3 June 2021: The Agricultural and Processed Food Products Export Development Authority (APEDA) organised a virtual meeting with various stakeholders for formulating strategies as part of its efforts to further boost the country agricultural and processed food exports to the Gulf region.

An official statement said that APEDA held the meeting in association with the Ministry of Agriculture and Indian embassies. Various issues faced by exporters and importers of India's agricultural produce were discussed during the meeting through the webinar.

The Indian embassies in Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates took part in the event along with leading exporters and importers from India and the Gulf countries. The Gulf countries are among the prominent export destinations for Indian agricultural product exports. Some of the major products exported are Basmati and non-Basmati rice, buffalo meat, other fresh vegetables, fresh onions, fresh fruits, sheep and goat meat, processed products, cereal preparations, and fresh mangoes.

Despite Covid-19 challenges, India's exports of agricultural and processed foods have been largely interrupted and have registered impressive growth during 2020-21 fiscal. But its export to the Gulf region totalled \$5.04 billion last fiscal compared with \$5.37 billion the previous fiscal. According to UN Comtrade, the Gulf region imported \$44.14 bn worth of APEDA monitored products across the globe. India had largest share as a sourcing country for the Gulf region, enjoying a share of 11.8%.

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Shrimp / Fish performs all their body functions and growth in water. Good quality water and proper D.O. levels determines the success or failure. Good quality water, optimum D.O. level is of prime importance for health and growth of Shrimp / Fish.

Irregular water exchange, excess and leftout feed, dead algae, fecal matter, increases the organic load at the pond bottom. Accumulation of such waste absorbs available oxygen, creating anaerobic condition which leads to pollution of pond bottom. Polluted pond bottom and unhealthy environmental conditions triggers the release of toxic gasses like Ammonia, H₂S, Methane, etc, The toxicity of Ammonia, Hydrogen Sulphide, Methane attributed mainly due to unionized form. As the concentration in water increases, ammonia excretion by aquatic organism diminishes and the level of ammonia in blood and in other tissues increases. Ammonia increases oxygen consumption by tissues, damage gills and reduces the ability of blood to transport oxygen, and increases the disease susceptibility. To eliminate / overcome the above problems 'GASSEN PLUS' Yucca Schidigera, it contains Steroidal"Saponin" which help to reduce ammonia and other noxious gasses such as H₂S, Methane, etc., Microbial enzyme "Urease' Production inhibited by Saponin which leads to an increases D.O. and reduction of BODand COD levels.

Bacterial strains such as Bacillus Subtilis, Nitrobactor, Nitrasomonas, 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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| Vitamin-B2 | | 1.25 mg |
| Vitamin-B6 | | 0.62 mg |
| Niacinamide | | 30 mg |
| D-Panthenol | | 1.26 mg |
| Inositol | | 10 mg |
| Folic Acid | | 10 mg |
| Biotin | | 15 mcg |
| Vitamin-B12 | | 6.25 mcg |
| L-Lysine | | 175 mg |
| DL-Methionine | | 150 mg |
| Vitamin-C | | 200 mg |
| Toxin Binders | | 200 mg |
| Hepato | | |
| Pancreatic stimulants | | 100 mg |
| LDLP | | 15mg |
| USFA | | 5 mg |
| APF | | 30 mg |
| Calcium Gluconate | | 20 mg |
| Magnesium | | 25 mg |
| Manganese | 20 | 15 mg |
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Feed Handling and Storage

E: jemilathangarani@tnfu.ac.in

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Feed for fish and shrimp is usually manufactured using a broader range of feed ingredients compared to livestock feeds. Some of these feed ingredients have certain chemical composition characteristics that make them more difficult to be stored as finished fish or shrimp feed (e.g., fish meals, because of their higher oil content, are susceptible to oxidation). Therefore, prepared feeds for fish and shrimp can be considered as perishable products. At the same time, they are also more or less fragile, depending on the type of feed. High oil content feeds usually are softer than conventional feeds, therefore they are more prone to damage if they are not properly handled or transported. Feed processors attempt to formulate and manufacture aquaculture feeds to extend their shelf life and improve durability. However, the degree to which aquaculturists can reduce wasted feed and realize its full purchase value is ultimately dependent on how well the basic principles of feed storage and handling are understood and applied. Feed most often represents the greatest percentage of the total cost of raising fish and shrimp, and substantial amounts can potentially be wasted through spoilage and breakage.

STORAGE

In the aquaculture industry, usually there are two types of feed, wet and dry, but for reasons of cost and convenience, dry diets are currently the most widely used feeds. These include extruded feeds, hard pellets, crumbles, and flakes. In the case of wet diets, special care needs to be taken because of their higher moisture content. In many cases these types of feed are stored in well-sealed containers and in bags, which may have modified atmospheres after opening and should be immediately used. The general rule for preservation of dry feeds is to store them in a dry, well ventilated area that affords some protection from rapid changes in temperature. The key factors that affect any feed or commodity storage are its moisture content, relative humidity, and ambient temperature.

Temperature

Cooler temperatures inside the storage structure (warehouse, silos, or bins) are best because of the effect they can cause on the reduction of mold growth and insect activity. However, actual ambient temperature is less important than minimizing extreme changes. The difference in temperature caused by the effects of day and night (warmer to cooler ambient temperatures) and the internal differences caused by the radiation effect of

Highlight Points

- Feed storage is more important to extend their shelf life and improve durability.
- The general rule for preservation of dry feeds is to store them in a dry, well ventilated area that affords some protection from rapid changes in temperature.
- The key factors that affect any feed or commodity storage are its moisture content, relative humidity, and ambient temperature.
- Coolertemperatureshouldbemaintained in storage structure (warehouse, silos, or bins) because of the effect they can cause on the reduction of mold growth and insect activity.
- ► The maximum recommended moisture content for extruded pet feeds is 12%.
- Even a small reduction in wasted feed can significantly affect production cost and directly influence bottom line profitability.

the sun on a section of the storage structure can create a condensation effect, which can cause water to drip into the feed. This condensed water will help promote and accelerate the growth of mold present on the surface of the feed. Therefore, a good storage facility should be designed to minimize the condensation effect and also provide adequate containment for the control of pests.

