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Inside...

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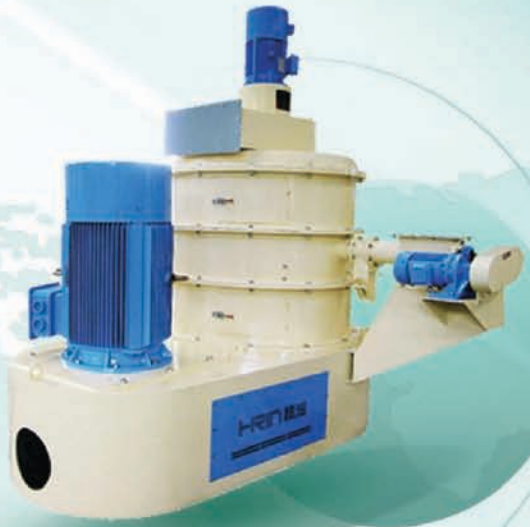

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(Established in May 1993)

Volume 28 Number 05 September 2020

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M. A. Nazeer

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CONTENTS

ADVERTISERS' INDEX

Frozen shrimp remains major export item followed by frozen fish

USA and China turned out to be the major importers of India's seafood

Dear Readers,

The September 2020 issue of ***Aqua International*** is in your hands.

In the News section, you may find news about –

India shipped 12,89,651 MT of seafood worth Rs 46,662.85 crore (USD 6.68 billion) during the financial year 2019-20, largely cushioning the adverse impact of the COVID-19 pandemic. Frozen shrimp remained the major export item in terms of quantity and value followed by frozen fish while USA and China turned out to be the major importers of India's seafood.

While giving seafood export details, as MPEDA Chairman K. S. Srinivas said, India missed the 7-billion-dollar target. However, exports are now likely to witness an uptick as lockdowns have been eased globally and there is an increased sale of value added products in retail chains. MPEDA's vision is to take Indian seafood exports to Rs one lakh crore by 2030.

China emerged as the largest seafood export destination from India in terms of quantity with an import of 3,29,479 MT worth USD 1,374.63 million, accounting for 25.55 per cent in quantity and 20.58 per cent in dollar terms.

Central Marine Fisheries Research Institute has launched a research project to assess the status of 27 species of marine mammals and five species of sea turtles in Indian waters. With an overall budget of Rs 5.66 crores, the project is funded by The Marine Products Export Development Authority for a period of three years. The study aims to address crucial information gap on status of stocks of marine mammals as well as by catch of sea turtle.

To provide employment to people during the pandemic period, the Odisha government has launched a new scheme for promoting intensive aquaculture through Biofloc technology in fisheries. Fisheries and Animal Resources Minister Arun Kumar Sahoo said the scheme will provide livelihood support to entrepreneurs, unemployed youth and interested progressive fish farmers and will also increase fish production in the state. He said the scheme is most suitable for youths who face unemployment during the pandemic.

Central Institute of Brackishwater Aquaculture informed that Kerala's shrimp production suffered a considerable loss of around Rs 308 cr owing to COVID-19 pandemic. In a survey conducted by CIBA to study the impact of COVID induced lockdown on shrimp aquaculture, Chennai head-quartered research institute found that the unprecedented circumstances following the pandemic led to significant reduction of shrimp production in the state up to 500 tonnes, leaving thousands of people unemployed.

About 325 families in Ghorapara, Daspara, Janapara, Mondalpara, Mistrypara, Gurepara areas of Udayrampur village near Amtala town in West Bengal breed and rear ornamental / aquarium fishes on rooftops, in cement cisterns beside home and backyard ponds commercially. Case-study was published on it in leading fishery magazine by News communicator Subrato Ghosh in Feb 2018 and scientists at ICAR-CIFA, Bhubaneswar described Udayrampur as 'ornamental fish village' in their article in 2009.

In the articles section – article titled "Methods of Assessing Aquatic Microbial Biomass Production" written by Dar Jaffer Yousuf and other authors highlighted that detection of microbial biomass is used to predict different nutrient biochemical cycles like carbon and nitrogen. Microbial activity in aquatic environment is determined by physical, biological two and Indirect methods.

Another article "Aquascaping: A Guide For Beginners" written by Naresh Raj Keer and other authors highlighted that aquascaping is the craft of arranging aquatic plants, as well as rocks, stones, cavework, or driftwood, in an aesthetically pleasing manner within an aquarium in effect, gardening under water. Many factors must be balanced in the closed system of an aquarium tank to ensure the success of an Aquascape. It also implies aspects regarding design and layout, which extent beyond the boundaries of the aquarium itself.

Another article titled "Status of freshwater aquaculture in Dhenkanal district of Odisha" written by S Shasani and other authors highlighted that Dhenkanal district of Odisha is blessed with bountiful natural resources with good potential for aquaculture production. However, the productivity status is low due to several bio-physical and socio-economic factors. Most important factor affecting the productivity is the non-adoption of scientific fish farming practices. The research-extension-farmer linkage needs to be strengthened to provide technical support to fish farmers. It is essential that fish farmers are made aware of promotional schemes and incentives enabling them to avail the advantages of those initiatives.

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 regularly and update yourself. Wish you all fruitful results in your efforts.

M.A.Nazeer
Editor & Publisher
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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Comments of a VIP Stakeholder

Dear Mr M. A. Nazeer,

Trust this note finds you and your family in good health.

I have gone through your Editorial in August 2020 issue of Aqua International August 2020.

The Editorial is well written by you, and is very thought provoking, bold

and meaningful.

You have exhibited great guts in writing a bold Editorial in your magazine and I take this opportunity to congratulate you on the vision you have for the state of Andhra Pradesh and specially for Aquaculture industry.

All good wishes in your future endeavours.

Regards,

Dr V.S. Prasad,
Chairperson,
Neospark Drugs & Chemicals Pvt Ltd,
Hyderabad.

Note: *Readers may send their responses and comments on the Editorial, News & Articles published in Aqua International to:*

info@aquainternational.in

India's seafood exports pegged at 12,89,651 MT in FY 2019-20

Frozen shrimp major item of exports USA, China, EU, South East Asia and Japan are the major importers.

Kochi, Aug 17: India shipped 12,89,651 MT of seafood worth Rs 46,662.85 crore (USD 6.68 billion) during 2019-20, largely cushioning the adverse impact of the COVID-19 pandemic.

Frozen shrimp remained the major export item in terms of quantity and value followed by frozen fish while USA and China turned out to be the major importers of India's seafood.

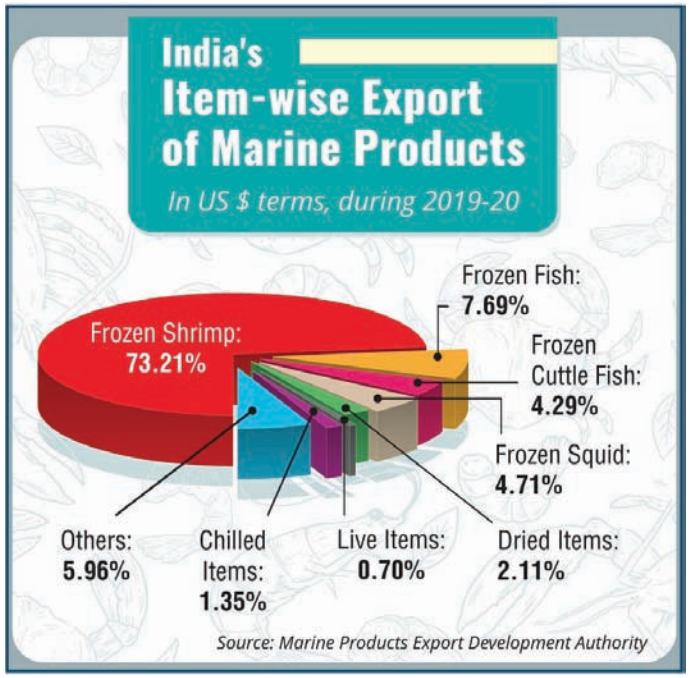
During the FY 2019-20, the export improved in rupee term by 0.16%, but the quantity and US dollar value declined by 7.39 per cent and 0.74 per cent, respectively. In 2018-19, India had exported 13, 92,559 MT of seafood worth Rs 46,589.37 crore (USD 6,728.50 million).

K. S. Srinivas, Chairman, Marine Products Export Development Authority (MPEDA), said India managed to export 12,89,651 MT of seafood, despite the sluggish demand in its major export markets caused by the pandemic, which led to cancellation of several orders, reduced and delayed payments, slowdown of cargo movements and difficulty in getting new orders. The decline in sea catch along the west coast due to reduced fishing days has also been a reason for the shortfall in quantity, he added.

"We missed the 7-billion-dollar target, though not by a fair distance. However, exports are now likely to witness an uptick as lockdowns have been eased globally and there is an increased sale of value added products in retail chains. MPEDA's vision is to take Indian seafood exports to Rs one lakh crore by 2030," he noted.

Frozen shrimp, which earned Rs34,152.03 crore (USD 4,889.12 million), retained its position as the most significant item in the basket of seafood exports, accounting for a share of 50.58 per cent in quantity and 73.21 per cent of the total dollar earnings. Shrimp exports during the period increased by 6.04 per cent in dollar value and 6.20 per cent in quantity.

The overall export of frozen shrimps during 2019-20 was pegged at 6, 52,253 MT, which fetched foreign exchange worth USD 4,889.12 million. USA, the largest market, imported (2, 85,904 MT) of frozen shrimp, followed by China (1, 45,710 MT), European Union (74,035 MT), Japan (38,961 MT), South East Asia (34,439 MT), and the Middle East (32,645 MT).



The export of Vannamei (white leg) shrimp increased from 4, 18,128 MT to 5, 12,189 MT in 2019-20. Of the total Vannamei shrimp exports in value terms, USA accounted for 51.07 per cent, followed by China (21.81 per cent), European Union (8.19 per cent), South East Asia (4.73 per cent), Japan (4.51 per cent), and the Middle East (3.66 per cent). USA also turned out to be the major market for Black Tiger shrimp with a share of 36.88 per cent in

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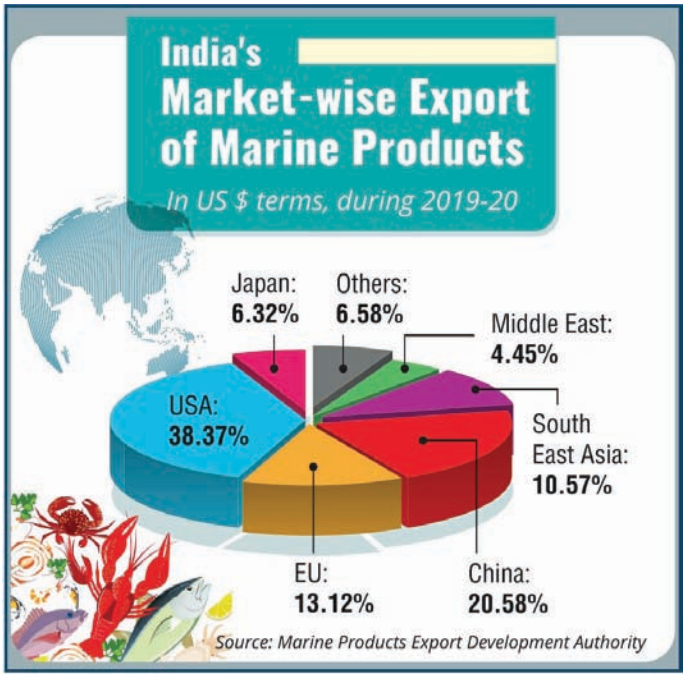
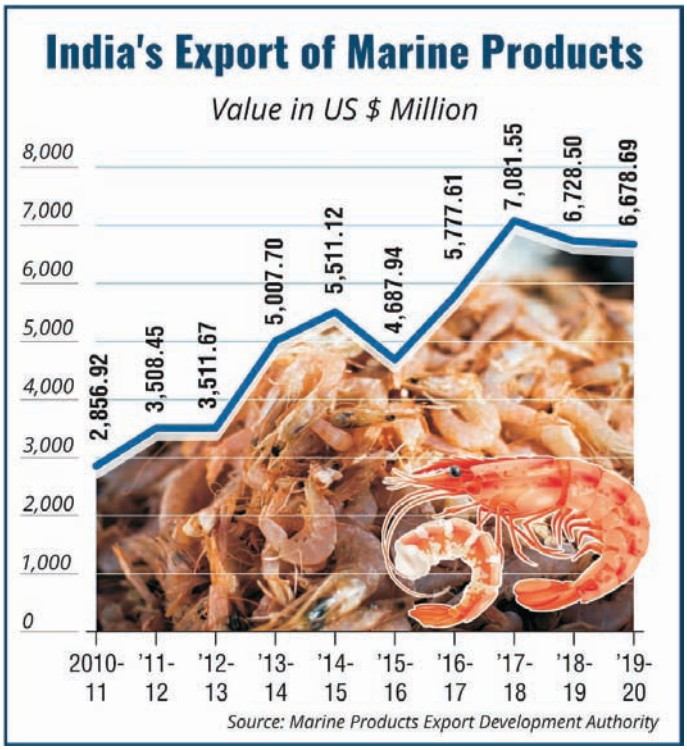


terms of value, followed by Japan (31.55 per cent) and European Union (10.40 per cent).

