Open-Lake Chlorophyll-a and Seabird Data

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Environmental Careers Organization

Introduction

- **R/V Lake Guardian Water Sample Collection Procedures**
  - Rosette sampler
  - Seabird *in situ* probe

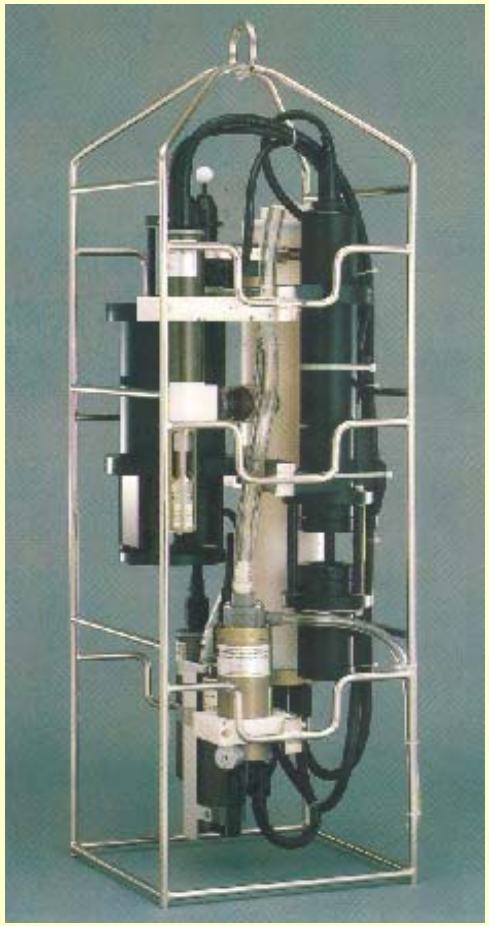
- **Seabird Data**
  - Header data
  - Physical measurement data
  - Upload to GLENDA

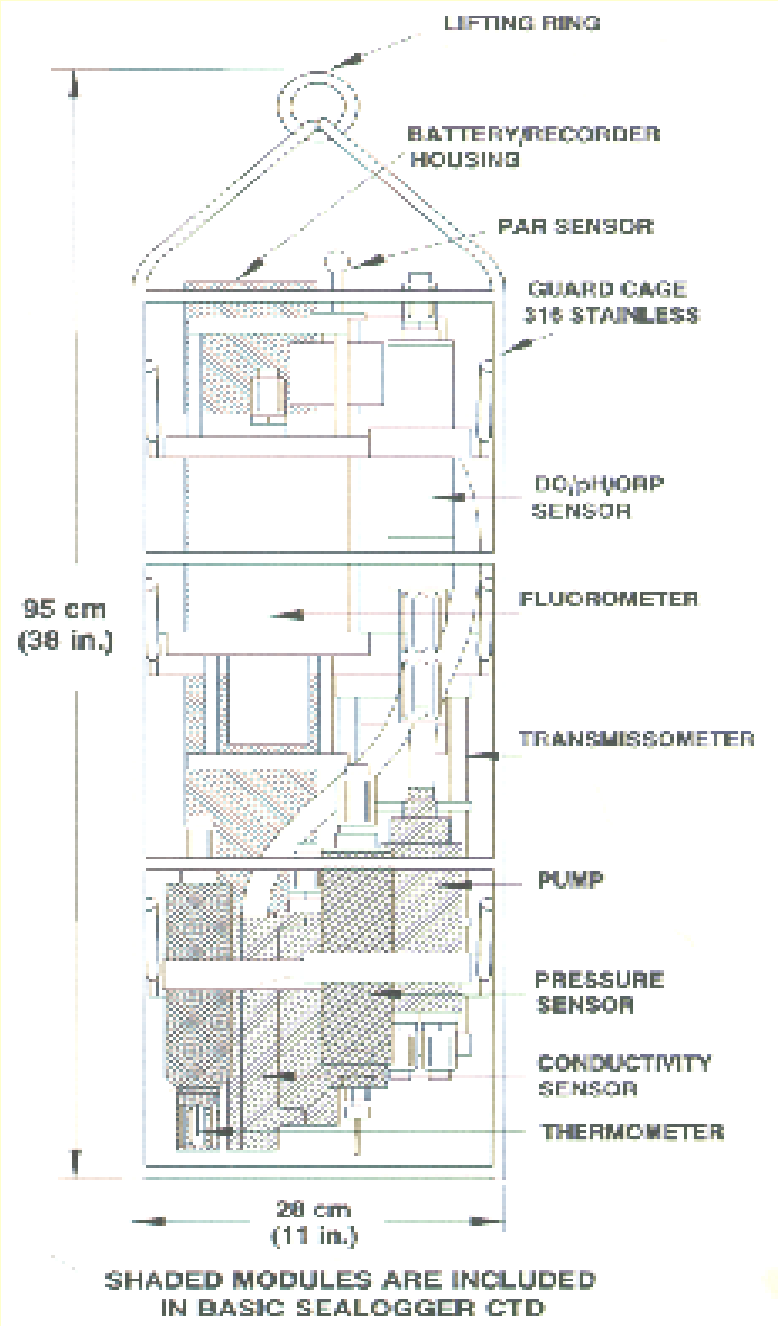
- **Chlorophyll-a Data**
  - Overview
  - Calibrating fluorometry data using extracted chlorophyll
  - Statistics

