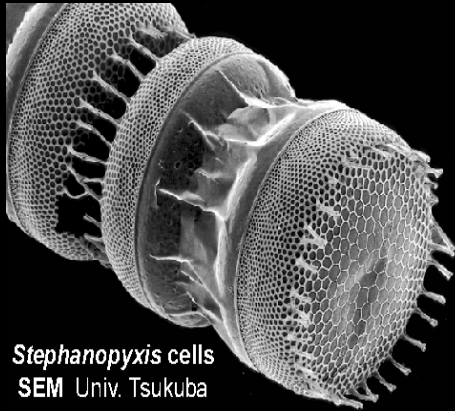
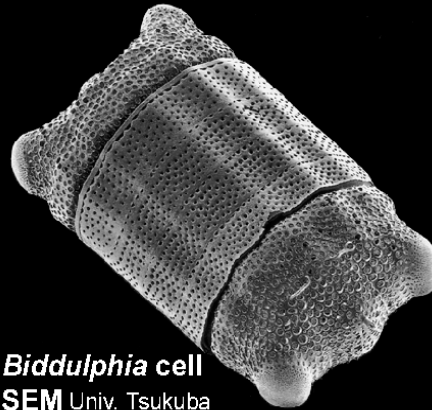
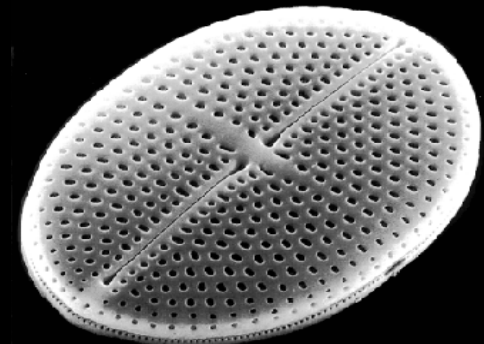




Stephanopyxis cells
SEM Univ. Tsukuba



Biddulphia cell
SEM Univ. Tsukuba



Mastogloia cell
SEM Univ. Tsukuba

Phyco-remediation of polluted water-bodies using Diatom algae

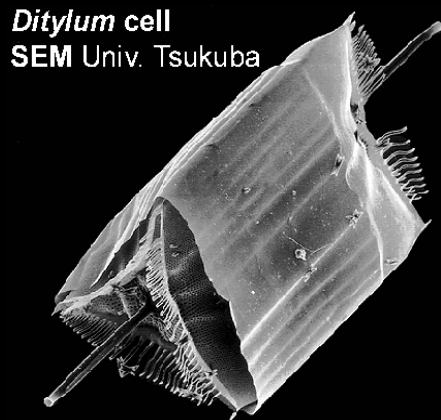
By

THOMAS KIRAN .M

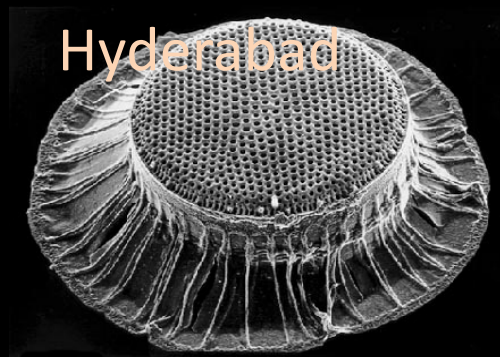
Chief Technology Officer

Kadambari Consultants Pvt. Ltd

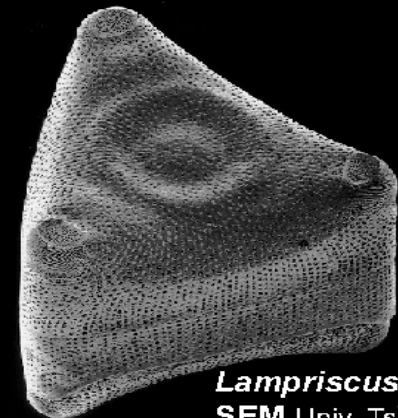
Hyderabad



Ditylum cell
SEM Univ. Tsukuba



Planktoniella sol SEM
Univ. Tsukuba



Lampriscus cell
SEM Univ. Tsukuba

Phycoremediation is defined as the use of algae to remove pollutants from the environment or to render them harmless. phycoremediation in a much broader sense as the use of macroalgae or microalgae for the removal or biotransformation of pollutants, including nutrients and xenobiotics from wastewater and CO₂ from air.

