Water Monitoring FlowCam® Applications

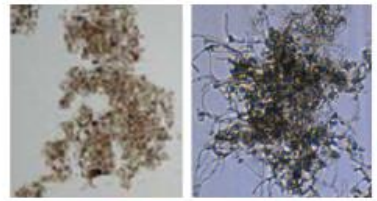
FlowCam
Particle Analysis with Vision
FLUID IMAGING TECHNOLOGIES, INC

- Aquatic Research for Aquatic Microorganisms
  - Discreet or Continuous Sampling –
  - In Lab, At Sea
- HAB Monitoring
  - Classification and Quantification
- Algae Cultures and Algal Research
  - Algae-to-BioFuels, Nutraceuticals, etc.
- Water Treatment (Drinking)
  - Taste and Odor Algae and Cyanobacteria Monitoring; Particle Removal Analysis
- Paleolimnology
- Waste Water Analysis
  - Monitor Microbial Activity and Total Suspended Solids
  - Methane Production
- Ballast Water Testing and Research
  - Viability Analysis – FDA, Neutral Red, etc.
- Microplastics
  - Presence and Identification
- Training and Education

FlowCAM® Applications in Water Treatment

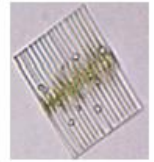
Floc Formation as seen by FlowCAM®


Poor Floc Formation


Good Floc SIze and Density

Filter Fouling Algae as seen by FlowCAM


Asterionella


Fragilaria


Didymosphenia geminata


Tabellaria

Filtration

Monitoring of individual filter efficiencies; filter surveillance and early warning of pathogen breakthrough.

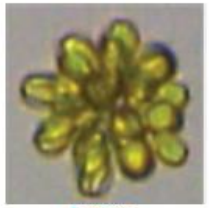
Coagulation/Flocculation

Monitoring the coagulation & flocculation process for removal of TSS and proper formation of Floc.

Water Source

Monitoring of rivers & lakes used for drinking water and water treatment in general.

Nuisance Algae as seen by FlowCAM


Synura

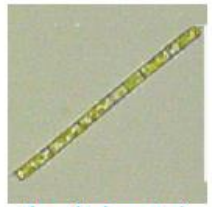

Anabaena


Pediastrum

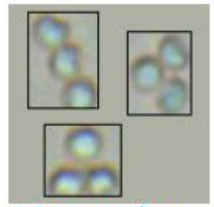

Ceratium

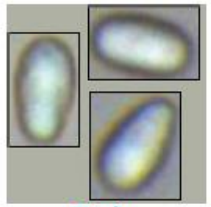

Aulacoseira

Microscopic Organisms as seen by FlowCAM®


Algae (Aulacoseira)

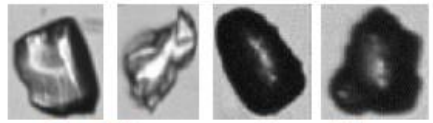

Crustacean (Daphnia)


Cryptosporidium


Giardia

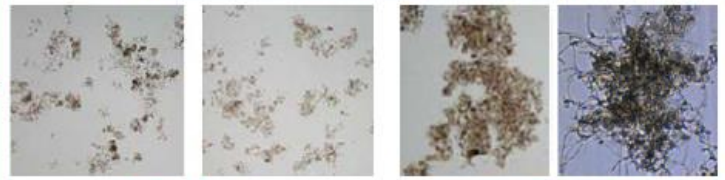
Wastewater Treatment

Grit Particles as Imaged by FlowCAM®



Ground Silica *Unground Silica*

Floc Formation as Imaged by FlowCAM®



Poor Floc Formation *Good Floc SIze and Density*

Primary Treatment

- Stormwater Particulate Analysis
- Grit Removal Optimization

Secondary Treatment

- Microbial Floc Analysis
- Sludge Age Determination
- Identification & Enumeration of Higher Life Forms

Tertiary Treatment

- Clarifier & Filter Optimization
- Final Effluent Early Warning

Microorganisms as Imaged by FlowCAM®

Filamentous Microorganism *Water Bear* *Rotifer* *Stalked Cillilate* *Amoeba*

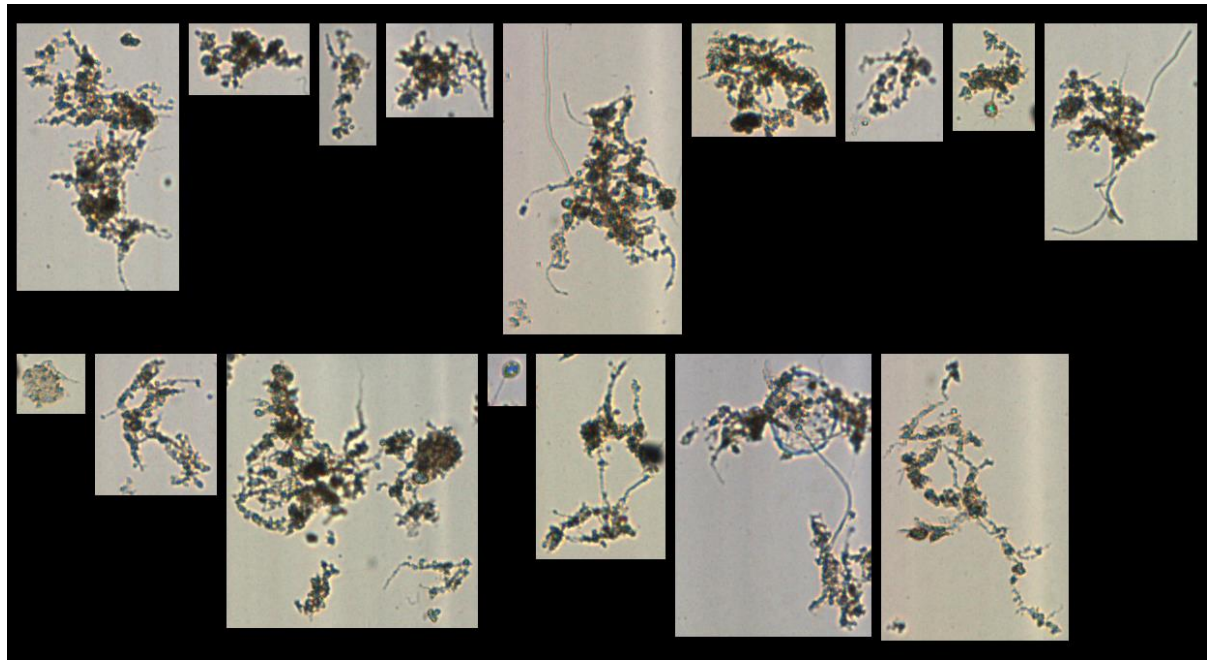
Digestion

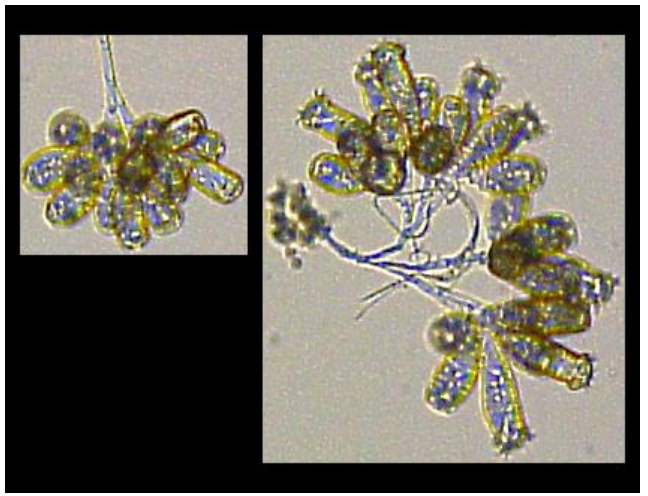
- Real-Time Digestion Process Optimization

