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2015 AQ Summit: Research Update by Nichole Price

Nichole N. Price

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Sharing Culture: What can Bigelow Laboratory for Ocean Sciences do for you?

Nichole N. Price

Senior Research Scientist
Ocean Health and Ecosystem Function



Collaborators:

Bigelow Services - Steve Archer, Director of Bigelow Analytical Services
Tim Pinkham, Seawater Facilities Technician
Mike Lomas, Director of Bigelow National Center for
Marine Algae and Microbiota
Nicole Poulton, Director of the Facility for Aquatic
Cytometry



Bigelow Laboratory for Ocean Sciences
Ocean Life, Planet Health



Outline:

4 Bigelow Laboratory Core Facilities:

National Center for Marine Algae and Microbiota (NCMA)

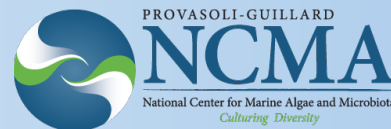
Bigelow Analytical Services (BAS)

Bigelow Seawater Facility

Facility for Aquatic Cytometry



Bigelow Laboratory for Ocean Sciences
Ocean Life, Planet Health



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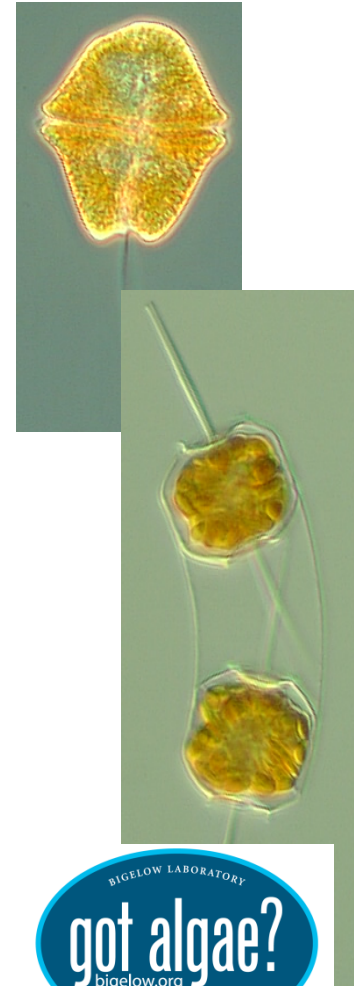
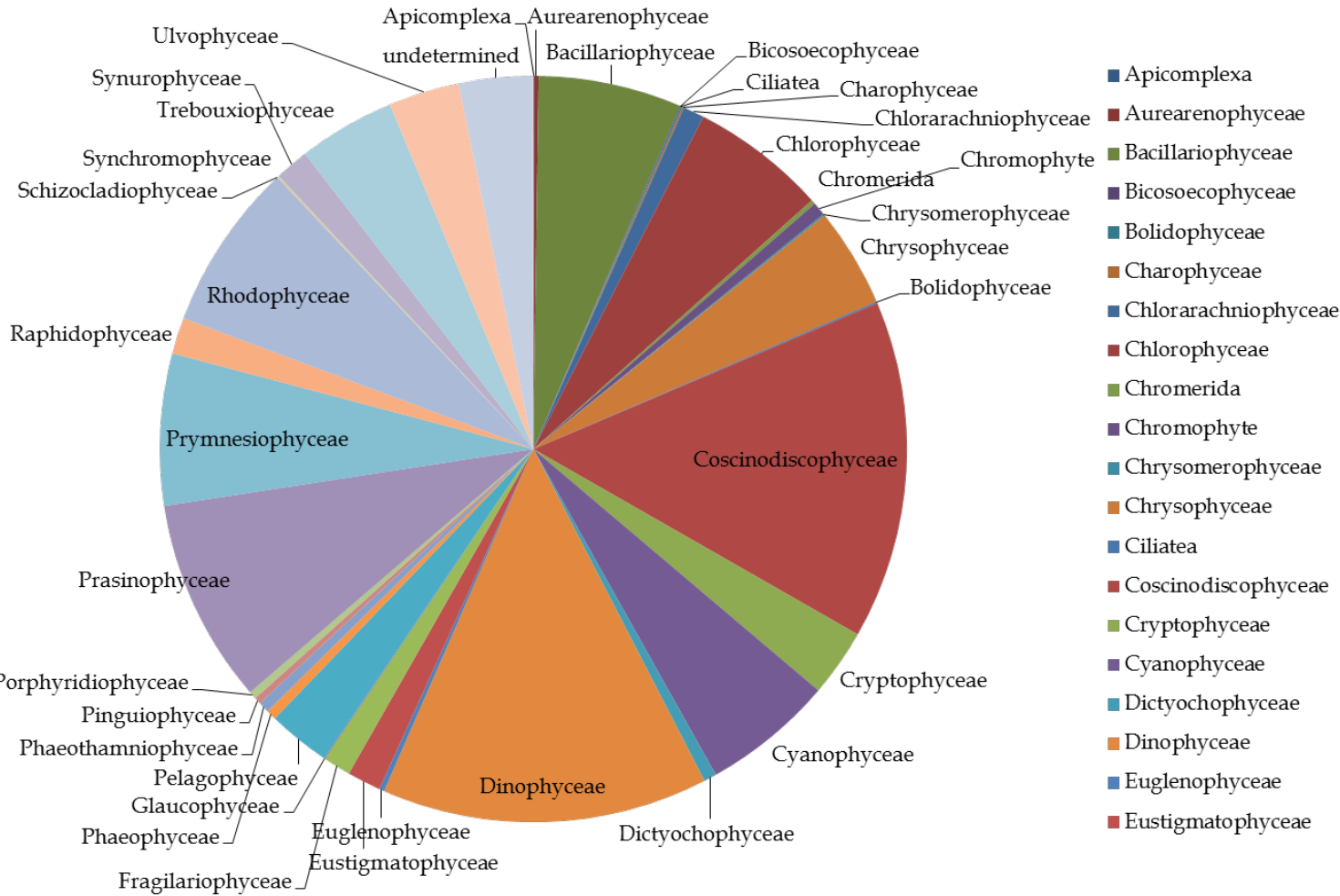
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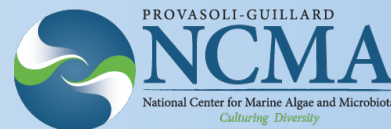
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NCMA: the largest and most diverse collection of microalgae in the world.