- **Conclusion and a Challenge for the Peer Review Panel Members**

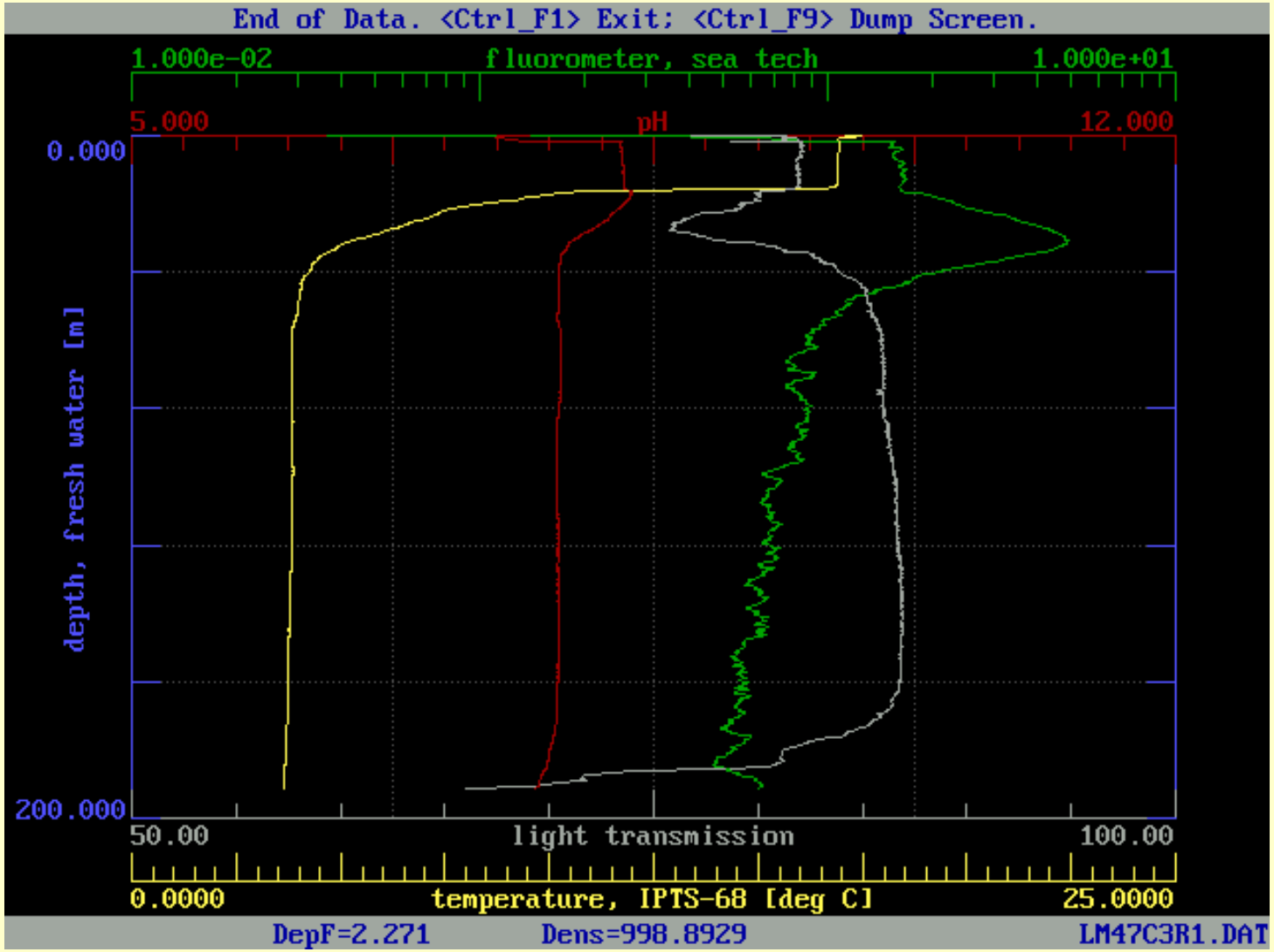
Water Sampling Activities and the Rosette Sampler

Seabird SBE 25
In Situ Probe





Seabird – Example Data



Seabird File - Header

```
* Sea-Bird SBE 9 Raw Data File:
* FileName = C:\SEA911\LMMBC7R1\LM41C7.DAT
* Software Version 4.203
* Temperature SN = 1554
* Conductivity SN = 1397
* Number of Bytes Per Scan = 24
* Number of Voltage Words = 4
* System UpLoad Time = Sep 25 1995 12:01:23
* Ship: R/V Lake Guardian
* Cruise:LMMB 7  Sept/Oct '95
* Station: 41
* Latitude:  44 44 04
* Longitude: 86 43 15
# nquan = 11
# nvalues = 1031
# units = metric
# name 0 = depF: depth, fresh water [meters]
# name 1 = t068: temperature, IPTS-68 [deg C]
# name 2 = oxMg/L: oxygen [mg per liter]
# name 3 = bat: beam attenuation coefficient
# name 4 = ph: pH
# name 5 = specc: specific conductance
# name 6 = flS: fluorometer, sea tech
# name 7 = c0uS/cm: conductivity [uS/cm]
# name 8 = par: irradiance (PAR)
# name 9 = nbf: number of bottles fired
# name 10 = flag:  0.000e+00
# span 0 = 0.500, 258.500
# span 1 = 3.6202, 15.6729
# span 2 = 7.76120, 13.34336
# span 3 = -1.106, 57.284
# span 4 = 8.745, 10.621
# span 5 = 254.066, 325.843
# span 6 = 1.315e-01, 3.405e+00
# span 7 = 1.699e+02, 2.298e+02
# span 8 = 2.390e+00, 4.606e+02
# span 9 = 0, 11
# span 10 = 0.000e+00, 0.000e+00
# interval = meters: 0.5
# start_time = Sep 25 1995 12:01:23
# bad_flag = -9.990e-29
# serial_numbers = t0:1554, c0:1397, pr:57476,
ox:130350, xmiss:609, fl:278, ph:180171, par:4378
# datcnv_date = Sep 25 1995 12:34:43, 4.203
# datcnv_in = LM41C7.DAT SEASOFT.CON 1554 1397
57476
# datcnv_skipover = 0
# binavg_date = Sep 25 1995 12:35:09, 4.203
# binavg_in = LM41C7.CNV
# binavg_bintype = Depth Bins
# binavg_binsize = 0.50
# binavg_excl_bad_scans = yes
# binavg_downcast_only = no
# binavg_skipover = 0
# binavg_surface_bin = no, min = 0.000, max = 0.000,
value = 0.000
# file_type = ascii
*END*
```

