DIATOM ASSISTED AQUACULTURE IN INDIA ; POTENTIAL FOR APPLICATION OF THIS TECHNOLOGY IN RUSSIA.

M SHAJI

FORMER JOINT DIRECTOR MPEDA INDIA
&
NATIONAL RESOURCE PERSON (FISHERIES)
NATIONAL RURAL LIVELIHOOD MISSION INDIA.

Let me express my sincere gratitude to the organizers of
Global Fishery Forum & Seafood Expo Russia,
for giving me this opportunity to present a technology widely practiced in the aquaculture farms of India.

Mr Nikhil & Mr Abhilash are two young entrepreneurs of South India who took up Biofloc / Semi Biofloc technology for producing Vannamei Shrimp with the support of government fisheries department.
For many reasons, they could not go ahead with Biofloc technology and then they decided to initiate Diatom assisted aquaculture technology and attained a profitable production of more than 4 kg / M2

In recent years, number of Biofloc farmers have switched on to Diatom assisted technology for Vannamei shrimp production.

Mr Nikhil

Mr Abhilash

Potential Drawbacks of Biofloc System :

- High energy requirements for continuous aeration & water movement.
- Active management by constant monitoring to address:
  Water quality issues.
  High suspended solids.
  Balancing Carbon to Nitrogen ratio.
  Waste management.

Diatom assisted aquaculture

Demonstration conducted at Mr Nikhil farm in Cochin S.India.

Infrastructure:

Reservoir: 1000 MT capacity Earthen pond with HDPE lining (27 x 29 Metres.)

Nursery Pond : 30 MT capacity (circular HDPE lined tanks 5 metre dia)

Culture Pond :1000 MT capacity (30 metre X 30 Metre) HDPE lined Earthen ponds with toilet area to collect and drain out solid waste.

Aeration for culture pond:

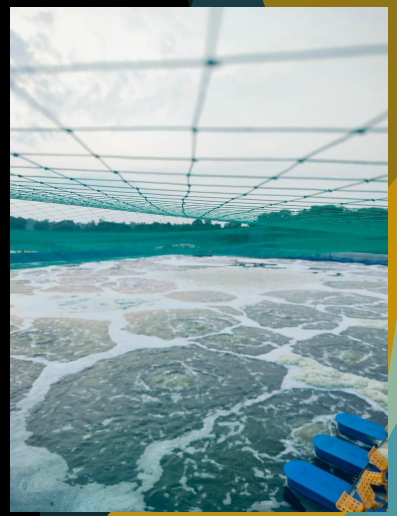
Paddle wheel aerators 2 HP 4 wheels - 4 Nos.
Blowers: 10 HP & 5 HP with 130 Grids. 1.25 HP for Reservoir pond.
Water inlet pump : 3HP Slurry removal pump : 1HP.
Generator : 25 KVA .

Reservoir Pond

Nursery Tanks

Culture Pond with Grids for aeration

Shrimp toilet in the culture pond .



Culture Pond in operation

AQUACULTURE OPERATIONS:

RESERVOIR:

The reservoir is filled with filtered saline water pumped from the creek or Bore well.

Disinfection by Chlorination .

Dechlorination by aeration.

Water tested for optimum parameters and corrected by addition of inputs.