Moisture

It is important to understand that the quality and specifically the moisture content of the feed are directly affected by its manufacturing process. In pelletized feeds, water in the form of steam is introduced into the feed mash in the conditioner before pelleting for easier processing and for obtaining better end-use quality. Therefore, the amount of water introduced (ranging from 3% to 6%) needs to be removed during the cooling process through the evaporative cooling effect. Failure to successfully perform this moisture removal results in a higher moisture content in the feed that can trigger faster mold growth. At the same time, the finished pellet temperature should be cool, down to 5-8 oC above the ambient temperature, to allow it to stabilize with the environmental conditions and to avoid the transfer of heat away from pellet into the storage







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WeWork, 12th Floor, Tower B, Embassy 247, LBS Marg, Vikhroli West Mumbai - 400079, Maharashtra, INDIA | S contact.india@skretting.com www.skretting.in | I Skretting-India | Skretting India structure, which can potentially cause condensation. These same concepts are also applied to extruded feed, with the only difference being that in the extrusion process, extra water in liquid form is usually added in the conditioning and in the extrusion process. Owing to the increased quantity of water added, the drying step of the process should be able to remove the excess water and the cooling step should be able to assist in removing the additional water (similar to the pelleting process) and allow the cooling of the extruded pellet.

Mold growth

All too often, feed stored in fish hatcheries and farms is destroyed by common molds. The potential for this to occur is always present because mold-producing fungi and other micro-organisms exist naturally throughout the environment. They are present in grains after harvest, inside storage structures, in the manufacturing equipment, and in animal carcasses prior to rendering. Food processing operations involved in stabilizing these feedstuffs and in manufacturing feeds typically use heat and dehydration steps that are sufficiently destructive to eliminate the original contaminating microflora. However, some fungal spores can survive harsh processing conditions. Other airborne spores may also recontaminate feed during handling and storage. All of these spores then remain dormant in and on the feed until conditions exist that are favorable for growth.

Contaminating fungi grow best when the moisture content of the feed is 14.5-20% and in equilibrium with a relative humidity of 70-90%. Extruded and pelleted feeds are manufactured at considerably lower moisture levels, allowing a safety margin for variability among individual feed particles. The maximum recommended moisture content for extruded pet feeds is 12%. Most aquaculture feed manufacturers take this a step further, keeping moisture levels at or below 10%. At moisture levels near 18%, there is a possibility that molding feed will become infested with *Aspergillus flavus*. This is an especially dangerous species of mold, because it is capable of producing aflatoxins.

The probability of aflatoxin production in complete feed is actually quite low. It is much more likely to occur in highmoisture crops such as peanuts, cottonseed, and corn. Studies have shown that the presence of other microorganisms in a complex substrate such as fish feed tends to interfere with aflatoxin production. However, among these interfering micro-organisms, there are also species of *Fusarium* and *Penicillium* fungi that can produce their own mycotoxins. For this reason, the practice of using feed that is obviously molded should be avoided.

It is very important to always inspect feed on arrival at the farm and during storage for any formation or contamination of molds on the pellets. If the feed presents any unusual change in color, such as gray, blue, or green, or it has a sour, musty, or mildewy odor, it is likely to have a high mold contamination. In addition to utilizing visual and odor inspection, a good way to determine if there is high mold activity in the feed is to measure the pellet temperature. An increase in temperature during storage can be caused by mold growth or insect activity. In these cases, if the mold contamination is not that severe, it is recommended to use the feed immediately.

Prevention of the presence of the insects in the facility is controlled with a number of strategies. Some of these strategies are:

- Routine visual inspection of the facilities and the feed for early detection of infestation. Also, inspection using monitoring equipment such as fly traps, pitfall traps, and insect cages.
- Rapid inventory rotation by not keeping feed stored for a prolonged time and by the constant movement from one place to another of the inventory in the warehouse.
- Avoiding contact of new feed with old feed that is in bulk storage, utilizing the principle for bag or bulk storage of "first in, first out."
- Good sanitation practices such as constantly cleaning the exterior and interior parts of the storage facility, almost immediately cleaning any possible spills of feed inside or outside of the storage facility, routinely cleaning the transportation and handling equipment to avoid any cross-contamination, and maintaining the surrounding areas of the storage structures (warehouses or hoppers) free of debris, vegetation, or old equipment.
- Application of physical exclusion whereby a physical barrier such as a screen is applied to any entry or opening to the storage structure (door, window, air vent, etc.) to block the entrance of insects or any other type of pest.
- As a final resort, utilize chemicals in the form of insecticides or fumigants to eliminate a persistent infestation.

Insects

Insect infestation can be a very serious problem in feeds stored over a prolonged period of time. An actively reproducing population of insects can quickly consume significant amounts of food and deteriorate the physical quality of the remaining feed. Internal infesting species such as grain weevils and warehouse beetles can bore through feed sacks, providing a port of entry for other insects. If present in sufficient numbers in bulk feed, they also have the potential to create localized heating, moisture migration, and molding. External infesting species, however, are more frequently the cause of problems in complete feeds. These include Indian meal moths and flour beetles, which prefer to obtain nourishment from processed grain products, along with carpet beetles that feed on meat meal, feather meal, and other ingredients of animal origin.