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~3000 Microalgal strains from every ocean.

Enter Location to narrow down your search: Radius: 200 mi

Filter Map by Tag: [Show all](#) | [Algae](#) [Cyanophyceae](#) [Prasinophyceae](#) [Trebouxiophyceae](#) [Fragilariophyceae](#) [Coscinodiscophyceae](#) [Bacteria](#) [Reset locations](#)

	CCMP100 - Achnanthes brevipes Falmouth Great Pond; Falmouth; Massachusetts USA
	CCMP1000 - Thalassiosira oceanica continental slope
	CCMP1001 - Thalassiosira oceanica continental slope
	CCMP1002 - Thalassiosira oceanica continental slope
	CCMP1003 - Thalassiosira oceanica Sargasso Sea
	CCMP1004 - Thalassiosira oceanica Gulf Stream Warm Core Ring 81D
	CCMP1005 - Thalassiosira oceanica Sargasso Sea
	CCMP1006 - Thalassiosira

Maintained by 3 curators, Julie Sexton, Tracey Riggins, Jeff Brown, who have >50 yrs experience culturing algae collectively.



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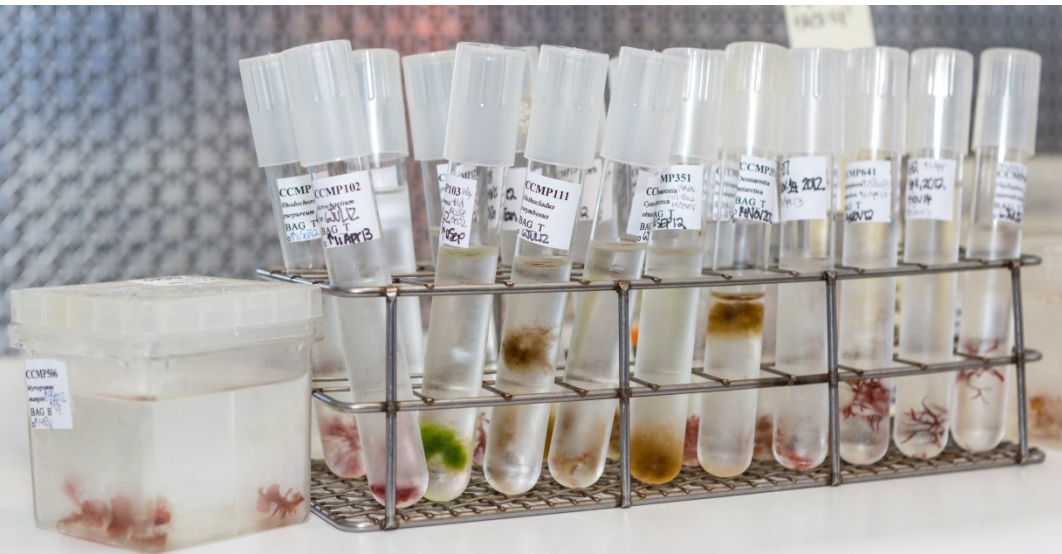
NCMA also has 159 macroalgal strains