Frozen fish, the second largest export item, fetched Rs 3,610.01 crore (USD 513.60 million), accounting for 17.32 per cent in quantity and 7.69 per cent in dollar earnings. However, the export of frozen fish declined by 34.11 per cent in quantity and 26.53 per cent in dollar value.

Export of frozen cuttlefish, pegged at 70,906 MT, showed a positive growth of 17.76 per cent in quantity, 1.71 per cent in rupee value and 1.45 per cent in dollar terms, and earned Rs2,009.79 crore (286.40 US D millions). Export of chilled items, which is considered as a promising sector, also increased by 23.22 per cent, 2.53 per cent and 1.29 per cent in terms of quantity, rupee value and USD earnings, respectively.



However, exports of frozen squid and dried items declined during the period. Though live items also showed a decline of 28.41 per cent in terms of quantity, the unit value realisation increased from 5.49 to 6.37 USD this year.

As for overseas markets, USA continued to be the major importer of Indian seafood in value term with an import worth USD 2, 562.54 million, accounting for a share of 38.37 per cent in in terms of dollar value. Exports to US registered a growth of 8.25 per cent in quantity, 10.38 per cent in rupee value and 9.30 per cent in USD earnings. Frozen shrimp continued to be the principal item exported to that country and the exports of Vannamei shrimp showed a growth of 18.94 per cent in quantity and 19.02 per cent in dollar terms.

China emerged as the largest seafood export destination from India in terms of quantity with an import of 3,29,479 MT worth USD 1,374.63 million, accounting for 25.55 per cent in quantity and 20.58 per cent in dollar terms. Exports to that country grew by 46.10 per cent in quantity and 69.47 per cent in USD value. Frozen shrimp, the major item of exports to China, had a share of 44.22 per cent in quantity and 62.65 per cent in dollar value while the frozen fish had a share of 40.12 per cent in terms of quantity and 23.54 per cent in terms of value out of the total exports to China.

European Union continued to be the third largest destination for Indian seafood with frozen shrimp, the major item of exports, registering an increase of 5.21 per cent and 1.63 per cent in quantity and dollar value, respectively.

South East Asia is the fourth largest market. However, overall exports to the countries in this region plummeted by 50.02 per cent in quantity, 53.32 per cent in rupee value and 53.90 per cent in dollar earnings.

Japan continued to be the fifth largest importer with a share of 6.09 per cent in quantity and 6.32 per cent in USD value terms, registering a growth of 0.02 % in rupee value. Frozen shrimp continued to be the major item of exports to Japan. Exports to the Middle East also showed a growth of 5.04 per cent in rupee and 3.82 per cent in dollar terms, but marked a 4.72 per cent negative growth in quantity.

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Amazing Biotech receives Appreciation Award for COVID-19 Service during the 74th Independence Day celebration

Dr Vinusiva, General Manager (Tech) received Appreciation award on behalf of APBL

"The best way to find yourself is to lose yourself in the service of others" is the words from Mahatma Gandhi. Amazing Biotech Pvt Ltd (ABPL) was started as a service based company in the year 2010. Amazing Biotech is doing PCR and qRT-PCR lab services to aquaculture farmers for 11 years. Slowly, we started hearing the problems of farmers which made us work on several projects and development of various products. With the vision of Dr Balasubramanian and Dr Sasikumar. we formed a

Dr Sasikumar, Executive Director, Amazing Biotech Pvt Ltd

Dr Balasubramanian, Managing Director, Amazing Biotech Pvt Ltd

Research and Development team, and worked for various projects like cheap and indigenous diagnostics, lab services, lab consultation, Aquatic Health Care Products and so on. We collaborated and published several papers with universities in order to unveil new probiotics or bioremediation bacteria and its potential application in aquaculture industry.

Certificate of appreciation

The year 2020 will be a roller coaster ride for all countries and everyone's life. COVID-19, pandemic took a toll on several lives, and gave economic losses. Aquaculture industry also got into the mayhem of economic loss. We, Amazing Biotech Pvt Ltd, have grown because of the aquaculture industry and our people. As a social responsibility, it is time for Amazing Biotech to give back to the society what we acquire. We are one who know the value of virus detection and its containment better than any other industry. So, we voluntarily gave our qRT- PCR machine to test COVID-19 in March onwards. We are happy that our machine is helpful to the government as well as our people against this pandemic war. We are also thankful to the government for remembering and inviting us to receive the appreciation award on the 74th Independence Day celebration informed a note from the company.

Shield of appreciation

T. Natesan Promoted as Managing Director of Virbac India

Mumbai: Mr T. Natesan is now promoted as the Managing Director of Virbac Animal Health India Pvt Ltd. Mr Satish Pasrija the leader who has vision, courage, humility and a brilliant strategic mind to plan and catalyze cooperation amongst all team members for perfect execution, was retired as the Managing Director of Virbac India on 30 June 2020.

Natesan joined erstwhile GlaxoSmithKline Pharmaceuticals Ltd in May 1990 as Business Officer based at Coimbatore. He was promoted as Area Sales Executive in the year 1993 and Area Sales Manager in 1997 based at Coimbatore. In July 1999, he was promoted as Regional Business Manager based at Bangalore to take care of the states of Tamil Nadu, Karnataka, Andhra Pradesh and Kerala. During his tenure under his leadership, the region was qualified twice for All India Best Region Award.

Excellent management practices

Natesan established excellent sales management practices and under him, he developed various managers who are currently heading the regions successfully.

Based on the performance and internal selection process, in the year 2008 he was promoted as Sr. Regional Business Manager based at Coimbatore. After 20 successful years in Virbac India, from Business Officer to Sr. Regional Business Manager, Mr Natesan was promoted as General Manager of Virbac Vietnam in January 2011, and subsequently as Asia Regional Director since January 2018. During these nine years, he has been instrumental in transforming Virbac organisation in Vietnam, and has made significant contributions in establishing or supporting new and successful business models in Asia.

To continue the successful journey of Virbac India, in these times of significant changes, both in the market and in our organisation, Mr T. Natesan was elevated from Bangkok Regional Office to Mumbai Office, as Virbac India's Joint Managing Director effective April 01, 2020 and consequently he took the charge as a Managing Director effective 1st July 2020, informed a note from the company.

He brings with his overall 33 years of core Animal Health Industry experience with working in India and South East Asia, Taiwan and Korea on different business models with successful transformation of the business and experience of working with different people, culture, market dynamics and different challenges.

India's shrimp exports drop 23% in July on lower supply

India's shrimp exports registered a 23 per cent drop in dollar terms and 16 per cent in rupee terms year-on-year in July, mainly due to lower supply.

Though shipments to the US continue to dominate, exports to the country declined by 14 per cent, said Equirus Securities in its latest report on aquaculture sector. The exports to China tanked to 5 per cent as sales plummeted 80 per cent.

The report attributed the reason for lower exports to reduced supply of farmed shrimp following the completion of the first crop as well as the delay in second crop. Labour issues in some of the seafood processing companies are also a contributing factor for lower exports, as it affected the capacity utlisation of these units.

According to the report, the subdued demand in China has led to a multifold increase in exports to countries such as Israel, Italy, Korea, Vietnam and the UK. To reduce the dependence on China, the Equirus report pointed out that Indian exporters have started exporting to new geographies such as Israel, Italy, and South Korea etc.

However, sources in the seafood export sector told BusinessLine that the Chinese market has been slow in the recent period reportedly because of the cash crunch. Moreover, the decision of US-based seafood companies to shift their base to Vietnam and Indonesia on account of the US-China standoff also led to a drop in procurement from countries like India.

Covid impact

On the subdued demand

in the US market, the sources pointed out it is now sourcing only small size shrimps for household requirements. The Covid lockdown and closing down of way-side eateries and restaurants has impacted purchase of big premium-sized shrimps in the US. The demand for this particular variety of shrimps has come down in the European and Japanese markets as well, forcing exporters to reach out to newer markets such as West Asia. Although Africa is a good market, the lockdown has reduced the purchasing power of people.

The sector is now facing a raw material shortage in many seafood processing factories in Kerala and the West Coast, as they mainly depend on sea catch. Though the authorities have lifted the annual trawling ban, the restrictions on fishing activities due to Covid and the resultant closing down of fishing harbours hampered the operations of many processing units. Coupled with this is the labour shortage in fishing boats as the crew is mainly from Tamil Nadu. The Covid restrictions hindered their free movement from Tamil Nadu to Kerala, the sources added.

Major companies acquiring market share extensively by establishing new aqua-feed plants. For instance, BioMar has established a new aqua-feed plant in Australia by investing Euro 40 million in 2020

The aquafeed market is projected to register a CAGR of 2. 3% over the forecast period. The growing demand for fish has increased export-oriented aquaculture and increased the adoption of 'Scientific Aquaculture Management Practices'.

As a result, fish farming is anticipated to grow, presenting an opportunity for the aquafeed market to grow. Owing to the limited availability of marine feed resources and the growing demand for fish, the fish farming trend is expected to increase, thus opening up an opportunity for the compound feed market to grow.

Asia-Pacific is anticipated to dominate the aquafeed industry in the next few years due to significant growth in the aquaculture industry. This is due to the ease of availability of natural resources, induced conditions for aquaculture, and cheap labor. In other regions such as Europe and North America, growing inclination toward salmon farming, rising demand for seafood, the hardiness of the species, and governmental interest has led to a higher demand for aqua feed from aquaculture species.

Cargill Inc. Biomar, Aller Aqua A/S, Charoen Pokphand Group, Nutreco NV and Alltech Inc. are some of the key players dominating the market. Key players in the market compete to gain market share by new product launches, mergers and acquisition other strategies.

Key Market Trends

Increase in the Global Fish Consumption

Population growth, rising incomes in developing nations and urbanization has led to a surge in global fish production. The level of income and consumption of animal protein is positively related to the increasing consumption of fish and other seafood at the expense of staple foods. Driven by higher incomes and urbanization, global consumption of fish is growing faster than the global population. Fisheries and aquaculture are increasingly becoming a primary source of protein, foreign exchange, livelihoods, and well-being of the population globally.

The highest growth for fish consumption is expected from the Asia-Pacific and Latin American regions because of changing diet patterns, urbanization, population, and economic growth. Chinese demand for fish continues to surpass the domestic supply, as stated by Agriculture and Agri-food Canada. North America and Europe, which have relatively small aquaculture industries, have a high demand for fish and other seafood products and depend on Asian producers to meet their demands. Seafood consumption in the US was around 7.2 kg per capita in 2009. The consumption of fish and seafood in the EU stood at 24.35 kg per capita in 2017, and Portugal recorded the highest per capita consumption in the EU.

Asia-Pacific Dominates the Market

Asia-Pacific has accounted for about 89% of world aquaculture production for over two decades. Asia-Pacific is anticipated to dominate the aquafeed industry in the next few years due to significant growth in the aquaculture industry. More than half of the domestic production in the countries, such as Vietnam, Thailand, Philippines, India, and Indonesia are destined only for Europe and North American markets, with Vietnam covering nearly three-quarters of production to export share in 2017.

The aquafeed industry in the region is driven by expanding aquaculture and increased demand for seafood. China is one of the largest producers of compound feed globally, with the production at around 168 million metric ton in 2019, of which aquaculture was valued at 16.5 million metric ton. As cited from the publication of the United States Department of Agriculture in 2018, corn and soybean meals dominate the commercial feed market in the country, with minor supplementation from other coarse grains, such as wheat and other oilseed meals, depending on the comparative pricing of the alternative meals.

Competitive Landscape

The global aquafeed market is a fairly-consolidated market with major players holding 62.0% of the market share and others hold 38.0% of the market share. Cargill Incorporated, Charoen Pokphand Group, and Nutreco NV are the major players in the market. Ridley Corporation, Biomin, Aller Aqua, Inve Aquaculture Inc., etc. are some of the other small players in the market. These major players are investing in new products and improvisation of products, expansions, acquisitions for business expansions.

Major companies are acquiring market share extensively by establishing new aqua-feed plants. For instance, BioMar has established a new aqua-feed plant in Australia by investing Euro 40 million in 2020. The production facility will produce up to 110,000 tons per year of aquafeed to support the Australian and Oceania aqua industry.

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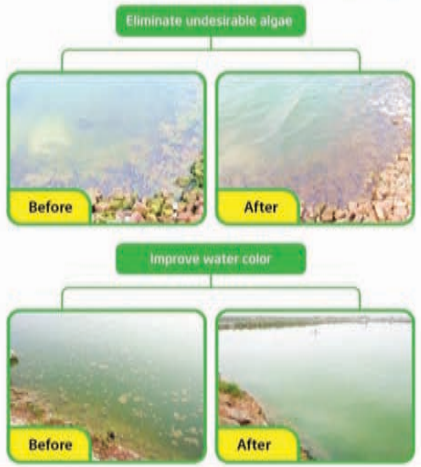
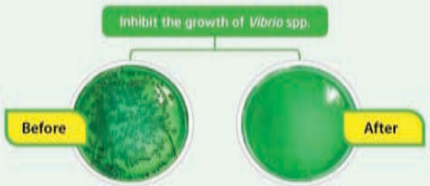
Improve water color regulate the algae and bacteria balance in water, turning your pond from green to clear



5. ESTABLISH BALANCED POND BACTERIA SYSTEM

Compete nutrition with vibrio and inhibit them to grow. Provide nutrition for probiotics in the pond, to establish a well-balanced farming system.



