Great Salt Lake Selenium Studies
Project 2B
Synoptic Survey of Selenium in Water, Seston, and *Artemia* Biomass

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In cooperation with: Utah Strategic Alliance

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Project Objectives

Objective #1:

- Document the temporal and spatial characteristics of total selenium (T-Se) in water and correlate with seston and *Artemia* tissue concentrations.

Objective #2:

- Correlate isotopic 15N and 13C levels with T-Se in *Artemia* tissue.

Objective #3:

- Monitor primary production indicators and record *Artemia* population dynamics.

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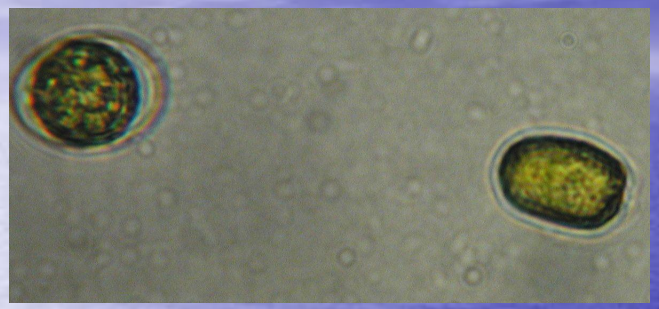
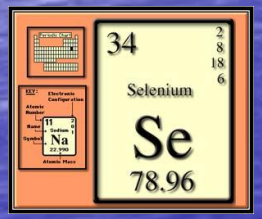
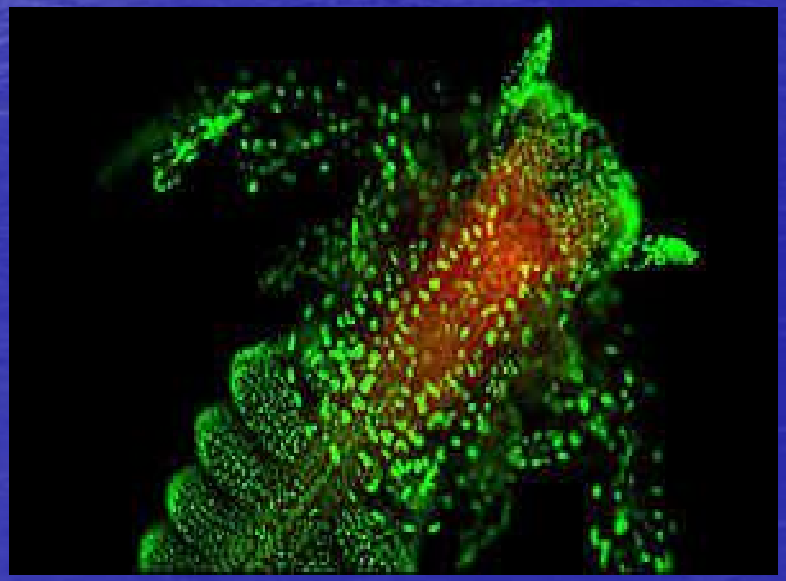
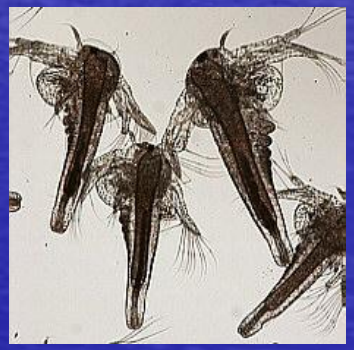
Contribution to Conceptual Model









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Project Calendar

Month	Workplan Sampling	Workplan # Sites	Completed/Add'l # Sites	Actual/Add'l Sampling Freq.	Sampling Program
April	1x	6	7	1x (no water/seston)	1
May	1x	9	9	1x (no water/seston)	2
May	1x	9	9	1x	3
Jun	1x	9	9	1x (no water / seston)	4
Jun	1x	9	9	1x	5
July	1x	6	6	1x	6
July	1x	6	6	1x	7
Aug	1x	6	6	1x	8
Aug	0x	0	6	1x	9
Sep	1x	6	6	1x	10
Oct	1x	6	6	1x	11
Nov	1x	6	6	1x	12
Dec	0x	0	6	1x	13
Jan	0x	0	6	1x	14
TOTAL	11	78	97	12/2	

Additional sampling proposed for Dec and Jan. Artemia population is anticipated to still be present in early Dec. Cysts should be the only Artemia biomass remaining in January.