5 classes:

- Bangiophyceae
- Florideophyceae
- Rhodophyceae
- Ulvophyceae
- Phaeophyceae

>30 genera:

- Palmaria decipiens*
- Porphyra plocamiestrus*
- Saccharina latissima*
- Laminaria digitata*



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Products and Services

- Strains provided as s
- Clean seawater and a
- Culturing Techniques optimization
- New isolations/strain clean up/taxonomic ID
- **Cryopreservation and perpetual culture maintenance**
- Private collections and International Depository Authority (patent depository)
- **Research services (e.g., Nucleic acids from algae, mass culture, macroalgal culture, growth/compound optimization, nutritional analyses)**

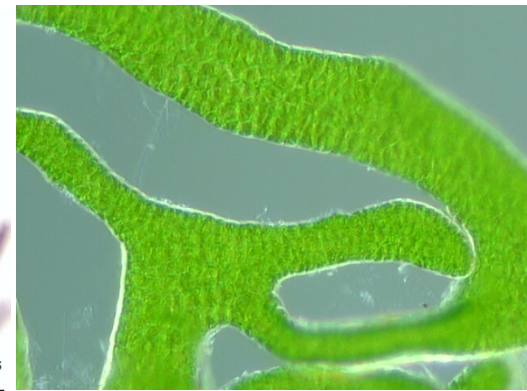
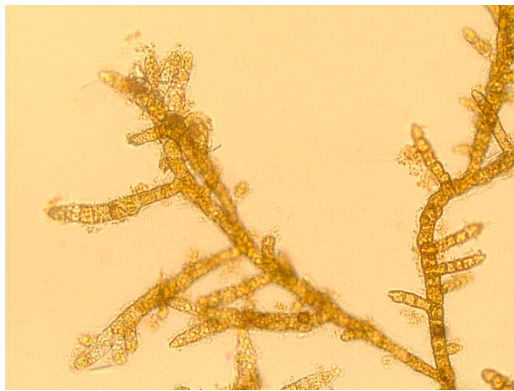
REGISTRATION NOW OPEN !!!

<https://ncma.bigelow.org/training-courses>

2015 Algal Culturing Techniques Course

Offered May 31-June 5

Bigelow Laboratory Research and Education campus



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PROVASOLI-GUILLARD
NCMA
National Center for Marine Algae and Microbiota
Culturing Diversity



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Bigelow Analytical Services

- Fee-for-service analytical facility
- Serving research, industry and State
- Open to new ideas and challenges



Analytical capabilities:

Elementary

- Colorimetric analysis
- UV/Vis spectrometry and fluorometry
- Elemental analyzer

Compound composition

- Liquid chromatography (HPLC)
- Gas chromatograph - mass spectrometry
- Liquid- chromatography - mass spectrometry

Production Rates

- Radioisotope approaches
- Stable isotope approaches (compounds and bulk isotope ratios)



Example: Biotoxin Testing

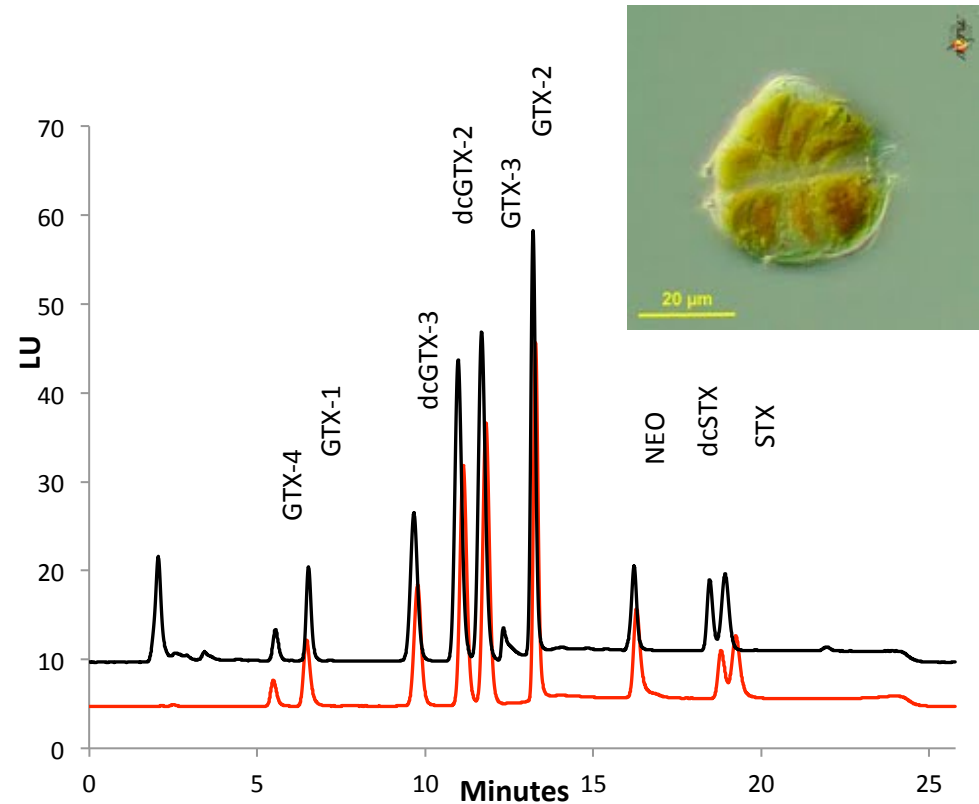
Microalgal toxins:
Paralytic and Amnesic Shellfish
Toxins (PSPs and ASPs)