Phycoremediation comprises of several applications:

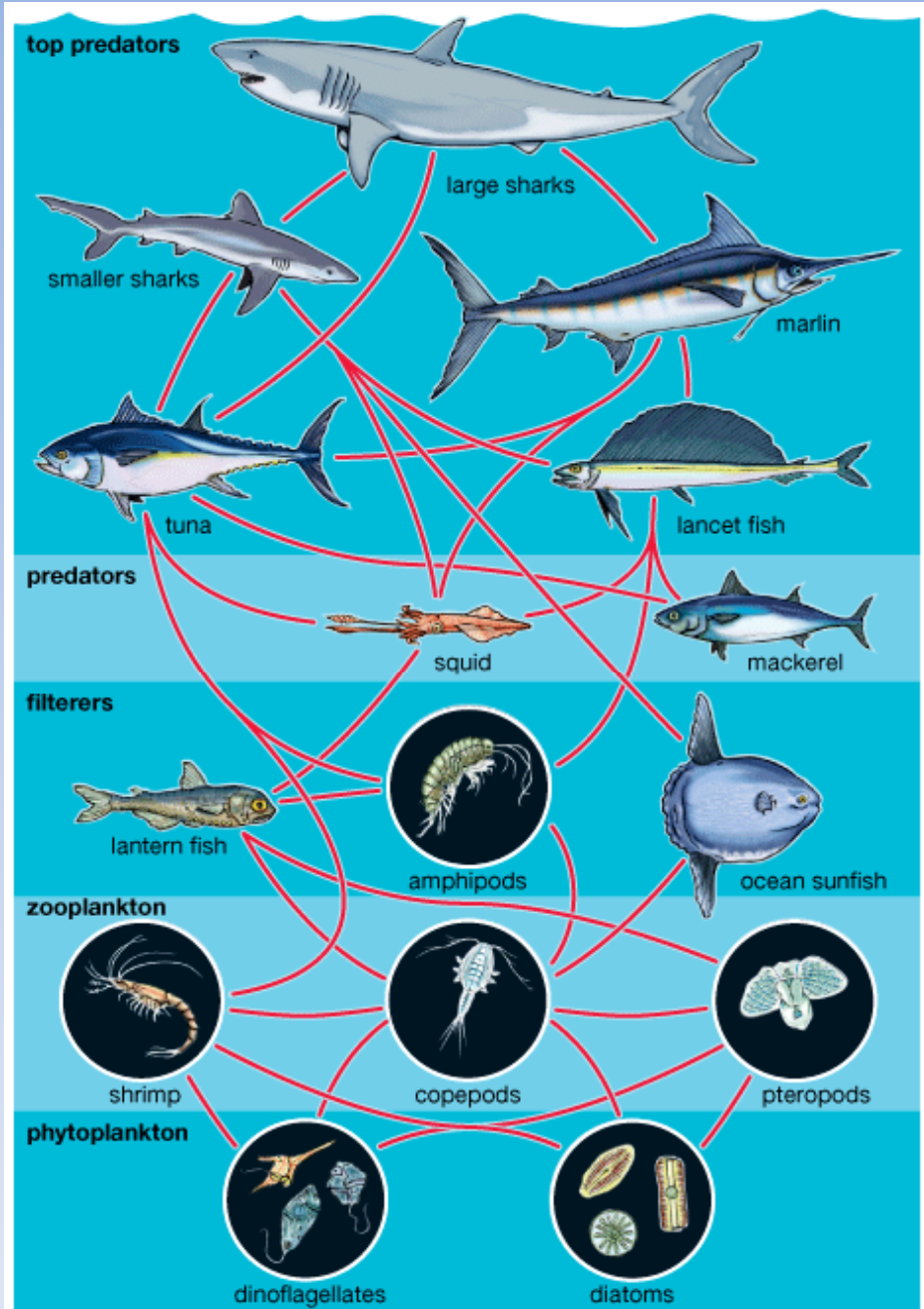
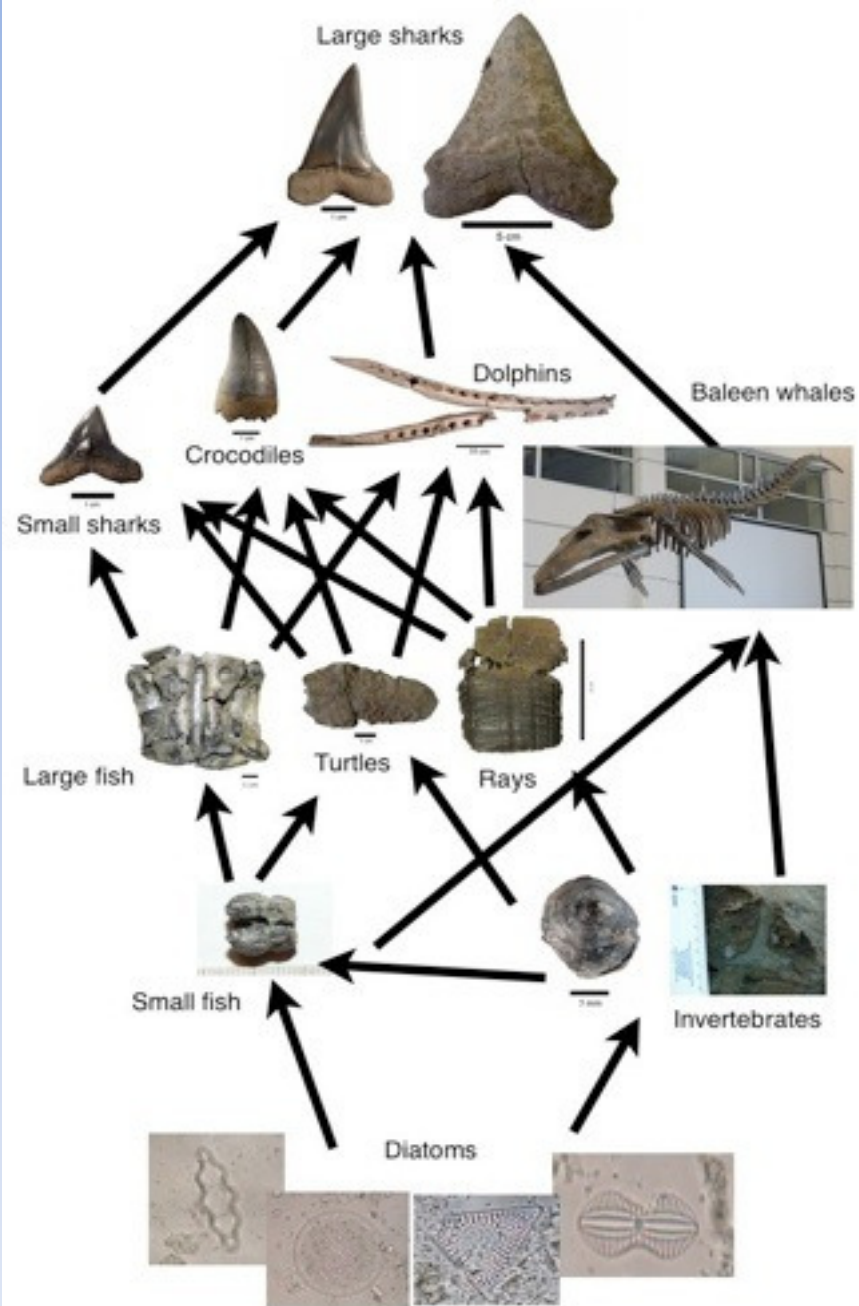
- ☐ **oxygenation of the atmosphere,**
- ☐ **nutrient removal from municipal wastewaters and effluents rich in organic matter,**
- ☐ **nutrient and xenobiotic compounds removal by biosorption using algae,**
- ☐ **treatment of acidic and metal wastewaters,**
- ☐ **CO₂ sequestration,**
- ☐ **transformation and degradation of xenobiotics,**
- ☐ **biosensing of toxic compounds by algae.**