6. INCREASE AQUACULTURE PRODUCTION

Good quality of water prevents fish/prawn infections, making high profit of production

* COMPOSITION:

Bacillus spp. > 1x 10^{11} cfu/kg	15%
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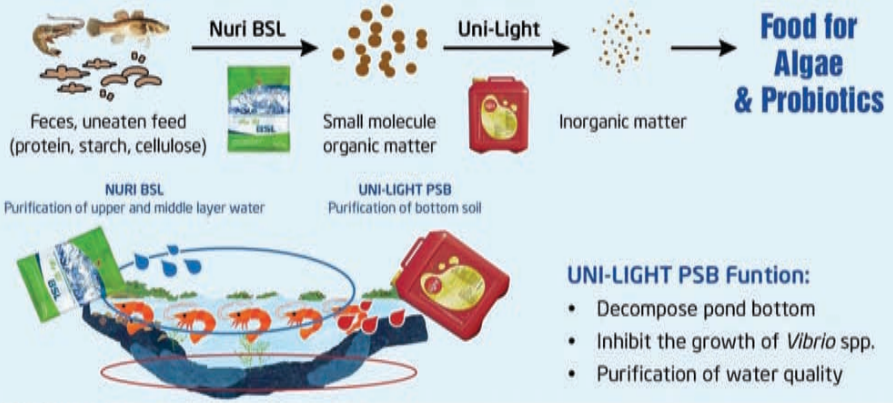
Keep at dry, well-ventilated condition. Avoid direct sunlight exposure and use as soon as possible once opened for best quality.

* DIRECTION OF USE:

No cultivation is needed. Apply Nuri BSL with water-soluble bag near to the working water wheel or pour into the pond evenly. Recommend apply Uni-Light PSB together with Nuri-BSL on sunny day to achieve a clear pond more efficiently.



UNI-LIGHT PSB Funtion:

- Decompose pond bottom
- Inhibit the growth of *Vibrio* spp.
- Purification of water quality

BSL Dosage:

/10,000 m² Quantity	10 - 30 pl/m² tiger prawn or < 80 pl/m² Vannamei	For >30 pl/m² tiger prawn or > 80 pl/m² Vannamei	For > 150 pl/m² Vannamei
7 days before stocking	800 g - 1,000 g	1,200 - 1,500 g	1,200 - 1,500 g
Day of stocking	300 g - 500 g	800 g - 1,000 g	800 g - 1,000 g
Every 7 - 10 days after stocking	300 g - 500 g	800 g - 1,000 g	3 - 5 days / use 1,000g - 2,000g

****Dosages can be adjusted according to the water conditions and practices.*

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Odisha introduces Biofloc fish farming technology

Bhubaneswar, Aug 24 (PTI) To provide employment to people during the pandemic period, the Odisha government has launched a new scheme for promoting intensive aquaculture through Biofloc technology in fisheries, a minister said.

Fisheries and Animal Resources Minister Arun Kumar Sahoo said the scheme will provide livelihood support to entrepreneurs, unemployed youth and interested progressive fish farmers and will also increase fish production in the state. He said this scheme is most suitable for youths who face unemployment during the pandemic.

Biofloc based farming system is a new technology for the promotion of intensive fish/ shrimp production in a limited area without significantly increasing the usage of the basic natural resources of water and land.

A person having small landholding (as small as 150-200 square metre of land) and having either municipal piped water supply or bore well water supply can establish this business with a small investment.

This programme aims to support fish farmers and young entrepreneurs for generation of income and livelihood support, he said.

Biofloc system is suitable for growing freshwater fish species such as GIFT Tilapia, Magur, Pangasius, Anabas, Common Carp and others depending on local market demands.

In Biofloc technology, the waste organic matter in the tank, such as feed waste, is digested using probiotics (helpful bacteria) and carbon source such as molasses and gets converted to fish feed.

In normal pond based farming system, one acre of an earthen tank (4000 square metre area) produces about 2,000 kg of fish in 6 months; while in biofloc fish farming system, the same 2000 kg fish can be produced only from 4 small tanks of each 4-metre diameter and 1.2-metre depth installed in a floor area of about 100-150 square metre, the minister said.

Each biofloc tank is stocked with about 1,000-1,500 numbers of quality fish (2-3 cm) or fingerlings (8-10 cm) with a target of 500 kg fish production over a 6 month period.

Fish grows to about 200 grams within 3 months and 700 -800 grams within 6 months. Therefore, depending on the local market demand, fish can be partially harvested on a daily basis to generate daily income for farmers. Biofloc farming system is also suitable for urban and semi-urban areas.

The minister said it can be set up even on terraces of buildings and backyard. It offers live or fresh fish to surrounding customers thus fetching higher market prices for the producer.

The unit cost for installation of a Biofloc unit of 2 tanks is Rs 1.50 lakh, while a biofloc unit of 6 tanks costs approximately Rs 4 lakh.

The state government provides a subsidy of 40 per cent while 60 per cent subsidy is provided to SC & ST beneficiaries for this scheme.

This new and emerging technology will provide an accelerated boost to the fish production of the state and encourage small landholders and entrepreneurs to take up fish farming in the state, the minister said, adding that the government will provide all technical know-how to implement the project. PTI AAM RG RG RG

Nearly 50,000 salmon escape from Scottish fish farm after storm damage

Damage from Storm Ellen has led to a major fish escape on a Mowi site near Campbeltown in Scotland, with almost 50,000 salmon escaping the torn nets.

According to reporting in the wind events associated with Storm Ellen damaged four out of the 10 fish pens on the North Carradale farm. Mooring ropes that attached the nets to seabed anchors had broken, ripping the nets and allowing almost 10 percent of the farm's stock to swim away. The site was raising 550,700 salmon before the pens were damaged.

Mowi reports that 48,834 salmon escaped the pens. 30,616 of the escaping salmon died due to the storm damage. The company harvested 125,900 fish from the pens.

The torn ropes have been sent to Aberdeen for further testing.

Speaking to the BBC about the incident, a spokeswoman for the Scottish Environment Protection Agency said that she "shares concern" regarding the escaped salmon.

"Whilst we are confident that marine pens have been returned to their authorised position and there was no significant pollution, we are liaising with Mowi and Marine Scotland, who have responsibility for fish escapes and their reporting," she said.

Many environmental campaigners are worried that the escaped salmon may breed with wild stocks.

Study reveals Kerala's shrimp production suffers a loss of around Rs 308 cr

Difficulty in availing seeds, feeds and labour causes drop in production, says Central Institute of Brackishwater Aquaculture

Kochi: Kerala's shrimp production suffered a considerable loss of around Rs 308 cr owing to COVID-19 pandemic, according to the Central Institute of Brackishwater Aquaculture (CIBA). In a survey conducted by the CIBA to study the impact of COVID induced lock down on shrimp aquaculture, Chennai head-quartered research institute found that the unprecedented circumstances following the pandemic led to significant reduction of shrimp production in the State up to 500 tonnes, leaving thousands of people unemployed.

Drop in production

The study revealed that the shrimp aquaculture was hit mainly due to reduction in farming activities and cut in days of culture during the lockdown period. Difficulty in availing seeds, feeds and labours, for which Kerala depends on other States, was the major reason which disrupted the farming. In addition, price hike in farming inputs and market uncertainty worsened the situation, the study said.

"About 50% of farmers gave up the practice, even after they prepared ponds prior to the farming, as they faced difficulty in accessing quality seed and uncertainty over the culture and market. In addition to constraints in sourcing seeds due to logistic issues, increased feed cost and difficulty in accessing other farming requirements caused a substantial reduction in farming area to the tune of 30% . The sector was badly hit as the lockdown restrictions affected transportation of shrimp feeds from Tamil Nadu and Andhra Pradesh which caused a price hike in feed", the study said.

Panic harvesting

Fearing larger financial losses over disease outbreak, farmers who had a standing stock resorted to 'panic harvesting' of small-sized shrimps and sold at lower prices, the CIBA said. "Farmers were forced to do panic harvesting as diseases were reported in about 10% of farming areas and aqua-laboratories and professional services remained unavailable to the farmers due to the lockdown, badly affecting the pond and health management of animals. Only 10% of farming ventures completed 80 days of culture, while around 25% of panic-stricken farmers harvested their crop within 30 days and another 15% of farmers did the harvest within 80 days. Shrimp healthcare products including nutritional supplements, probiotics and pond management inputs are crucial for successful shrimp farming", according to the study.

Unemployment

The study also threw light into the huge rise of unemployment in Kerala's shrimp farming sector. According to the CIBA, around 12,000 people who engaged in shrimp farming, processing and distribution became jobless for one season (6 months), making a loss of around Rs108 cr. Shrimp supply chain heavily depends upon labour and offers a wide range of job opportunities in farms, hatcheries, processing units, manufacturing and marketing sectors and wholesale and retail businesses etc.

Dr K K Vijayan, Director of CIBA said that it was estimated a probable loss of 40% in Indian shrimp sector due to COVID-19 lockdown and the total loss in value terms was estimated to be 1.60 billion USD. "However, both the Central and State government stepped in to take proactive measures such as notifying aquaculture as an essential activity, easing the restrictions for the movement of farming inputs and people and ensuring minimum procurement price for the farmed shrimp", he said, adding that additional efforts are required to implement the plans at the ground-level and follow-up the initiatives using government mechanism.

"In Kerala, shrimp farming is practised in about 3144 ha with an average production of 1500 tonnes per annum. The State is dependent on the east especially Anadhra Pradesh and Tamil Nadu for accessing seed, feed and other supplements. Hence, inter-state movement of seed, feed and farmed produce for processing and export are of utmost importance for sustaining shrimp aquaculture in the State", he said.

Financial support

He suggested for providing credit and insurance support for the farmers through Central and State government channels and financial support for crop loss due to natural disaster. He also stressed the need for strengthening aquaculture quarantine facility to ensure the quality of incoming shrimp seeds. "The State needs to develop hatcheries for the production of vannamei seeds and adopt nursery rearing facility in the State to avoid the dependency on the neighbouring States", he added.

Ornamental fish growers at Udayrampur hit by COVID-19 pandemic

A woman OFG at Uttar Jafarpur, Falta

About 300-325nos of families in Ghorapara, Daspara, Janapara, Mondalpara, Mistrypara, Gurepara areas of Udayrampur village near Amtala town at Bishnupur-II Block of Dist. South 24 Parganas, WB breed and rear ornamental/aquarium fishes on rooftops, in cement cisterns beside home and backyard ponds commercially. Case-study was published on it in leading Fishery magazine by News communicator Subrato Ghosh in Feb 2018 and scientists at ICAR-CIFA, Bhubaneswar described Udayrampur as 'ornamental fish village' in their article in 2009. More can be read about ornamental fish growers (OFG) of Udayrampur at https://ruralindiaonline.org/. Recently a leading Bengali daily on 4/8/2020 reported that OFG at Udayrampur suffered loss and severe monetary crisis in above three-month period since 21/3/2020 due to COVID-19 pandemic-induced lockdown in entire WB. To them, ornamental fish rearing business is main livelihood.

Grown-up fishes in hapa-cloth enclosures in ponds and in cisterns could not be sold upto expectations as market 'haat' was closed. Galiff Street market in Kolkata, opened on Sundays, is largest wholesale ornamental fish market of eastern and NE India and is the market facility for these

Tapan Mondal, OFG at Ghorapara, Udayrampur

OFG. It remained shut and unusual since 22/3/2020 in the wake of COVID-19 pandemic. Lockdown has completely stopped export of some high-priced aquarium fish species produced at Udayrampur. Somehow these people are earning by selling ornamental fishes to some small local buyers at low price. Construction work of wholesale ornamental fish market building (funded by BENFISH) at Udayrampur on main road is further delayed due to lockdown situation. Produced ornamental fishes could not be transported to other states as express train services also remained suspended. OFG stated that goldfish and fighter fish are sold @ Rs 20/- and Rs 15/- / piece respectively normally but both have to be sold at Rs 7-8/- / piece under ongoing adverse and unexpected circumstances. Normal income for an OFG here is Rs 3000-8000/- per week but now most of them are able to earn only Rs 2000-3000/- per week, not more than that. Many of them have started selling vegetables in local market for a living.

Additionally many OFG had damage in infrastructure due to devastating supercyclone Amphan on 20/5/2020. Tubifex worm collectors normally sell tubifex to OFG at Udayrampur in glass bottles; their sale has reduced from 30-32nos to 10-12nos of bottles per month. Self-employment and entire rural economy in South 24 Parganas, viz., agriculture, horticulture, fish seed production, both freshwater and brackishwater pisciculture, shrimp culture, poultry farming, marine capture fishery have been brought under considerable stress due to enforced lockdown.

With sophisticated devices, MPEDA relaunches quality control lab in Bhubaneswar and Porbandar

Bhubaneswar, Aug 16: Marine Products Export Development Authority (MPEDA) opened its refurbished Quality Control Laboratory at Nayapalli in this city, ensuring high-precision tests using state-of-the-art equipment that can also detect banned antibiotics.

MPEDA QC Lab at Porbandar

The facility, which has shifted to Raptani Bhavanwas inaugurated by MPEDA Chairman Mr K S Srinivas on Saturday, will provide facilitate testing of antibiotic residue in farmed shrimps as per the regulatory requirements prescribed by the importing countries and the Export Inspection Council (EIC) of India as well. The lab will also issue PHT (pre-harvest test) certificates to aquaculture farmers as per the regulatory requirements for export of farmed shrimps to the European Union.