Approach:

- HPLC-PCOX method
- Maine 1st in US to adopt chemical analysis

Conducting PSP and ASP analysis for MEDMR shellfish monitoring program (2013-2014 season).

Funding: Sewall and Ingalls Foundations



Comparison of primary standards and mussel matrix-matched standards of saxitoxins, gonyautoxins and neosaxitoxins.



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Example: Nutritional analyses

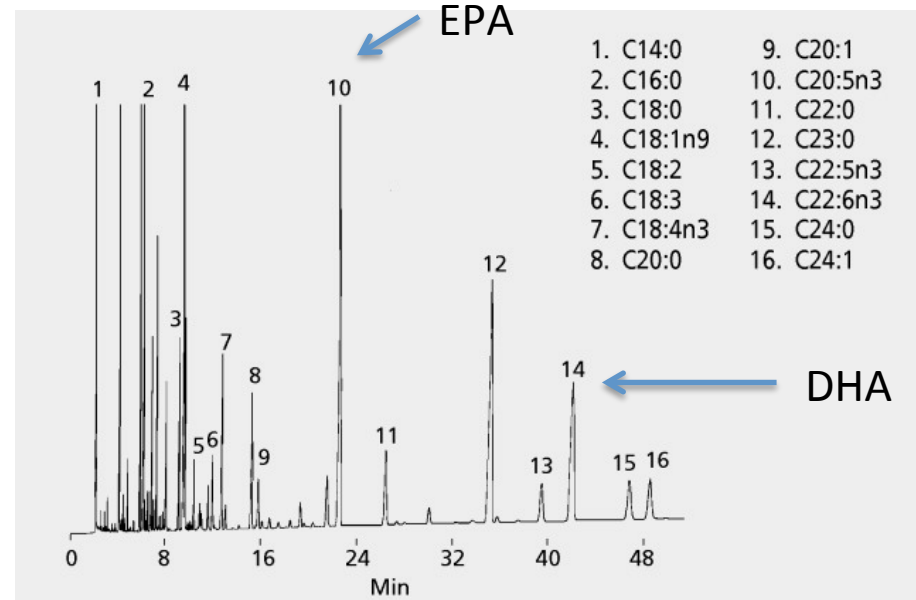
e.g. Ω -3 and Ω -6 PUFAs

key components for:

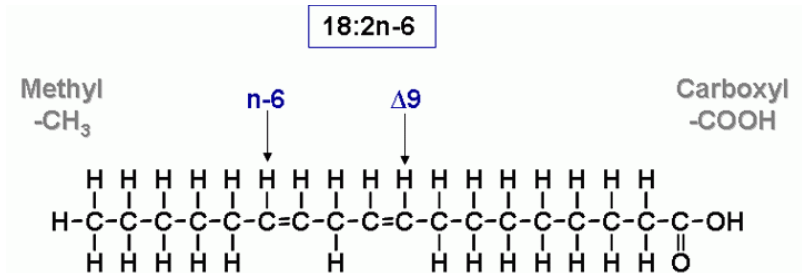
- Growth/development
- health
- taste

- elemental analysis
- antioxidants
- vitamins
- pigments
- toxins

Current project: Gordon and Betty Moore Foundation



Polyunsaturated Fatty Acids (PUFAs)