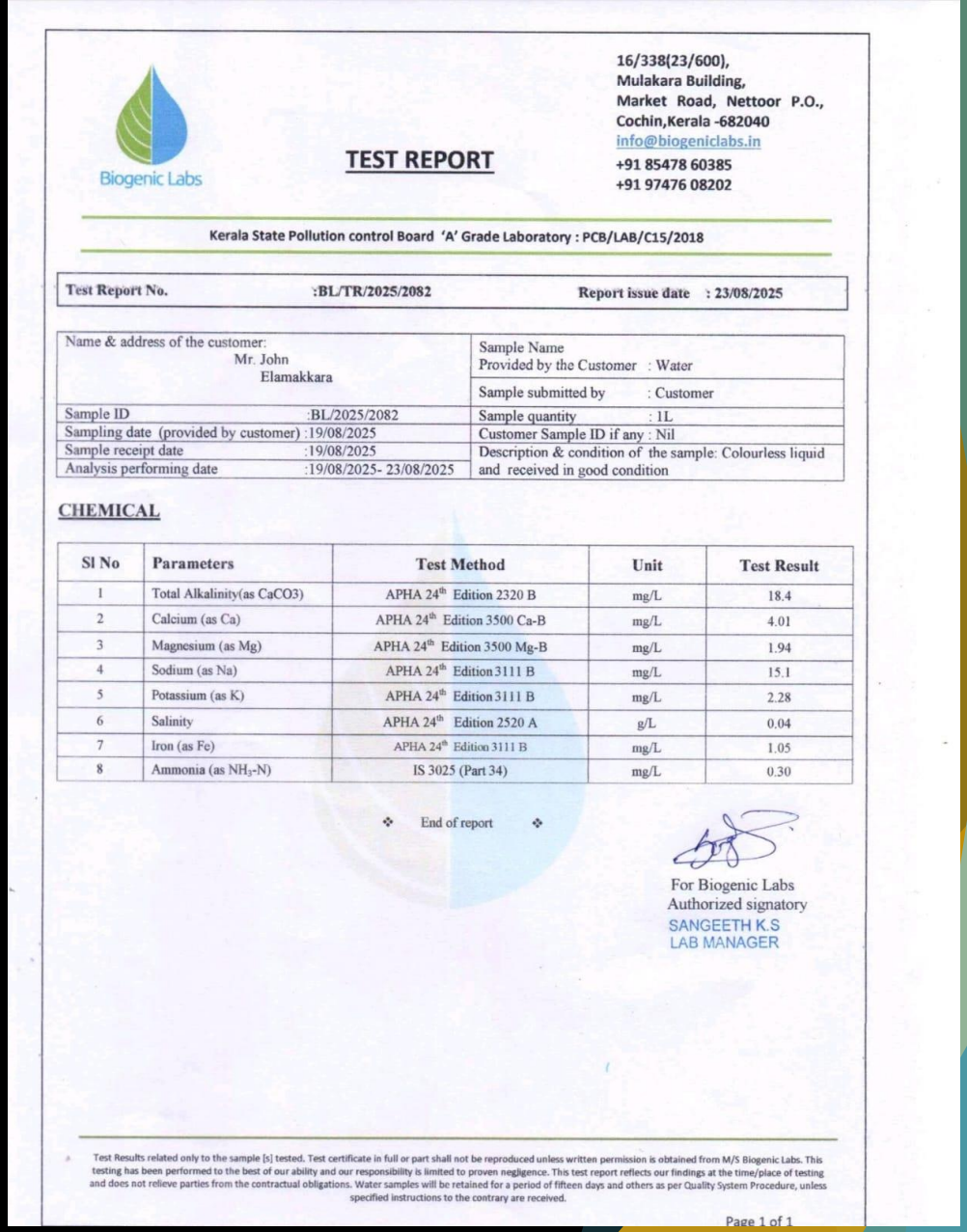
WATER TEST KITS:

Ammonia,PH, Nitrite,Nitrate

Alkalinity test kit

DO Test Kit

Salinity Meter



Biogenic Labs

TEST REPORT

16/338(23/600),
Mulakara Building,
Market Road, Nettoor P.O.,
Cochin,Kerala -682040
info@biogeniclabs.in
+91 85478 60385
+91 97476 08202

Kerala State Pollution control Board 'A' Grade Laboratory : PCB/LAB/C15/2018

Test Report No.	:BL/TR/2025/2082	Report issue date	: 23/08/2025

Name & address of the customer: Mr. John Elamakkara		Sample Name Provided by the Customer : Water
		Sample submitted by : Customer
Sample ID	:BL/2025/2082	Sample quantity : 1L
Sampling date (provided by customer)	:19/08/2025	Customer Sample ID if any : Nil
Sample receipt date	:19/08/2025	Description & condition of the sample: Colourless liquid and received in good condition
Analysis performing date	:19/08/2025- 23/08/2025	

CHEMICAL

Sl No	Parameters	Test Method	Unit	Test Result
1	Total Alkalinity(as $CaCO_3$)	APHA 24th Edition 2320 B	mg/L	18.4
2	Calcium (as Ca)	APHA 24th Edition 3500 Ca-B	mg/L	4.01
3	Magnesium (as Mg)	APHA 24th Edition 3500 Mg-B	mg/L	1.94
4	Sodium (as Na)	APHA 24th Edition 3111 B	mg/L	15.1
5	Potassium (as K)	APHA 24th Edition 3111 B	mg/L	2.28
6	Salinity	APHA 24th Edition 2520 A	g/L	0.04
7	Iron (as Fe)	APHA 24th Edition 3111 B	mg/L	1.05
8	Ammonia (as NH_3-N)	IS 3025 (Part 34)	mg/L	0.30

❖ End of report ❖

For Biogenic Labs
Authorized signatory
SANGEETH K.S
LAB MANAGER

Report of water tested in the LAB

WATER PARAMETERS:
Ideal Mineral Levels for 10 ppt salinity

Mineral composition will be different in different water sources. We need to adjust it to ideal levels before introducing seeds.

Calcium - 116 ppm
Magnesium - 390 ppm
Pottassium - 108 ppm
Sulphate - 700 ppm
Chloride - 5500 ppm
Sodium - 3024 ppm
Iron - < 1 ppm
Phosphate - 0.5ppm.

Evaluate the Lab results and decide the minerals and quantity of minerals to be added.