The lab will pursue accreditation by the National Accreditation Board for Testing and Calibration Laboratories (NABL) as per ISO/IEC 17025:2017 and approval by the Export Inspection Council (EIC) soon after inauguration.

Mr Srinivas highlighted the lab's "strategic location", as it ensures processing and export of residue-free shrimps produced in not just Odisha but neighbouring West Bengal as well.

"Together, the two states contribute to 11 per cent of the country's cultured shrimp production," he pointed out. "This adds to the relevance of the new lab."

The Nayapalli laboratory has sophisticated devices such as liquid chromatography tandem mass spectrometers, high-performance liquid chromatographs and automated ELISA reader. The test parameters include nitrofuran metabolites, chloramphenicol, nitroimidazole. sulphonamides, quinolones, flouroquinolones and tetracyclines with 4-epimers.

The inaugural ceremony over video-conferencing was held in the presence of Fisheries and Animal Resource Development Department Commissioner-cum-Secretary Mr R Raghu Prasad IFS, MPEDA Director Dr M Karthikeyan, MPEDA Director (Marketing) Mr T Dolasankar IOFS, MPEDA Member Mr Aditya Dash, Seafood Exporters Association of India Managing Committee Member Tara Ranjan Patnaik, its Odisha Regional President Dr Kamlesh Mishra and Mr. B Sreekumar, Adviser, MPEDA.

Mr Srinivas noted that Odisha has shown an average annual growth of 13 per cent in the export of marine products over the past decade: from 21,311 metric tonnes (worth Rs 800 crore) in 2011-12 to 66,654 MT (Rs 3,243 crore in 2019-20.

Odisha is India's third-largest state's producing cultured shrimp, with a 6.2 per cent share in the country's total shrimp production. When it comes to cultured shrimps of the exotic vannamei variety, the state has registered an average of 52% yearly growth in production: from 100 MT in 2012-13 to 44,007 MT in 2019-20.

Odisha's seafood finds major markets in China (37 per cent) and USA (36 per cent). The other countries that buy the products are Japan and Southeast nations besides European.

Gujarat has relatively low instances of antibiotic residue in seafood exports, yet a number of cephalopod consignments are rejected overseas due to the presence of heavy metals, mainly cadmium. This prompted MPEDA, under the Union Ministry of Commerce & Industry, to set up QC lab in Porbandar to test seafood samples, Mr Srinivas said.

The state comes second only to Tamil Nadu in marine fish landings, contributing 7.49 lakh tonnes in 2019, as per CMFRI data. Gujarat is also making strides in shrimp farming, producing 73,842 tonnes of the product (from 9,709 hectares) and 1,890 MT of scampi.

During 2019-20, Gujarat exported *Contd on Page 32*

MPEDA QC Lab at Bhubaneswar

Central Research Body Seeks Govt support to Boost Pearl Spot Production

Kerala produces a meagre 2000 tonnes of pearl spot against a demand of 10,000 tonnes per annum through aquaculture, according to CIBA

Kochi: Voicing concern over the below-par performance of pearl spot (karimeen) farming in Kerala, the Chennai head-quartered Central Institute of Brackishwater Aquaculture (CIBA) has sought the state government intervention to boost the aquaculture production of Kerala's state fish.

It is high time that the state had a road map for the successful utilisation of highly prospective brackishwater resources of the state towards the betterment of pearl spot farming practices in Kerala, said Dr K K Vijayan, Director of CIBA while speaking at a webinar held for fish farmers in Kerala . "Even as the fish has a huge demand and market value in the state, the pearl spot farming sector is on a stagnation, unable to yield expected output given the potential resources", he added.

Low production

According to the CIBA estimates, Kerala produces around 2000 tonnes of pearl spot per annum through farming against a demand of 10000 tonnes. "This data shows how far the state is lagging behind the targeted aquaculture production of this fish", Dr Vijayan said. In a bid to increase the production, the sector requires a solid network of farmers, government agencies and aquaculture experts for ensuring the quality seeds and feeds which are essential for the smooth functioning and growth of the farming practice, he said.

Ready to provide tech support

The CIBA Director said that the institute successfully developed the technology of pair breeding of the fish that would help set up cost-effective modular units of pearl spot hatcheries and produce quality seeds for the farming, in required quantities at the required time. "The institute is ready to provide all scientific and technological support if the state government develops a road map to improve the sector. Farmers should be advised to follow scientific practices to make the ventures both profitable and sustainable. Under CIBA's guidance, a pearl spot hatchery is functioning by a farmer in Alappuzha district and the institute provides species specific feeds and technical support to farmers in different parts of the state, and the model can be emulated across the state, which is highly resourceful and prospective for pearl spot farming", Dr Vijayan said.

Selective breeding for fast growth

Slow growth of pearl spot is one of the reasons being faced by the aqua farmers as this fish would attain weight up to 200g during a long farming period of one year. "In order to tackle this, CIBA proposes to go for selective breeding of the species which would help farmers harvest the crops with a profitable growth rate within six months. A safe method of genetic improvement as did in the case of tilapia (GIFT), selective breeding is the future of pearl spot aquaculture that would become a milestone in the history of brackishwater aquaculture in Kerala. However, it requires a comprehensive plan and financial assistance from the state government as the process is likely to take up to 5 years costing 5 to 10 crore for completion. In addition, coordinated efforts among the scientific community and the government are required to make this happen accordingly. If the government take steps regarding this, the CIBA will wholeheartedly support the government to provide its scientific expertise", the CIBA Director said.

With sophisticated devices, MPEDA relaunches quality control lab in Bhubaneswar and Porbandar ed by ICAR-CIFRI, Barrackpore

Contn from Page 30

27,9750 MT of seafood worth Rs 5019.49 crore ($716.25 million). The major export items are frozen fin fish, frozen cephalopods, dried items and frozen shrimp in terms of quantity. Value-wise, fish is the principal item.

Gujarat's major markets for seafood exports are China, European Union, South-East Asia, Japan and USA. The state is also a major exporter of surimi to markets, primarily Japan.

To guarantee quality seafood for world-wide export to consumers conscious of health and quality, MPEDA has set up labs at Bhimavaram, Nellore (both in Andhra Pradesh) and Porbandar (Gujarat) besides Bhubaneswar and in the headquarter city of Kochi (Kerala). These have facilities to test seafood samples for heavy metals, dyes, pesticides and antibiotic residues using advanced technology. Also, MPEDA has established 12 ELISA screening labs for monitoring residues of banned antibiotics from primary production to processing plants for export.

On Saturday, MPEDA also opened a Quality Control Laboratory in Porbandar, facilitating tests for seafood processors and exporters to confirm product safety as per international regulatory requirements.

MPEDA, formed in 1972 under the Union Ministry of Commerce, is a coordinating agency with central and state-level establishments engaged in fishery production and allied activities.

Best Management Practices for shrimp pond effluent treatment

Worldwide brackish water aquaculture production (4.7 million tons) consisted of crustaceans, freshwater fishes, diadramous fishes, marine fishes, and marine mollusks among which, shrimp farming occupies major share. Water pollution from shrimp pond effluents is the most common problem faced by society and it is important to consider the effect of shrimp farming on the environment directly or indirectly. Most commonly shrimp aquaculture systems use inland ponds that are near or on the coast. Water is discharged from these shrimp ponds to coastal ecosystem as part of the water exchange when ponds are drained. The main components in the shrimp farm effluents are organic matter mainly in particulate form from different sources, organic and inorganic forms of nitrogen and phosphorous and suspended solids. In addition it has been reported that water quality shows increase in parameters of water bodies receiving shrimp discharge waters. The impact of pond effluents on adjacent ecosystems is variable and depends on various factors, including the magnitude of discharge, chemical composition of the pond effluents and specific characteristics of the environment that receives the discharge, such as circulation and dilution rates. The characterization of the shrimp farms effluents in terms of water quality is very important to gauge the environmental health of an ecosystem in order to achieve a better regulation of the industry. So, continuous monitoring of the physical, chemical and biological parameters of pond effluent and inlet waters helps not only to predict and control negative conditions for shrimp farming but also avoids environmental damages and collapse the production process. A proper waste management plan is needed to maintain the legality, profitability and environmental soundness of any aquaculture facility.

Applications of Best management practices are affordable to improve the water quality and reduce the volume of pond effluents.

- Use fertilizers only as needed to maintain phytoplankton blooms
- Select and stocking of good quality seed (SPF) and feeding rates that do not exceed the assimilation capacity of ponds
- Feeds should be of high quality, water stable, and contain no more nitrogen and phosphorous than necessary. Feed protein levels should be 32-36%.
- Apply feeds conservatively to avoid overfeeding and to assure that as much of the feed is consumed as possible
- Do not use water exchange or reduce water exchange rates as much as possible
- In intensive aquaculture, apply enough mechanical aeration to prevent chronically low dissolved oxygen concentration and to promote nitrification and other aerobic, natural water purification processes
- Provide storage volume for heavy rainfall to minimize storm overflow
- Provide Central drainage system or Shrimp toilet in the centre of the pond. Deep water release structures should not be installed in ponds, for they discharge lower quality water from near pond bottoms
- Where possible, seine harvest fish without partially or completely draining ponds;
- Where possible, discharge pond draining effluent through a settling basin or a vegetated ditch;
- Reuse water where possible.
- Provide good aretion facility.
- Application of probiotic in the pond with recommend dose.100 – 200 gms of Probiotics or any probiotic product, which includes at least 10 ^9 CFU/g of Bacillus amyloliquefaciens, Bacillus pumilus, Bacillus megaterium, Bacillus licheniformis, Bacillus subtilis and Saccharomyces sp.

1.100g Probiotic products
2.2 kgs of rice bran(or) Wheat bran(or)Soybean powder(or)Maize powder(or) Tapioca flour
3.10 kgs of molasses
4.50-100 liters of water
5.100g yeast
6.1.kg jaggary
Use aerating pump in 24 hours, then pour to the pond.
Do the routine 5 times in 5 days Before and After shrimp stocking

First Month: Do the routine once or twice a week.

Second Month: Do the routine 2-3 times a week.

Third Month: Do the routine 3-4 times a week.In the course of shrimp growing, add the molasses to the pond. Frequently measure NH3/NH4 concentration. If NH3/NH4 appears at low level (0.25-0.5), add 40 kgs of molasse and 50 kgs of zeolite per 1000 m3.In the first 45 days, we don't need to exchange water. Just add the replacing water against evaporation, and discharge from middle pond BOTTOM HOLE.(CENTRAL DRAINAGE SYSTEM), Measure NH3/NH4 concentration 1-2 times per week. At the end of second month and whole third month, we need to measure NH3/NH4 concentration daily. If 3-4 days in a row, after adding molasses and zeolite, the NH3/NH4 concentration still increases at 2-3 mg/l level, we need to continuously exchange water in 2 or 3 days. Then the NH3/NH4 concentration becomes stable at low level 0 – 0.25 mg/l, and we again add the probiotics to the pond.

- Adopting Biofloc Technology in the pond to improve feeding efficiency of Shrimp, immune system, reduce the water exchange, converting ammonia in to available nitrogen by feeding the Shrimp, thus introducing hetrotrophic bacteria population in the pond, hence water quality of the pond improved.
- Provide Bird fencing in the pond to improve Bio -Security.
- Introduce Nursery rearing of Shrimp for one month to improve Survival rate of Shrimp health conditions and avoid WSSV infection in the grow- out system.

Aquaconnect launches 'Aquaconnect HUBS' for Fish Farmers

India's Leading Aquaculture Technology Company, Aquaconnect announced the launch of Aquaconnect HUBS, a first of its kind Direct to Farmer initiative. The integrated HUBS will help to accelerate the technology adoption with aqua farmers, improve last-mile connectivity and also source feed, health products & farm equipment. The first HUBS have been launched in the coastal cities of Andhra Pradesh - Bapatla, Ongole, and Avanigadda.

The company plans to launch 25 HUBS in the next two years in Tamil Nadu, Andhra Pradesh and Gujarat and aims to engage more than 45000 farmers. Aquaconnect HUBS will also enable direct connection to Banks for farmers to secure loans. The company has empanelled leading Banks and facilitates aquaculture loans to the fish and shrimp farmers. The HUBS will provide farm advisory solutions and act as a diagnostic centre for aquaculture.

Aquaconnect witnessed 10 x growths during the pandemic. Agri sector had a limited impact of COVID - 19 and it is the right time to improve the ecosystem for aqua farmers according to the company. The hubs will improve the support system for farmers and provide services on the ground today. The company will, directly and indirectly, employ 700 plus people via the HUBS.

A World Economic Forum - Young Global Leader, Rajamanohar Somasundaram, CEO and Co-Founder of Aquaconnect said, "It is exciting to nurture a much underserved aqua-farmer market. A brick and mortar approach will bridge and accelerate technology adoption for aqua-farmers and encourage sustainable growth of the Seafood industry."

"The industry is exploding with opportunities, and we believe that Aquaconnect HUBS will holistically serve the farmers to better their product quality, output, and eventually farm income."

India's government has prioritized the fisheries sector in its 2020 annual budget, setting the target for fisheries production at 20 million metric tons (MT) by 2022-2023.