The factors which influence the efficiency of phycoremediation are

- ❖ Growth rate of algae in polluted water**
- ❖ Metal concentration factor attained by algae**
- ❖ Concentration of heavy metals and other pollutants in the medium,**
- ❖ Desired percentage of pollutant removal from the medium,**
- ❖ Metal or pollutant recovery in relation to capital and operation costs.**

Redfield ratio or Redfield stoichiometry is the molecular ratio of carbon, nitrogen and phosphorus in plankton. The stoichiometric ratio is $C:N:P = 106:16:1$. The term is named after the American oceanographer Alfred C. Redfield

- ❑ This ratio has become a fundamental feature in the understanding of the biogeochemical cycles of the oceans**
- ❑ Redfield ratio is instrumental in estimating carbon and nutrient fluxes in global circulation models.**
- ❑ Also help in determining which nutrients are limiting in a localized system, if there is a limiting nutrient.**
- ❑ The ratio can also be used to understand the formation of phytoplankton blooms and subsequently hypoxia by use of comparison of the ratio between different regions.**

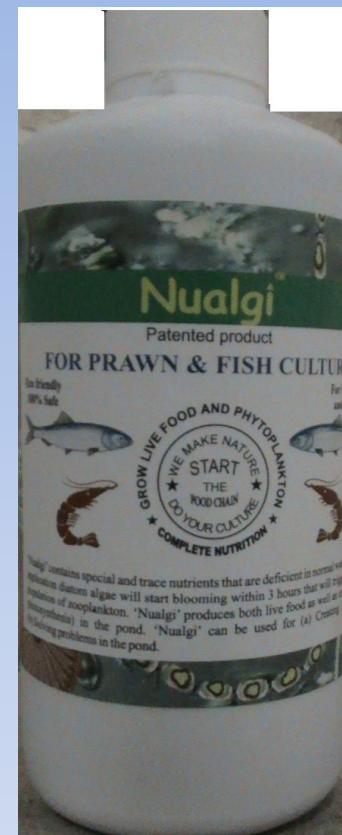


Why diatoms ????

- Diatoms are abundant unicellular algae in aquatic habitats.
- Diatoms are exceedingly robust and can inhabit virtually all photic zones from the equator to seemingly inhospitable sea ice where they are highly useful indicators of environmental conditions
- They can produce enormous amounts of biomass and are thought to be responsible for about 20% to 25% of global carbon fixation.
- As much as 16 gigatons of the organic carbon produced by marine phytoplankton per year, or about one third of total ocean production is thought to sink into the ocean interior preventing re-entrance of this carbon into the atmosphere for centuries
- A significant fraction of the organic carbon generated by diatoms remains in the upper ocean and supports production by higher trophic levels and bacteria.

Why Nualgi ?

- ☐ A composition *comprising* micro nutrients adsorbed on metalate modified silica sol
- ☐ The material dispersed in water looks like a solution but has very fine particles of the size estimated to be 5 to 20 nanometers.
- ☐ Nualgi contains P, Ca, Mg, Fe, Mn, Zn, Cu, B, S, Co, Mo, Si etc in a balanced form
- ☐ It contains all the micro nutrients required for diatom growth in nano form.
- ☐ It is consumed by Diatoms and there is no residue.
- ☐ It is harmless to fish and other organisms in the lakes.