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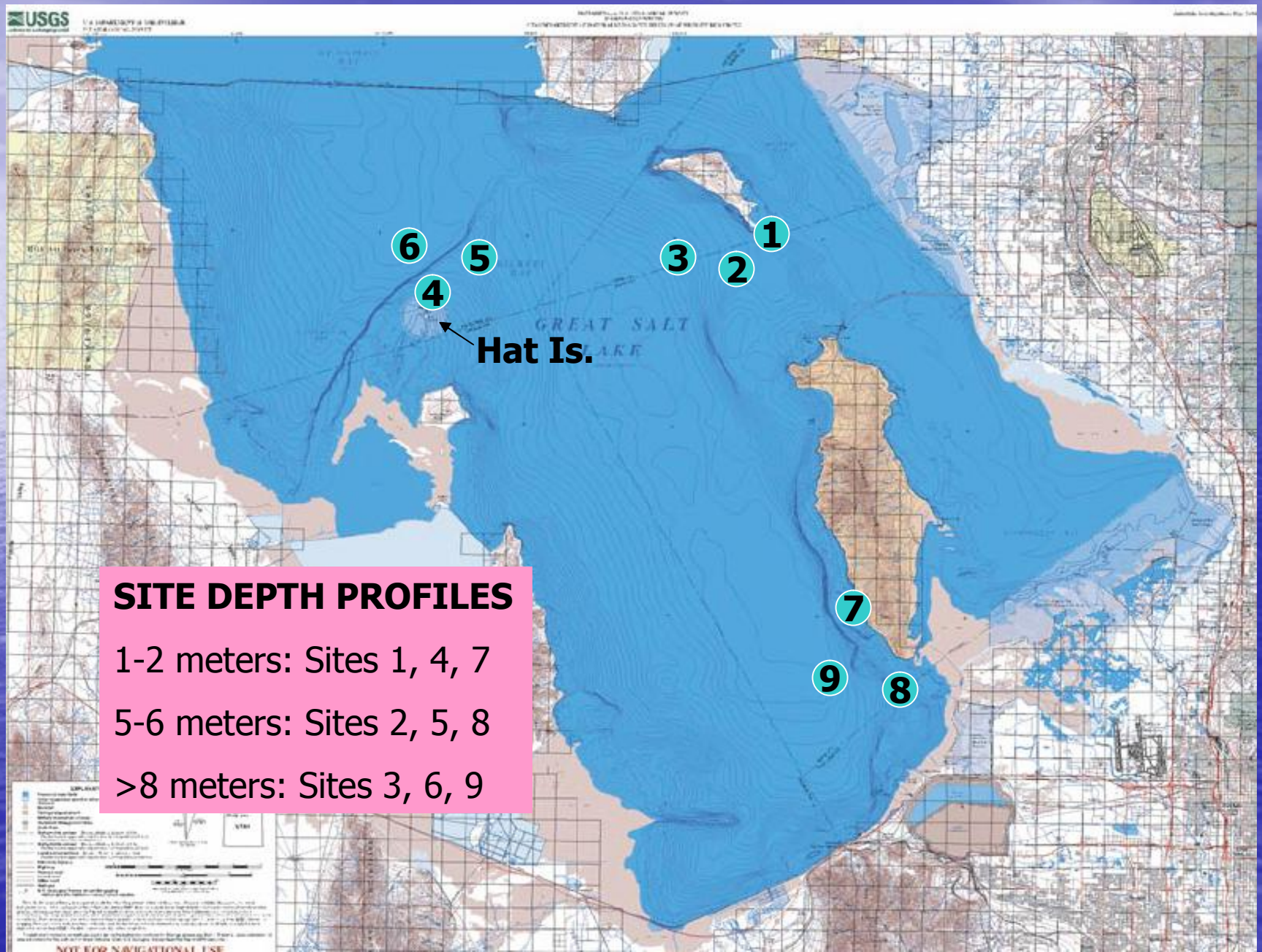
Sampling Locations



SITE DEPTH PROFILES

1-2 meters: Sites 1, 4, 7

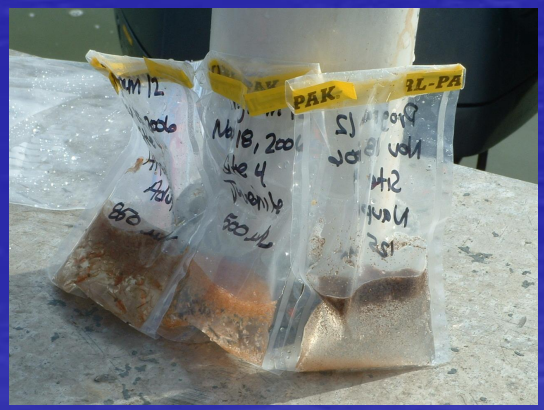
5-6 meters: Sites 2, 5, 8

>8 meters: Sites 3, 6, 9

Samples and Methods

Artemia Biomass

- **Vertical plankton net haul (minimum 2 net hauls)**
- **Biomass separated into three size/age-classes (adults, juveniles, nauplii & cysts).**
- **Artemia isolated and other zooplankton removed. Samples stored at -25C.**
- **Adult fraction analyzed for all sites.**
- **Juvenile and nauplii/cyst fraction analyzed for selected sites.**