Seabird File – Physical Measurements

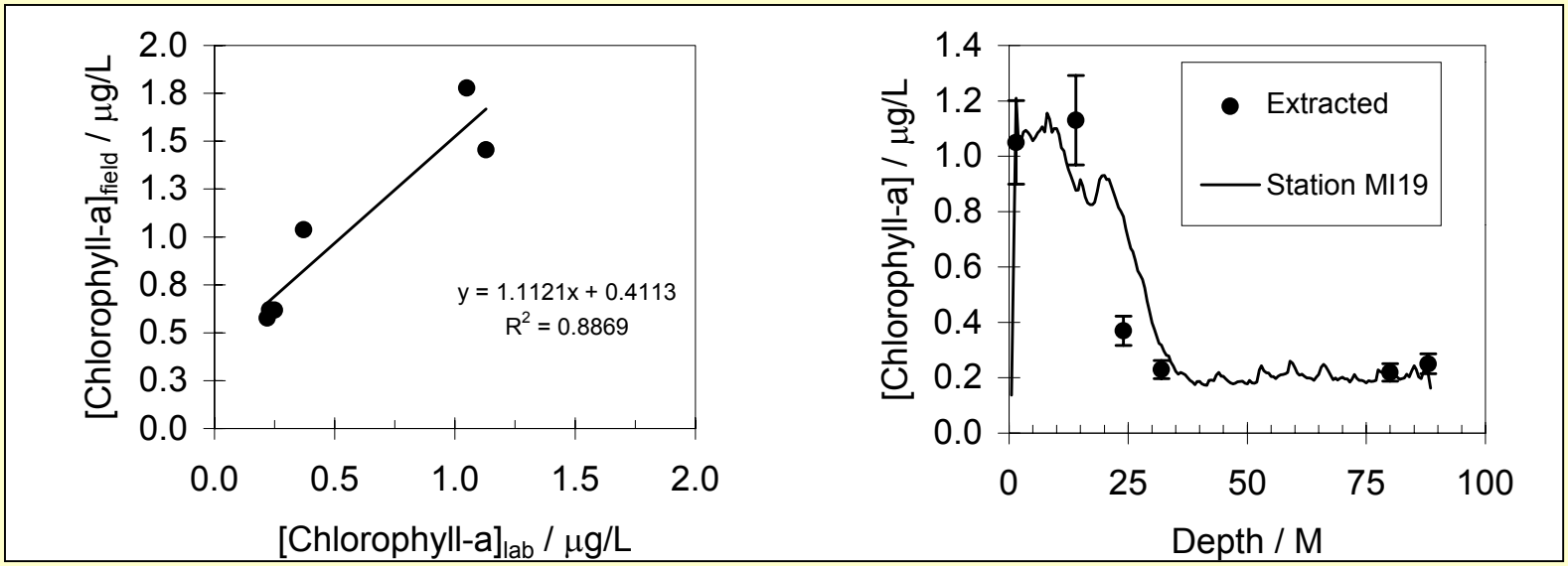
Downcast: 0 - 5 meters

```
0.500    15.6489   10.33576     12.573     10.621    254.066  1.315e-01
2.065e+02  4.606e+02          0  0.000e+00
1.000    15.6636   10.17430      1.980      8.957    275.623  6.201e-01
2.241e+02  2.393e+02          0  0.000e+00
1.500    15.6606    9.23548      0.935      9.601    279.260  1.630e+00
2.271e+02  1.541e+02          0  0.000e+00
2.000    15.6653    7.76120      1.048      9.923    281.166  1.578e+00
2.287e+02  1.525e+02          0  0.000e+00
2.500    15.6507    8.11331      1.047      9.858    278.660  1.508e+00
2.265e+02  1.529e+02          0  0.000e+00
3.000    15.6653   10.19740      1.047      9.863    282.368  1.441e+00
2.297e+02  1.454e+02          0  0.000e+00
3.500    15.6653   10.23493      1.046      9.866    282.424  1.440e+00
2.297e+02  1.327e+02          0  0.000e+00
4.000    15.6661   10.23045      1.048      9.867    282.423  1.449e+00
2.297e+02  1.177e+02          0  0.000e+00
4.500    15.6704   10.22440      1.048      9.867    282.440  1.473e+00
2.297e+02  1.028e+02          0  0.000e+00
5.000    15.6706   10.22745      1.050      9.869    282.430  1.484e+00
2.297e+02  8.995e+01          0  0.000e+00
```

Calibration of *In Situ* Fluoresence using Known Concentrations of Extracted Chlorophyll

The Strategy in 1994 & 1995:

- Station-by-station calibration (semi-quantitative)



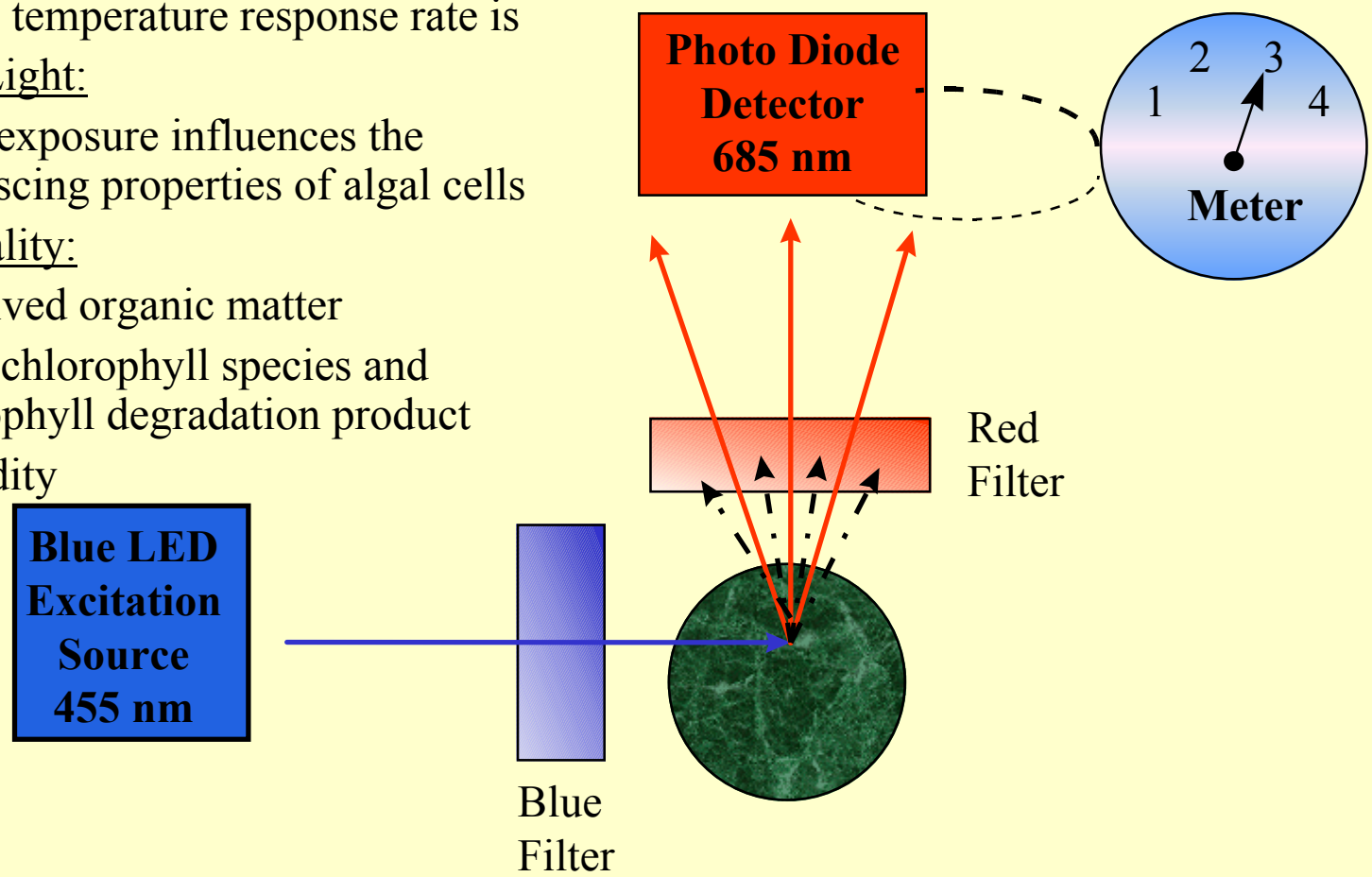
- Laboratory chlorophyll samples
  - Samples were improperly stored
  - Calibration standards were not prepared correctly
  - Invalid (INV) flag applied to all data, *except* fall 1995

The Reality in 1999:

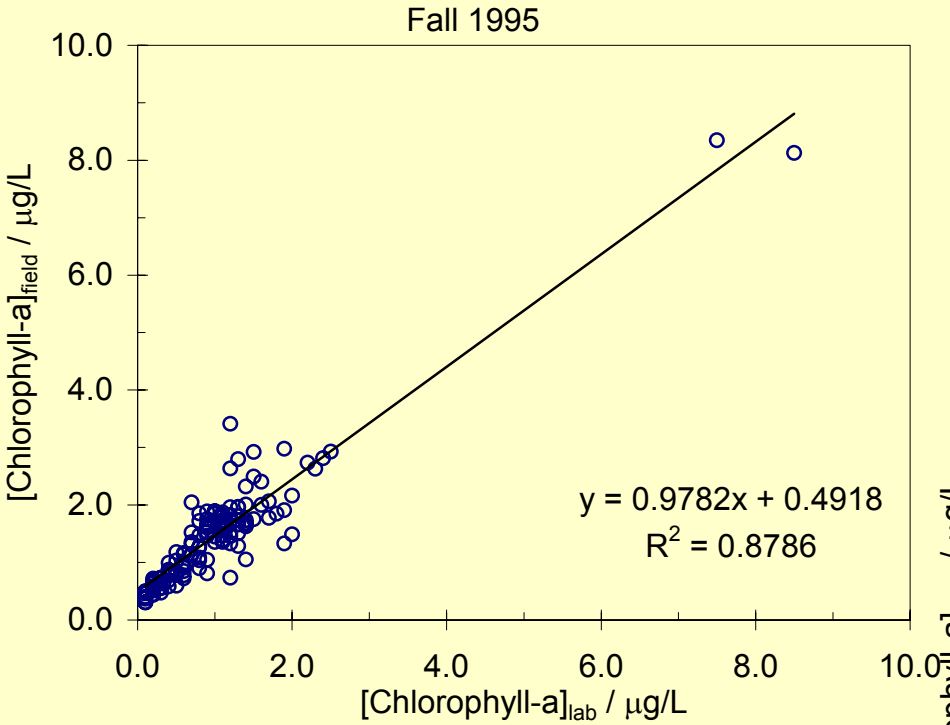
General Calibration Model (semi-quantitative)

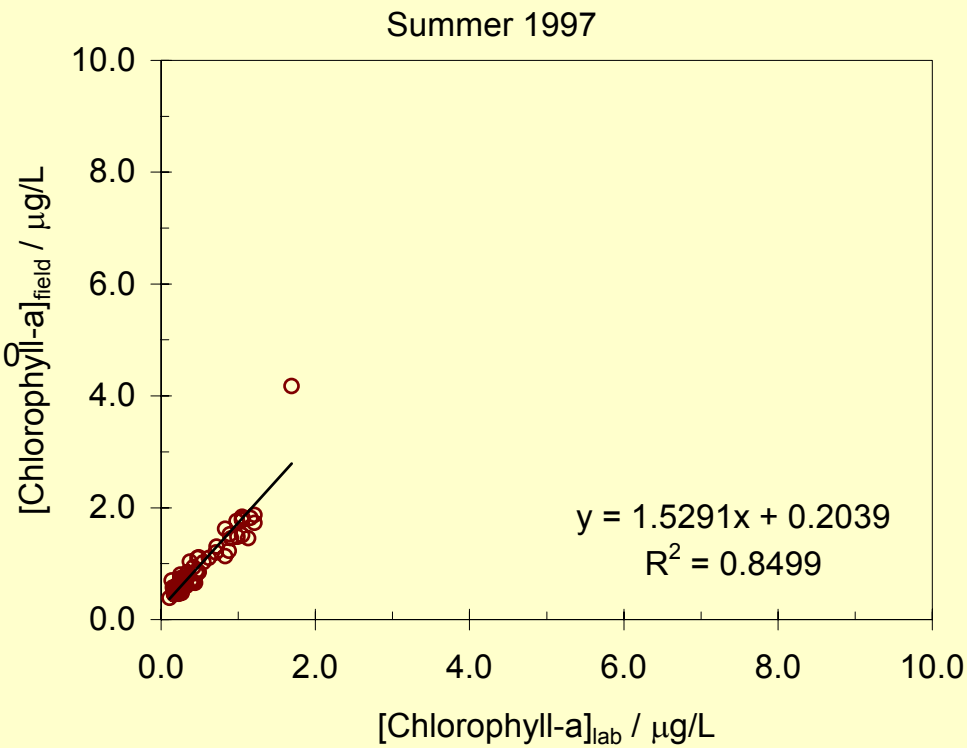
Fluorometer Schematic & Interferences

- Temperature:
  - Inverse temperature relationship
  - *In situ* temperature response rate is
- Ambient Light:
  - Light exposure influences the fluorescing properties of algal cells
- Water Quality:
  - Dissolved organic matter
  - Other chlorophyll species and chlorophyll degradation product
  - Turbidity