Most of these insects thrive on food containing 12-14% moisture. They are capable of completely developing from an egg to a reproductively active adult within 30 days when temperatures are between 20 and 30OC. At 16OC most of these species reduce their reproductive activity. They usually become dormant at about 4.5OC. Under optimal environmental conditions, propagation of tremendous numbers of insects can occur in a very short period of time because of their short maturation time and relatively high fecundity.

Rodents

Populations of rats and mice that become established in storage areas obviously consume some amount of feed. However, the losses that they cause through packaging damage, the resultant feed spillage, and exposure to insects and molding conditions are probably far greater. They pose a substantial health hazard to workers handling the feed and also can carry diseases and bacteria through their body into the feed, which can cause potential fish health problems.

As with insect pests, several methods of control must be employed in a concerted manner to be effective. The basis for a rodent control program should always be good housekeeping, both inside the warehouse and around the exterior perimeter. Combining this with maintenance of physical barriers that limit entry and an aggressive trapping effort will noticeably minimize feed losses caused by rodents.

Use of poisons should be considered only as a last resort to control rodent populations in feed storage areas. Baits containing strychnine or other acute rodenticides, in close proximity to stored feed, impose an increased risk of feed contamination and dangerous contact with humans or pets. These same risks exist with the use of anticoagulant rodenticides such as warfarin, even though they are much less dangerous. In many countries, the usage of poison in bait inside traps is limited to the exterior of the feed manufacturing and storage facility.

CHEMICAL CHANGES DURING STORAGE Lipid rancidity

Lipids used in aquaculture feeds are usually the type that contains significant levels of unsaturated fatty acids, which are required for good health and growth of most species of fish and shrimp. The high degree of unsaturation of these fatty acids causes them to be particularly prone to oxidative rancidity. Feed manufacturers attempt to prevent oxidation in lipid sources such as fish oil by stabilizing them with antioxidants. However, the commonly used antioxidants, such as ethoxyquin, butylated hydroxy anasole, and butylated hydroxy toluene, are sacrificial in the way that they protect the oil. Once they are used up, free radicals that are already present in the oil begin to react with unsaturated fatty acid components and the process of oxidation begins.

It is often thought that freezing is the best method of longterm preservation. However, cold temperature in the range achievable with most freezers is not effective in reducing the rate of free radical formation or the resulting lipid oxidation. In actuality, the experience with low-moisture feeds has been that freezing accelerates lipid oxidation. It is believed that the reason for this is that only free water is frozen at ordinary freezer temperatures. This results in the concentration of metal salts and other pro-oxidants in an unfrozen phase, making interaction with lipids more probable. It is also thought that the further reduction of water activity caused by freezing dry feed allows oxygen to penetrate the pellets more freely. What all of this means is that there is very little that can be done on the farm to improve lipid stability in stored feed. Rotating the feed inventory as quickly as possible is the only effective strategy to avoid having feed go rancid before it is used. This can be accomplished easily with feeds that are fed in high volume. However, inventories of starter feeds, crumbles, and broodstock pellets are usually more difficult to manage. Animals that eat these feeds are also most likely to be at a point in their life stage at which they are extremely vulnerable to the negative effects caused by consuming rancid lipids.

Vitamin potency

The potency of most vitamins contained in formulated feeds declines during storage. This is because many of these organic compounds are highly reactive and unstable. Under certain conditions they can be easily denatured by heat, oxygen, moisture, and even ultraviolet light. The rate of vitamin activity loss in a given feed formulation is dependent on the particular vitamin, its source, and the conditions under which the feed is stored. Most manufacturers of aquaculture feeds recognize these potential losses. They attempt to fortify their diets with sufficient overages of each vitamin to provide the intended levels of activity within the declared product shelf life.

HANDLING

Movement of feed on the farm can only be considered as a necessary evil. Some amount of feed or nutrient loss occurs each time that it is handled in the processes of receiving, storing, and feeding. These chronic losses are usually small, but they accumulate over time. A good general control strategy is to identify the causes of greatest loss and make any practical modifications necessary to handle feed as gently and as little as possible.

Both pelleted and extruded dry feeds have excellent handling characteristics. Pellet durability of both types of dry feed is usually quite good. However, variability in the consistency of feed ingredients may cause some batches of feed to be softer and more fragile. Feed manufacturers reduce the incidence of soft feed by using ingredients with good binding characteristics and by the inclusion of feed additives that help increase pellet hardness. The cylindrical or spherical particle shape of pellets also reduces breakage and allows dry feed to flow easily from trucks, bins, and feeders.

Physical characteristics of dry feeds are so well suited to the handling and distribution requirements of aquaculture that inherent limitations are often challenging. It is easy to overlook the fact that even the most durable crumbles and pellets can break down into dust and fines when subjected to sufficient amounts of compression and abrasion. It is important to give ample consideration to moving the feed as little as possible and as gently as possible.

With bagged feed the challenge is to reduce the amount of particle size attrition that occurs when pellets or crumbles are forced to rub against each other. Use of forklifts and pallets, or hand trucks and minipallets, allows bags to be handled in multiple units. This minimizes the amount of feed movement within each bag and reduces the creation of dust and fines. When it is necessary to handle single bags, the process should be done as gently as possible. Obviously rough treatment such as throwing or walking on sacks of feed should be avoided.

Pellet-against-pellet abrasion in bulk feed is more difficult to control. The very nature of this method of storing and handling feed requires that pellets flow from the delivery vehicle to a bin, and from the bin throughout the farm. It also necessitates the use of conveying equipment. These mechanical devices are often the source of, or solution to, most problems with excessive levels of dust and fines in bulk feed.