Dewatering

- BFP & Centrifuge Polymer Optimization
- Lagoon Treatment Optimization

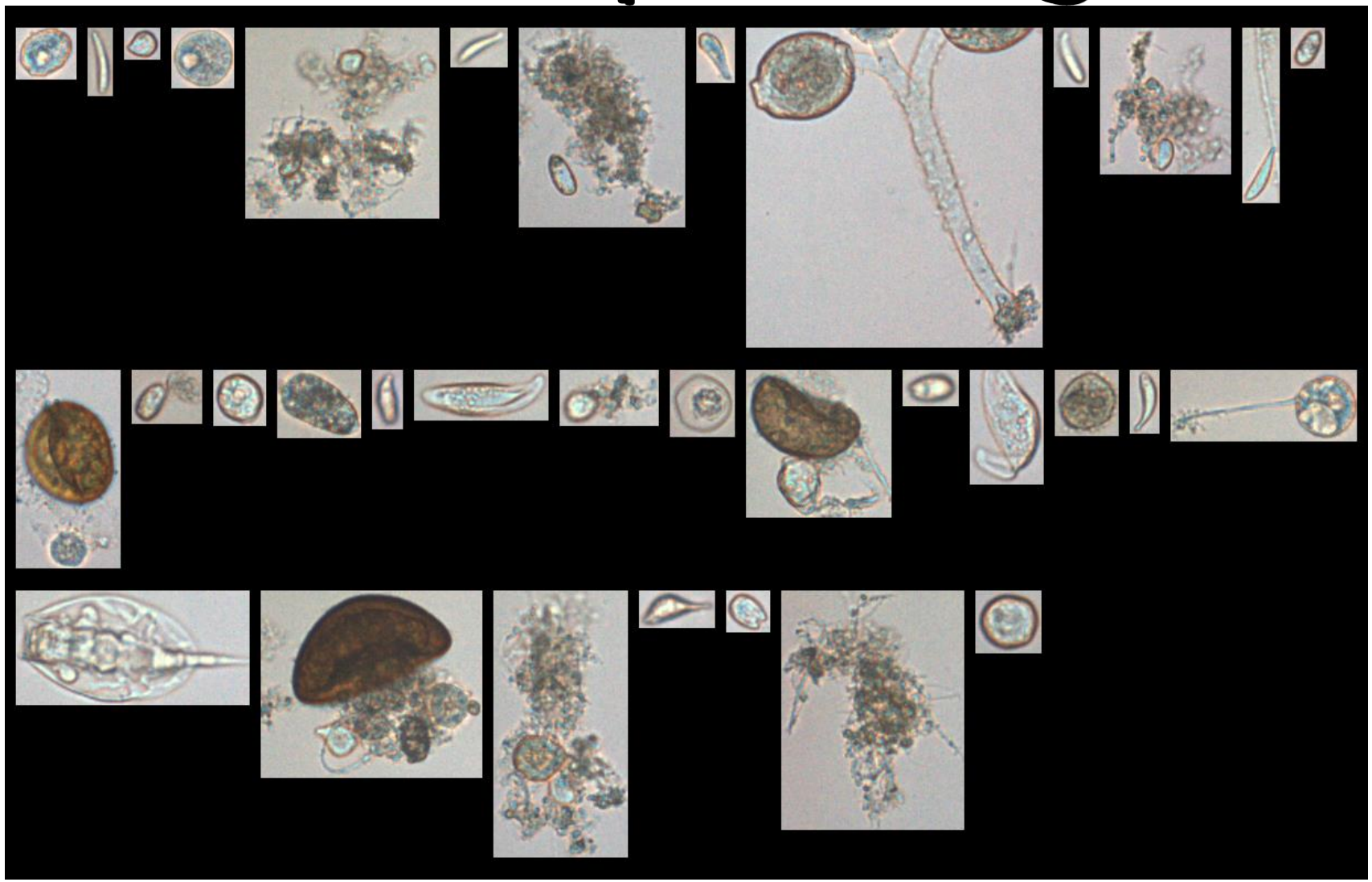
Mixed Liquor Images





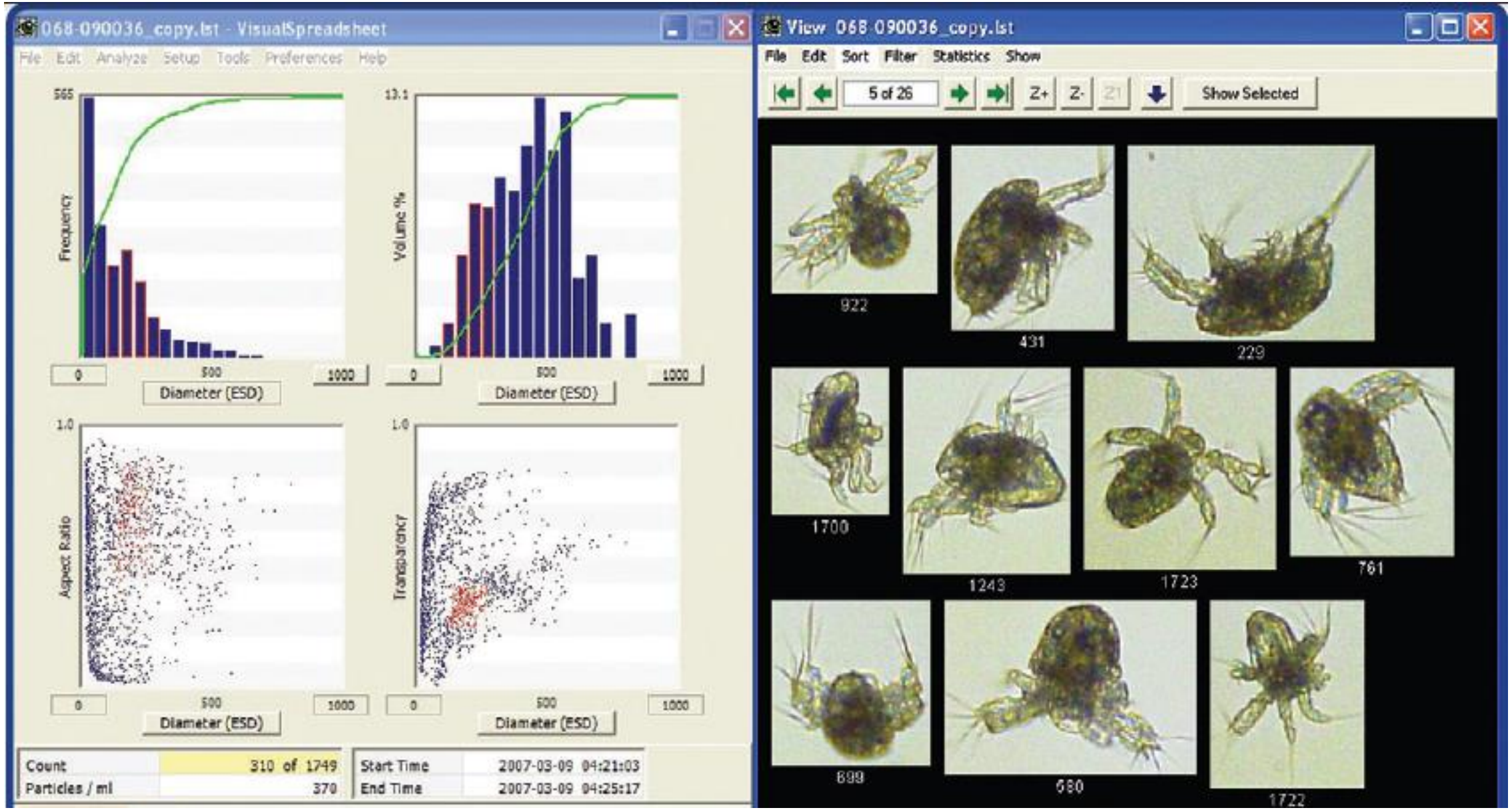
Mass Water Resource Authority (4X)

Mixed Liquor Images

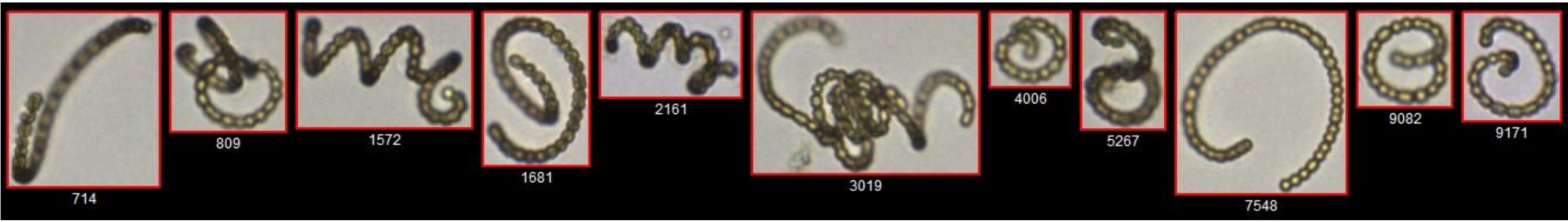


Mass Water Resource Authority (10X)