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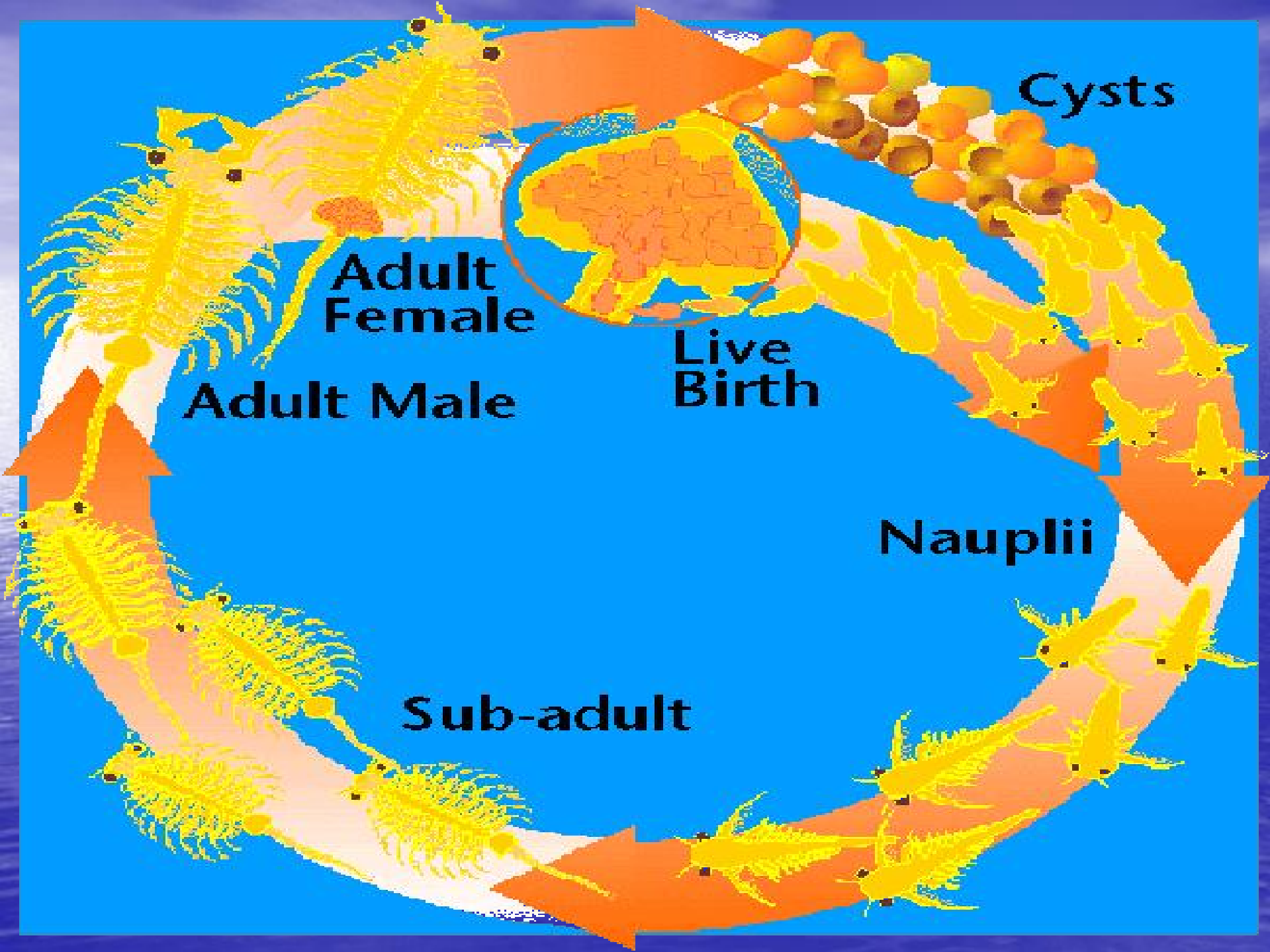
Cysts
Adult
Female
Live
Birth
Adult Male
Nauplii
Sub-adult

Samples and Methods

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Artemia Cysts:

- **Floating accumulations of cysts in close proximity to sample sites were opportunistically collected when available.**
- **Stored at -25C until shipment to lab for analysis.**

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Samples and Methods

GSL Water Samples:

- **Collected with Geotech peristaltic pump and teflon lined tubing.**
- **Filtered through 125 micron sieve.**
  - **Two 250 ml volume preserved with nitric acid (pH 2)**
  - **One 1000 ml volume preserved with Lugol's solution and saved for micro-algae analysis.**
- **Filtered through 0.45 micron high capacity capsule filter**
  - **One 250 ml volume preserved with nitric acid (pH 2).**

All water samples to be analyzed for total selenium.

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Samples and Methods

Seston:

- **1000 to 3700 ml filtered via positive pressure through 0.45 micron 150 mm CA filter then stored at -25C until shipment for analysis.**

Chlorophyll A

- **50 to 100 ml filtered through 0.45 micron 47 mm CA filter.**
- **Filter wrapped in foil then stored at -25C until shipment to lab for analysis.**

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Samples and Methods

Phytoplankton:

- **1000 to 1200 ml samples collected per site:**
- **Shallow Sites: 1000 ml from 1 meter**
- **Medium Depth Sites: 400 ml each from 1, 3, 5 meters**
- **Deep Sites: 400 ml each from 1, 3, 5 meters**
- **Sample preserved with Lugol's**
- **Stored in Amber bottles at +5C**
- **Samples pooled by region (1,2,3 / 4,5,6 / 7,8,9)**
- **Shipped to Laboratory Ichthyology and Hydrobiology, Institute of Zoology, Tashkent, Uzbekistan for Analysis**

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Samples and Methods

ABIOTIC:

- **Dissolved Oxygen**
- **Temperature**
- **Salinity**
- **Depth intervals: 1m, 2m, 3m, 5m, 6m, 7m, 8m**