Among the types of conventionally used feed-conveying equipment, bucket elevators, belt conveyors, and drag conveyors are the least destructive. These work well because they control movement of feed against feed and minimize the potential of shearing or pinching pellets in conveying mechanisms. Pneumatic, oscillating, and vibratory conveyors cause only slightly more abrasion. However, they almost eliminate losses from pellet breakage when properly maintained and operated.

The most potentially destructive conveyance mechanism for feed is the auger. Tube-type screw conveyors as well as flexible augers are widely applied in feed handling systems on farms because of their low cost and simplicity of operation. Their most frequent use is in unloading bulk bins. In this application the equipment design is usually more appropriate for handling mash feeds or whole grain, where the auger turns at a high rate of speed and has an inclined discharge. Most are also "chokeloaded," meaning that feed completely covers the inlet to the conveyor, causing compression and breakage as pellets enter the tube. While proper equipment design can minimize many of these problems, the added expense usually ends up favoring selection of conveyors that are more appropriate for use with feed.

Conclusion

The importance of careful attention to the specific requirements for proper storage and handling of aquaculture feeds cannot be overstated. At most farms that raise fish or shrimp, feed cost is the largest single expense item. Therefore, even a small reduction in wasted feed can significantly affect production cost and directly influence bottom line profitability. Finally, it is important to have in mind that the quality of finished feed will never improve during storage but can be maintained at the same level at which it is received.

Application of Monoclonal Antibodies in Aquaculture

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- 1. Monoclonal antibodies (MAbs) are being utilized in pathogen classification, disease diagnosis, epidemiological investigation and improvement of vaccines.
- 2. Monoclonal antibodies will bind to the specific target molecule, without any undesirable side effects.
- 3. MAbs based ELISA have been used for studies of *Vibrio anguillarum* strains and for investigation of clinical cases of furunculosis (*Aeromonas salmonicidae*) and Enteric Red mouth (*Yersinia ruckeri*) in fish farms.

Introduction

Monoclonal antibodies (MAbs) are crucial reagents used in biomedical studies and developments, in analysis of diseases and their treatmentlike infections and malignant growth. MAbsare produced by clones or cell lines got from animals that have been inoculated/immunized with the substance. The cell lines are developed by intertwining B cells from the vaccinated animal with myeloma cells. For the production of ideal MAbs, the cells must be cultured in either of two ways: by in vitro tissue culture or by injection into the peritoneal cavity of a suitably prepared mouse (in vivo). Further proceeding of the mice ascitic fluid and of the tissue-culture supernatant might be needed to getMAbs with the prescribed purity and concentration.

In last two decades, Aquaculture have been set up as an industry in India. Due to intensive culture of species (fish and shellfish), chance of disease and economic loss



ARTICLE Application of Monoclonal...

have been continuously increasing in rearing and grow out ponds.Hence, to maintain the aquaculture industry, development of diagnostics and vaccines are very important for proper health management. Evolution of specific, sensitive and rapid diagnostic methods are very essential to determinedifferent stages of disease like per acute, acute to sub-acute and chronic infection. In addition, there is a need to develop basic and delicate strategies for diagnosing pathogens for epidemiological study. At present diagnosis is performed in numerous research centersusing the regular biochemical strategieswhich are repetitive, costlyand even not effectively sensitive to differentiate the large number of heterogeneous isolates. Development of effective vaccines for disease prevention is another area of interest in health management. Since an enormous number of isolates of various virulence and stereotypes exists in a disease situation, there is a need to recognize general immunogenic immunogens shared by different isolates to develop a proper polyvalent vaccine.



Production of Monoclonal antibody

Monoclonal antibodies are generally made by combining myeloma cells with the spleen cells from a mice/rabbit that has been vaccinated with the desired immunogen. Polyethylene glycol is utilized to intertwineadjacent plasma membranes, but the effectiveness is low.Along these,a selective medium in which only combined cells can grow is used. That is the reason myeloma cells have lost thepotential to secrete hypoxanthine - guanine - phosphoribosyl transferase (HGPRT), a chemical substance important for the salvage synthesis of nucleic acids. By uncovering cells to aminopterin (counterpart of folic acid, which hampers Dihydrofolate reductase, DHFR), they are impotent to use the de novo procedure and become completely auxotrophic for nucleic acids prerequisite supplementation to survive.

HAT is the selective culture medium because it contains hypoxanthine, aminopterin and thymidine. It is particular for

fused hybridoma cells. Unfused myeloma cells lack HGPRT so they cannot grow and accordingly cannot replicate their DNA. Uncombine spleen cells cannot grow endlessly because of theirrestricted life expectancy. Only fused hybrid cells, known as hybridomas, can grow regularly in the media because the spleen cell partner provides HGPRT and the myeloma partner has property that make it undying like a cancer cell. This mixture of cells is then diluted and clones are developed from single parent cells on separated small wells. The antibodies synthesized by the numerous clones are then assessed for their potential to bind to the antigen (with an assaylike ELISA or Antigen Microarray Assay) or immuno-dot blot. The most beneficial and stable clone is then designated for future use.

The hybridomas can be multiplyendlessly in a desirable cell culture medium. They can also be infused into mice/ rabbit (in the peritoneal cavity, surrounding the gut). There, they give rise tomalignantexcreting, antibody-rich fluid called ascites fluid. The medium has toimproveduring in-vitro selection to further help hybridoma growth. This can be accomplished by the utilization f a layer of feeder fibrocyte cells or supplement medium such as briclone. Culture-medium nourished by macrophages can also be used. Production in cell culture whichgenerallyrepresents ascites technique, is traumatic to the animal.