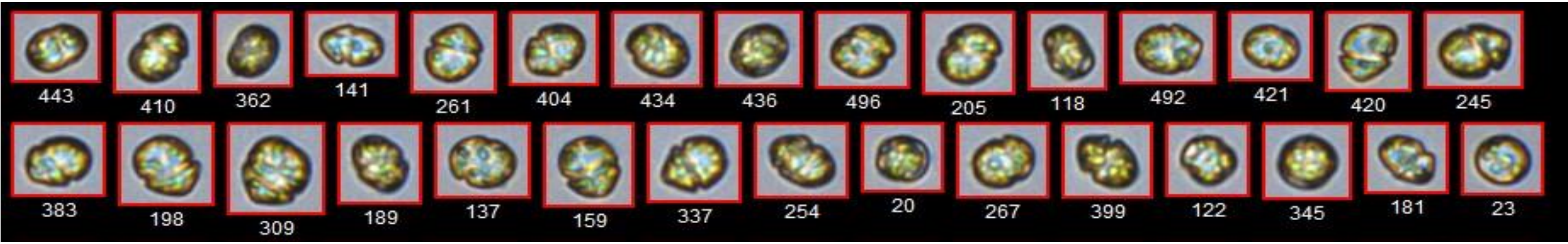
Zooplankton Analysis



Harmful Algal Bloom Monitoring

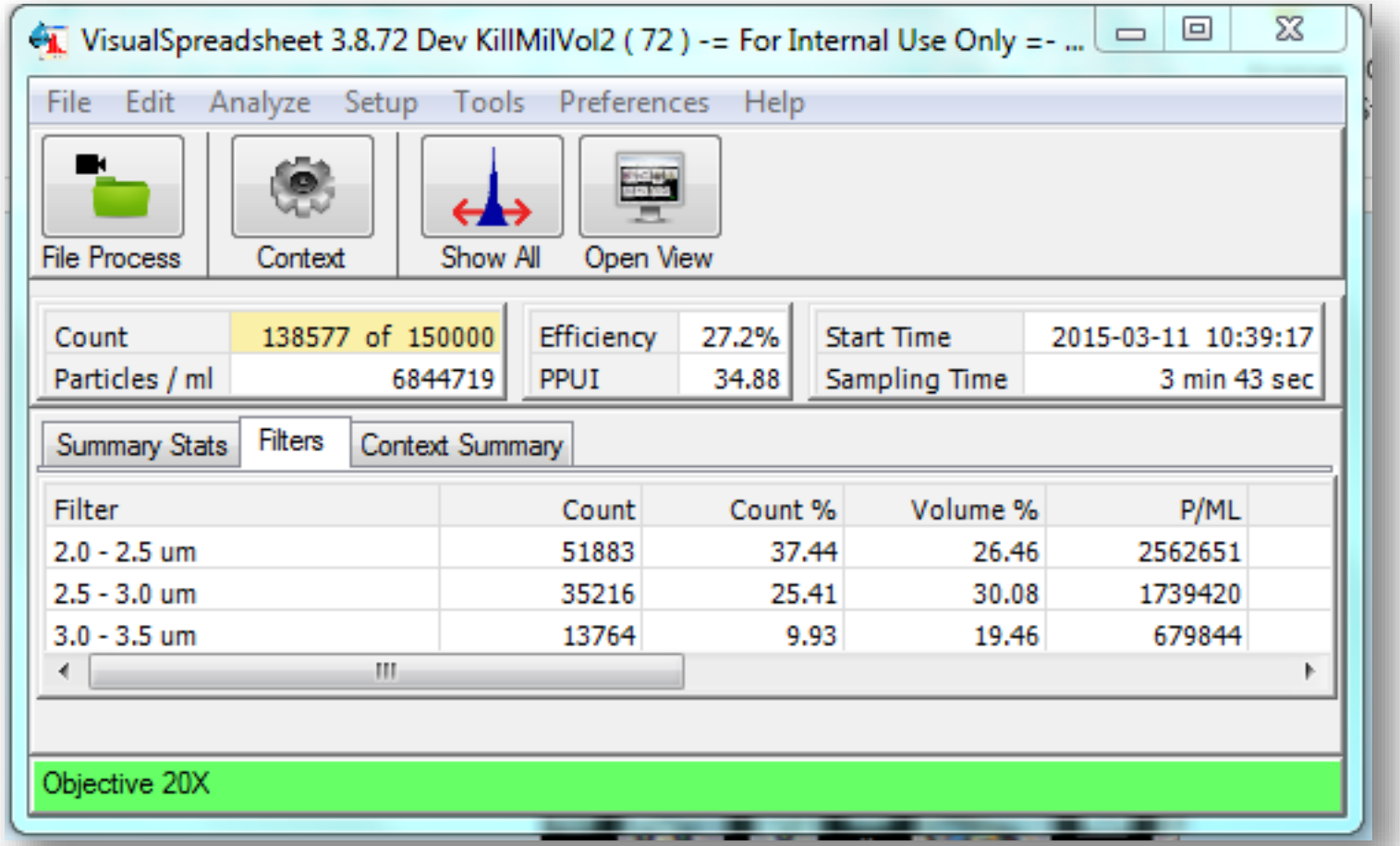


Anabaena, Newnan's Lake, Florida

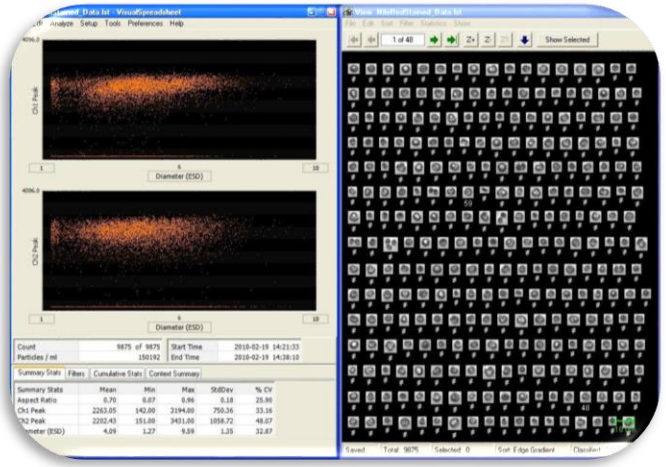


Karenia Brevis
Gulf of Mexico, November 11, 2011

Algae Technology

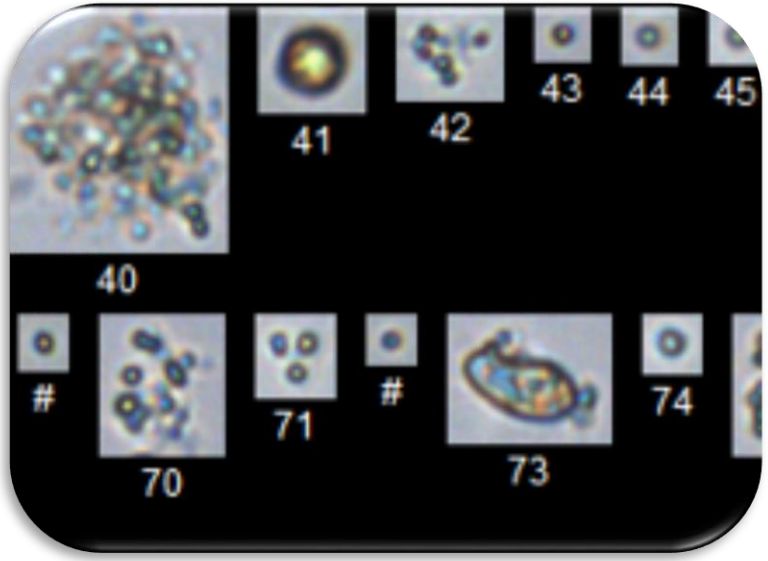


Growth Rate Monitoring



Lipid Analysis

Contaminant Monitoring



Invasive Species Monitoring:

Veliger Mussels

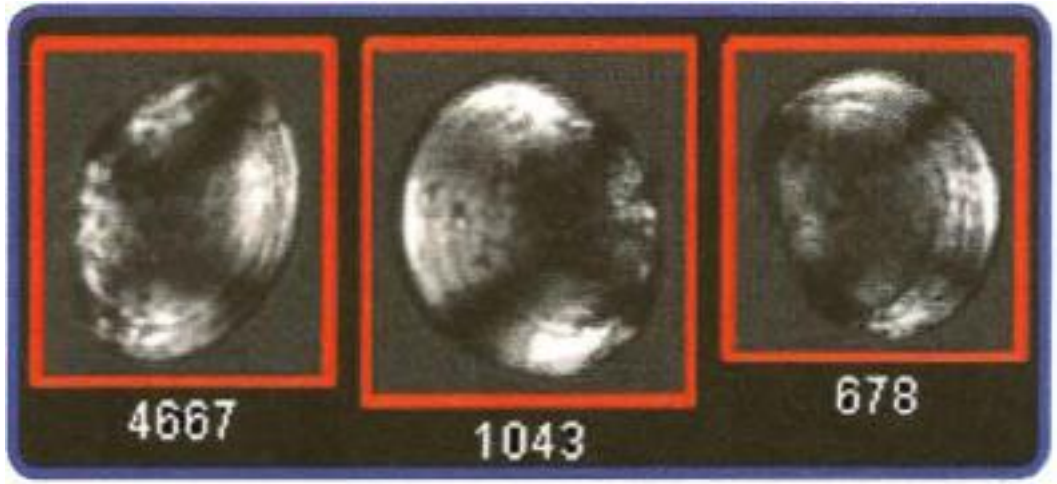
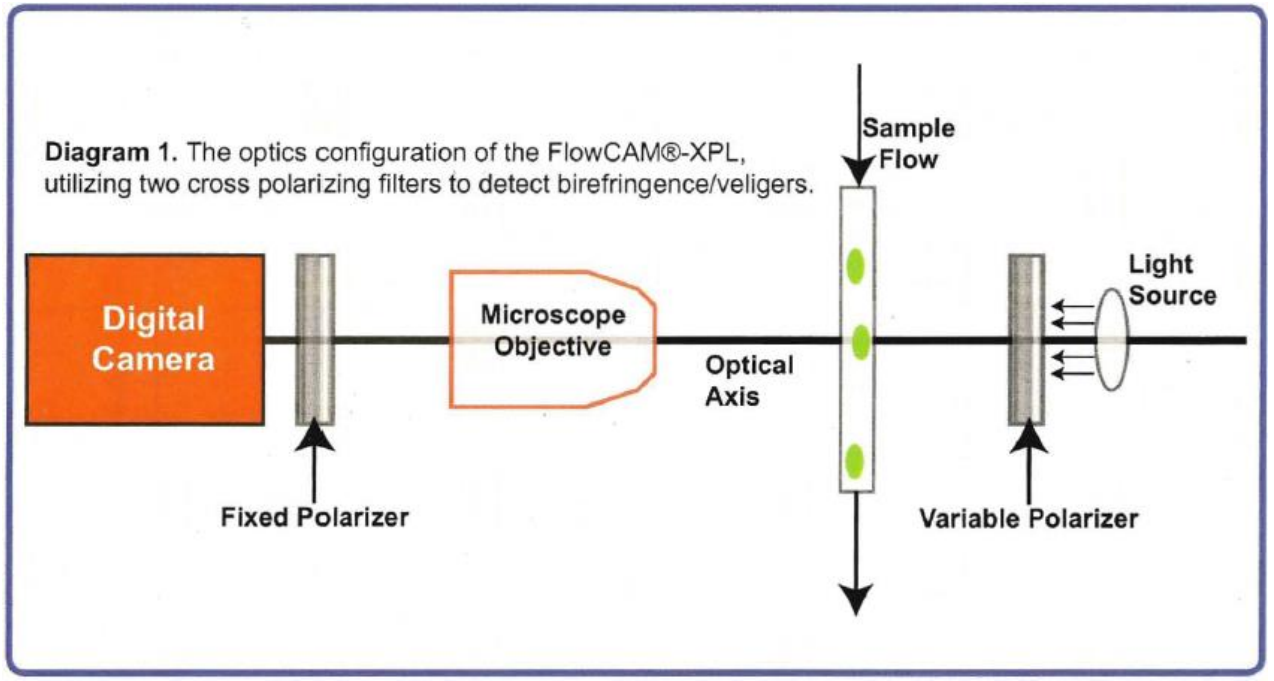
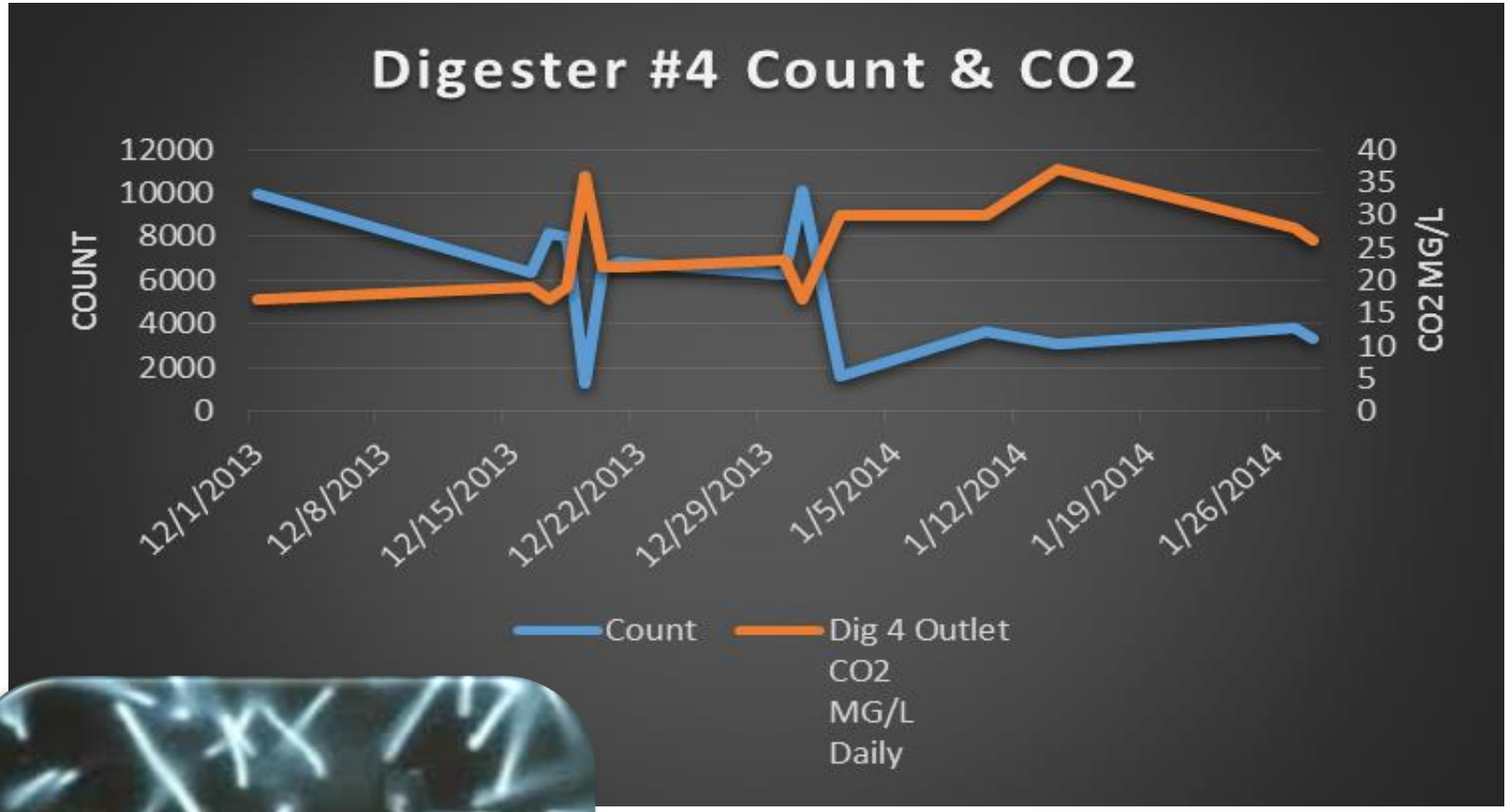


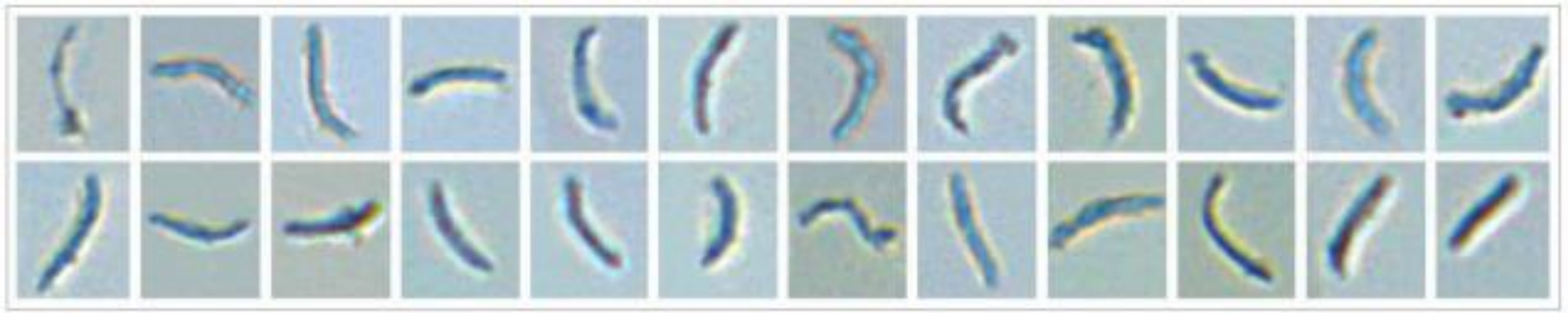
Figure 1. Zebra mussel veligers under cross polarized light as imaged by the FlowCAM-XPL.