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End of report

For Biogenic Labs
Authorized signatory
SANGEETH K.S
LAB MANAGER

Test Results related only to the sample [s] tested. Test certificate in full or part shall not be reproduced unless written permission is obtained from M/S Biogenic Labs. This testing has been performed to the best of our ability and our responsibility is limited to proven negligence. This test report reflects our findings at the time/place of testing and does not relieve parties from the contractual obligations. Water samples will be retained for a period of fifteen days and others as per Quality System Procedure, unless specified instructions to the contrary are received.

Page 1 of 1

Mineral composition will be different in different water sources. We need to adjust it to ideal levels before introducing seeds:

Calcium - 116 ppm
Magnesium - 390 ppm
Potassium - 108 ppm
Sulphate - 700 ppm
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Sodium - 3024 ppm
Iron - < 1 ppm
Phosphate - 0.5ppm.

Evaluate the Lab results and decide the minerals and quantity of minerals to be added.

Following ingredients are used for supplementing deficient chemical/mineral requirements.

Magnesium sulphate

Potassium Chloride/Potash(MOP)

Calcium Chloride

Sodium Bicarbonate

Calcium carbonate/Dolomite.

Alkalinity:

Alkalinity in shrimp farming is crucial for providing a stable pH and supporting the shrimp's exoskeleton formation during moulting.

Calcium carbonate or sodium bicarbonate is used. For a long-term solution dolomite is applied which also help to increase calcium and magnesium levels

AQUACULTURE OPERATIONS:

NURSERY TANKS:

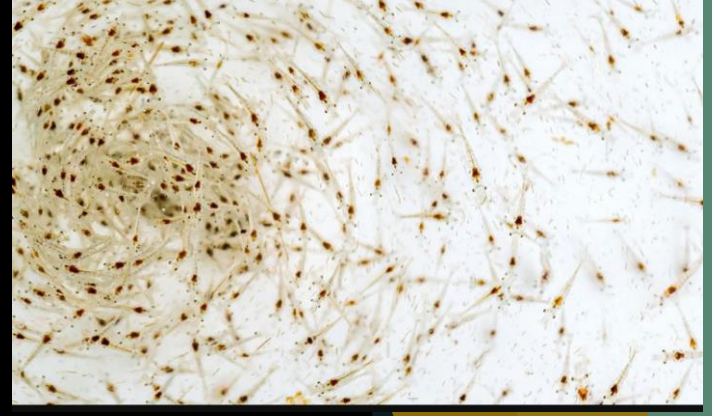
Treated water from the reservoir is used in the nursery tanks .

Biofloc technology is followed in the Nursery tanks to rear post larvae of shrimp to juvenile size. 10 to 15 days are required for the same.
Sugar is used as carbon source.

SEED STOCKING IN NURSERY:

Vannamei Shrimp seeds procured from SHAPHARI certified Hatchery.

SHAPHARI certified shrimp seeds are tested free from banned antibiotics & are free from pathogens listed by the World Organization for Animal Health .



No. of PL seeds :300,000
Nursery Period : 15 Days

Preparation for diatom culture in the main pond :

1. Drying the Pond.
2. Removing debris.
3. Setting up of grids for blower aeration and feed check trays for monitoring feed consumption.
4. Pumping saline water from Reservoir.
5. Adjusting pH & Alkalinity.
6. Adding a source of silicon and other essential nutrients for the diatoms to thrive.
7. Introducing a diatom starter culture.
8. Providing adequate sunlight.
9. Ensuring aeration for initial growth.

Well aerated Culture pond.

What are Diatoms :

Most abundant phytoplankton group .

Significant portion of total primary production & global oxygen production.

Vital food source for primary consumers in marine food web.

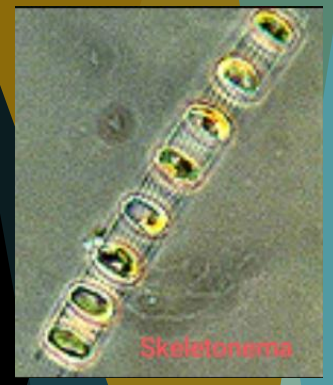
High growth rates for rapid proliferation.

Able to thrive under varying environmental conditions.

DIATOMS SPECIES:

India has a diverse marine diatom population, with numerous species from genera namely:

Chaetoceros
Thalassiosira
Skeletonema
Nitzschia
Amphora &
Cocconeis.