Different stages in production of monoclonal antibody

Stage 1: Immunization of Mice and Selection of Mouse Donors for Production of Hybridoma Cells

Mice are vaccinated with an antigen that is ready for infusion either by mixing the antigen with adjuvants or by integrating a gel slice that inhibits the antigen. Intact cells, whole membranes, and microorganisms are occasionally used as antigens. Mostly, mice are used to develop the required antibodies. Normally, mice are vaccinated every 2-3 weeks but the immunization protocols differ among examiners. When desirable amount of antibody titer is reached in serum, immunized mice are sacrificed and the spleen extracted to use as a source of cells for fusion with myeloma cells.

Stage 2: Screening of Mice for Antibody Production

After a few weeks of vaccination, blood samples are acquired from mice for estimation of serum antibodies. Serum antibody titer is resolved with different techniques, for exampleflow cytometry and enzyme-linked immunosorbent assay (ELISA). If the antibody concentration is high, cell fusion can be carried out. If the concentration is too low, mice can bestimulated until a satisfactory reactionis achieved, as decided by continuous blood sampling. When the antibody titer issufficiently high, mice are normally stimulatedby infusing antigen without adjuvant intravenouslyor intraperitoneally three days before fusion but two weeks after the previous immunization. Then the mice are sacrificed and their spleens extracted for in vitro hybridoma cell production.

Stage 3: Preparation of Myeloma Cells

Fusing antibody-producing spleen cells, which possess restricted life expectancy, with cells derived from an

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everlasting tumor of lymphocytes (myeloma) results in a hybridoma that is efficient forimmeasurable growth. Myeloma cells are undying cells that are rearedwith 8-azaguanine to ensure their reactivityto the HAT selection medium used after cell fusion. Seven days before cell fusion, myeloma cells are grown in 8-azaguanine. Cells must have high feasibility and rapid development. The HAT medium permits only the fused cells to remain in culture.



Fig. 1. A schematic illustration of the production of monoclonal antibodies

Stage 4: Fusion of Myeloma Cells with Immune Spleen Cells

Single spleen cells removed from the vaccinated mouse are intertwinedwith the recently prepared myeloma cells. Fusion is completed by co-centrifuging newly harvested spleen cells and myeloma cells in polyethylene glycol, a chemical substance that favors cell membranes to fuse. As discussed in step 3, only fused cells will flourish in the special selective medium. The cells are then circulated to 96 well plates having feeder cells got from saline peritoneal washes of mice. Feeder cells are used to supply growth factors that stimulate development of the hybridoma cells. Commercial production that arise from the collection of media favoring the growth of cultured cells and carry growth factors are available that may be used instead of mouse-derived feeder cells. It is also conceivable to utilizemurine bone marrow acquired macrophages as feeder cells.

Stage 5: Cloning of Hybridoma Cell Lines by "Limiting Dilution" and Stabilization of Clones by Ascites Production

In this stage new, small groups of hybridoma cells from the 96 well plates can be grown in tissue culture followed by antigen binding selection or propagate by the mouse ascites method with cloning period of time in the future. Cloning by restricting dilution at this time ensures that most of wells containsnot more than a single clone. Extensive judgment is important at this stageto select hybridomas capable of development versus collapse of the cell fusion product due to under population or insufficient in vitro developmentat high dilution.

Advantages of Monoclonal antibodies:

- Highly specific recognition of only one epitope of an antigen
- Immortal hybridoma cell lines can deliver unlimited amounts of antibodies
- High consistency among tests
- Minimal cross-reactivity

• Excellent for affinity purification

Disadvantages of Monoclonal antibodies:

- Developing a monoclonal requires high technical skills and takes time.
- They can produce lot of specific antibodies but may be too specific to detect over a range of species.
- Vulnerable to the change of epitope. Even a slight change in conformation prompt drastically decreased binding capacity.

Application of Monoclonal Antibodies in Aquaculture

Monoclonal antibodies (MAbs) are being utilized in pathogen classification, disease diagnosis, epidemiological investigation and improvement of vaccines. Because of their specific-nature, monoclonal antibodies are better than the polyclonal antibodies of regular methods and possibly more powerful than contemporary medicationsused for fighting disease. Drugs often attack the body's own personal cellsin addition to the foreign particle, causing side effects such as itching and nausea. Monoclonal antibodies will bind to only the particular target molecule, without any undesirable side effects. When monoclonal antibodies for a desirable substance have been produced, they can be utilized to recognize the presence of this substance.

| | Conventional | Monoclonal |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| | antiserum | antibody |
| Determi- nant | Several | Single |
| Specificity | Variable with animal and bleed Partial cross-reactions with common determinants Seldom too specific | Standard Unexpected cross reactions may occur; May be too specific for requirements |
| Affinity | Variable with bleed | May be specific during cloning |
| Yield of use- ful antibody | Up to 1 mg/ml | Up to 100 mg/ml in tissue culture; up to 20 mg/ml in acidic fluid |
| Contaminat- ing immu- noglobulin | Up to 100% | None in culture; 10% in acidic fluid |
| Purity of antigen | Either pure antigen or serum absorption | Some degree of antigen purification desirable but not essential |

| Table 1. The monoclonal antibodie | s are superior in a nun | nber of |
|-----------------------------------|-------------------------|---------|
| aspects to conventional | polyclonal antisera | |

Source: K.M Shankar et al., 2000

Monoclonal antibodies (MAbs) were developed against enterotoxin of Vibrio cholerae, a brackish water and estuarine bacterium which causes cholera. MAbs based ELISA have been used for studies of Vibrio anguillarum strains and for investigation of clinical cases of furunculosis (Aeromonas salmonicidae) and Enteric Red mouth (Yersinia ruckeri) in fish farms. MAbs are also used to investigate fish parasities. MAbs have been produced against pathogenic protozoans (Cryptobia salmonsitica, Ceratomyxa shastia, Bonamia ostreae, Perkinsus maximus) of shell fish. Monoclonal antibodies for EUS fungus Aphanomyces invadans, A. hydrophila, and white spot virus of shrimp have been developed and being utilized in diagnosis in India. Use of a MAbs against virus: -Identification of Infectious Pancreatic Necrosis virus (IPNV) by ELISA. ELISA could be used for the detection of different serotype of IPNV. Infectious hematopoietic necrosis (IHN), caused by IHN virus (IHNV), is a critical and acute epizootic among salmonid fish. MAbs against IHNV HV - 7601, were produced.