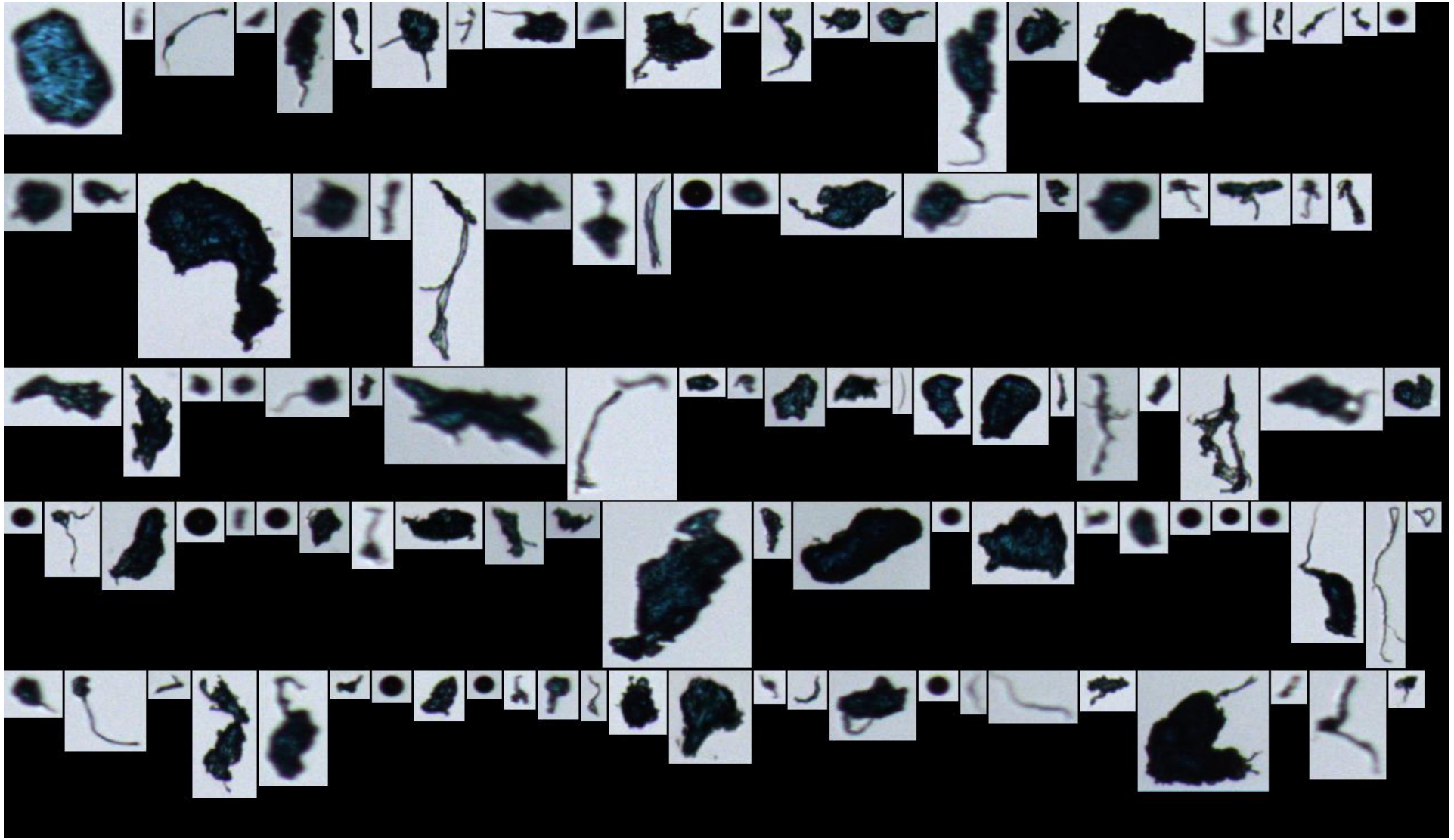


Predicting Methane Production

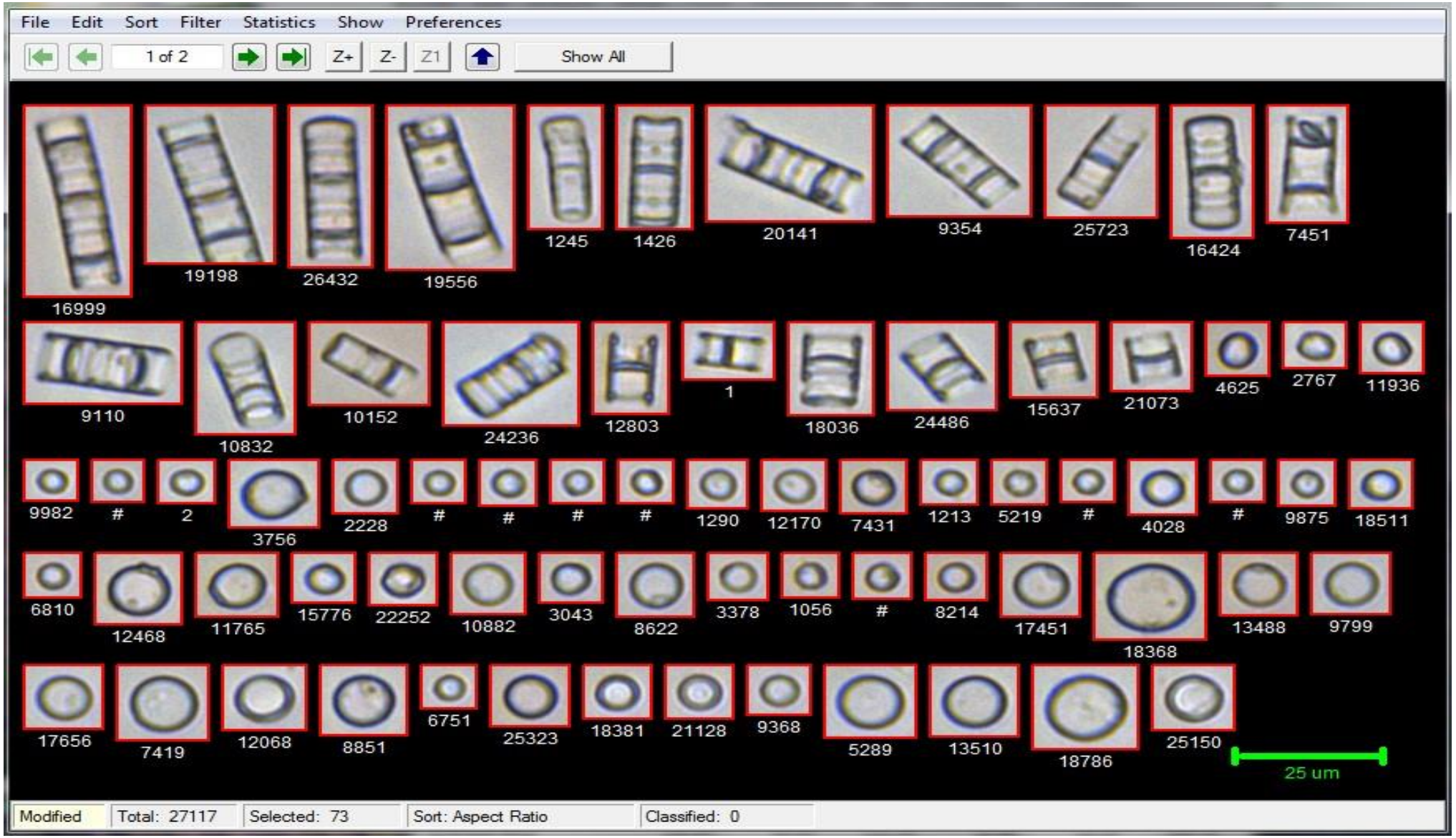
Bacilli-Shaped Microorganisms



Microplastics
Presence and Basic Identification



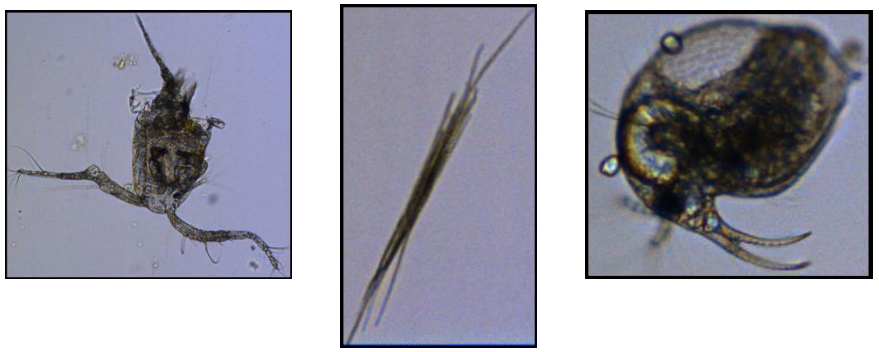
PaleoLimnology



Aulacoseira and Pollen Fossils

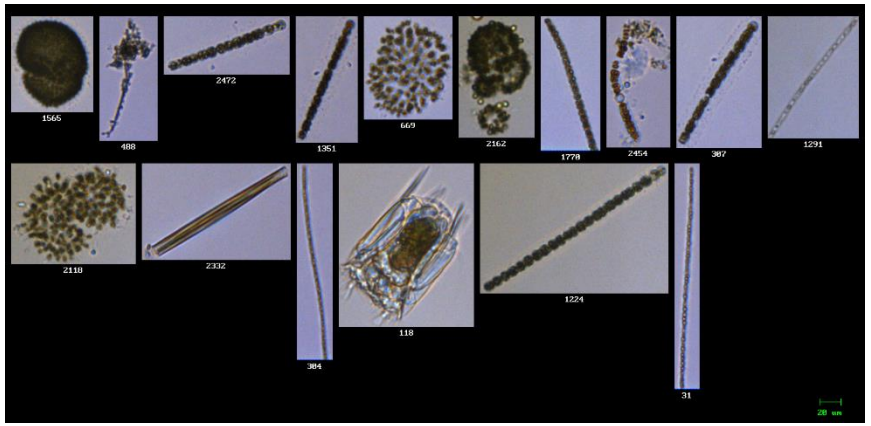
Algae at the Root of Everyday Issues

Short Filter Runs



Taste and Odor

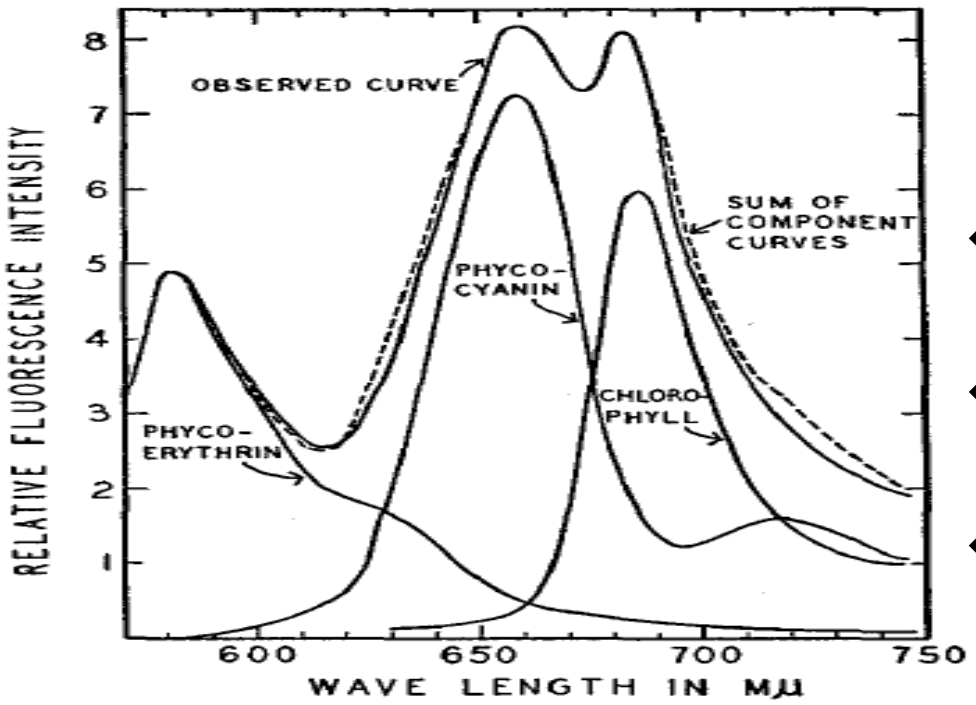
Manganese Spikes



Can Careful Monitoring of Algal Population Dynamics Lead To Better Environmental Management and Treatment Solutions?

FlowCam™
Particle Analysis with Vision
FLUID IMAGING TECHNOLOGIES, INC.