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Number of Samples Collected

Month	Artemia Biomass (A&N) (Workplan)	Artemia Biomass (A, J, & N)	Seston Samples (Workplan)	Seston Samples (Collected)
April	12	18	0	0
May	36	46	18	9
June	36	36	18	9
July	24	24	12	12
Aug	12	24	6	12
Sep	12	18	6	6
Oct	12	18	6	6
Nov	12	18	6	6
Dec	0	(18)	0	(6)
Jan	0	(6)	0	(6)
TOTAL	156	202 (226)	72	60 (72)

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Number of Samples Collected (Continued)

Month	GSL Water (Workplan)	GSL Water (Collected)	GSL 0.45 uM Water (Workplan)	GSL 0.45 uM Water (Collected)
April	0	0	0	0
May	18	9	0	9
June	18	9	0	9
July	12	12	0	12
Aug	6	12	0	12
Sep	6	6	0	6
Oct	6	6	0	6
Nov	6	6	0	6
Dec	0	(6)	0	(6)
Jan	0	(6)	0	(6)
TOTAL	72	60	0	60
ADD'L	0	12	0	12

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Sample Analysis: Frontier Geosciences

Sample Program	Program Date	GSL Water 125 micron	GSL Water 0.45 micron
1	April 30	0	0
2	May 6	0	0
3	May 25	9	3
4	June 12	0	0
5	June 27	9	3
6	July 13	6	2
7	July 27	6	2
8	Aug 22	6	2
9	Aug 28	6	2
10	Sep 24	6	2
11	Oct 14	6	2
12	Nov 20	(6)	(2)
Storage Exp.	July 27	8	0

Count does not include replicates and field blanks. Count = unique sample only.

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Sample Analysis: LET

Program Date	Seston C.A. Filter 0.45 micron	Artemia Biomass Adult	Artemia Biomass Juvenile	Artemia Biomass Naup/Cyst
April 30	0	7	0	0
May 6	0	8	0	0
May 12	6	0	0	0
May 25	9	9	0	0
June 12	0	0	0	0
June 27	8	9	0	0
July 13	6	6	0	0
July 27	6	6	0	0
Aug 22	9	6	0	5
Aug 28	6	6	0	6
Sep 24	6	6	5	6
Oct 14	6	6	5	6
Nov 20	6	6	6	6

Does not include method blanks and filter blanks.
All analyses have been completed for Programs 1-11 (through Oct 14).

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Sample Analysis: Aquatic Research Inc.

Sample Program	Program Date	GSL Chlorophyll A 0.45 micron C.A. Filter
1	April 30	6
2	May 6	8
3	May 25	9
4	June 12	6
5	June 27	9
6	July 13	6
7	July 27	6
8	Aug 22	5
9	Aug 28	6
10	Sep 24	6
11	Oct 14	6
12	Nov 20	0

Count does not include blanks. Count = unique sample only.

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Sample Analysis: Stable Isotope Lab

Sample Program	Program Date	Artemia Biomass Adult	Artemia Biomass Nauplii/cyst
1	April 30	7	3
2	May 6	8	3
3	May 25	9	3
4	June 12	9	3
5	June 27	9	3
6	July 13	6	3
7	July 27	6	3
8	Aug 22	6	3
9	Aug 28	6	3
10	Sep 24	6	3
11	Oct 14	6	3
12	Nov 20	6	3

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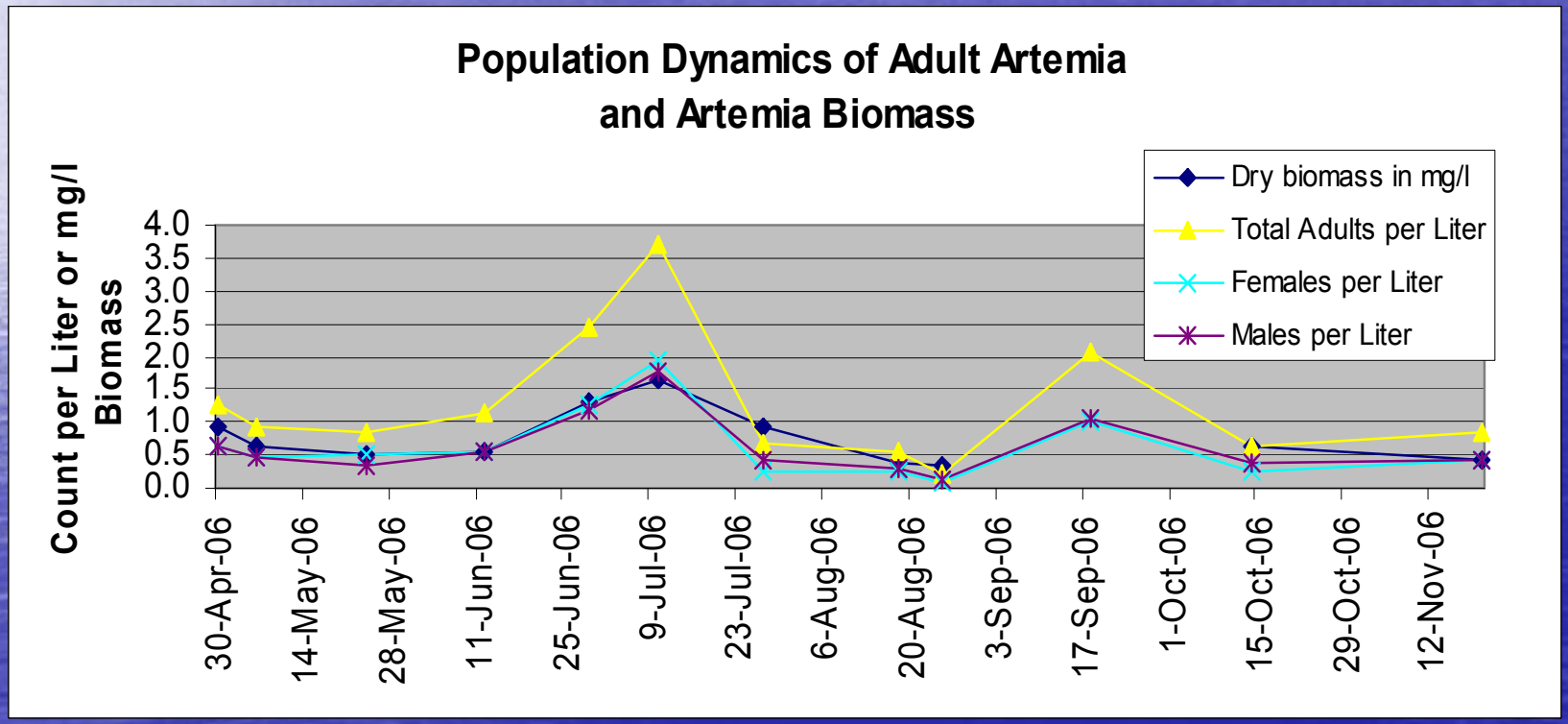
RESULTS
Artemia Population Dynamics