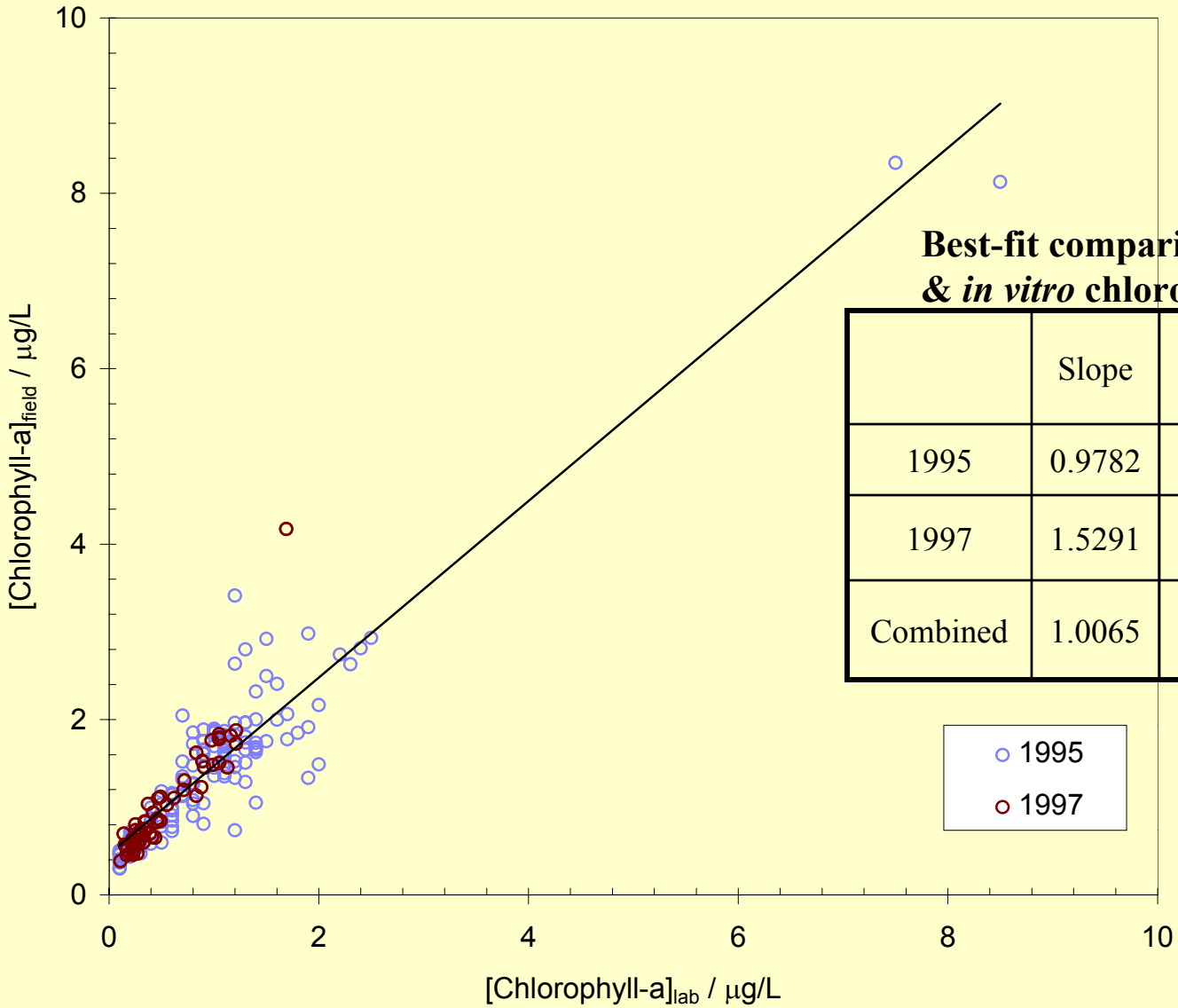


Chlorophyll-a Correlation





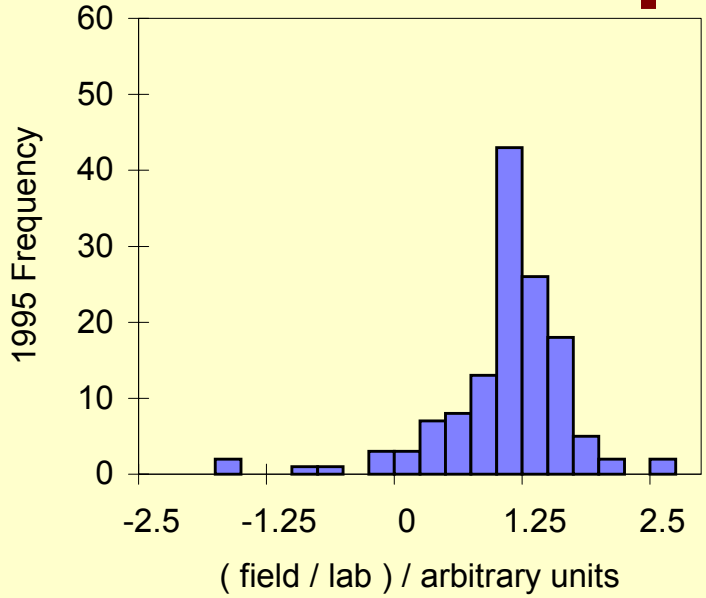
Chlorophyll-a Correlation

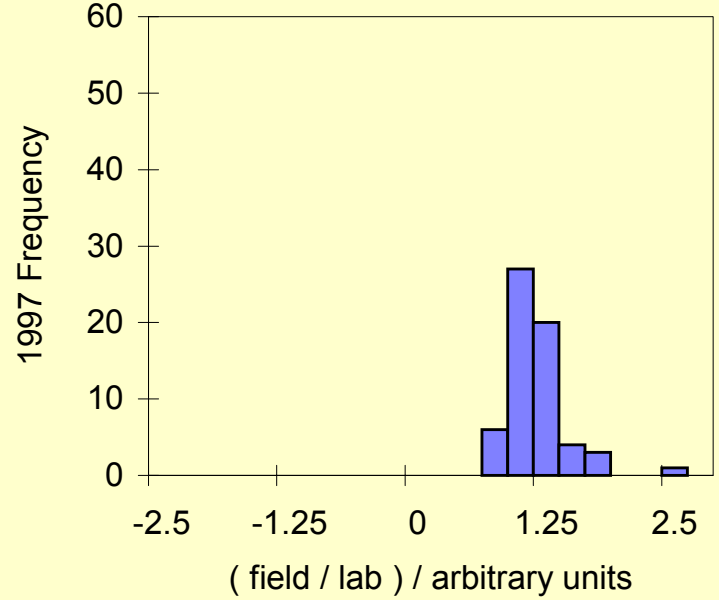


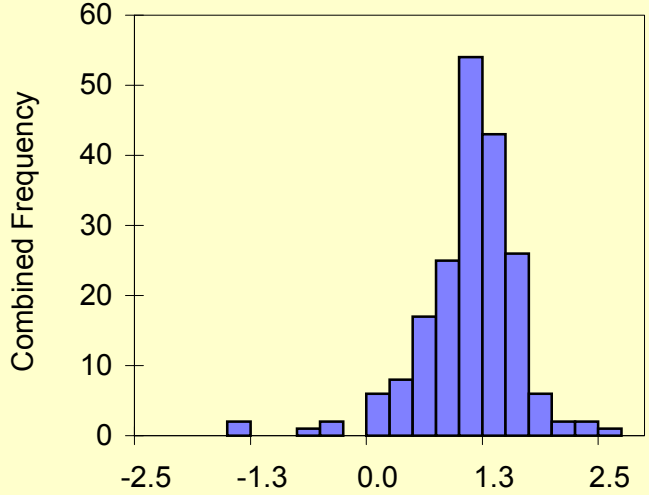
Best-fit comparison of *in situ* & *in vitro* chlorophyll-a data.

	Slope	Y-Intercept	R^2
1995	0.9782	0.4918	0.8786
1997	1.5291	0.2039	0.8499
Combined	1.0065	0.4663	0.8695