Aquaconnect works with more than 17,000 fish and shrimp farmers and helps them with its AI-powered farm advisory solution Farm MOJO which supports farmers to monitor and track farming activities such as a change in water quality, feed intake, shrimp growth, and disease occurrence precisely. The full-stack aquaculture technology venture improves farm productivity and sustainability through AI and Satellite remote sensing technologies.

Goa proposes policy to boost sea cage farming

Panaji: Mariculture, a specialised branch of aquaculture, may soon get a boost in Goa. The department of fisheries has proposed the Goa State Mariculture Policy 2020 to enable fish farmers in the state to take up this initiative.

Sea cage farming is still in its infancy in Goa with no open sea cage farms installed in the state besides a pilot project initiated by the department of fisheries at Talpona, Polem, Nuvem in Canacona.

Mariculture involves the cultivation of marine organisms for food and other products in an enclosed section of the sea such as cages, pens, or in tanks, ponds or raceways which are filled with saline water.

The department has formulated a leasing policy to introduce systematic management strategies both for conservation and sustained fish production and to encourage artisanal fishers to take up offshore open sea cage culture so that they shift from capture fisheries regime to culture fisheries regime.

"There is a need felt to consider open sea cage farming as a commercial activity so as to augment the seafood production in a sustainable manner. However, Goa has no water leasing policy for this new technology and as such it becomes necessary to formulate a policy for leasing the open waters to meet the requirement of the sector," the notification read.

Zonation of open water bodies with the help of competent bodies/research institutions will be drawn as and when required.

Common property use conflicts will be drawn out so that mariculture activities as such will not hinder navigation, fishing and other users.

The leasing policy and management will rest with a single entity so that full potential of the objectives may be established.

Carrying capacity, environmental protection and conservation of aquatic ecosystems will also be chalked out.

CMFRI launches a mega project to assess status of marine mammals and sea turtles

Kochi: The Central Marine Fisheries Research Institute (CMFRI) has launched a research project to assess the status of 27 species of marine mammals and five species of sea turtles in Indian waters. With an overall budget of Rs 5.66 crores,the project is funded by the Marine Products Export Development Authority (MPEDA) for a period three years. The study aims to address the crucial information gap on status of stocks of marine mammals as well as bycatch of sea turtle.

This research assumes significance in the context of emerging seafood trade related challenges faced by the country. The National Oceanic and Atmospheric Administration (NOAA), the USA had issued import provisions of Marine Mammal Protection Act (MMPA), stating that seafood exporting countries should not allow intentional killing of marine mammals in commercial fisheries. For exporting fish and fish products, the US has given a five-year exemption period starting January 1, 2017 to nations for developing regulatory programs by assessing marine mammal stocks, estimating by-catch, calculating bycatch limits, and reducing total by-catch. Likewise, US Public Law provides that shrimp products should not be imported unless the US certifies that the exporting nation harvests shrimp without adversely affecting sea turtles. Following this, the US has banned import of wild caught shrimp from India from May 2018.

Dr JK Jena, Deputy Director General of Indian Council of Agricultural Research (ICAR) inaugurated a webinar during the launch of the project. According to him, this research project would bolster the preparedness of the country in meeting the challenge faced by the seafood export industry, and enhance the indigenous capacity to address the emerging conservation concerns of marine mammals and sea turtles.

Speaking on the occasion, K.S. Srinivas, IAS, Chairman, MPEDA said that country is looking forward to this project, which is being implemented with the technical support of NOAA, with a hope that it would help solve the issues related to seafood export of the country. Dr Kate Stafford, marine acoustic research expert, University of Washington and Dr Mridula Srinivasan, Director, National Marine Fisheries Service (NMFS (NOAA Fisheries) of USA shared their pioneering experiences in the use of advanced acoustic and Artificial Intelligence (AI) based technologies in the marine mammal stock assessment in US waters. They lauded the initiative and offered cutting edge collaborative research support.

Dr A Gopalakrishnan, Director of CMFRI recalled the significant achievements made by scientists of the institute in the field of marine mammals and sea turtles research. "Marine mammals and sea turtles play key roles in maintaining marine ecosystems. Considering the need for conservation, the Wildlife (Protection) Act 1972 listed all the species of marine mammals and sea turtles under Schedule I. However, fisheries interaction and other human interventions have negative effects on the population of these megafauna. This is evident from frequent reports on bycatch and stranding of these animals along the coastline of India. While government and non-government organisations have undertaken studies on distribution, biological and ecological characteristics, the information on status of stocks of marine mammals as well as bycatch of sea turtle are not available", he said.

Dr P. Pravin, Assistant Director General of ICAR, Dr L. Ramalingam, Director General of Fishery Survey of India (FSI), Dr Latha, Group Head, National Institute of Ocean Technology (NIOT), Alex Ninan of Seafood Exporters Association of India, Dr E. Vivekanandan Dr Leela Edwin, Dr R. Jeyabaskaran, principal investigator of this project and Dr J Jayasankar spoke during the webinar.

Mozambique warns of red spot disease among fish

Mozambique's fishery authorities say they are on high alert for a potential outbreak of red spot disease after a recent outbreak in neighbouring Malawi.

According to reporting in Market Watch and Xinhua News Agency, Mozambican fish producers are being told to report any potential cases of epizootic ulcerative syndrome (EUS), or red spot disease, to local authorities. The disease can cause mortalities in some fish species and can cause catastrophic losses on fish farms. In Mozambique specifically, an outbreak could pose a serious threat to regional inland aquaculture operations.
"In case of suspicion of the existence of a possible case of the EUS, the fishermen must send us samples so that we examine them and understand if we are facing that disease or not," said the Director of the Research and Aquaculture Center Rafael Rafael at a press conference in Maputo.
Though the disease is not deadly to humans, consumers are warned not to eat any fish that have been infected with red spot disease.
"People should not consume animals that are possibly infected by this disease because they can transmit other kinds of bacteria to humans," said the director.

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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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Aquascaping: A Guide For Beginners

Highlight Points

▶ Aquascaping is the craft of arranging aquatic plants, as well as rocks, stones, cavework, or driftwood, in an aesthetically pleasing manner within an aquarium in effect, gardening under water. ▶ Many factors must be balanced in the closed system of an aquarium tank to ensure the success of an Aquascape. ▶ It also implies aspects regarding design and layout, which extent beyond the boundaries of the aquarium itself.

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Introduction

Now-a-days the craft of aquascaping has become increasingly popular. Aquascaping is 'underwater gardening', involving techniques of setting up, decorating and arranging a set of elements (aquatic plants, stones, driftwood, rocksetc) in such a way that it becomes aesthetically pleasing to human perception. Loving aquarists knows that fishkeeping in a small tank is more than just growing fish and aquariums do not only display one's interest in beautiful and fascinating species of aquatic organisms. Aquascaping also implies aspects regarding design and layout, which extent beyond the boundaries of the aquarium itself.

Aquascaping of an aquarium has two purposes.

i) To make the bare tank more attractive and beautiful.

ii) To simulate/mimic natural environment by keeping aquatic plants, rocks, gravels, etc.

Choosing a location

The tank should be set up in an attractive and convenient place, which should be free from direct sunlight. Aquarium can be set up in home, hospitals, restaurants, hotels and all other communal places. The aquarium should stand on a very firm base in order to avoid shaking and toppling.

Steps involved in setting up of aquarium

i) Fitting an under gravel filter

The purpose of the filter is to remove dirt or dirty part from the aquarium for making it clean. Under gravel filters are otherwise called as biological filters. Toxic substances like ammonia and nitrite are converted to relatively harmless substances like nitrate by the beneficial bacteria developed on the gravel added in the biological filter.

ii) Adding the gravels

Gravels with a particle size of 3-5 mm are used to allow good water circulation and to enable the plants to root.

iii) Installing the air pump

Air pump is installed to operate biological filter for airlifting and aeration.As their name says it, the purpose of water filters is to remove excess food, the fish's waste, dangerous chemicals and decaying organic matter within the aquarium. There are three basic methods which can filter water: mechanical, biological and chemical, and most water filters on the market involve a combination of two of them.

- Carbon Dioxide – The CO_2 systems might be slightly costly, but they are essential for the growth of plants. No plant grows without carbon dioxide, period. Those who truly adore about aquascaping think for the long term and know that purchasing a good CO_2 system enables them to grow their plants to their full potential.
- Liquid fertilizers –Depending on the lighting and CO_2 systems of the aquarium, there are two types of fertilizers can be used to keep the plants healthy: macronutrients and micronutrients. They both need proper dose to create an appropriate aquatic environment.

iv) Adding rocks

Suitable rocks should be firmly laid down on gravel. The rocks are grouped for creating natural look. Several piece of rock can be stuck together with silicon gel to make a cave like structure, which is essential for maintaining cichlid fishes.

v) Filling the tank

Tank can be filled with clean water by hose pipe directed over a rock in order to avoid displacement of gravels.

vi) Keeping plants

Tall plants should be kept at the back and sides. The corners are filled with short species. The roots are buried in the gravel.

vii) Putting the cover glass into position

Cover glass or plastic sheet is used to cover the top. This type has cut-outs for cables and for feeding access.

viii) Fitting the electrical wiring

Electrical wiring with respect to light and filters are properly fixed and connected.

ix) Setting up the hood and lighting

This is last and one of the most important steps of aquascaping, with crucial influence upon the health and growth of the aquascape plants, the lighting is considered to be the functioning heart of an aquarium. Fluorescent tubes are used which is fitted inside the hood. The hood may be metallic or made by wood or fiberglass sheets.

x) Adding the fishes

Friendly and compatible fishes are introduced in order to avoid fighting between the fishes. Stocking density of fishes for aquascaping is given below.

Tropical freshwater species

For 1 cm lengthy fish, 30cm² surface area is desirable.

Freshwater (Cold water) species

For 1 cm lengthy fish, 75cm² area is desirable.

Introduction care

The fishes should not be released into the aquarium tank immediately just after purchasing. Transported polythene bags containing live fishes should be first placed in the tank water to conditioning the water temperature. Then the some water from tank may be mixed with that of the polythene bag and this may be kept for about 15 minutes so that the fish would acclimatize to the new water environment. Subsequently, the fishes can be transferred into the new tank by using hand nets. Avoid immediate feeding of fishes after stocking.

Here is a couple of criterion one has to take into account before even thinking of getting started with aquascaping:

- **Simplicity** – Aquascaping is all about taste and usually, fewer elements are more. Very often people are tempted to incorporate as many types of plants, thinking that this would ensure a great visual variety, but most of the times the result is the opposite.
- **Variety** – Keeping it simple does not mean using same species of plant only. Even intention is to create a theme, it should not look boring. Here, imagination plays a key role in aquascaping.
- **Proportion** – It's very important to give a sense of harmony to the tank, it should have much open space as filled space. Avoid using only large leaf plants because they take from the proportion and depth of the aquascape.
- **Persistence** – sometimes aquascaping can become frustrating, so ready to deconstruct and reconstruct if there is something do not like about the design.

Aquascaping styles

Like any form of art, aquascaping offers a variety of approaches and styles. There are seven major types of aquascapes, each of them having particular characteristics and unique features. Some important styles of aquascapingis given below.

The Dutch Aquarium

Popularized in the 1930's in the Nederlands, with the marketing of the first aquarium equipment, this aquascaping style is entirely focused on the culture and arrangement of aquatic plants. The Dutch style doesn't involve the use of driftwoods or any hardscape materials. The main focus is placed at height, colour and texture of a wide variety of plants and the basic technique of construction is the terracing approach. It may look easy to accomplish, but the truth is aquascapers need to possess a great quantity of knowledge regarding different plants in order to create an aesthetically pleasing aquascape.

The Jungle Style

This is one of the simplest styles of aquascape to reproduce. As the name itself says it, the final product should resemble the wild, untamed appearance of a jungle. One of the most common characteristics of the Jungle scaped tanks is that vegetation is often left to its own device and it becomes quite dense, which means it requires less maintenance and enables the scape to last longer. The Jungle style aquascape may not be the complex of layouts, but it can become very eye-catching and functional over time, as numerous fish species prefer its dense vegetation environment.

The Iwagumi Style

It is the opposite to the Dutch style, which only makes use of plants, the implementation of the Iwagumi aquascaping style is based on the development of an arrangement of rocks (hardscape), their positioning being particularly careful. The use of low-growing plants is common in order to enhance their natural beauty and their disposal. The setup for an Iwagumi aquascape involves the use of three main stones, out of which a larger one, called the big Buddha and two smaller stones (attending stones. In order to create a sense of unity and harmony to the tank, it is important to use stones having the same colour and texture.

Taiwanese Style

This isn't very common anymore, and has in some areas fallen 'out-of-style' compared to the Iwagumi or Nature aquarium tank. It is usually seen with high terraces of varying depth, and its strangest feature is small objects or figurines placed in the tank to create a sense of 'life'.