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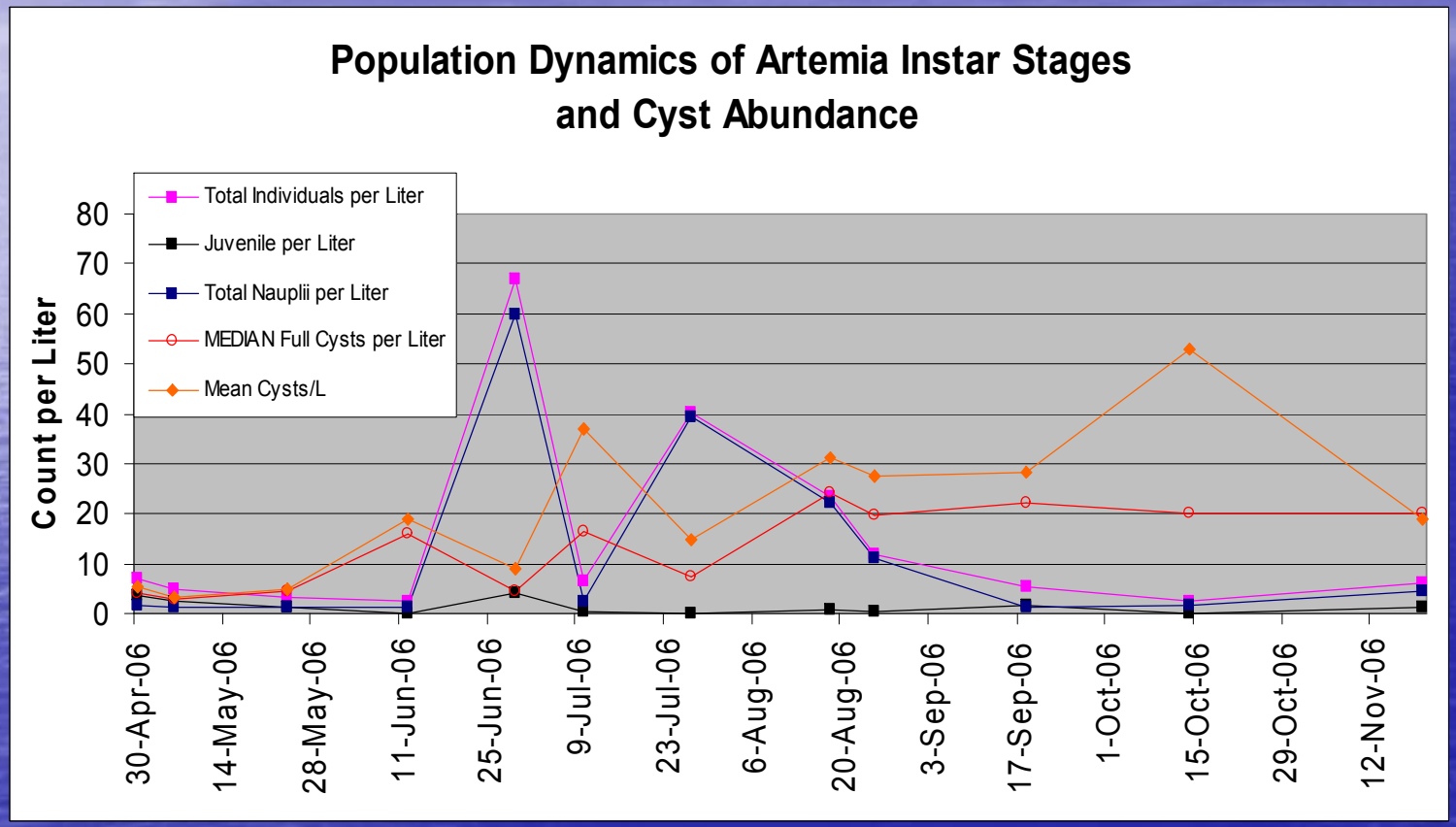
RESULTS
Population Dynamics