Role of Diatoms in Aquaculture :

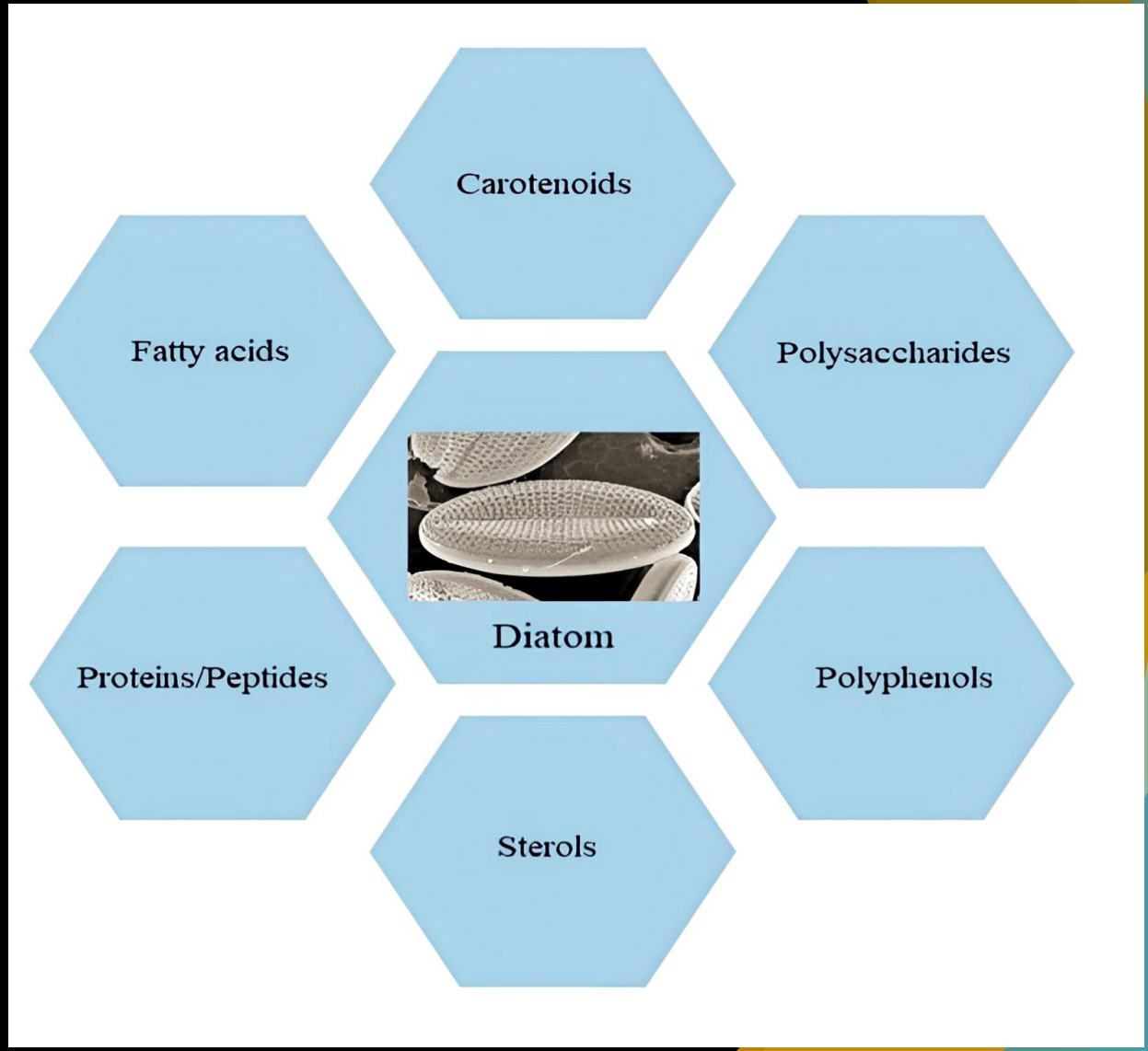
Improving water Quality by:

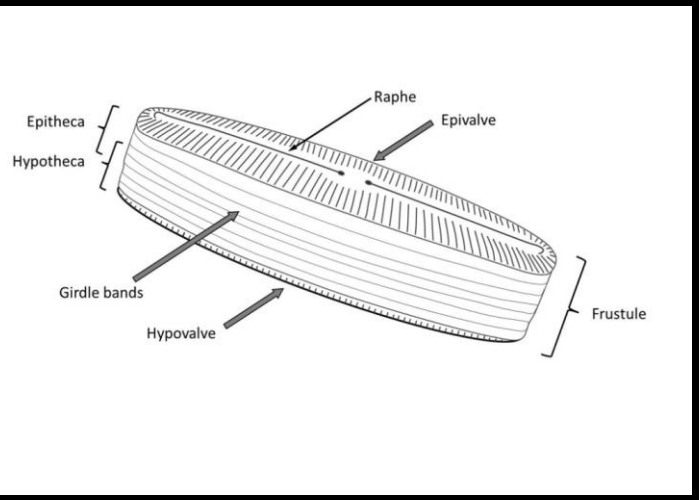
1. Reducing toxicity through Nutrient removal.
2. Photosynthetic Oxygen Production .

High Quality food source rich in Omega 3 fatty acids for zooplankton & farmed species.