Chlorophyll-a Descriptive Statistics







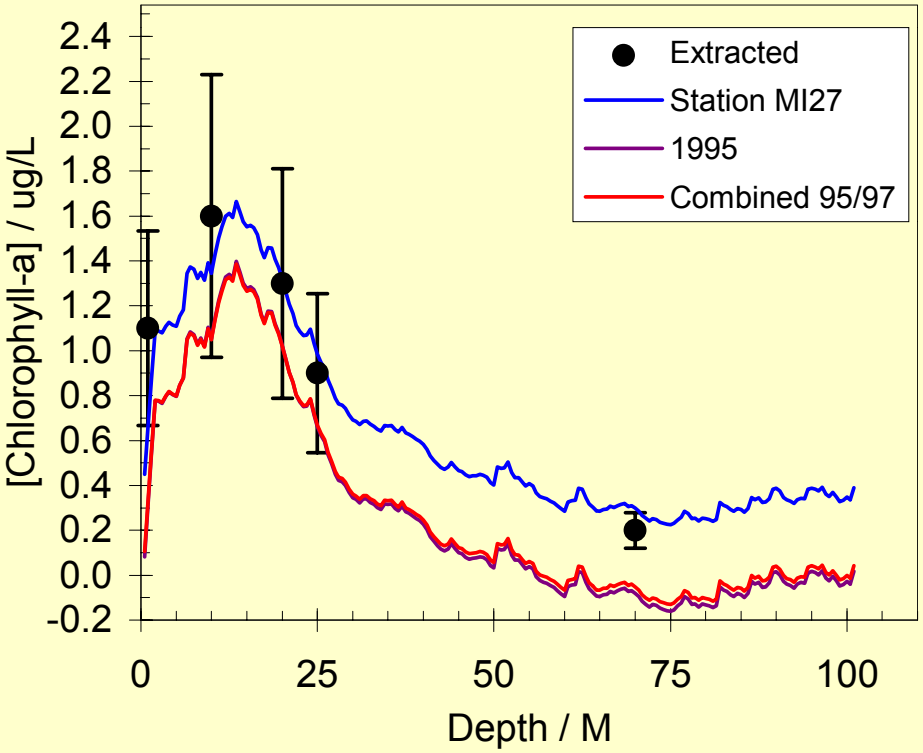
Chlorophyll-a Descriptive Statistics

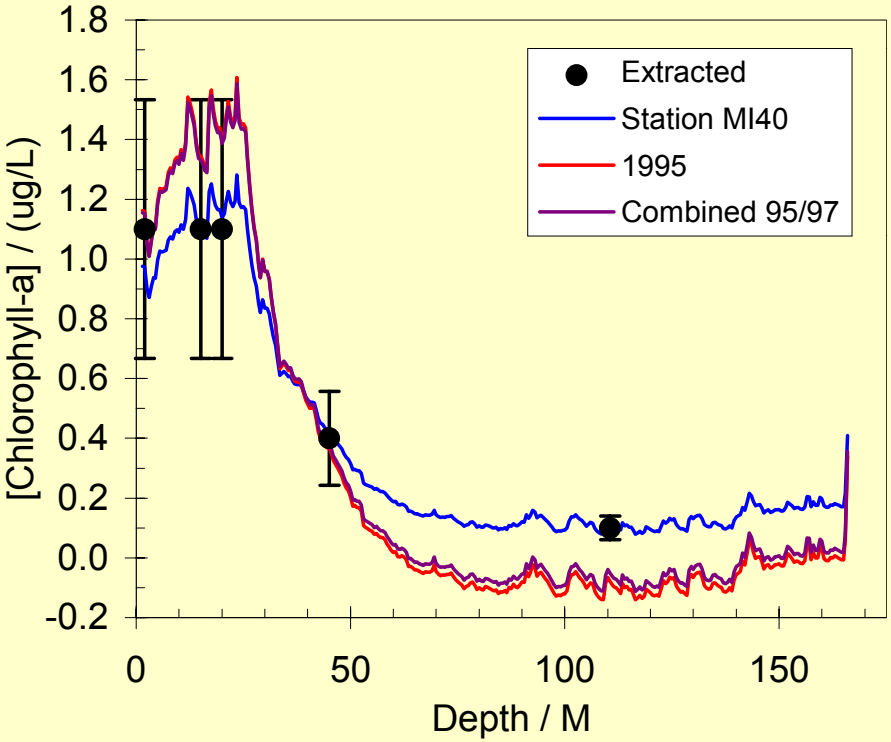
1995 Descriptive Stats	
Mean	0.84791
Standard Error	0.05337
Standard Deviation	0.61785
Kurtosis	5.96417
Skewness	-1.65403
N	134
Range	4.43604

1997 Descriptive Stats	
Mean	1.04609
Standard Error	0.03504
Standard Deviation	0.27364
Kurtosis	6.35597
Skewness	1.89215
N	61
Range	1.64298

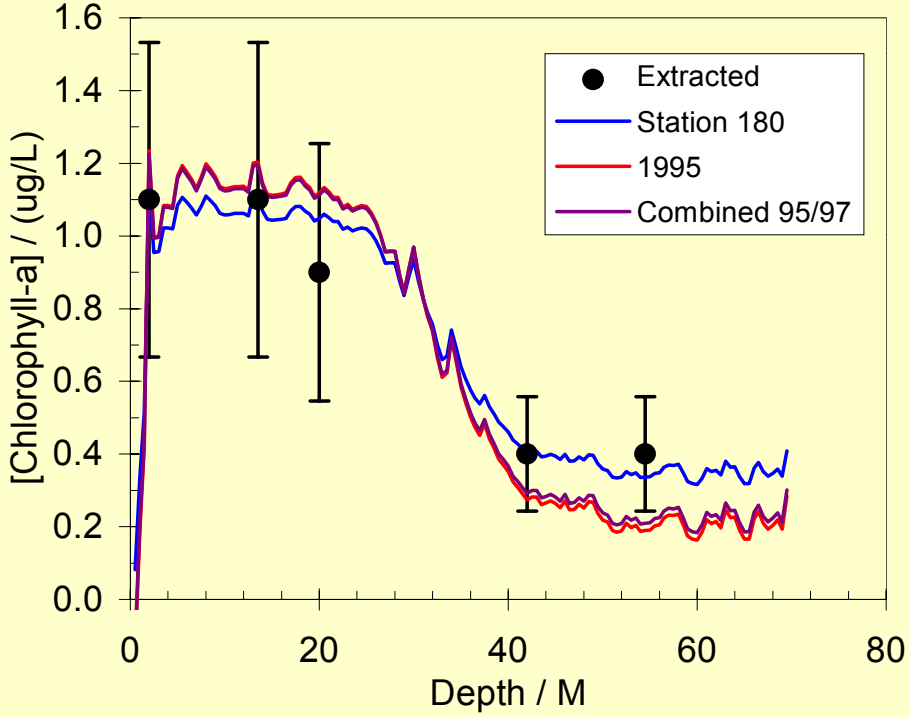
Combined Descriptive Stats	
Mean	0.85547
Standard Error	0.03833
Standard Deviation	0.53531
Kurtosis	4.68103
Skewness	-1.20027
N	195
Range	4.07907