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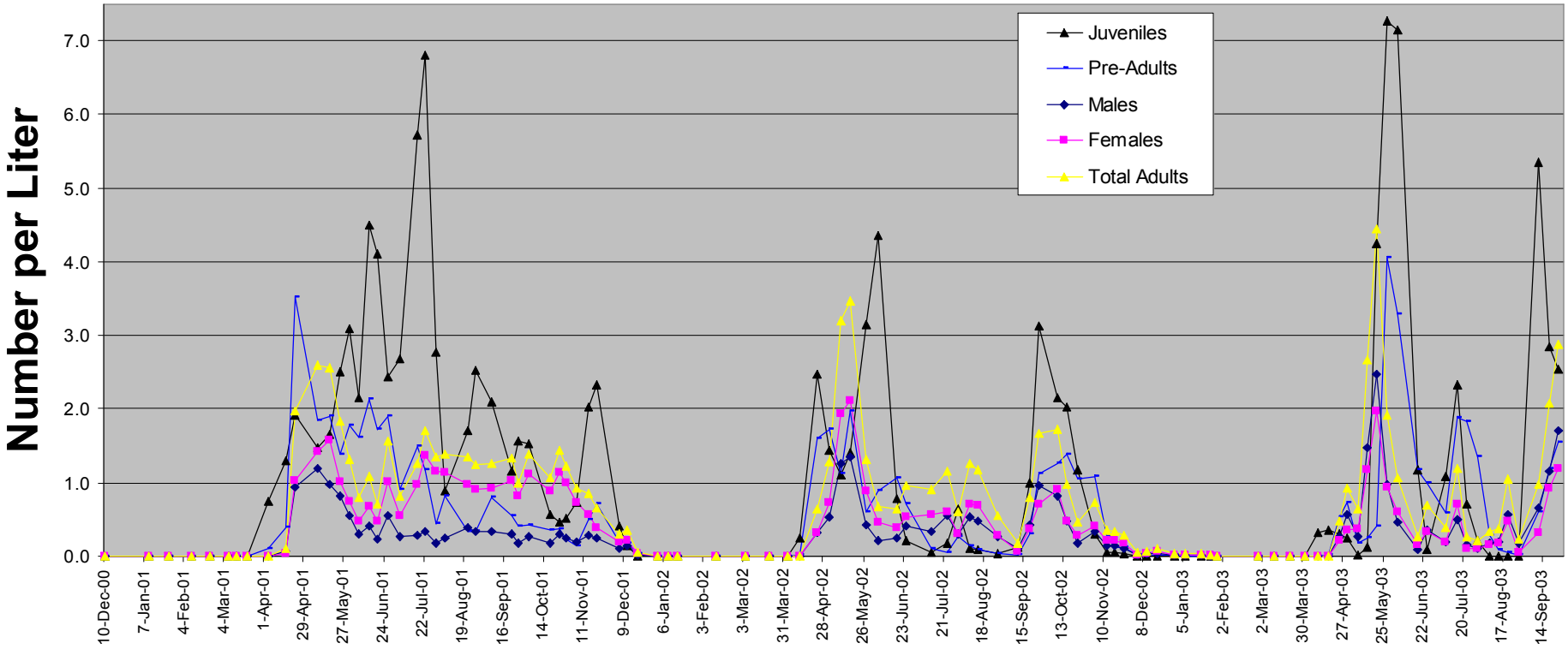
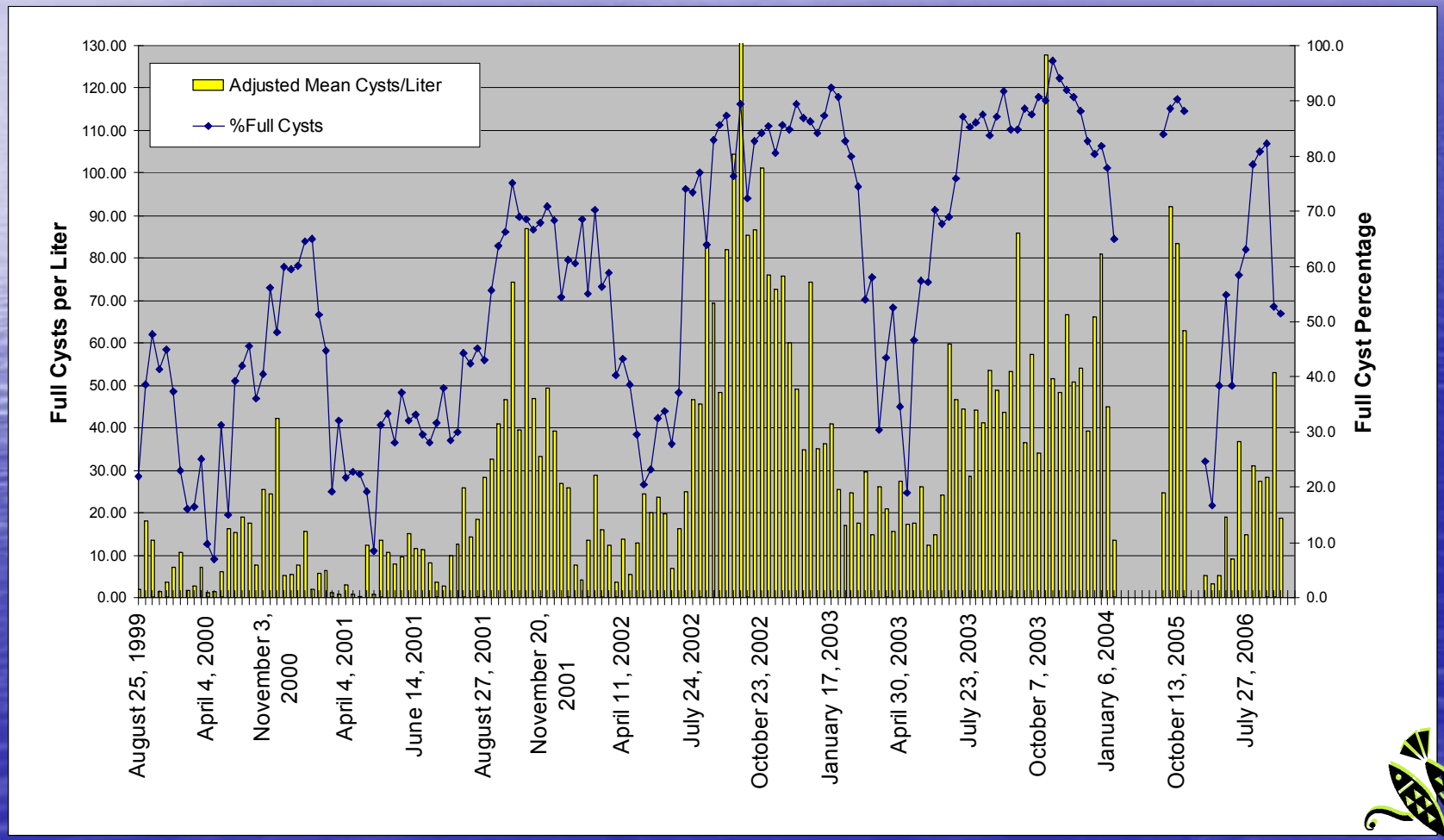
RESULTS
Comparative Population Dynamics
2001 to 2003