The Nature Aquarium Style

This style was introduced by Japanese, Takashi Amano in the 1990's and it is characterized by a very natural look and feel. Distinguishing from the Dutch well-manicured garden style, the Nature Aquarium style aims to create a scape that resembles a landscape or image from the natural world. Most common nature aquarium depict miniature versions of rainforests, mountains, hillsides or valleys. Both hardscape

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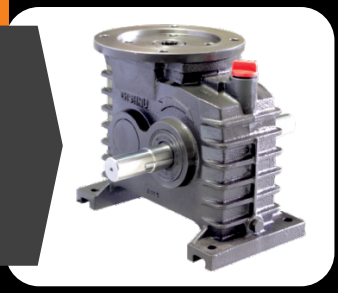

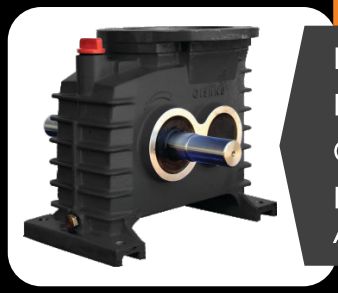

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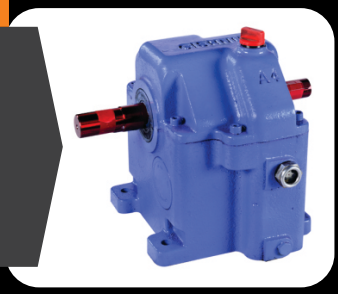

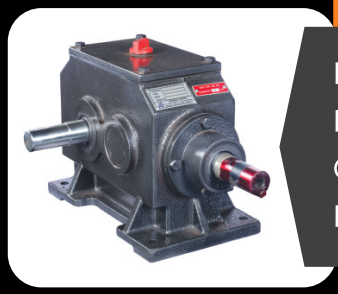

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material (wood, rock) and plants play an important role in the quest for balance in the aquarium.

Biotope Style

This is to emulate a natural environment, including water conditions, flora and fauna species, and even the hardscape of stone and/or driftwood. These can be quite beautiful, and are useful for some biologists to study environments that would otherwise be a challenge to study.

Oddly enough, these tanks are usually somewhat easier to setup and maintain, since there isn't any research needed to determine whether the flora and fauna you're using are compatible, they exist side-by-side in the wild.

The Walstad Method

This style of aquascaping is very visually interesting layout that is because the goal is not necessarily winning beauty awards, but recreating a completely natural situation. Where this style differs from nature aquariums and biotopes is its completely random placement of hardscape and plants. This is to pretend the way things are naturally in nature, instead of placing for optimal beauty.

These tanks are most often deliberately low-maintenance, and are by design low budget tanks. They usually use potting soil and also require very few water changes, because of the plant density.

Note: this style ensures, using a potting soil without any additives or other chemicals, as these may leach into the water and kill the stock.

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7 aquascaping styles for aquariums

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Methods of Assessing Aquatic Microbial Biomass Production

Highlight Points

▶ Detection of microbial biomass is used to predict different nutrient biochemical cycles like carbon and nitrogen. ▶ Microbial activity in aquatic environment is determined by physical, biological two and Indirect methods.

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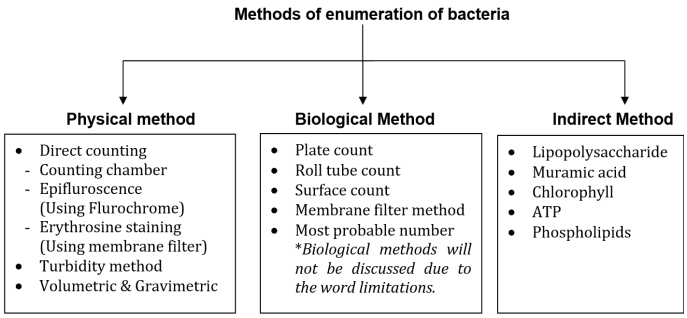
Introduction

Bacterial biomass may be defined as the mass of living bacteria present in a habitat. To estimate biomass, the methods used must distinguish between the live bacterial cells and the other micro-organisms or other non living organic matter present, but this is practically difficult. Bacteria are found in all aquatic habitats and similar techniques are used to estimate their biomass from marine, estuaries and freshwater samples. Many aquatic bacteria are attached to the surfaces and these populations need special approaches such as *Epiphytic*: organisms attached to the plants and *Epilithic*: organisms attached to the animals and stones. Soft sediments often require homogenizing samples before estimation of biomass of the population. Such treatments results in suspensions containing large amount of organic debris which often interferes with the assay being carried out.



Direct method of estimation of bacteria from water

This method aims to estimate biomass by direct microscopic observation. It is used as total counting procedures to enumerate bacteria and then estimate the mean cell volume. The product of these two estimates is the bio-volume and this must be converted to biomass by multiplication with an appropriate conversion factor.

This method is used in microscopy such as

- Epifluorescence microscopy
- Phase contrast
- Bright field microscopy

Sample preparation

Water samples are normally fixed with 0.2-2% formaldehyde solution and vigorously shaken by hand 20 times or for 30 sec is all that is normally required. In case of attached bacteria usually present in nutrient rich environments, such as ponds, estuaries and salt marshes, differential filtration is required to separate the attached and planktonic bacteria.

1. Enumeration by epifluorescence microscopy

Bacteria are stained with fluorochrome, filtered onto a membrane filter and counted under epifluorescence illumination. All aquatic bacteria observed by epifluorescence microscopy are viable and hence the method is satisfactory basis for biomass estimation. All water used should contain 2% (v/v) formaldehyde (fixative) and should be membrane filtered (0.2 µm porosity filter) autoclaved and stored at 4 ºC until used. Polycarbonate membrane filters 0.2 µm pore size are the best to use because they have a perfectly flat surface on which the bacteria are collected, so the organism all lie in one focal plane and easy to see and count. Polycarbonate membrane filters must be stained black before use to prevent autoflorescence when viewed. Two milliliter is the minimum total volume that should be filtered through a 25 mm filter in order to ensure even distribution.

2. Enumeration by phase contrast

The most popular method of total counting bacteria before the introduction of epifluorescence method was erythrosin stain on membrane filters, the bacteria being viewed by either phase contrast or bright field microscopy (Rodina, 1972). Agar coated slide (0.8-1.0 mm) microscopic slides stored in 95% ethanol sterilized by flaming and marked on the slide with 1cm^2. Water samples to be counted must first be concentrated by centrifugation 2000g for 20 min in 10 ml clean glass centrifuge tubes with tapered ends. An aliquot (10 µl) of the concentrated samples is then spread evenly over the marked 1cm^2 on the agar surface and allowed to dry for 10 min at room temperature. Next, the agar is covered with the cover slip end viewed by phase contrast microscopy.

3. Enumeration by bright field microscopy

A known volume of water (10-30 ml) is filtered through white cellulose membrane filters (25 mm; 0.22 or 0.45 µm pore size). These are dried under vacuum and mounted in cedar wood oil, under cover slips. In order to count the total numbers of epiphytic bacteria directly on the leaves of submerged aquatic plants, the leaves are stained in filtered phenolic-aniline-blue for 1-2 min and mounted in a little of the stain solution. The bacteria appear dark blue and can readily be distinguished from other material by their shape. Some aquatic plants absorb stain and need pre-treatment to prevent stain absorption. Pre-treatment is as follows: 1) Addition of 40% formaldehyde for 30 min. 2) Rinse with distilled water 3) Treatment with fresh eosin yellowish 0.2gL^{-1} for 1 hour and 4) Again a distilled water rinse.

Indirect method

It relies on estimating an indicator chemical that is only found in living bacteria and is rapidly degraded as the bacteria die. The chemical must be at a known constant ratio to the cell mass in the population. Biomass indicator must be extracted from aquatic samples and then arranged by a variety of chemical and physiochemical procedure.

1. Adenosine Triphosphate

The use of adenosine triphosphate (ATP) as a biomass indicator in aquatic habitat was first suggested 20 years ago by Holm-Hansen and Booth, 1966. ATP is an indicator of total biomass and not a specified bacterial biomass indicator. Sampling natural habitat must be done carefully if it is intended to estimate biomass with ATP. The water sample is filtered through a 0.2 µm cellulose membrane filter. Extraction of ATP is done from the bacteria through boiling buffer solution, inorganic acids, organic acids, organic solvents and inorganic bases. The amount of ATP in the extracted sample is then measured. The most popular method is to assay ATP with the enzyme luciferase. This involves a light emission reaction.

$$\underset{\text{(reduced)}}{\text{ATP + luciferin + } O_2} \rightarrow \underset{\text{(inorganic)}}{\text{AMP + pyrophosphate + } CO_2 \text{ + light}}$$

The amount of ATP is calculated from a calibration curve, normally prepared between 1x 10^{-3} and 100 µg ATP ml^{-1}.

2. Phospholipid

All cell membrane contain phospholipids, which are quantitatively extractable from the cell. They constitute approximately 50% of eukaryotic lipids and 98% of bacterial membrane lipids (White et al.,1979), but are not present as storage lipids. A conversion factor of 50 µmoles lipid phosphate g^{-1} dry weight has been recommended (White et. al,1979). The principle of the assay is to extract the lipids with chloroform and methanol, digest them with perchloric acid and measure the released phosphate colorimetrically. Approximately 5-20 g of fresh, frozen or frozen lyophilized sediment should be extracted with 30 ml 50 mM phosphate buffer (pH 7.4), 75 ml anhydrous methanol and 37.5 ml chloroform for 2 hr. The resulting extract is digested with 1.5 ml 35% perchloric acid at 190 ºC for 24 hr. The cooled extract is added as 2.4 ml molybdate reagent and 2.4 ml of 12:1 diluted ANSA reagent. The reaction mixture is heated in a boiling water bath for 7-10 min, and the phosphate is measured by absorbance at 830 nm. This assay gives a minimum sensitivity of about 10^9 mole lipid phosphate, equivalent to about 2 x 10^9 bacteria of *E. coli* size, which is satisfactory for sediment.

3. Chlorophyll

Both chlorophyll *a* and the bacteriophyll may be used as biomass indicator. Chlorophyll *a* is present in both eukaryotic algae and cyanobacteria, so it should only be used as indicator of cyanobacterial biomass if eukaryotic algae are absent and this situation only arises in some microbial mats. So chlorophyll *a* is a general biomass indicator for oxygenic photosynthetic microorganism. Bacterio-chlorophylls are confined to prokaryotes so are some specific indicators for the presence of photosynthetic bacteria. Chlorophyll *a* may be measured either chlorometrically or by florimetery.

Procedure

- First the chlorophyll must be extracted directly from the sample or after concentration on a filter.
- One liter of water is usually the maximum volume that can be filtered before particulate debris clogs the filter.
- The efficiency of the extraction is variable and may increase by grinding. The filter is stored in the cold solvent for 18 hours in the dark.
- If the mixtures of pigments are expected then a two phase extraction with n-hexane (13 ml) and a methanol NaCl mixture (13 ml) partitions the pigments between the two phases making measurement easier.
- The quantity of pigment is then determined spectrophotometrically at fixed wavelength (750 nm for chlorophyll a and 820-850 nm for bacteriocholorophylls)

Chlorophyll estimation: $\mu gL^{-1} = V_e E \times 10^3 / V_s AL$

where, V_e= volume of solvent (ml)

V_s = volume of sample (L)

E = absorbance in solvent

A = absorption coefficient

L = light path of cuvette (cm)

4. Lipopolysaccharide (LPS)

LPS is a component of all Gram-negative bacteria cell walls. About 80-90% of prokaryotes in sea water are Gram-negative (Watson et. al., 1977). LPS is commonly assayed by the turbidometric method by adding an aqueous extract from the blood cells of the horse shoe crab (*Limulus polyphereus*) to give a turbid suspension in the water samples. The turbidometric assay is said to detect 500 bacteria per sample (Ford, 1985). A sample (1ml) is added with amoebacyte lysate (0.2ml) gently mixed and incubated at 37°C for 1 hr and the absorbance is read at 360nm. Calibration curve is used to estimate the LPS concentration from turbidity. This concentration of LPS is multiplied by the conversion factor of 6.35 to estimate the amount of bacterial carbon present.

5. Muramic acid

The cell wall of prokaryotes is comprised of muramic acid in their micropeptides. However, Gram-positive bacteria contain much more muramic acid than Gram-negative bacteria, and cyanobacteria may possess upto 500 times more than is present in other bacteria (King and White, 1977). Muramic acid estimation is suitable for sediments.

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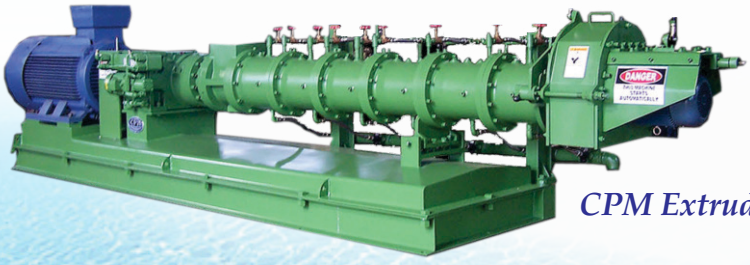

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6. Lipids and fatty acids

There is a wide variety of lipids and fatty acids in micro-organisms. These compounds are detected by solvent extraction followed by GLC or HPLC. Although, this methodology is complex, this technique is very promising. For use in sediments and biofilms, the sensitivity is poor, thus they are only suitable for use in biofilms or sediments. No conversion factor is available. These compounds are used to indicate the presence of biomass rather than quantify it.

Conclusion

There is no single method that can be universally recommended because different research groups have obtained contrasting results and the selection of best extraction method will be dependent upon the characteristics of the samples used for analysis.