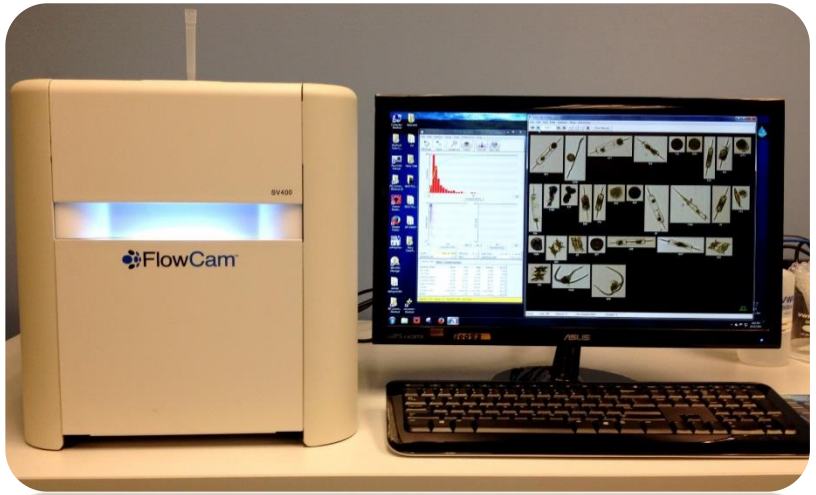
FlowCam 8400



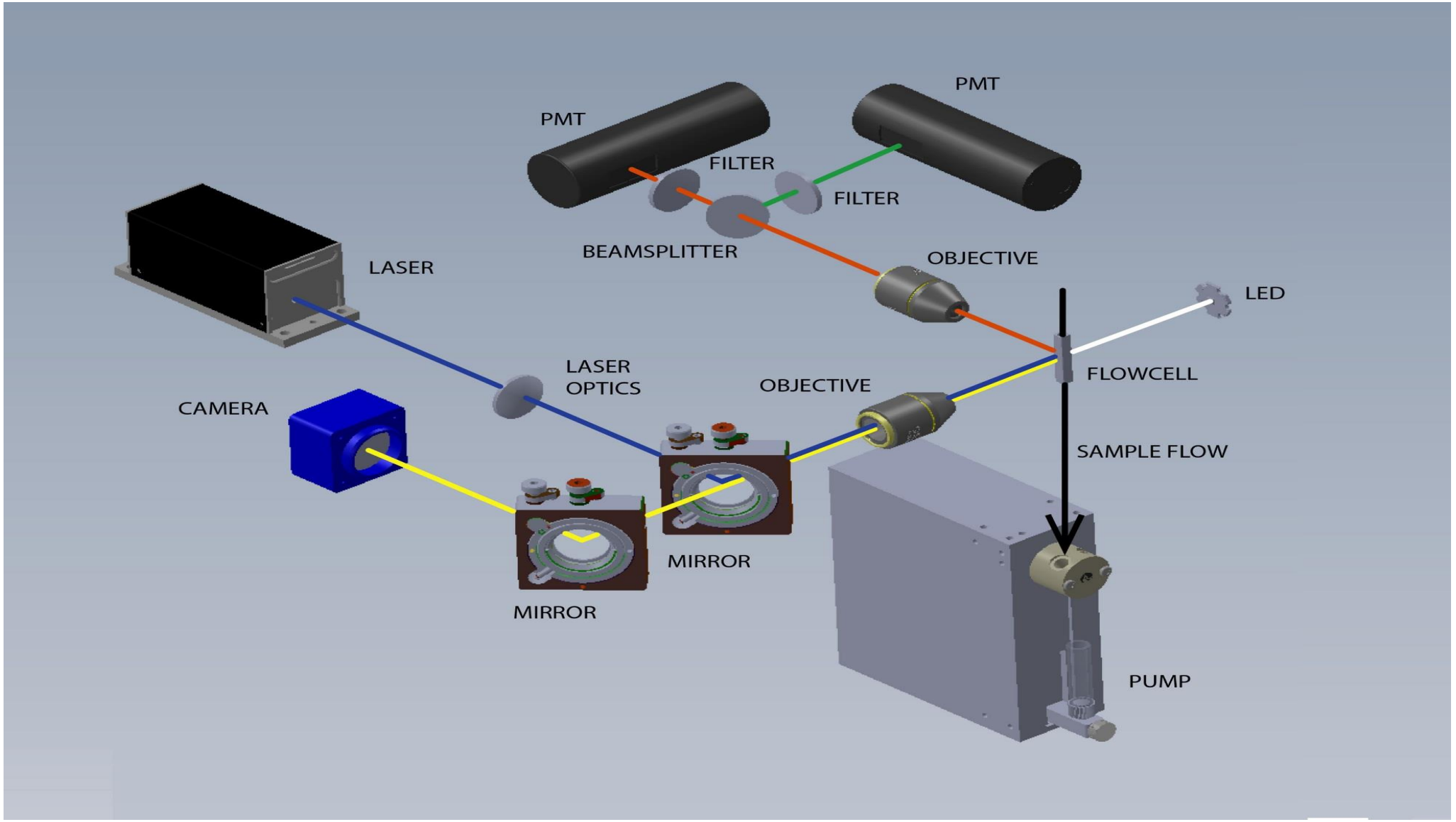
French, Young, 1951

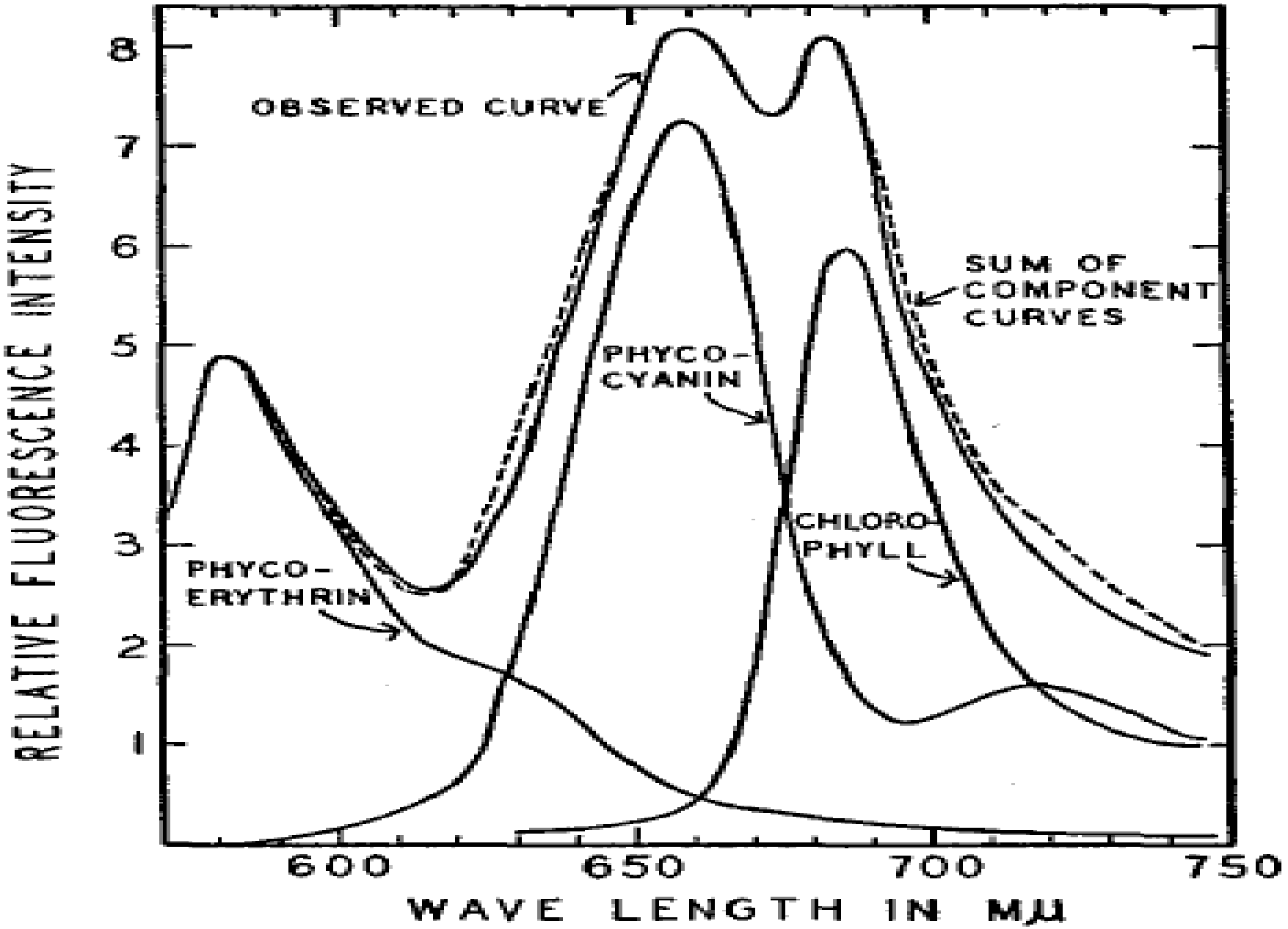
- High Sensitivity Fluorescence Detection
- Images and Identification
- Ratio-Metric Separation

Can an Understanding of Pigment Intensity, Combined with Identification and Particle Analysis, Lead to a Better Prediction of Cyanotoxin Abundance?