Juvenile, Pre-adult, and Adult Population Trends
2001-2003



RESULTS
Cyst Abundance
1999 to 2006



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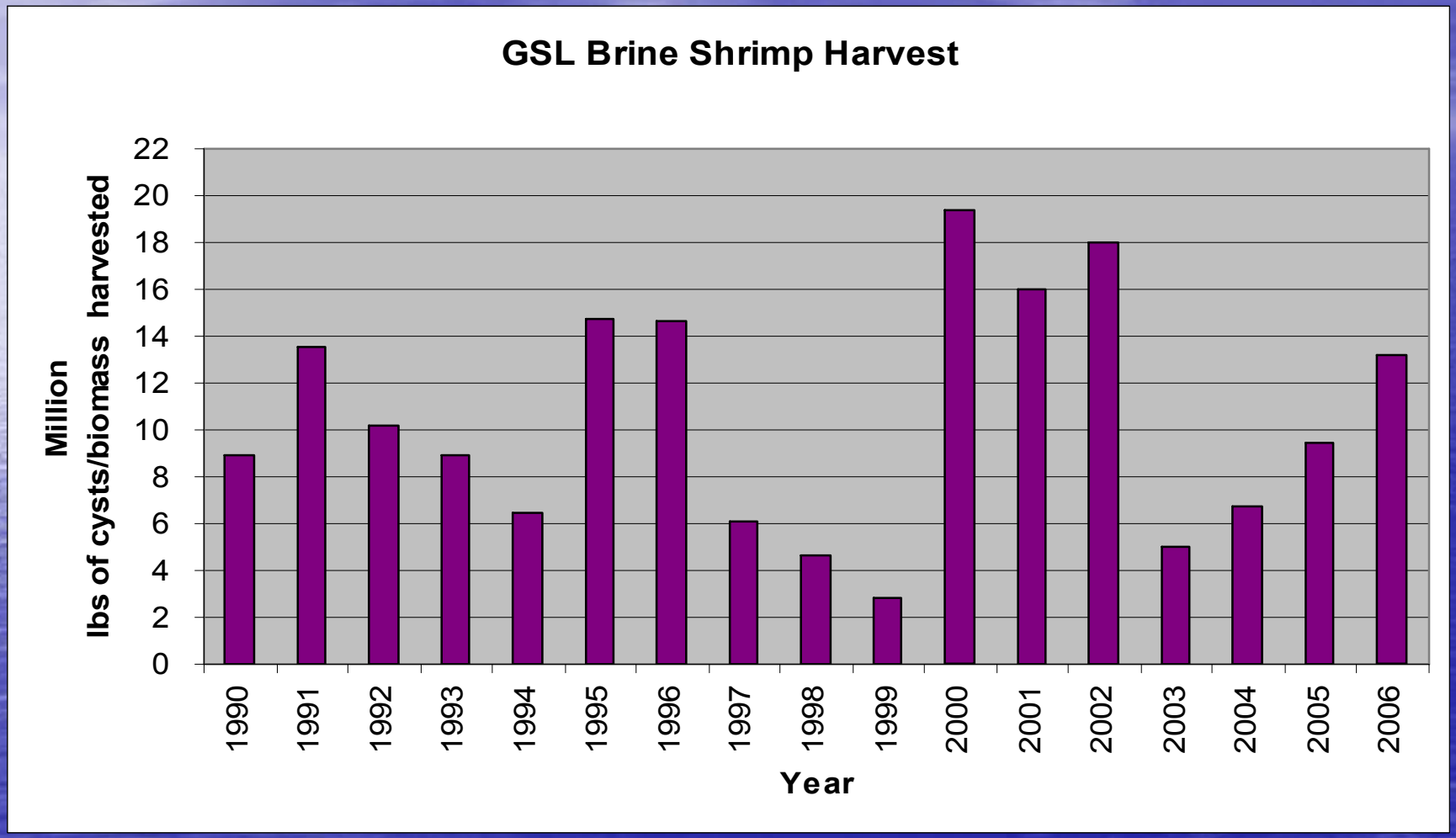
GSL Artemia Industry Harvest