| | Specificity | Availability |
|---|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Aeromonas salmonicida | Diag Xotics Inc*, 27 Cannon Road, Wilton CT 06897 USA |
| | Renibacterium salmoninarum | Aquatic Diagnostics Ltd., Institute of Aquaculture, University of Stirling, Stirling FK9 4LA, Scotland, UK Diag Xotics Inc*, 27 Cannon Road, Wilton CT o6897 USA |
| | Infectious Pancreatic necrosis Virus (IPNV) | Diag Xotics Inc*, 27 Cannon Road, Wilton CT 06897 USA Test-Line Ltd Clinical Diagnostics, Krizikova 70, 61200 Brno, Czech Republic* |
| | White spot virus (WSV) | Diag Xotics Inc*, 27 Cannon Road, Wilton CT 06897 USA |
| - | Taura syndrome virus (TSV) | Diag Xotics Inc*, 27 Cannon Road, Wilton CT 06897 USA |
| | Spring viraemia of carp virus (SVCV) | Test-Line Ltd Clinical Diagnostics, Krizikova 70, 612 00 Brno, Czech Republic* |
| | Viral haemorrhag- ic Septicaemia virus (VHSV) | Test-Line Ltd Clinical Diagnostics, Krizikova 70, 612 00 Brno, Czech Republic* |
| | Snakehead (Channa striata) IgM | Aquatic Diagnostics Ltd. Institute of Aquaculture, University of Stirling, Stirling FK9 4LA, Scotland, UK |
| | Catfish IgM (Clarias sp.) | Aquatic Diagnostics Ltd. Institute of Aquaculture, University of Stirling, Stirling FK9 4LA, Scotland, UK |

Table 2. Specificity and commercial availability of monoclonal antibodies for use in aquaculture

Source: http://ecoursesonline.iasri.res.in

Conclusion

Monoclonal antibodies present an appealing alternative for the improvement of new treatment methods against a wide variety of common diseases, because of their specificity, effectiveness and flexibility.Understanding a pathogen itself is a main step in disease. There is lot of scope for the application of MAbsin aquatic animal health management worldwide. At present, MAbs of pathogenic protozoans, Aphanomyces invadans associated with EUS and white spot syndrome virus (WSSV) are being developed mainly for diagnosis and epidemiological examination. Apart from the impact on laboratory diagnostics, monoclonal antibodies illustrate a highly efficient treatment tool. There is a need to alter conventional treatment methods and shift interest towardsMAbs to avoid or minimize pain and suffering by the animals. In vitro techniques for the development of monoclonal antibodies should be embraced as the standardroutine method. The manipulation of antibodies via binding other molecules or designing new antibody fragments opens the door to a wide range of possible applications in medicine.

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Shrimp Hemocyte Iridescent Virus (SHIV): An Emerging Potential Threat to the Shrimp Aquaculture Industry

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Introduction

Aquaculture is one of the fastest food-producing sectors in the world, which accounts for 46% of the total fish production (FAO 2020). It is the primary source of animal protein for billions of people Worldwide, where capture fishery and aquaculture serves the livelihoods of more than 10% of the global population (Ngasotteret al., 2020). The target of more production in aquaculture needs more intensive farming methods with extreme stocking density and other inputs, which ultimately leads to stress in the cultured system. Due to intense intervention of the farming practices, many viral diseases have emerged in the shrimp aquaculture industry, including White spot syndrome virus (WSSV), Yellow head virus (YHV), Infectious myonecrosis virus (IMNV), etc. Recently, a new emerging virus, known as Shrimp Hemocytelridescent Virus (SHIV) belonging to the family Iridoviridae, has been isolated in China, which cancause high mortalities in white leg shrimp (Penaeus vannamei) and other shrimp species. The virus is also capable of infecting freshwater prawn (Macrobrachium rosenbergii).

SHIV

Shrimp hemocyte iridescent virus (SHIV) is an emerging virus that hasa huge potential threat to the shrimp aquaculture industry. It is a typical icosahedral structure with a mean diameter of about 150 nm belong to the family Iridoviridae and within the subfamily Betairidovirinae. In March 2019, the Executive committee of the International Committee on Taxonomy of Viruses (ICTV) approved the proposal made by Chincharet *al.* (2018)that a new

Highlight Points

- Shrimp hemocyte iridescent virus (SHIV) is a virus that causes disease in shrimps and prawns, and thusis considered an emergingpotential threat to the shrimp aquaculture industry.
- SHIV/DIV1 was first reported in Zhejiang ProvinceChina2014, and so far, it is currently distributed only in China and Vietnam.
- ► The mortality rate of the disease caused by SHIV is over 80%.
- As per the NACA (2019) report, captured broodstock-size specimens of *Penaeus monodon* from international waters of the Indian Ocean were found to be PCR positive for DIV1.

species of Decapod iridescent virus 1 (DIV1) in a new genus Decapodiridovirus to include SHIV as a strain. To date, DIV1 has been detected in farmed *P. vannamei*, *P. chinensis*, *P. japonicus*, *Cheraxquadricarinatus*, *Procambarusclarkii*, *Macrobrachium nipponense*, and *M. rosenbergii* in China since 2014, indicating that DIV1 is a new threat to the shrimp farming industry.Qiuet *al.* identified an iridescent virus named shrimp hemocyte iridescent virus (SHIV), which was isolated from farmed *Penaeus vannamei* in 2014 and also detected in *P. chinensis* and *Macrobrachium rosenbergii*.