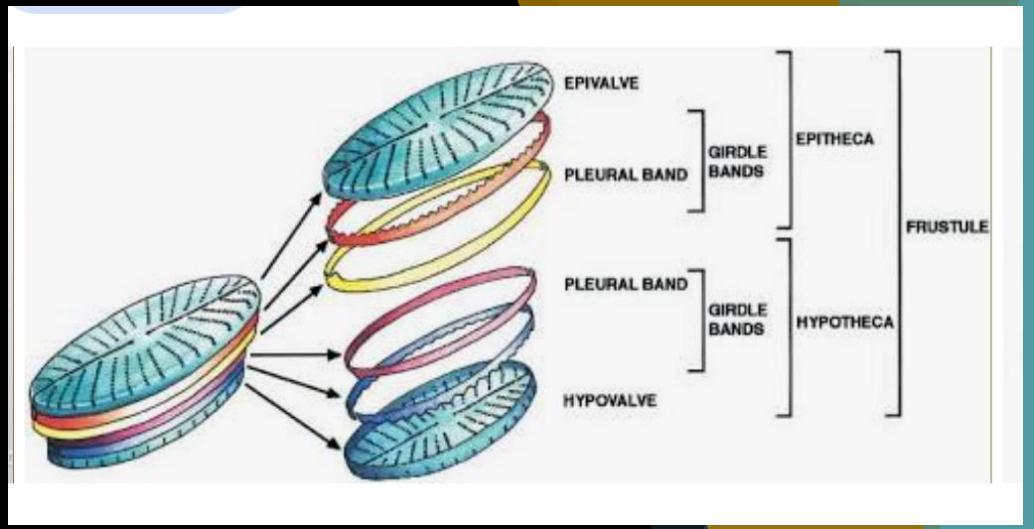
Bioremediation : Removes Heavy metals & other pollutants from pond water.

NUTRIENT PROFILE OF DIATOMS:





DIATOM MORPHOLOGY



FRUSTULE:

The two-part siliceous cell wall of Diatom.

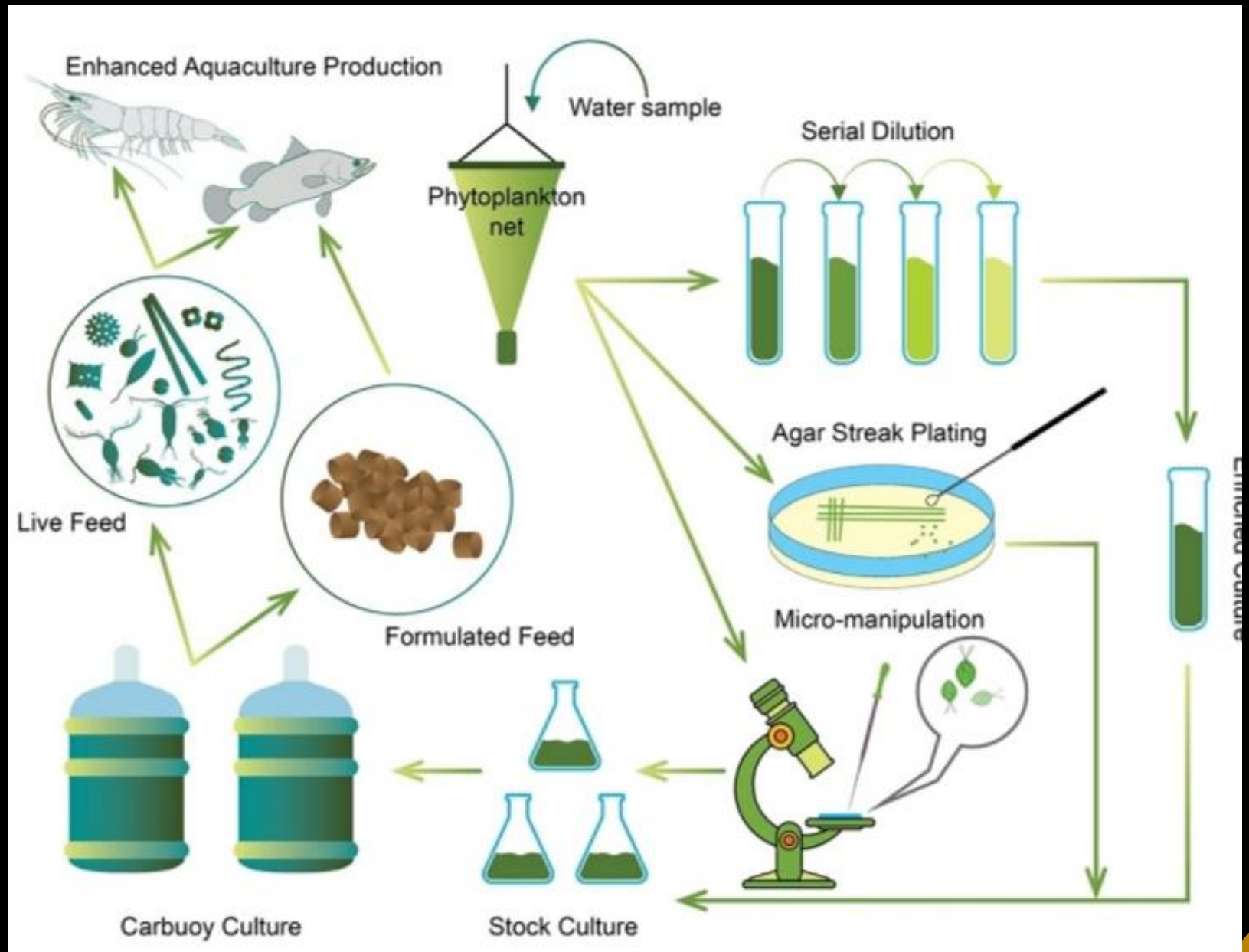
An overlapping epitheca (upper) and hypotheca (lower).