Nualgi 500 ml bottle

Indian Patent
PCT NO: **PCT/IN05/00195**

Inventor:

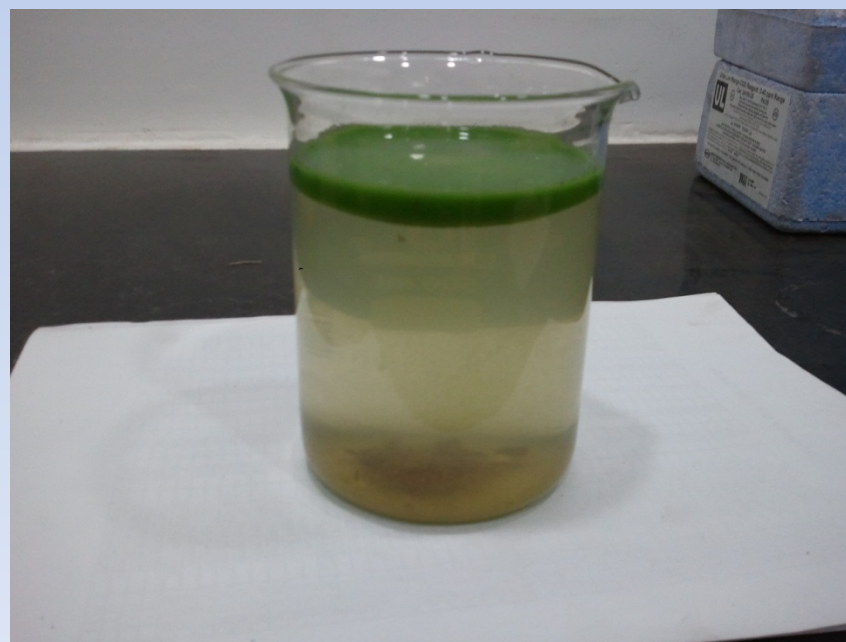
- **Nualgi invented by Mr.T.Sampath kumar of Bangalore,**
- **He worked with his own funds from 1994 to 2004 to develop Nualgi**
- **Since 2005 it is being marketed to aquaculture forms and fishermen fishing in polluted urban lakes**
- **It is patented in India, USA, Europe etc.**

Nualgi

Case study
Bioremediation of Eutrophicated
pond in Jindal Steel plant,
Bellary,
Karnataka.



water before addition of Nualgi (DO 2.16)



water 2h after addition of Nualgi (DO 4.67)

Shrimp pond May 2010

– before and after use of Nualgi





Accelerating Nature's Way™

Lake Savers, LLC

800.840.8744

www.lake-savers.com

Project:

Duck Pond, Croton On Hudson New York

**Preliminary Assessment of Impact of Nualgi Aqua
on a Hyper-Eutrophic Pond**

Nualgi

Duck Pond is a three acre urban pond in Croton On Hudson, New York. Lake Savers was contracted to restore the pond in August of 2011.

- Water Clarity of less than 1 foot**
- Septic odors**
- Complete coating of duck weed and water meal on the surface**
- Dense beds of coontail throughout the lake**
- Filamentous algae growth on the bottom and on the surface**
- Abundant planktonic algae in the water column**

Lake Savers has had significant successes in lake and pond restoration projects utilizing a combination of Laminar Flow Oxygenation Systems and the addition of Beneficial Bacteria and Enzyme formulations