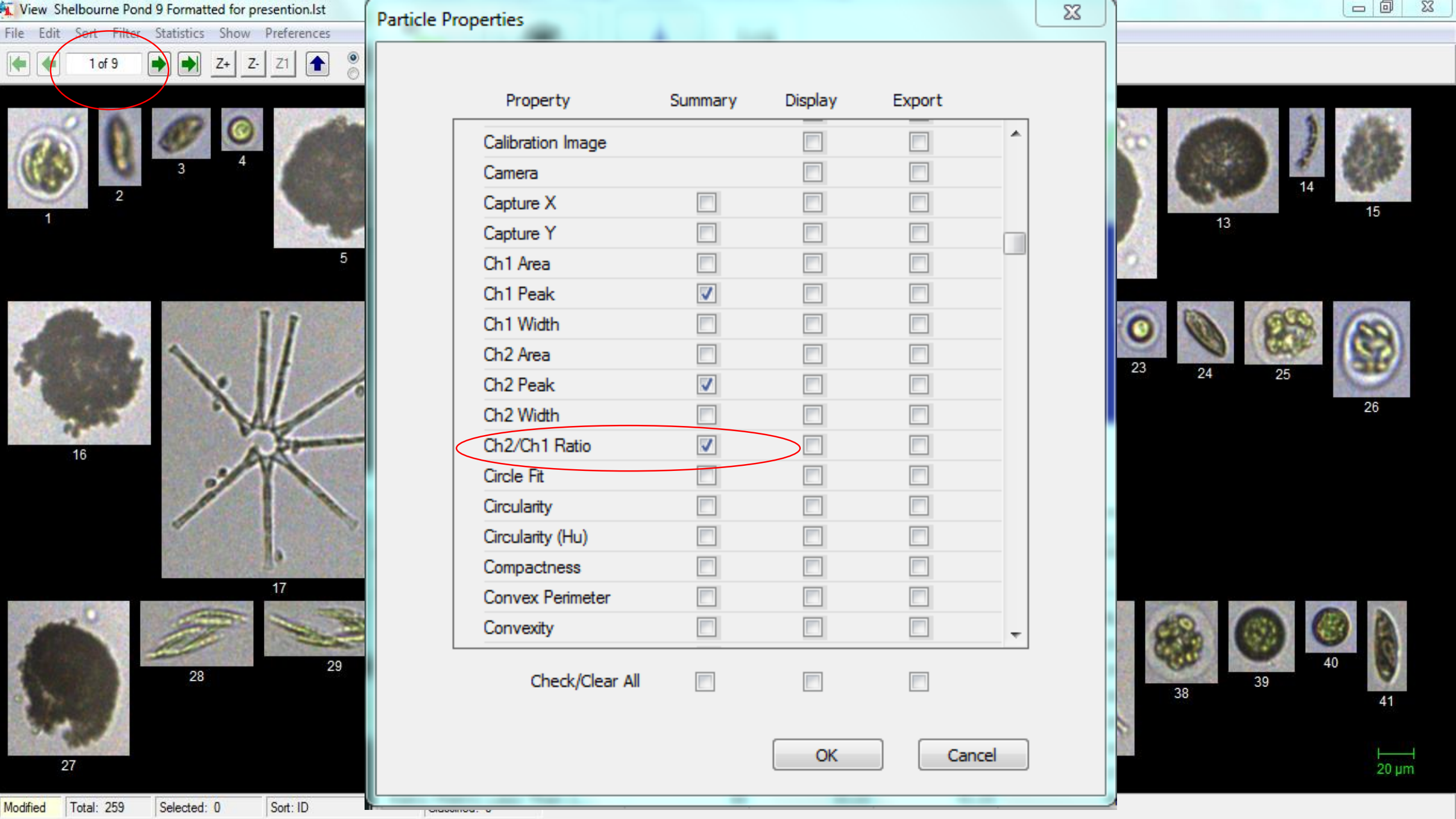


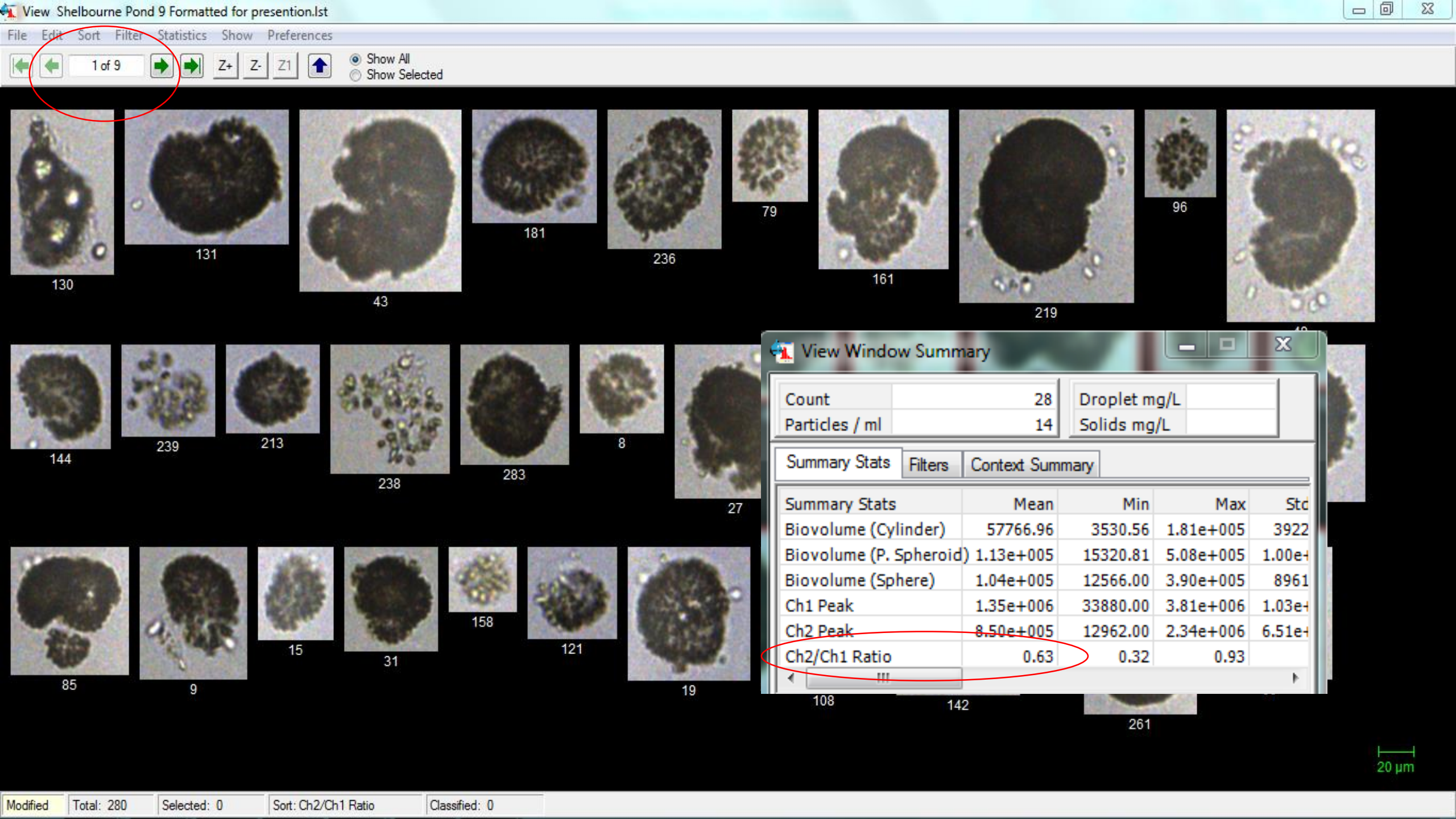
Fluorescence Detection





French, Young, 1951

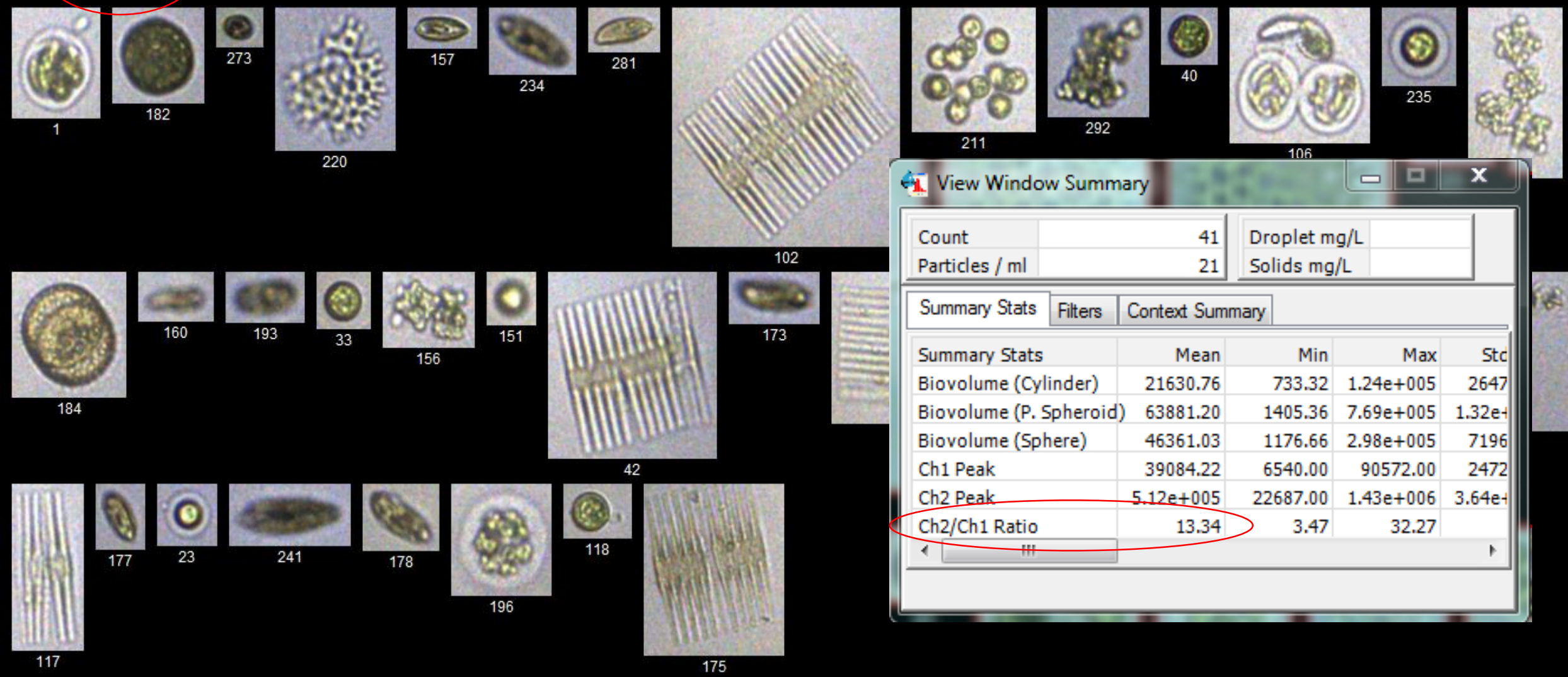

View Shelbourne Pond 9 Formatted for presention.lst
File Edit Sort Filter Statistics Show Preferences
1 of 9
Z+ Z- Z1
Particle Properties
Property Summary Display Export
Calibration Image
Camera
Capture X
Capture Y
Ch1 Area
Ch1 Peak
Ch1 Width
Ch2 Area
Ch2 Peak
Ch2 Width
Ch2/Ch1 Ratio
Circle Fit
Circularity
Circularity (Hu)
Compactness
Convex Perimeter
Convexity
Check/Clear All
OK
Cancel
20 µm
Modified
Total: 259
Selected: 0
Sort: ID


View Shelbourne Pond 9 Formatted for presention.lst
File Edit Sort Filter Statistics Show Preferences
1 of 9
Z+ Z- Z1
Show All
Show Selected
130
131
43
181
236
79
161
219
96
144
239
213
238
283
8
27
85
9
15
31
158
121
19
108
142
261
View Window Summary
Count 28
Particles / ml 14
Droplet mg/L
Solids mg/L
Summary Stats Filters Context Summary
Summary Stats Mean Min Max Stc
Biovolume (Cylinder) 57766.96 3530.56 1.81e+005 3922
Biovolume (P. Spheroid) 1.13e+005 15320.81 5.08e+005 1.00e+
Biovolume (Sphere) 1.04e+005 12566.00 3.90e+005 8961
Ch1 Peak 1.35e+006 33880.00 3.81e+006 1.03e+
Ch2 Peak 8.50e+005 12962.00 2.34e+006 6.51e+
Ch2/Ch1 Ratio 0.63 0.32 0.93
20 µm
Modified
Total: 280
Selected: 0
Sort: Ch2/Ch1 Ratio
Classified: 0

View Shelbourne Pond 9 Formatted for presention.lst

File Edit Sort Filter Statistics Show Preferences

7 of 9 | Z+ | Z- | Z1 | Show All | Show Selected



View Window Summary

Count	41	Droplet mg/L	
Particles / ml	21	Solids mg/L	

Summary Stats | Filters | Context Summary

Summary Stats	Mean	Min	Max	Std
Biovolume (Cylinder)	21630.76	733.32	1.24e+005	2647