Provide structure and protection.

Key role in Photosynthesis .

Helps to Maintain the ecological position as highly productive organisms in the ocean.

Isolation of Diatom species:



Isolation of Diatom :

Isolation of species in the lab (AlgaGen Biosolutions) by micromanipulation & dilution plating ,followed by culturing in sterile medium to obtain pure culture.

Scaling up from flasks to 5 litre container.

Scaling up in 1000 litre plastic tanks in the Farm premises for starter culture.

Nutrients required for large-scale cultivation of diatoms:

In addition to nitrogen (N) and phosphorus (P) for growth Diatoms require silicon to build their frustules.

Sodium Silicate, Calcium silicate, or nanosilica are used for domination of diatom .

Role of Aerobic bacteria in a Diatom dominated aquaculture System:

Breakdown of excess Nitrogen and Phosphorus in the nutrients and organic matter .

Broken down nutrients are consumed by Diatoms.

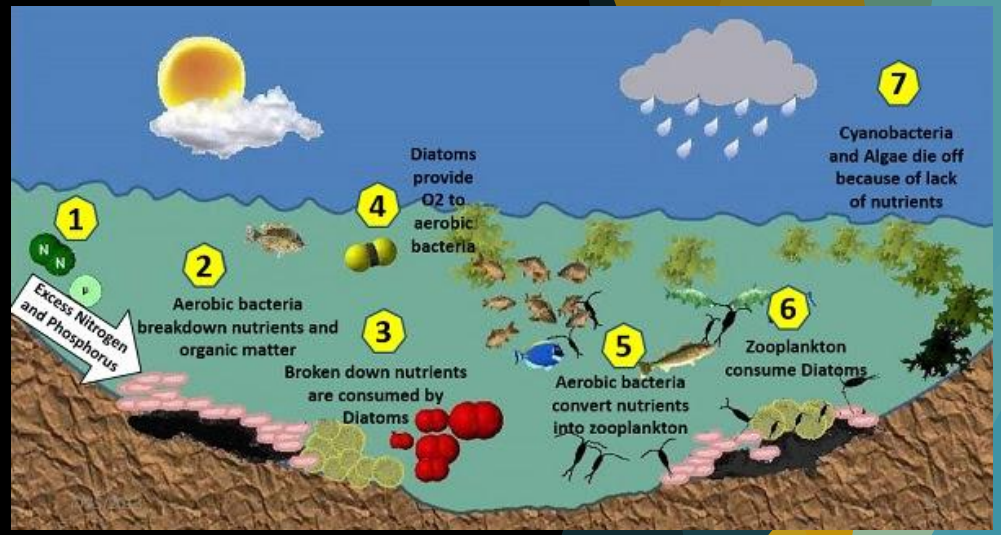
Cyanobacteria and Algae die off due to lack of nutrients thus making it a Diatom dominated aquaculture system.

Diatoms provide Oxygen to aerobic bacteria.

Aerobic bacteria convert nutrients into zooplankton.

Zooplanktons consume the Diatoms.

Zooplanktons are consumed by the Fishes/shrimps



STOCKING SHRIMP JUVENILES IN THE CULTURE POND:

Nursery reared Shrimp juveniles acclimated with the Pond water and stocked.

AERATION:

During day hours the photosynthetic Oxygen from diatoms could maintain DO2 to the optimum level.

Hence aerators were operated only during night hours.

Removal of filth from the water surface & solid waste and exuviae from the toilet area are carried out during early morning hours after switching off the aerators.

Shrimp Feed :

Crumple & pellet feeds starting from size 0.5 mm to 4 mm with 35 to 45 % protein content .

Since the Pond water is dominated with nutrient enriched diatoms , feeding is calculated based on check tray observations.

Application of Probiotics consisting nitrifying & Sulphur reducing bacteria are introduced based on water parameters .

Monitoring

Health and Growth of the animals are monitored by Check tray observation / Cast net operation.