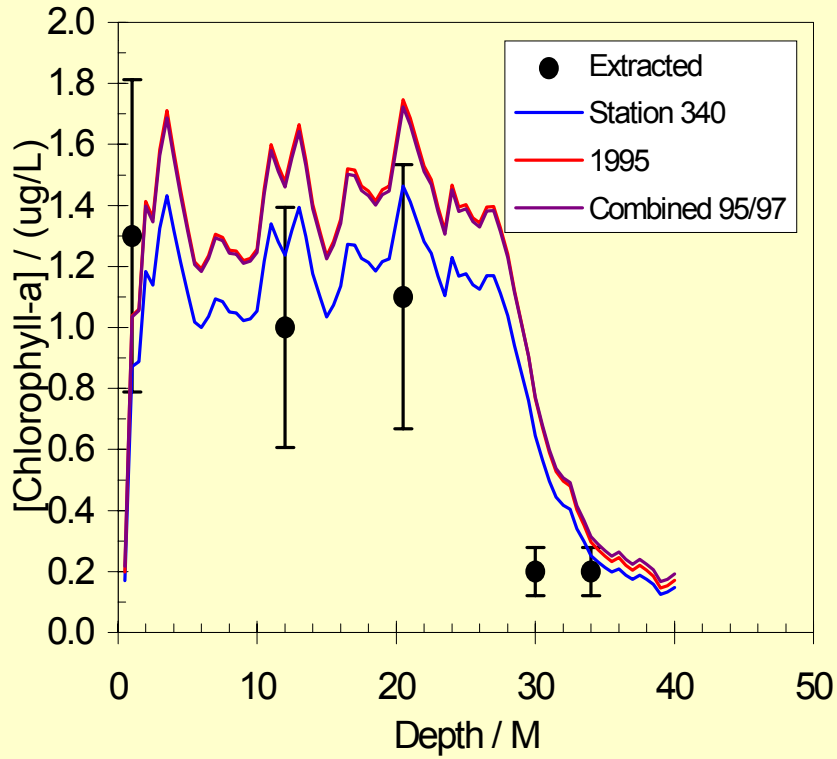
1995 Calibrated Chlorophyll-a Profiles



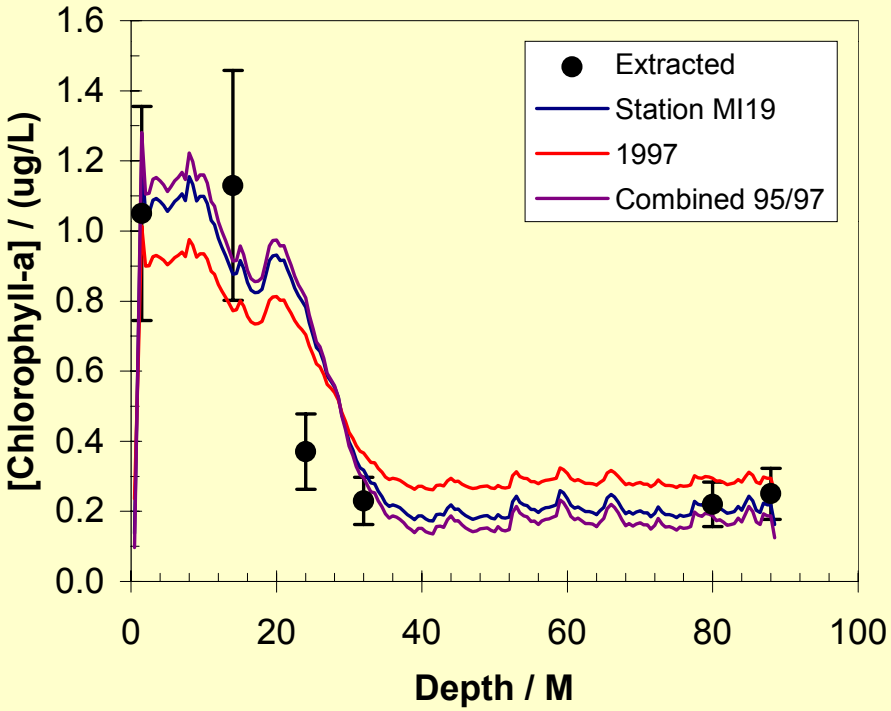


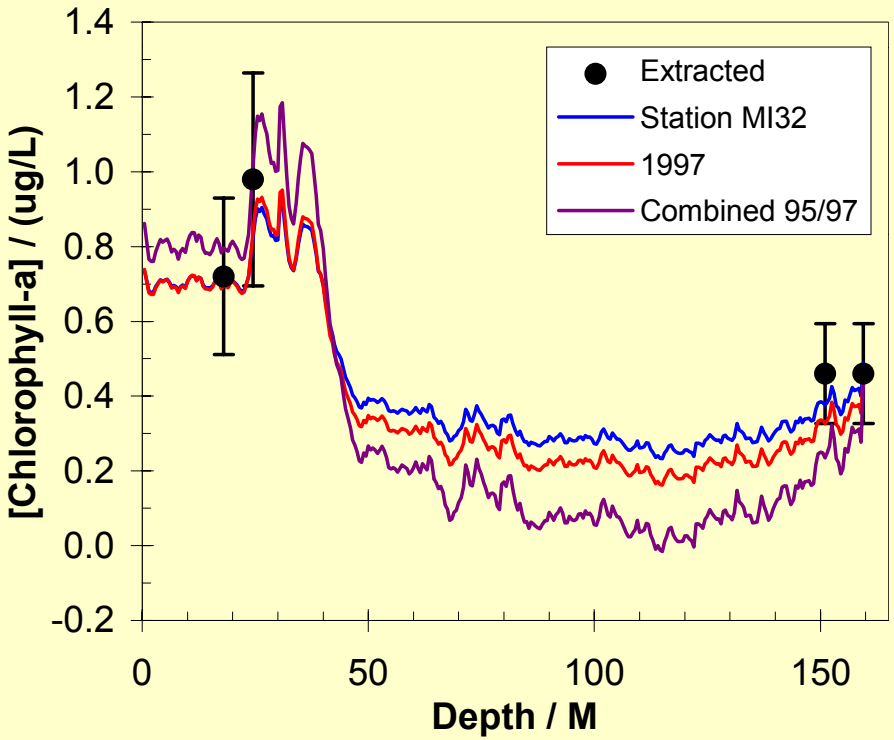
1995 Calibrated Chlorophyll-a Profiles



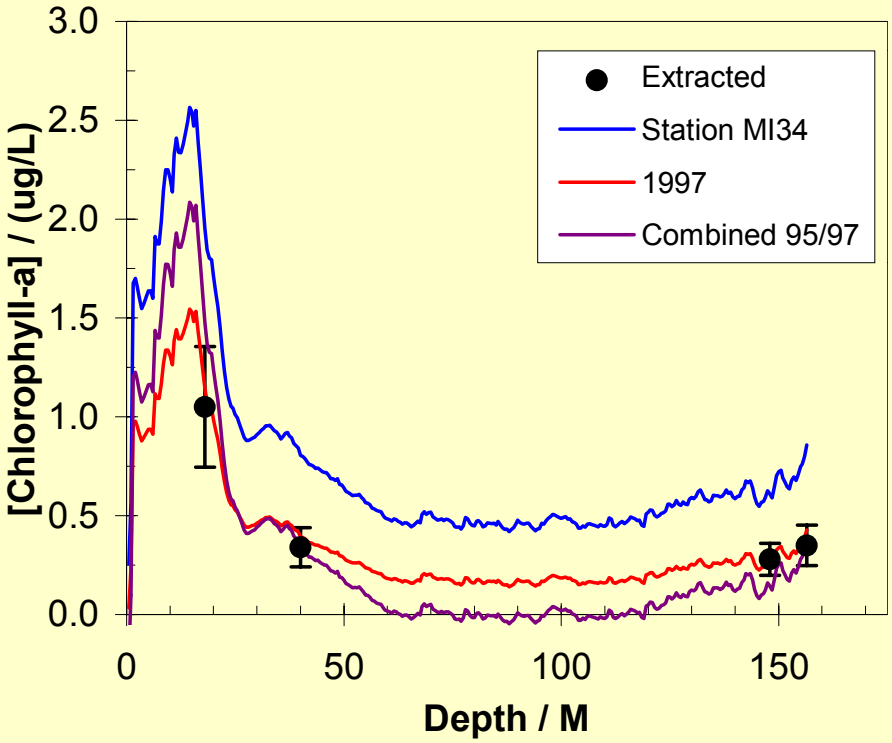


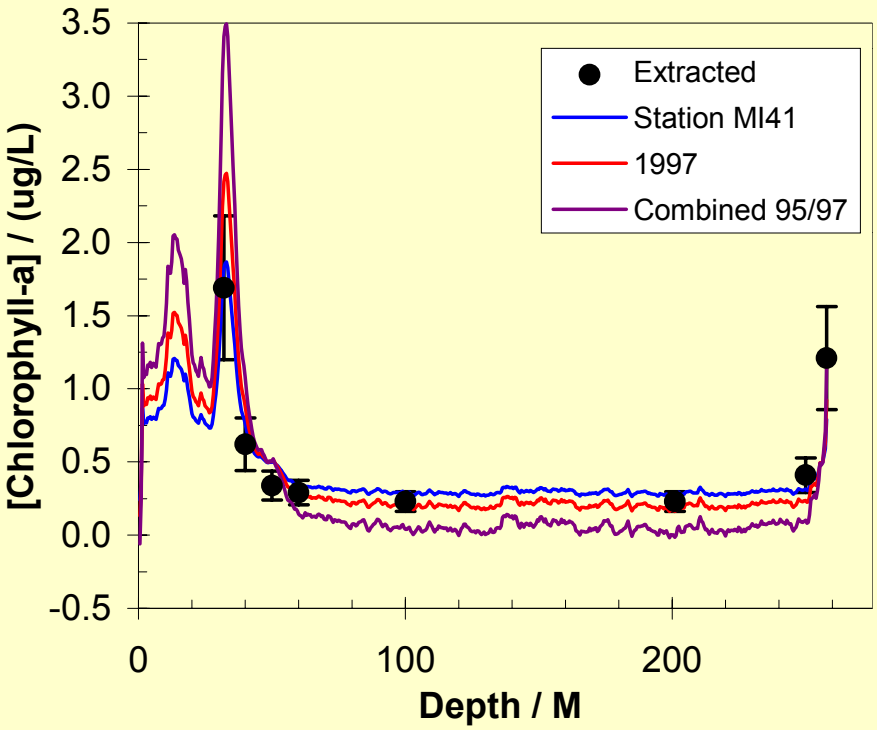
1997 Calibrated Chlorophyll-a Profiles





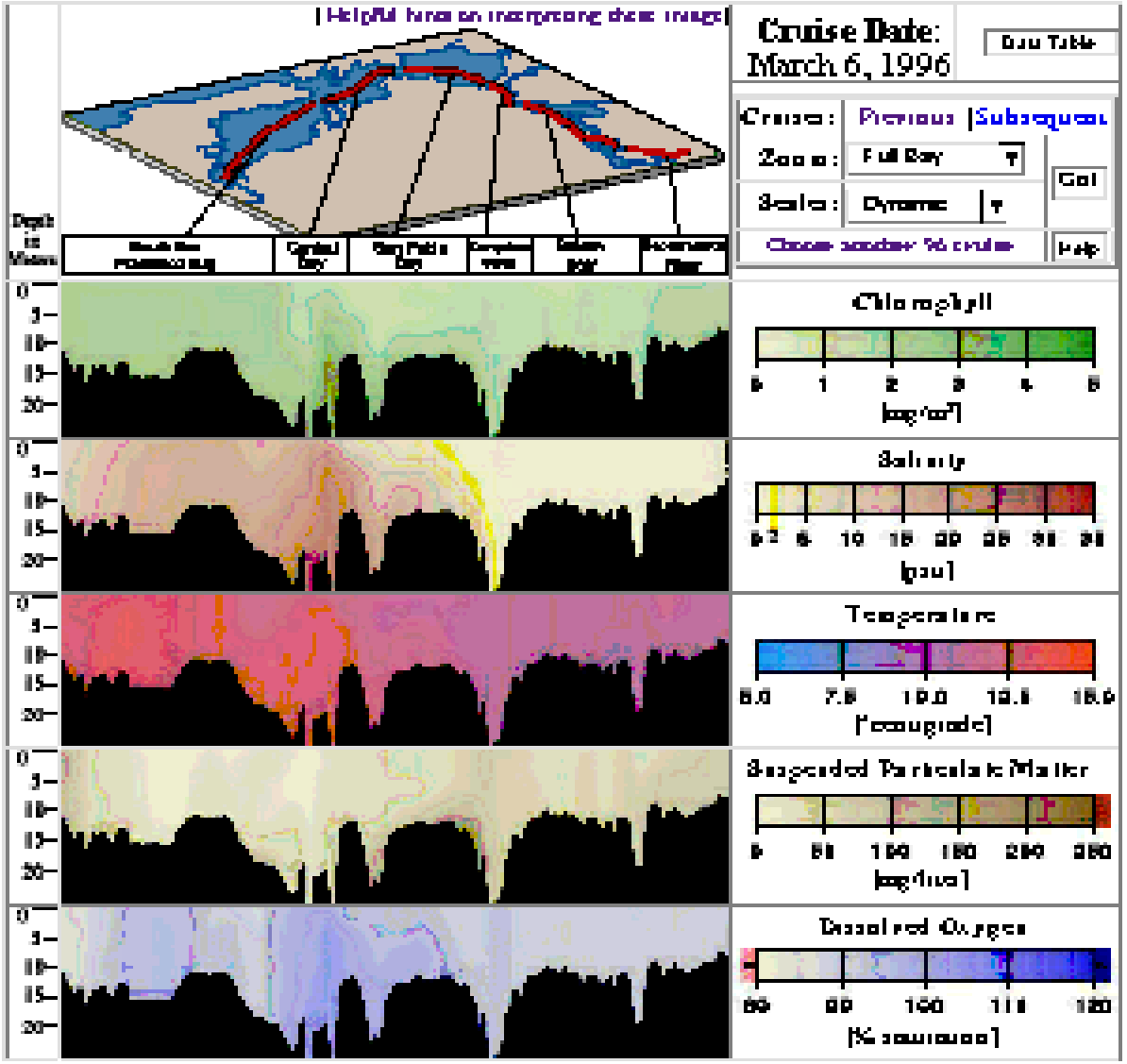
1997 Calibrated Chlorophyll-a Profiles





Online Seabird Results from USGS

http://sfbay.wr.usgs.gov/access/wqdata/index.html



Conclusion

Then. . .

Poor laboratory & sample handling practices have restricted the data quality

Implementation of the R/V Lake Guardian audit recommendations

Now. . .

Field-lab correlation is excellent on a per cruise basis

Field-lab correlation is weaker for the interyear comparison

1995 lab data is questionable

Looking toward the future. . .

Stratify by depth and season

Upload Seabird files into GLENDA

Data availability through GLNPO website (e.g., USGS)

Challenge to the peer review panel. . .

In consideration of the stated error limits for this project, is the General Calibration Model credible?

What are the limitations of using this approach?

How could the General Calibration Model be improved?