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Captive Breeding and Farming of Turtles

Highlight Points

▶ When in-situ conservation efforts fail or are unsustainable, conservationists may turn to captive breeding with plans to reintroduce juveniles into the wild. ▶ Providing facilities for the hatching of wild eggs, will ensure higher chance of survival to adulthood and commercial production through captive breeding or ranching can benefit conservation, just as it has done for crocodilians (Hutton and Webb 2002). ▶ Hence in India, ban on turtle farming can be removed to promote better conservation.

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Introducton:

Turtles are reptiles belongs to the order Testudines or Chelonii which is characterized by a special bony or cartilaginous shell developed from ribs and act as a shield. Turtles are ectotherms and their internal body temperature varies according to the ambient environment. However, due to high metabolic rate, leatherback sea turtles have a body temperature that is significantly higher than that of the surrounding water. Turtles are classified as amniotes and like other amniotes; they breathe in air and do not lay eggs under the water, although many species live in and around water. Wild sea turtles and freshwater turtles have a long history of being harvested for meat, eggs, leather and other products. But harvesting was often excessive and unsustainable, causing declines in wild stocks, and thus generating series of conservation problems. In 1975, CITES was enacted, to control and restrict international trade of wild-caught sea turtles and freshwater specie. The aim of CITES was to ensure international trade was legal, verifiable and sustainable, and that wild harvesting for international trade did not contribute to the further endangerment of wild populations.

Taxonomic classification:

Class - Reptilia

Order – Testudines

Families: 2 families.

All sea turtles having scutes (horny plates) covering their shells belongs to family Cheloniidae.

Family Dermochelyidae includes scuteless turtles. Example:leatherback turtle. A leatherback turtle is generally covered by leather like skin. It is the only known marine turtle whose backbone is not attached with its shell.

Genus, Species

1. Most scientists recognize seven species of sea turtles:
   - green (*Chelonia mydas*);
   - loggerhead (*Caretta caretta*)
   - Kemp's ridley (*Lepidochelys kempii*)
   - olive ridley (*Lepidochelys olivacea*)
   - hawksbill (*Eretmochelys imbricate*)
   - flatback (*Natator depressus*)
   - leatherback (*Dermochelys coriacea*)

Among these, 5 sea turle species and 26 freshwater species of turtles are found in India.

Feeding behaviour:

Diet of the turtle varies greatly depending on the environment in which it lives. Adult turtles feeds on aquatic plants and invertebrates such as worms, insects, snails etc and also been reported to occasionally graze on dead animals. Several small freshwater species of turtles are carnivorous in nature, and prefer to eat small fish and a wide range of aquatic life. Generally Sea turtles feed on sponges, jellyfish, and other soft-shelled organisms. Some species of marine turtle with stronger jaws have been reported to eat shellfish while some of the turtle species, such as green sea turtle do not eat any meat instead feed on algae.

Breeding biology:

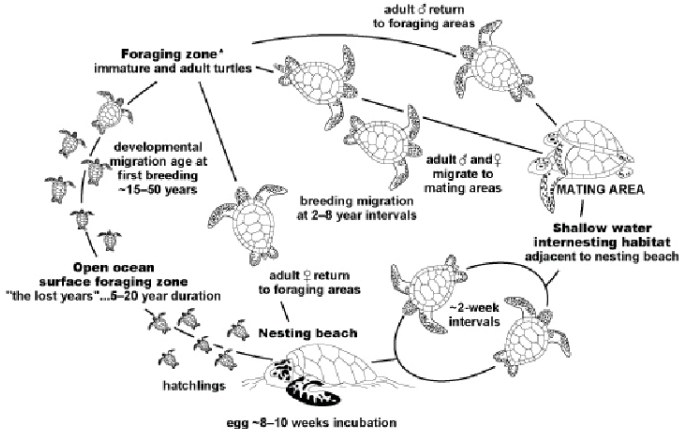
Turtles are oviparous in nature. Adult male and female will migrate to the area where they hatched before one or two decades earlier.the distance between breeding and feeding ground may be thousands of kilometres.The return migration by adult turtle to the beach of its birth is called natal homing. It is not known exactly how they are able to navigate to the beaches where they were born,but there are number of theories to explain this amazing phenomenon including the use of the earth's magnetic field(kind of mental GPS)

Mating: Mating generally occurs in offshore area ,far from nesting beaches. Multiple paternities are common in sea turtles i.e females mate with a number of different males. Female store the sperm and use it to fertilize several clutches of eggs that will be laid over the course of a couple of months. once the male have mated and are unsuccessful in finding more mates they will return to their feeding areas.

Nesting beach: During nesting season only female come ashore to lay eggs within few weeks of mating. Females usually nest at night to avoid direct sunlight. They crawl out of the water and search for a suitable location to dig a nest in the sand and lay their eggs. Depending on the species a female may lay as many as 7 clutches of eggs in each nesting season. Females return to their foraging grounds once the nesting season is over.

Hatching: Eggs hatch after 7-12 weeks depending upon the species and environmental condition.sea turtles have temperature dependent sex determination. warmer temperature produce female hatchlings, where as cooler temperatures produce male hatchlings. The baby turtles dig through the sand and crawl into the sea.

Life Cycle



Turtle farming in world context:

Turtles are facing a problem of global extinction particularly in Asia due to China's insatiable demand for turtle meat to prepare soup and shells for traditional Chinese medicine (van Dijk et al. 2000; Turtle Conservation Fund 2002). Due to an increased demand of turtle it fetches a higher market price, and hence encouraged the entrepreneurs to develop farms in China. Farming of Chinese Soft-shell Turtle (*Pelodiscus sinensis*) is reported from Japan in 19th Century (CITES 2003a).The relatively high prices and demand offered for freshwater turtles in the 1980s and 1990s turtle farming has been developed in countries such as Malaysia, Thailand ,Taiwan and China.China is a significant producer of farmed turtles. *Pelodiscus sinensis* is the most common species of turtles being farmed in China and other parts of Asia (Artner and Hofer 2001)due to its high growth rates, high reproductive potential, widespread consumer acceptance and the understanding of conditions for farming (CITES 2003b). Hardshelled Turtle farming is not considered as effective as it is for soft-shelled species, because of the lower reproductive potential and slower growth rates (CITES 2003b). However, species such as *Cuora trifaciata* are farmed in modest quantities due to their high individual market value (perceived cancer curing qualities), or for niche markets such as TCM, religious release and the pet trade (CITES 2000).

Captive breeding technique:

A breeding pen of 30 m x 5 m x 0-0.8 m at deepest point having water and sandy "beach" areas was built. Water depth varies from 0.8m along one side, to 0 m at the other side, where a gentle incline allows turtles to crawl out onto the land area. Total water volume should be around 70 kl. The land area along one side of the pen consisted of a 1.7 m wide area filled with sand (70 cm deep) for nesting. On the other side of the pen consists of a bitumen pathway. polyethylene prawn trawl netting (3mm, 5 x 5 cm mesh; 1.5 mm, 3 x 3 cm

mesh; 3 mm, 2.5 x 2.5 cm mesh was used to subdivide the pen into separate enclosures, The netting sits 20-30 cm above the waterline, which proved sufficient to stop turtles climbing into adjacent enclosures.

Although turtles appear to prefer marine fish and squid but from a cost point of view brooders are fed with mixture of fish and pellets.

Turtle farming in India:

Unlike other countries turtle farming is banned in India. Out of the 26 species of non-marine chelonians found in India, 19 are reported from north-eastern region (Das, 1996), thus making it an important repository of chelonian diversity. Even though commercial farming of turtle is illegal in India but turtles have historically getting community-sanctioned religious protection in many temple tanks in the north eastern region of India. Example: Softshell turtles protected in Kamakhya temple at Guwahati, Assam and protection of *Aspidaretes gangeticus* in the Tripureshwari temple at Tripura. More recently, the Shiva temple located at Tinsukia, Assam started turtles sanctuary. Hence ex situ conservation of chelonian turtles in community ponds and temple tanks and in public gardens could also be a useful mechanism for conservation.

Factors affecting turtle population:

i) Habitat destruction

Several pulp and papper mills are exerting a unsustainable pressure on the bamboo forests of Assam. This forest destruction leads to shortage of food, as bamboo sprouts were reported to be the favorite food item of some species of turtles. Deforestation leads to soil errosion, especially in hilly areas, resulting in increased siltation in the streams and rivers. The deep pools that are the favourable habitats of many species, are rapidly coverting into shallow water bodies, leading to detorioration in habitat. These changes resulted in a sharp decline of chelonian density.

ii) Hunting or trapping for flesh

A majority of indigenous residents of a particular region are mostly carnivorous and crave turtle meat and eggs.The Ningthouja community of Meiteis, Manipur, for example, considered it a taboo to consume turtle or tortoise meat (Gupta and Guha, 2002).

iii) Use in traditional and alternative medicine

Both flesh and eggs of turtles are believed to have medicinal properties. The blood is, believed to cure piles and fistula. The flesh is used as a remedy for gout and arthritis, while the carapace of the soft shell turtles are also used as medicine.

iv) Superstition

There are several superstitious beliefs that encourage the killing of turtles. Hanging turtle carapace in the cattle-shed is considered to be a good luck charm and it will keep snakes away from the premises; hanging a carapace on the door or wall of a house is believed by some to keep away burglars.

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Thai Magur: An Invasive Alien species Banned 'Thai Magur'consumption continues unabated in many parts of India

Highlight Points

Clarias gariepinus (Thai magur) is an invasive African catfish that was first introduced in India during the 1990s and has since then colonized many major rivers, wetlands, and a variety of water bodies across the country. Due to the potential threat to health and aquatic biodiversity, in 1997, the Ministry of Agriculture in India banned the culture, breeding, transportation, and import of *Clarias gariepinus* (Gopi & Radhakrishnan, 2002). However, due to the simplicity of rearing, it appears that several fish farmers and aquaculturists have given little consideration to this ban and continue to rear this catfish.

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The term 'alien'species refers to the plants or animals that are introduced, accidentally or intentionally outside their natural geographic range, into an area where they are not naturally present. They are often introduced as a result of the globalization of economies.For instance, by trade via ships, a shipment of wood products infested with insects, or the transport of ornamental plants that then establish and spread themselves in the wild (IUCN webpage).*Clarias gariepinus*, commonly known as African catfish or Thai magur, is an invasive African catfish that was first introduced in India during the 1990s.This catfish was first noticed in AndhraPradesh (Middendorp, 1998) and has since then colonized many major rivers, wetlands,and a variety of water bodies acrossthe country (Thakur, 1998).Initially, the fish was cultured on a large scale in West Bengal and Assam, together with Indian major carps (Baruah *et al.,* 1999). However, the culture and sale of this fish wereeventually banned after observing its drastic ecological and health impacts. Currently, the fish isreportedly found in lakes of Maharashtra, Odisha, and Coimbatore.

Why is it so popular?

Due to the potential threat to aquatic biodiversity, in 1997, the Ministry of Agriculture in India banned the culture, breeding, transportation, and import of *Clarias gariepinus* (Gopi &Radhakrishnan, 2002). However, due to the simplicity of rearing, it appears that severalfish farmers and aquaculturists have given little consideration to this ban and continue to rear this catfish (Singh & Lakra, 2006). Also, taking advantage of their morphological similarities, in many Indian fish markets, traders are selling *Clarias gariepinus* as "Magur"(*Clarias batrachus*). Despite being banned, its culture and consumption never stopped.

Clarias gariepinus was brought to India from neighboring Bangladesh (Thakur, 1998) and cultured initially in the two north-eastern states of West Bengal and Assam and the southern state of Andhra Pradesh, together with the indigenous Indian Major Carps (Baruah *et al*., 1999). This resulted in severe losses to the carp production in such mixed culture ponds; in due course of time, the farmers preferred the monoculture of *C. gariepinus* due to its high growth rate and commercial benefits (Middendorp, 1998; Thakur, 1998; Baruah *et al*., 1999). Easy culture, meager investment,and high yielding return in a short time attract the breeders and farmers to culture this invasive species (Singh and Lakra, 2006). The fish attains about 1kg weight in six months as compared to the local Indian variety, which reaches 300 grams at the same time. Less market price (Rs. 80 to Rs. 100 per kg) than the local Indian magur (Rs. 150 to Rs. 160 per kg) compels the consumers to buy it.

The fecundity of *Clarias gariepinus*is extremely high about 400000 eggs in comparison to the local Indian catfish (*Clarias batrachus*),which ranges between 7,000 to 15,000 eggs. The input cost of breeding is also very less compared to native catfish (Krishnakumar *et al*., 2011).

Additionally, due to its transportation surviving capability and survivalin muddy waters as well as water scarcity conditions, densely vegetated regions, and burrowing capabilities, fish farmers and the ordinary public are always interested in buying this fish for rearing and consumption. In southern India, the fish is secretly transported from Andhra Pradesh

to other states (Fish site webpage). African catfish thrive at water temperature ranging from 8 to 35˚C and salinities from 7 to 15ppt (Britz and Hecht, 1989). Owing to the enlisted reasons, its illegal culture and sale have not entirely stopped yet in India.

Effects on ecology and public health

Scientists have warned about the invasion of this fish into non-native water bodies, as it destroys the natural tropic status of the ecosystem and deprives other native species of their food and breeding space.