Check tray video

HARVEST:

Partial Harvest: 2000 kgs After 45 days 7 gms size.
Partial Harvest: 1000 kgs After 65 days 12 gms size
Final Harvest:1186 kgs After 90 days 27 gms size

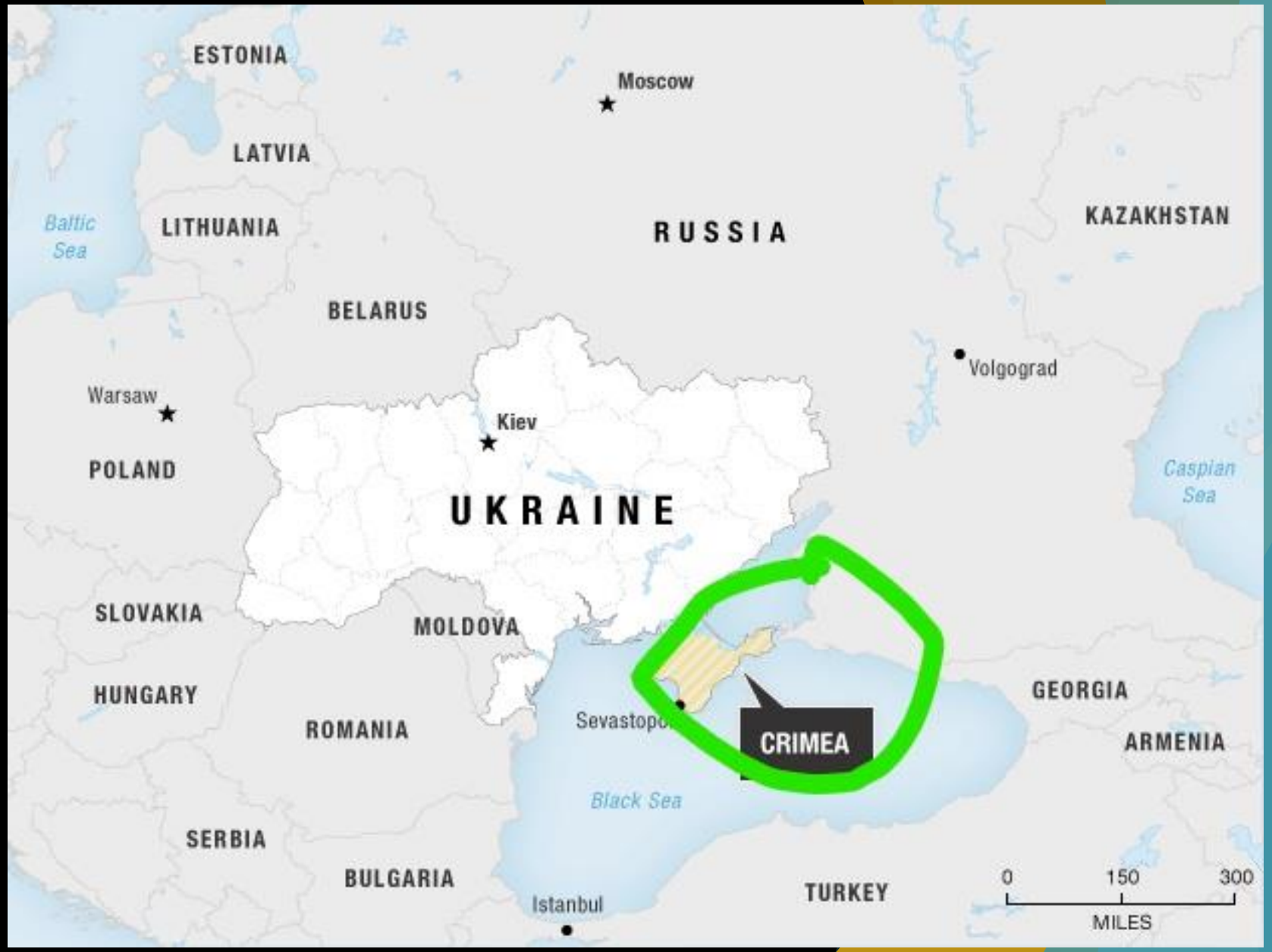
Total quantity: 4.19 MT from 1000 M3 (4.19 kg per M3).
Feed consumed: 5.07 MT
FCR : 1.21 : 1.
Total Realisation : Rs 1,600,000/=
Profit : Rs 400,000/=