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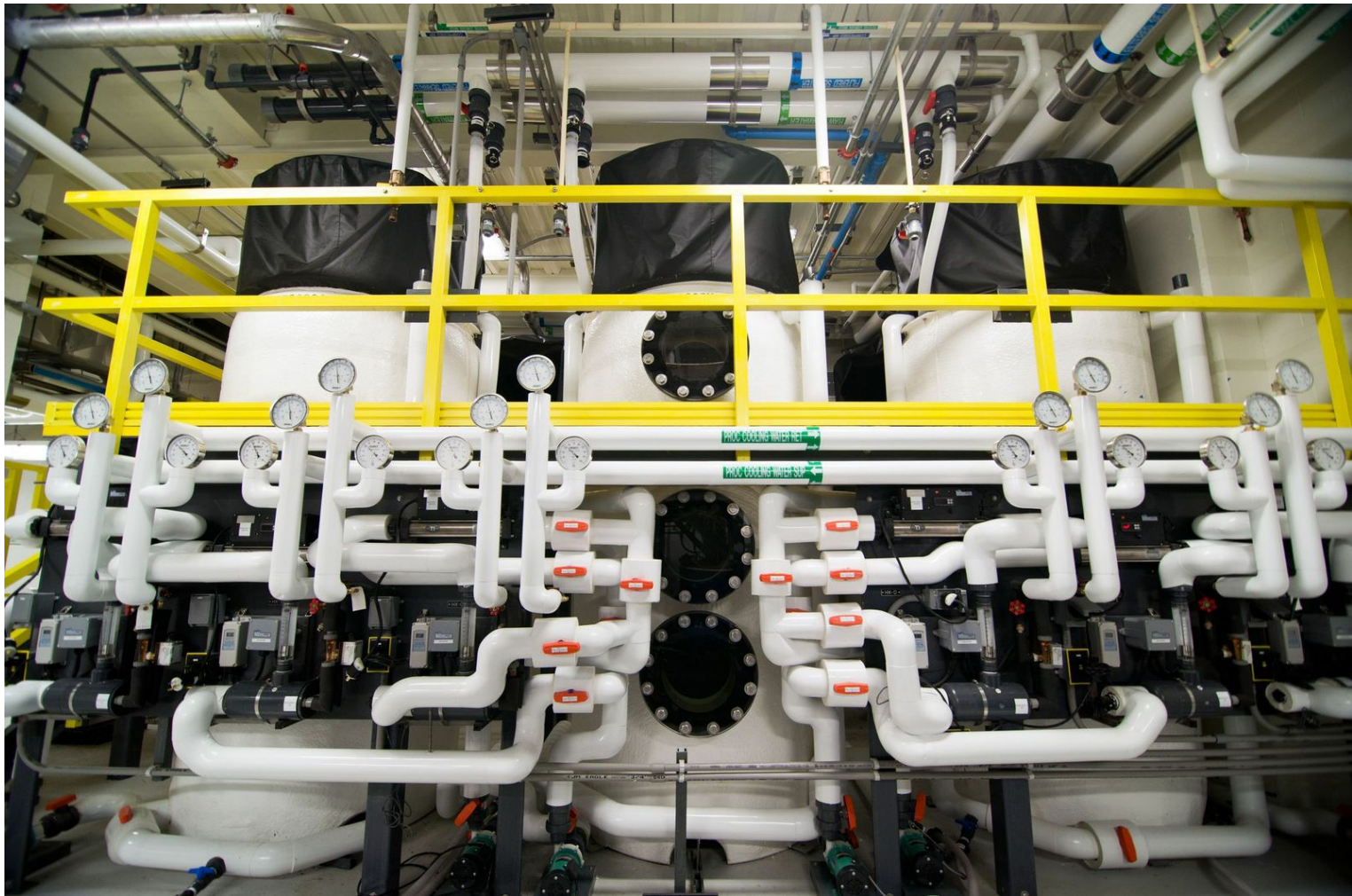
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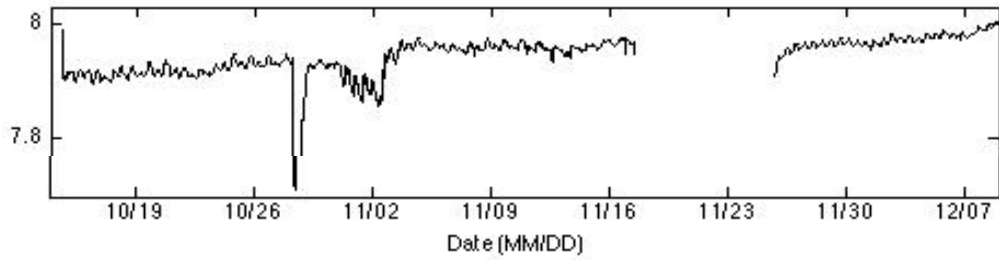
Seawater system Description:

- Located on the Damariscotta River Estuary, Shore facility and floating dock w/ overboard pumps
- Raw and Filtered Seawater Available
 - Pasteurized upon request
- Partially powered by 20 kW solar system
- Able to test Artic to Equatorial Species (can control light and temperature)
- Systems can be set as flow-through or batch mode



Seawater system capabilities:

Type	Capacity (L)	Low Temp C°	High Temp C°	Temp Variation C°	# of Units
Mesocosm	2460	4	37	1.5	6
Water Table	300	7.5	30	1.5	3
Kalwall tubes	94.5	7	25	1	8
Bag Vessels	400	7	25	1	6



- High frequency monitoring of seawater pH, dissolved oxygen, and temperature
- Experimental manipulation of temperature, light, and pH (pCO₂)



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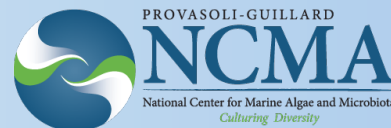
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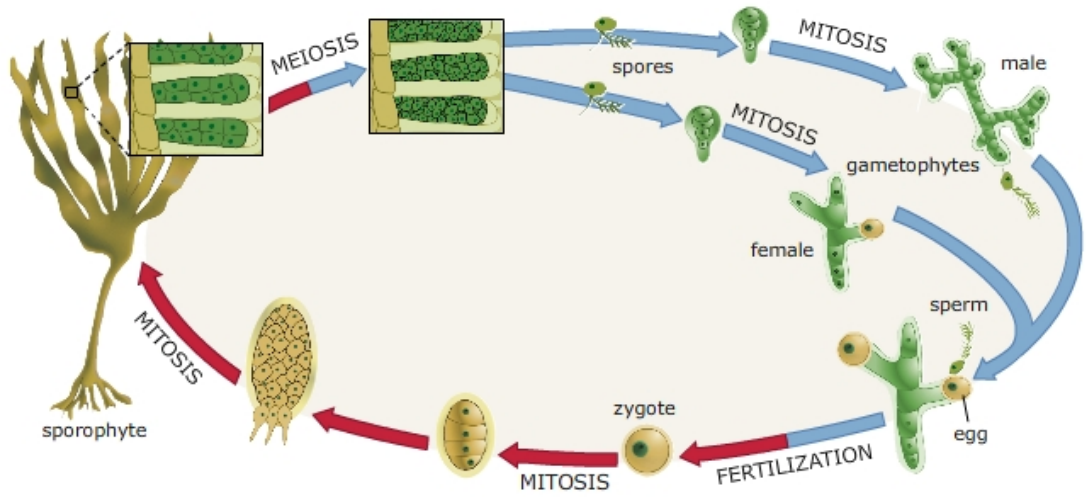


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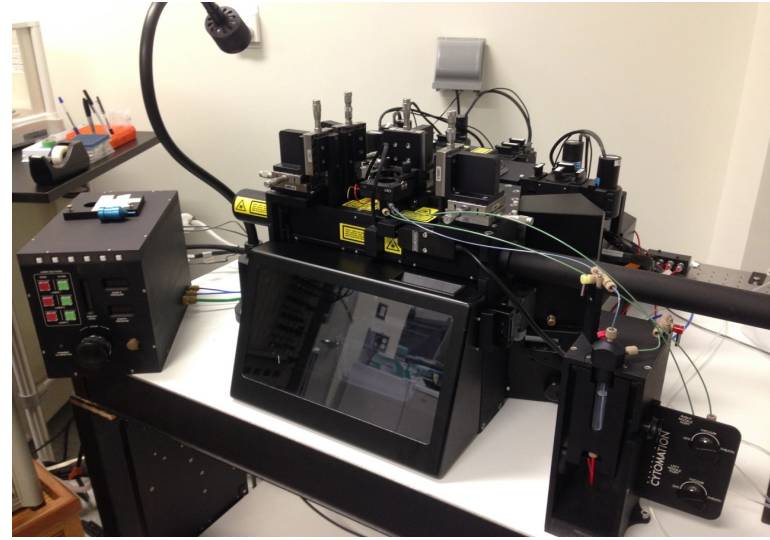


J.J. MacIsaac Facility for Aquatic Cytometry

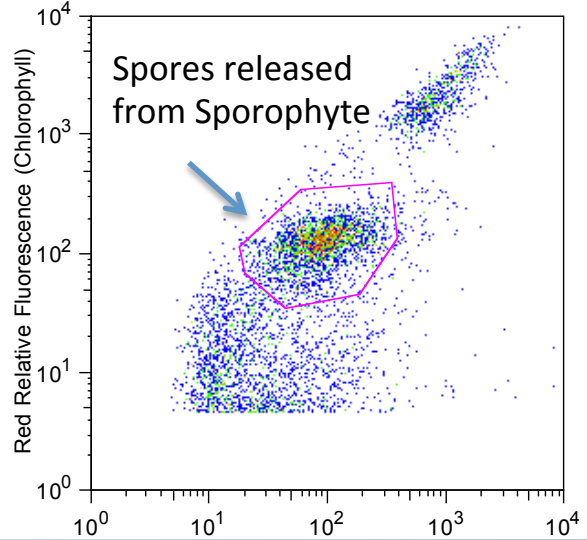
Saccharina Life Cycle



Adapted from *Biological Science* by Freeman © 2008 Pearson Education, Inc.