African catfish, being nocturnal,highly carnivorous/omnivorous, and cannibalistic, occupies the habitat of indigenous fishes in the ecosystem and competes with the food resources of these fish. For instance, there has been a 70% decline of native fish species over the past two decades at Lake Powai in Mumbai, India. Similarly, more than 100 indigenous species could be endangered due to the introduction of this fish near Krishna River in Mahabubnagar district of Telangana (Fish site webpage). The African catfish is believed to be dominating most of the river systems in the Western Ghats. de Moor and Bruton(1988)reported that this species also devours on small reptiles, amphibians, and birds, destroying the ecological balance of water bodies by affecting indigenous biodiversity that, inturn, reduces the food base for water birds.

The fish is known for crawling behavior on land with the aid of their strong pectoral fins and enters into adjacent wetlands during monsoon (Burgess, 1989). Indian farmers used to stock very high densities of *C. gariepinus* in their pondsresulting in the large-scale periodical escape of the species to the neighboring wild habitats (Pascal *et al*., 2009). The introduction and culture of *C. gariepinus* have negatively impacted the native fish fauna of Manalur in Kerala (Gopi & Radhakrishnan, 2002). The occurrence of *C. gariepinus* has also been reported from many inland river systems of India like Ganga, Yamuna, Sutlej, Godavari, Periyar, and lakes like Vembanad lake (Krishnakumar *et al*., 2011; Singh*et al*., 2014).

Under captive conditions, the fish is fed with rotten meat and spinach that pollutes water. Because of the higher tolerance to severe aquaculture conditions and comfortabledwelling in unhygienic and uncleanplaces, the percentage of lead and iron is found to be very high in this fish, leading to many public health implications.

What needs to be done?

Though the central government has banned its culture in ponds and tanks since 2000, several state governments are not still enforcing the ban leading to its illegal farming and sale. Being a top predator, it is crucial to determine and minimize the possible impacts on indigenous fish fauna. Recently Maharashtra government has destroyed around 32 tonnes of this fish by destroying their breeding centers; other states can do the same. The new effective methods for its capture and control must be introduced. Proper management plans should be introduced, which should come up with the rigorous application of existing laws and increasing the awareness of this invasive alien species by scientists, farmers, legislators, and the general public.

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Status of Freshwater Aquaculture in Dhenkanal district of Odisha

Highlight Points

Dhenkanal district of Odisha is blessed with bountiful natural resources with good potential for aquaculture production. However, the productivity status is low due to several bio-physical and socio-economic factors. Most important factor affecting the productivity is the non-adoption of scientific fish farming practices. The research-extension-farmer linkage needs to be strengthened to provide technical support to fish farmers. It is essential that fish farmers are made aware of promotional schemes and incentives, enabling them to avail the advantages of those initiatives.

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Fish is the cheapest and most accessible animal-origin food for poor consumers. Fish is recognized as a global super food. Fisheries and aquaculture is one of thefastest growing food sectors and has been playing a pertinent role in the economic development front on account of its contribution to food and nutritional security, national income, employment opportunities as well as generating livelihood options (GoO, 2017-18). In India, where 70% of its population reside in rural area, small scale aquaculture plays a pivotal role in uplifting the socio-economic status of the fish farmers. Odisha, being a coastal state has a vast potential for freshwater aquaculture. Though there is a lot of scope for freshwater aquaculture in the state, but the resources available are underutilized. Hence, it is worthwhile todocument the resource potential for freshwater aquaculture and suggest measures for improving production.

For the present study, Dhenkanal district was selected randomly from Odisha. It has ponds & tank resources of 1749.22 ha. Three blocks *viz.*,Sadar block, Odapada block and Gondia block were selected purposively because of the presence of majority fish farmers. Primary data were collected from 71 fish farmers through structured interview schedule. Secondary data was collected through reviewing various literatures, Directorate of Fishery, Odisha and District Fishery Office, Dhenkanal.

Resource Potential of Odisha

The state of Odisha has an area of 1, 55, 707 Sq. km.Total population of this state is 41,947,358 as per 2011 census.It is a coastal state with a coastline of 480 kms, is situated in eastern India, between West Bengal in the north and Andhra Pradesh in the south. The entire State lies in the tropical zone and is divided into four distinct parts, *viz.,* the northern plateau, the Eastern Ghats, the central part and the coastal plains. Three great rivers of the subcontinent viz., Mahanadi, Brahmani and Baitarani drain the state, along with a number of east-flowing smaller rivers. State of Odisha is bestowed with inland, brackish water and marine resources and the fisheries activity is prominent in the state.The state has 6.83 lakh ha of freshwater resources.The state occupies fifth position in inland fish production in India.Optimum utilization of inland water resources for pisciculture, improving professionalism through training of those involved in fisheries sector, forming cooperatives and SHGs for community participation and expanding market potentials, dissemination of new technologies through its extension machinery and providing livelihood support to unemployed youths through self-employment were some of the important mandates of Odisha Fisheries Policy, 2015. The state has set a target to double fish production and to achievethe export target of Rs.20,000 Crores by the year 2020.

Table 1: Freshwater Fisheries Resources & Potential in Odisha

Resources	Water area (In lakh ha.)	Total production potentiality (In lakh MT)	Present production level (2016-17) (In lakh MT)
Culture Fisheries (Tanks & Ponds)	1.32	3.9	3.31
Culture based Capture Fisheries (Reservoirs)	2.00	0.20	0.30
Capture Fisheries (Lakes / Swamps /Beels)	1.80	0.36	0.05
Rivers & Canals	1.71	0.14	0.28
Total	**6.83**	**4.6**	**3.94**

(Source: Fisheries and Animal Resources Development Department, Government of Odisha, 2017-18)

It is depicted from the table 1 that there is a gap between the total production potentiality and present productivity level. In case of culture fisheries the present productivity stands at 3.31 lakh MT against the total production potentiality of 3.9 lakh MT indicating a gap of 60,000 MT. In case of culture based capture fisheries and rivers & canals the present production figure are more than the total production potentiality0.30lakh MT and 0.28lakh MTagainst 0.20lakh MT and 0.14 lakh MTrespectively. With regard to the sector of Capture Fisheries production is very less i.e. only 0.05 lakh MT as against 0.36 lakh MT.

Table 2. Fish seed hatcheries and their capacity

Freshwater Fish Seed Hatchery:	Unit (No.)	Fry Capacity (in millions)
Government (R&D)	05	489.00
Government hatchery	20	121.70
Government rearing farm	89	
OPDC (Orissa Pisciculture Development Corporation)	05	210.00
Private	86	520.00
Total	**205**	**1340.70**

(Source: Fisheries and Animal Resources Development Department, Government of Odisha, 2017-18)

In Odisha, there are total 205 no. of freshwater fish seed hatcheries owned by government as well as private, with a total fry production capacity of 1340.70 million as in 2017-18. Despite of this, the fish farmers are buying the fish seeds from West Bengal.

Resource Potential in Dhenkanal

Total geographical area of the district is 4,452.00 sq. km. The total population of the district is 1,192,811as per 2011 census. Around 70 percent of its population is literate. Dhenkanal district is centrally located on the Geo-Political map of Odisha and is surrounded by beautiful wild lives and forests.Dhenkanal has ponds and tanks resources of 1749.22 ha, 1545.73 ha of reservoirs, 2230 ha of rivers/ canals with no swamps/beel. Thus the total inland fisheries resources of the district stand at 5524.95 ha contributing 2.2 percent towards the total inland fishery resources of Odisha(Das *et al*. 2017).

Salient Findings

Socio-personal characteristics of the respondents

Socio-economic and personal characteristics of the respondents is presented in Table 1. It is evident that majority of the respondents (59.15%) were from the age group of 35-50 years while 32.40 percent of them were falling in the category of >50 years and only 8.45 percent of them were in 20-35 years age group. With regard to education level 22.53 percent of the respondents had higher secondary level of education followed by middle level (21.12%), primary level (16.94%), matriculation (14.08%), no formal schooling (9.85%), graduation (7.04%) and 3 percent of them were in the category of illiterate and post-graduation level each. Majority (54.94%) of them had a pond area of 1-2 ac. Whereas 29.57 percent of the respondents had a pond area of less than 1 ac and only 15.49 percent of the respondents had more than 2 ac of pond. Majority (61.97%) of the respondents were having medium level of extension contact followed by high level (22.54%) and low level (15.49%).Most (50.71%) of the respondents have medium level of exposure to mass media followed by low level (25.35%) and high level (23.94%) of exposure to mass media. Most (66.20%) of the farmers possessed a medium level of knowledge while 21.13 percent of them were having a high knowledge level and only 12.67 percent of them possessed a low knowledge level. Majority (43.67%)of them were found in the category of high adoption. Whereas, 38.02 percent of them had a medium level of adoption followed by low level of adoption (18.31%) of the recommended practices of composite carp culture technology.

Prevailing Carp Culture System in the District

1. Pre-stocking Management: The important operations in this phase are control of aquatic weeds and removal of predatory and weed fishes. The fish farmers of the district are not practicing it due to economic and technical barrier. Application of lime and fertilizer to improve the quality of soil is another important aspect of pre-stocking management. Farmers are usually manuringthe ponds with raw cowdung @3-4 tonnes/ha15 days prior to stocking as the basal dose. Liming is carried out in the ponds 3-4 days prior to stocking for correction of soil and water pH, which also helps in mineralisation of the organic matter and pond disinfections. Usually, a pond with slightly acidic to neutral soil pH are applied with 200-300 kg of lime.

2. Stocking: The carp culture ponds are stocked with proportionate number of surface, column and bottom feeders for minimizing the competition among them for the food available in pond. A proportion of 30-40% surface feeders (silver carp and catla), 30-35% column feeders (rohu) and 30-40% bottom feeders (common carp and Mrigal) are commonly recommended. Stocking density of 5000 fingerlings/ha is recommended for carp polyculture with a production target of 3-5 tonnes/ha/yr. The size of the fish seed stocked by the farmers is around 15-20 mm. The fishfarmers of the districtstock the seed at a density of 12,000- 15,000/ ha. The stocking density, however, depends largely on the input use and levels of management. Two species culture with 80-85% rohu and 15-20% catla is fast catching up with the farmers and is probably driven by market forces.

3. Post-stocking management

The post-stocking pond management primarily involves the aspects of intermittent liming and fertilization, supplementary feeding, water management and health care. The post-stocking fertilization measure includes fortnightly application of cowdung @ 0.5 tonnes/ha, urea@ 10kg/ha and SSP @ 15kg/ha.Farmers of Dhenkanal mostly practice extensive fish culture because the ponds are being utilized for other domestic purposes as well as lack of exposure towards scientific aquaculture. The farmers are using cow dungfor fertilizing their pond. The time and doses vary depending upon the water quality and plankton content. Mixture of groundnut/ mustard oil cake and rice bran at 1:1 by weight is the most commonly used supplementary feed in carp polyculture. Farmers use mash feed as supplementary feeding incur high cost.

4. Harvesting and Marketing

Grow-out carp culture is usually carried out for a period of 8-10 months. Intermittent partial harvesting of larger size fishes can also be initiated after six months of culture, which will ensure continuous return, reduction of investments and risks and congenial environment for the remaining fishes to grow. At the time of harvest the average size is 1-1.5 kg. The study found that the farmers are getting an average productivity of 2.13tonnes/ha/year which is lower than theaverage annual yield of FFDA ponds of around 3.0 tonnes/ha/year (DADF, 2018-19). This is possibly due topoor management and inadequate supplementary feeding practiced by the fish farmers.Most of the fish farmers are selling their fish at their own place to the local agent, wholesaler or retailer at a price of around Rs.120-140 / kg.The fish farmers are getting anaverage profit of Rs 1.00 lakh/ha.

Constraints faced by the fish farmers

The fish farmers are facing a no. of constraints like:-

- Non-availability of bigger size quality fish seed in time.
- Paucity of financial aid from the Government for the initiation of carp culture in their own pond.
- Low water retention of ponds*i.e.*,most of the ponds have water retention of 8-10 months.
- Lack of awareness and updated information about the technology of fish farming.
- Not adopting all the recommended practices of scientific farming.
- Less extension efforts.

Suggestions

In order to increase the productivity in the district, technological intervention along with extension measures should be emphasized. Fish farmers should have assured access toquality carp seed for the cultivation.They should be made aware of the recommended doses of feed and proper feeding habit. Prior to the culture the ponds should be cleaned properly and be made free of aquatic weeds and predatory fish species. More emphasis should be given on utilizing the unused water resources to draw maximum benefits. Government of Odisha proposes to take up massive horizontal expansion of culture areas and

to enhance productivity to 5.00 tonnes/ha/year. Under Central Plan scheme, development of inland fisheries and aquaculturecomponent mainly focuses on increasing of fish productivity from the existing aquaculture farms and water bodies besides aquaculture area expansion and species diversification (DADF, 2018-19).In order to strengthen the extension network utilizing them for the intervention, under the umbrella of Agriculture Technology Management Agency (ATMA) modified Extension Reforms Scheme was introduced in 2010. Dissemination of technologies, capacity building of farmers through a mix of physical outreach and use of ICT are being emphasized.With Govt. doing its bit, now it is for the farmers to switch over from extensive culture to semi-intensive culture; from household level production to fishery enterprises; from only culture to the entire value chain-breeding, seed rearing, feed manufacture, input supply, marketing and value addition.

References can be provided on request.

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