Nualgi

Sample Date	TP (mg/L)	Ortho-P (mg/L)	Nitrite (ppm)	Nitrate (ppm)	NH3 (mg/L)	% Organic Matter
7/15/2011	0.16	0.06	0.3	1.7	< 0.1	36.11
4/5/2012	0.08	0.04	< 0.1	1.2	< 0.1	28.1
5/24/2012	0.05	0.02	< 0.1	< 0.5	< 0.1	
6/20/2012	0.06	0.03	< 0.1	< 0.5	< 0.1	
7/24/2012	0.08	0.02	< 0.1	< 0.5	< 0.1	

- ❑ Total Phosphorus has dropped by 50%
- ❑ Ortho Phosphorus has dropped 66%
- ❑ Nitrate and Nitrite has dropped to non-detect through July 24, 2012
- ❑ % Organic Matter in Sediment has dropped 22% from July 2011 to April 2012. (We will sample again within the next 30 days)

	Surface	
Sample Date	4/5/2012	7/24/2012
Temp	12.86	27.52
DO (mg/L)	12.1	10.21
Conductivity (uS/cm)	891	827
pH	8.83	8
	Middle	
Sample Date	4/5/2012	7/24/2012
Temp	12.79	27.24
DO (mg/L)	13.94	9.9
Conductivity (uS/cm)	891	828
pH	8.9	7.62
	Bottom	
Sample Date	4/5/2012	7/24/2012
Temp	12.78	26.02
DO (mg/L)	13.66	6.86
Conductivity (uS/cm)	907	843
pH	8.54	6.65

□ Higher levels of DO at the benthos than we typically observe in hyper-eutrophic water bodies where we are utilizing Laminar Flow Oxygenation and Beneficial Bacteria/Enzymes alone.

□ Much higher levels of diatom growth and diversity than expected in an urban, hyper –eutrophic system

Nualgi

Duck Pond Croton on Hudson, NY Prior to Restoration Program Installation – July 2011



(Surface fountains are not part of our program)

Laminar Flow System and Duck Weed Harvesting Effort August 2011



Nualgi

Post Duckweed Harvest Date of Nualgi Application August 2011



Duck Pond July 2012



Nualgi

Conclusions:

- **Nualgi Aqua is the key driver in the sustained reduction/elimination of the duck weed problem in the pond.**
- **Nualgi Aqua is the key driver in the sustained reduction of coontail growth in the pond.**
- **Nualgi Aqua is the key driver in the dramatic reduction in Ortho P in the pond. (We have seen similar reductions in Total P in other projects, but Ortho P reductions are not nearly this dramatic)**
- **Nualgi Aqua has proven to be able to stimulate diatom growth in the pond with an increasing diversity over time.**
- **Nualgi Aqua has proven to deliver higher DO in the benthos than with aeration alone. We believe that this will accelerate reduction in organic sediments on the bottom through aerobic digestion.**

Nualgi





Emerging Nanotechnology Products

Nualgi for Environmental Remediation and Nano Agriculture

Can nanotechnology clean-up large polluted rivers of India? How can it boost agricultural productivity? What does nanotechnology have to do with prevention of mosquitoes from breeding in polluted water bodies and absorption of excess carbon dioxide in oceans?

Nualgi Nanobiotech

photosynthesis. A distinct kind of algae, produces more than 50% oxygen, thereby, increasing the oxygen content of the water. This water is used to grow and decompose the pollutants in the water. These grass-like microalgae are consumed by zoo planktons which are then consumed by small fishes which, in turn, are consumed by the big fishes. These diatoms in polluted water bodies not only

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Culture medium optimization and lipid profiling of *Cylindrotheca*, a lipid- and polyunsaturated fatty acid-rich pennate diatom and potential source of eicosapentaenoic acid

Keerthi Suman^{1,a}, **Thomas Kiran**^{1,a},
Uma Koduru Devi^{1,*} and Nittala S. Sarma²

respectively. NH_4Cl , phosphate, and Nualgi micronutrient ready-mix in concentrations optimal for each strain contribute to a good culture medium for *Cylindrotheca*.

Nualgi

THANK
YOU

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nualg@gmail.com