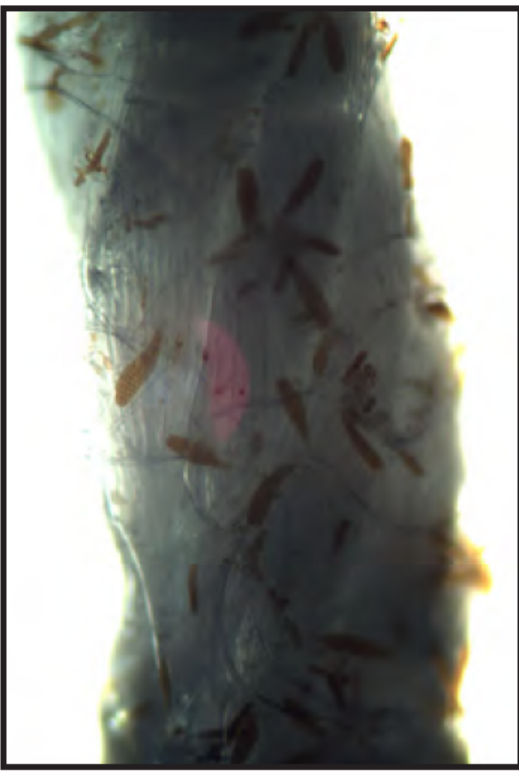
Sorting spores prior to the formation of gametophytes



Flow Cytometry and Macro-algal culture



Figure 2.13 Sample twine viewed under the microscope used to monitor growth of sporophytes



Ocean Approved Kelp Manual

- Spore sorting and gametophyte cloning
- Cryopreservation of favored strains
- Seeding lines for aquaculture
- Sporophyte grow-out in optimal conditions





Michael W. Lomas

Director

Provasoli-Guillard National Center for Marine
Algae and Microbiota (NCMA)



Steve Archer

Director

Bigelow Analytical Services



Meredith White
Postdoctoral Researcher

'The biological responses of multiple Northeast taxa to ocean acidification'
3:30 Friday, 'Ocean Acidification II' Session in the New Hampshire Rm

Visit the Bigelow
Booth in the Casco
Bay Exhibit Hall!



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Thank you for your attention.

<https://ncma.bigelow.org>

<https://www.bigelow.org/bas>

<https://www.bigelow.org/seawater>

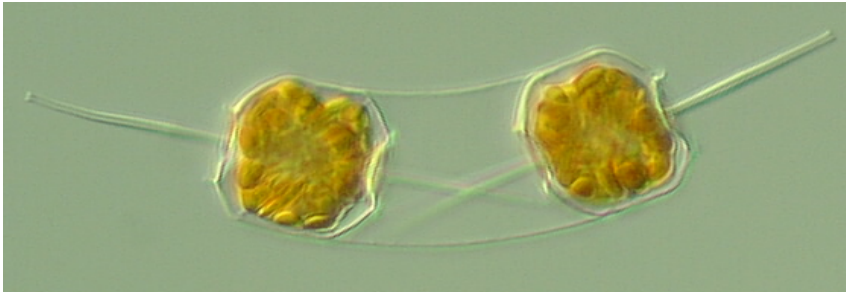
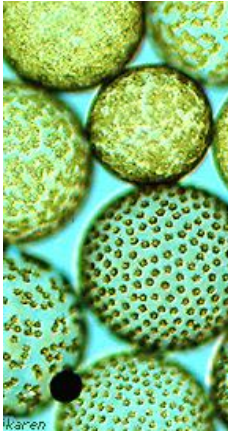
<https://www.bigelow.org/flow-cytometry>



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Proposal for a Maine Algal Cluster (MAC) Initiative



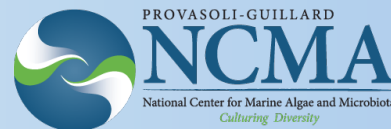
VISION

To create an operational environment through academic, private and educational collaboration that encourages innovation and fosters the vibrant growth of a sustainable, ecologically sound, and profitable macroalgae and microalgae industry sector in Maine.