Video of Harvest from Abhilash farm

DIATOM ASSISTED SHRIMP AQUACULTURE : POTENTIAL FOR APPLICATION OF THIS TECHNOLOGY IN RUSSIA

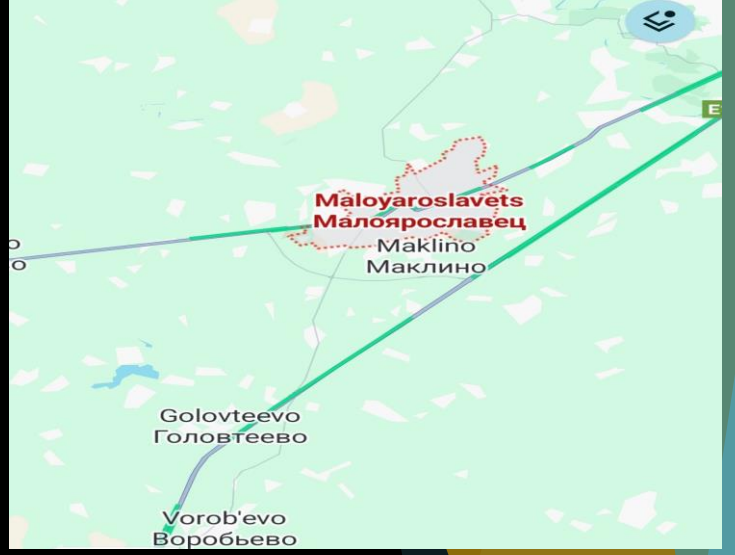
Primorye Province is a temperate region bordering the Sea of Japan & China ,centred on marine farming of high-value shellfish and seaweed.

It is learned that In 2015 a Company by name Crym - Agro started an indoor RAS Shrimp Project in Razdolnensky District in Crimea bordering the Black Sea .
They also started a Shrimp hatchery in 2020.

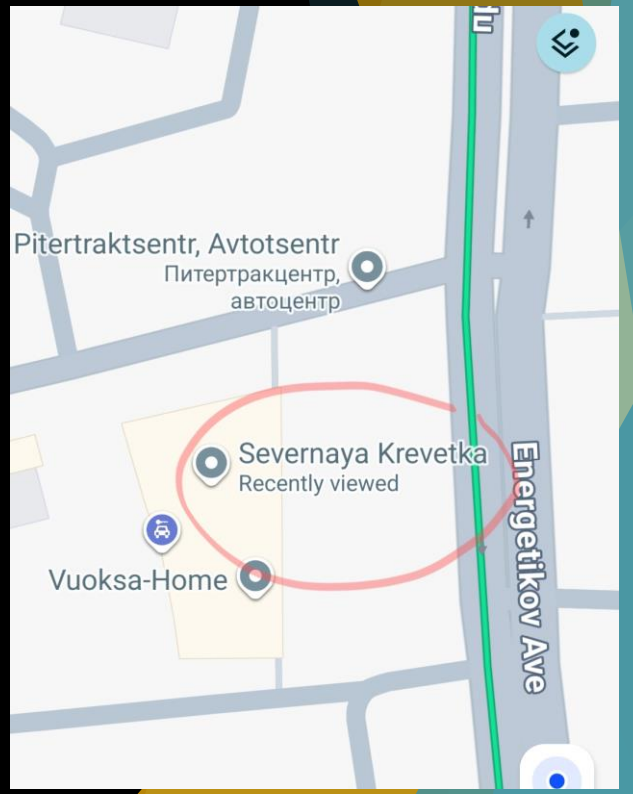


Brackishwater Aquaculture is also being taken up in the Rostov & Astrakhan region in the Southern Federal District .

Russkaya Krevetka is a company in Russia that runs an innovative indoor, biofloc shrimp farm for producing Pacific white leg shrimp.
The company operates in the Kaluga region, uses high-tech systems, and it is learned that they have plans to scale up production significantly.



Severnaya Krevetka is a Russian shrimp farm in the Leningrad Region, established in 2018 to operate using a recirculating aquaculture system. The company was founded as one of Russia's first domestic shrimp producers.



Diatom Assisted shrimp farming is a technology that can be looked into by these companies.

Diatom assisted aquaculture in open farms needs at least subtropical climate.

Possibilities of taking it up in closed climate controlled polyhouse structure, typically covered in a special polythene sheet allowing sunlight can be explored on a pilot scale basis.

Krasnodar Krai & Sochi city bordering the Sochi River connected to the Black Sea is a Sub tropical region .

The climatic conditions of Sochi from May to September are found to be suitable for Diatom assisted shrimp farming.

However it is learned that Hydrogen Sulphide content is often noticed in the water flowing from upstream .

Detoxification of H2S by application of Probiotics with Sulphur reducing bacteria in the reservoir tank is an option that can be tried for Diatom assisted Vannamei aquaculture.

INDOOR DIATOM CULTURE.

This is an indoor diatom culture unit in Saudi Arabia.
Vertically-placed, submerged, fluorescent 40-watt light tubes, fixed in situ with 92 percent transparent acrylic cylinders are placed within the Chaetoceros culture tank to ensure a photosynthetically active radiation of 300 to 500 lux within the culture water.
This is another option which can be tried for Diatom assisted Shrimp farming projects in Russia.

Diatom-assisted aquaculture is a promising and innovative method gaining traction for its potential, largely due to its capacity for lower operational expenses and reduced power use.

This system, utilizes the natural abilities of diatoms to improve water quality and serve as a natural food source for farmed aquatic life and promote a healthy and self-sustaining pond ecosystem.

THANK YOU

M SHAJI 0091 9447684872

shajeeka@gmail.com.