Clinical Signs

The affected fish exhibit clinical signs such as slight loss of colour on the surface, anorexia (animal stop feeding),







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softshell, mutilated antennae, empty stomach and gut, whitish to yellowish head of carapace due to pale hepatopancreas, slightly reddish body in 1/3rd of the infected shrimps in P. vannamei(Fig. 1). Other signs include loss of swimming ability and sinking to the pond bottom, distinct white triangle area under the carapace at the base of rostrum, white head and yellow gills, atrophy (shrinkage) of hepatopancreas with fading of colour (yellowing), slightly whitish muscle and mutilated antennae are remarkably observed in affected Macrobrachium rosenbergii. The cumulative mortality of SHIV has reached over 80%.



Host Species

So far, SHIV is found to be prevalent inPacific white shrimp, Australian red claw crayfish, giant freshwater prawn, Oriental river prawn, and red swamp crayfish. Also, other known susceptible or carrier hosts include Chinese white shrimp, tiger Japanese shrimp, Superb freshwater shrimp, Ridgetail white prawn, and water fleas. This indicates abroad host

Fig.1. Clinical signs of P. vannamei challenged with the potential range of SHIV. iridescent virus compared with Target those of the control group: (a) External appearance of the shrimp (b) Section of hepatopancreas(Source: Qiuet al., 2017).

Tissues and Histopathology

The target tissues that can be infected by SHIV includehematopoietic tissue, hemocytes in the

following tissue/organs such as gill, hepatopancreas, pereiopods, uropods, pleopods, and muscle.

Histological examination showed that dark eosinophilic inclusions bodies mixed with basophilic tiny staining and shrunken or condensed cell nuclei in the hematopoietic tissue andhemocytes in gills, hepatopancreas, and pereiopods (Qiuet al., 2017).

Geographical Distribution and Spread of the Disease

SHIV is one of the emerging diseases of crustacean, particularly in shrimp. It was first reported in China, and so far, it is currently distributed only in China and Vietnam. However, as per the NACA (2019) report, captured broodstock-size specimens of Penaeus monodon from international waters of the Indian Ocean were found to be PCR positive for DIV1.

How Does SHIV Transmit?

Generally, there are two types of disease transmission viz., horizontal and vertical transmission. The horizontal disease transmission is spread/transmitted from one animal to another by direct contact via a medium such as infected feces, fomite or any farm input, etc. In contrast, vertical transmission is the spreading of disease from parent to offspring. In the case of SHIV, the disease is spreading by cannibalism of diseased shrimp or through contact with infected feces indicating only horizontal transmission occurs.

A Threat to Indian Shrimp Farming

SHIV is considered to be a potential threat to Indian shrimp farming due to the following reasons:

- 1. SHIV infects all stages of farmed shrimps, P. vannamei, such as post-larvae, juveniles, and adults.
- 2. It has a wide host range
- 3. High infection rate and lethality of the virus
- 4. Since the initial report of SHIV in 2014 in Zhejiang Province, a targeted surveillance study has shown that the virus is found in 10 other provinces of China, indicating the spread of the virus.
- 5. Another country in South East Asia, i.e., Vietnam, also recently reported it.
- 6. DIV1 is reported from wild-collected P. monodon from the Indian Ocean.

How to Prevent Disease Outbreaks?

"An ounce of prevention is better than a pound of cure." It implies that prevention is always better than cure from the infection. Some of the following preventive measures that can be taken up to avoid the outbreak from diseases, including SHIVare:

- 1. Screening of imported brood-stock like P. vannamei
- 2. Screening of all aquaculture inputs having the potential to carry the virus such as seed and live feed
- 3. Proper biosecurity protocols at the farm levels
- 4. Screening of cohabiting fauna for the potential carriers of the disease
- 5. Active farm level surveillance

Conclusion

High demand for food due to the increasing population make more production in food-producing sectors. Aquaculture contribution in this sector is tremendous by adopting high stocking density intensive farming, particularly the shrimp aquaculture industry, which has potentially highvalue food. As a result, new emerging diseases are being reported. Therefore, proper aquaculture practice in shrimp farmsshould be followed to avoid the outbreak of disease, including SHIV, that has a potentially massive loss to shrimp aquaculture.

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SEAGRASSES



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- **Highlight Points** Significance of marine seagrass ecosystem.
 - Conservation and protection of Seagrass.
 - Major threats to seagrass habitats.

What is seagrass?

Seagrasses are flowering plants that grow in the Marine environment, found on all continents except Antarctica. They have roots, stems, and leaves and produce flowers and fruits. They are closely related to land plants, and probably evolved from land-living angiosperms (flowering plants). The closest relatives to seagrass, on land, are the monocots - grasses, lilies, and palms.

Seagrasses are an unusual group of marine angiosperms, all having a somewhat grass-like appearance (they are not true grasses). They are found growing in soft substrates, and often forming extensive underwater meadows. As with mangroves, they are not particularly diverse as a group, being made up of about 48 species from two families. The global composition of seagrass ranges from 0.1 to 0.2 % of the aquatic flora. Seagrasses provide a habitat for Dugong dugon, the only herbivore that exists in the sea. They also provide exceptional habitats for a wide variety of marine organisms, both plants, and animals. These include meiofauna and flora, benthic flora and fauna, epiphytic organisms, plankton, and fish, not to mention parasitic organisms. Sixty species of seagrasses are described from the world's ocean. Fourteen species of seagrass under 6 genera are known from the Indian seas.