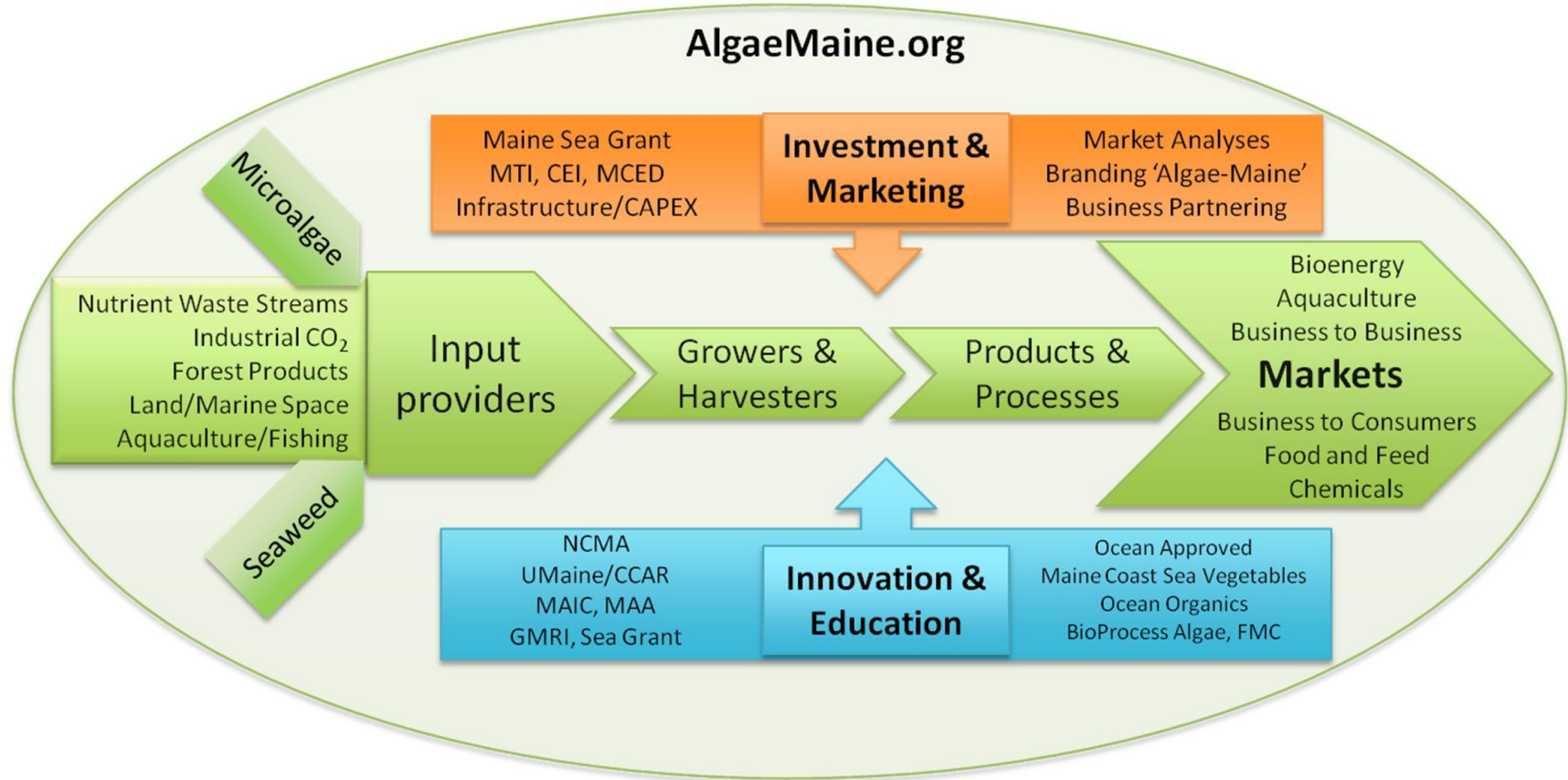
Credit: Maine Algal Cluster Initiative proposal



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What are the perceived bottlenecks for a more vibrant Maine algae industry?



Credit: Maine Algal Cluster Initiative Steering Committee



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What are the objectives of the Maine Algal Cluster Initiative?

- 1) Solve the discontinuities of a combined macro and micro Algal Cluster
- 2) Determine, and implement, the Cluster organization, governance, and administration
- 3) Identify further R & D needs that tighten the efficiencies of producers/businesses, create new products and processes
- 4) Identify profitable markets
- 5) Plan for production scaled to market demand
- 6) Structure investment to fuel expansion
- 7) Select and promote education and outreach methods in support of commercial production