Biovolume (P. Spheroid)	63881.20	1405.36	7.69e+005	1.32e+
Biovolume (Sphere)	46361.03	1176.66	2.98e+005	7196
Ch1 Peak	39084.22	6540.00	90572.00	2472
Ch2 Peak	5.12e+005	22687.00	1.43e+006	3.64e+
Ch2/Ch1 Ratio	13.34	3.47	32.27	

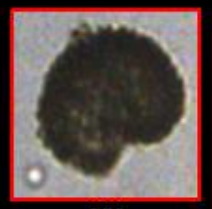
20 µm

Modified | Total: 280 | Selected: 0 | Sort: Ch2/Ch1 Ratio | Classified: 0

View Shelbourne Pond 9 Formatted for presention.lst

File Edit Sort Filter Statistics Show Preferences

1 of 1


222


87

temp.csv - Excel

FILE HOME INSER PAGE L FORM DATA REVIE VIEW Michael C...

Clipboard Font Alignment Number Conditional Formatting Format as Table Cell Styles Styles Cells Editi

A14

	A	B	C	D	E	F
1	Genus	Particle ID	Ch1 Peak	Ch2 Peak	/Ch1 Ratio	
2	Woronichinia	1	3806489	2207329	0.58	
3	Woronichinia	2	2915901	1716965	0.59	
4	Anabaena	3	175049	103584	0.59	
5	Woronichinia	4	2382406	1491661	0.63	
6	Anabaena	5	672932	500089	0.74	
7	Aphanizomenon	6	2510496	2336572	0.93	
8	Staurastrum	7	50296	291588	5.8	
9	Pediastrum	8	22716	171445	7.55	
10	Fragilaria	9	21045	187829	8.93	
11	Pediastrum	10	32735	397254	12.14	
12	Fragilaria	11	42298	651948	15.41	
13	Fragilaria	12	20979	552659	26.34	
14						
15						

temp

READY 100%

0 - 10 um	0 - 10 um ABD.flt
10 - 20 um	10 - 20 um ABD.flt
20 - 30 um	20 - 30 um ABD.flt
30 - 40 um	30 - 40 um ABD.flt
40 - 50 um	40 - 50 um ABD.flt
50 + um	50 + um ABD.flt
Ratio Metric Less Than 2.5	Ratio Metric
Ratio Metric Greater Than 2.5	Ratio Metric

20 µm

Saved Total: 293 Selected: 12 Sort: Ch2/Ch1 Ratio Classified: 0

THANK YOU

www.fluidimaging.com

Michael Cohrs
Applications Engineer
Fluid Imaging Technologies
michael.cohrs@fluidimaging.com
(973) 650-6152

FlowCam™
Particle Analysis with Vision
FLUID IMAGING TECHNOLOGIES, INC.