Species from Palk Bay include C. serrulata, H. ovalissub sp. ovalis, K.pinifolia, and S. isoetifolium. Thirteen species occur in Gulf of Mannar Biosphere Reserve, with Halophila, Halodule, Enhalus, and Cymodocea are common among them. Thalassiahemprichii and Cymodocearotundata are dominant, occur in Andaman and Nicobar Islands. From



the Lakshadweep Islands, seven species are known, among which Thalassiahemprichii is dominant.

The importance of seagrass for the environment

Where are seagrass found?

Seagrasses are found along the coast, in clear, shallow waters that allow light for photosynthesis, to penetrate. Some species occupy the intertidal zone, the area between the high tide line and the lowest tide line, from which the sea retreats at low tide to expose the seabed.

Importance:

Despite their low species richness, they remain of critical importance and, in many areas, account for a large proportion of inshore marine productivity. Seagrass meadows account for 15% of the ocean's total carbon storage. The ocean currently absorbs 25% of global carbon emissions.

Moreover, they serve as an important habitat, adding structural complexity as well as a source of nutrition for many species. Unlike mangroves, seagrass communities are widely distributed in both tropical and temperate seas. They provide more directly tangible economic benefits through their importance to many artisanal and commercial fisheries. Seagrass habitat is vital as the feeding ground for several threatened species, notably seahorses, green turtles, and dugongs. They are a major input to food chains, which provide an indirect source of food for many marine organisms (Sea urchins, turtles). The high primary production rates of sea grass are closely linked to the high production rates of associated fisheries. The associated economic values of seagrass beds are also very large, although not always easy to quantify.

What are the ecosystem services that seagrasses provide? Dense seagrass growth traps flowing sediment and nutrients, and creates a world where life can thrive. Seagrass form the basis of one of the most productive ecosystems of the world, providing food and shelter to a diverse community of animals. The leafy canopies support a bewildering diversity of tiny plants that grow as epiphytes (like moss on trees) and small marine invertebrates, which in turn attract sea anemones and fish, and mega herbivores like green sea turtles and dugongs.

The seagrass meadows with their extensive rhizome and root systems, and leaf growth and epiphytic growth together accumulate a huge amount of biomass.

Why we must conserve the world's seagrass:

- 1. Protection and restoration of seagrass can play a significant role in mitigating climate change.
- 2. Seagrasses are flowering plants that grow submerged in shallow marine waters like bays and lagoons. With

tiny flowers and strap-like or oval leaves, they require sunlight for photosynthesis.

- 3. Terrestrial plants evolved about 850 million years ago from a group of green algae. Seagrass evolved from terrestrial plants that recolonized the ocean 70-100 million years ago. 60 species belong to four families in the order *Alismatales*.
- 4. Seagrass occur all along the coastal areas of India. They are abundant in the Palk Strait and Gulf of Mannar in Tamil Nadu.
- 5. Seagrassinhabits all types of substrates (layers) from mud to rock, the lush green seagrass beds are found extensively in muddy and sandy substrates. There are 21 islands in the Gulf of Mannar. Seagrassabounds in the waters around the islands of Kurusadi, Pumarichan, Pullivasal and Thalaiyari. All six genera and 11 species of seagrasses are found here.
- 6. The important seagrassis Sea Cow Grass (Cymodoceaserrulata), the ready. Seagrass (Cymodocearotundata), Needle Seagrass (Syringodiumisoetifolium), Flat-tipped Seagrass (Haloduleuninervis), Spoon Seagrass (Halophilaovalis) and Ribbon Grass (Enhalusacoroides). These were once abundant in the Gulf of Mannar region but are now threatened.
- 7. Like terrestrial plants, seagrass also photosynthesize and manufacture their own food and release oxygen.
- 8. Seagrassreproduces through both sexual and asexual methods. The pollen from the flower of the male plant is transferred to the ovary of the female flower through the sexual reproduction method. This is known as submarine pollination. Most species undergo this process and complete their life cycle underwater.
- 9. Seagrass can also reproduce asexually by branching off at their rhizomes (modified subterranean plant stem that sends out roots and shoots from its nodes). Because of this character, they can recover after being cut by grazers like dugongs or disturbed by storms.



The ecological value of seagrass beds What are the main threats to seagrasses?

The natural causes of seagrass destruction are cyclones, intensive grazing, fungal, heat waves, temperature, and other infestations and diseases. Seagrass in the intertidal habitat is prone to drying out. In estuaries, increased freshwater incursion and siltation can also destroy seagrass beds.

- ► The most significant threat is from various human activities that threaten the health of the seagrass ecosystem.
- ▶ Pollution from agriculture and industrial sources.
- Disposal of mining wastes.
- Overfishing –disruption of ecological interaction.

- Sediment movement from boat propellers.
- Dredging of harbors, ports and shipping lanes

Threats to seagrass meadows:

Seagrass meadows supply a vast site of ecosystem services such as carbon sequestration, Fisheries support, and coastal protection. They are part of an interconnected seascape; degradation of any habitat in this seascape has negative consequences for the other component habitats.

Major threats:

- 1. Habitat destruction, coastal development, and aquaculture lead to increased input of nutrients and other pollutants into the sea, threatening coastal habitats.
- 2. Overfishing threatens biodiversity, ecosystem resilience, and the food security of local people. Anchors and moorings result in direct physical damage to seagrass meadows.

Consequences

- 3. Local buffering of ocean acidification by healthy seagrass meadows may help to reduce the negative impact of changing pH on nearby calcifying organisms such as corals.
- 4. Seagrass meadows store large amounts of carbon in both the plants and the sediments below. If their integrity is disturbed, this carbon is released.
 - 5. Seagrass meadows are important habitats for marine herbivores such as turtles and dugongs. The loss of these habitats threatens the survival of these species.



Diverse threats to seagrass ecosystems and impacts of habitat destruction.



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