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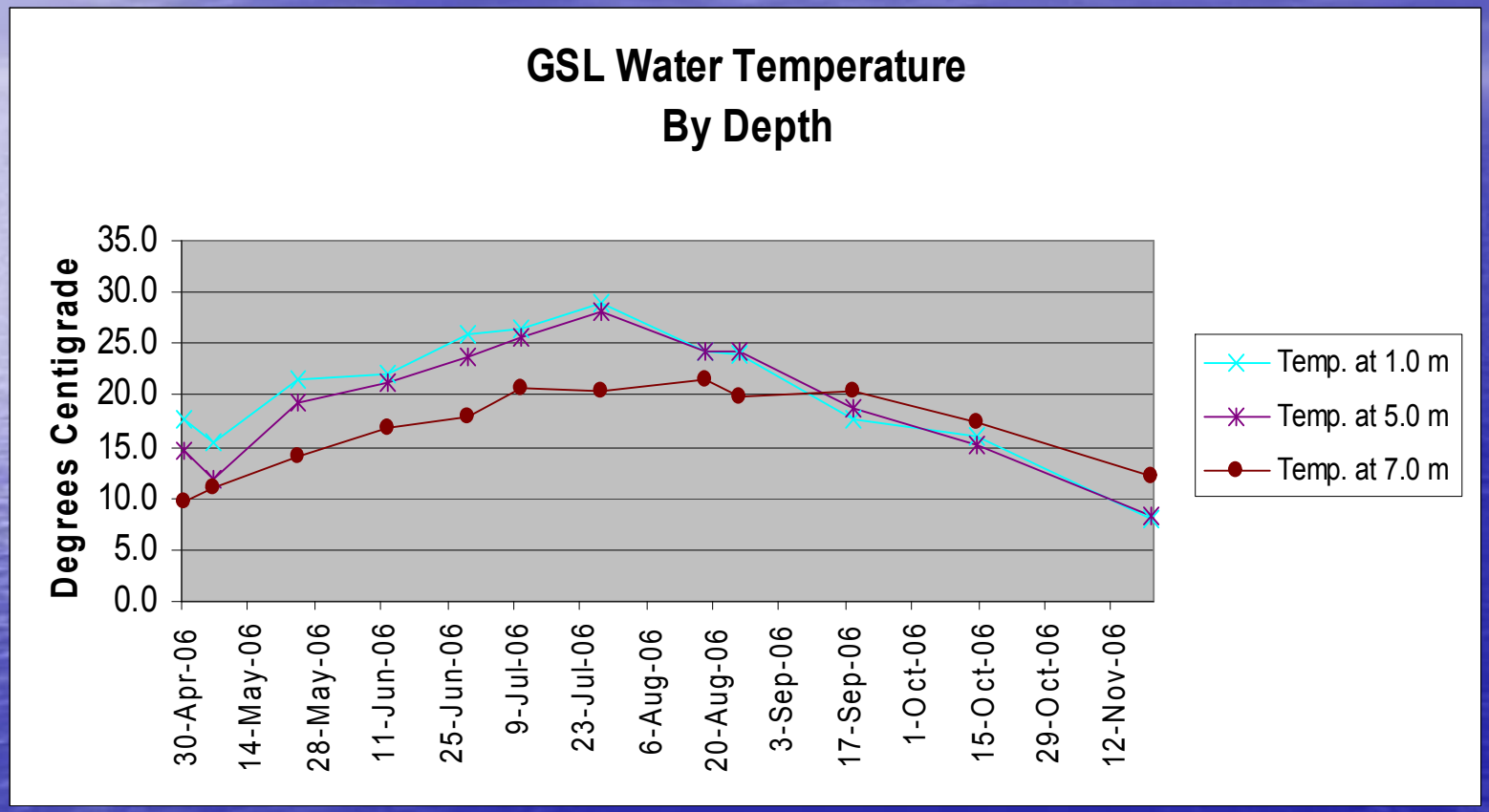
RESULTS
Water Temperature



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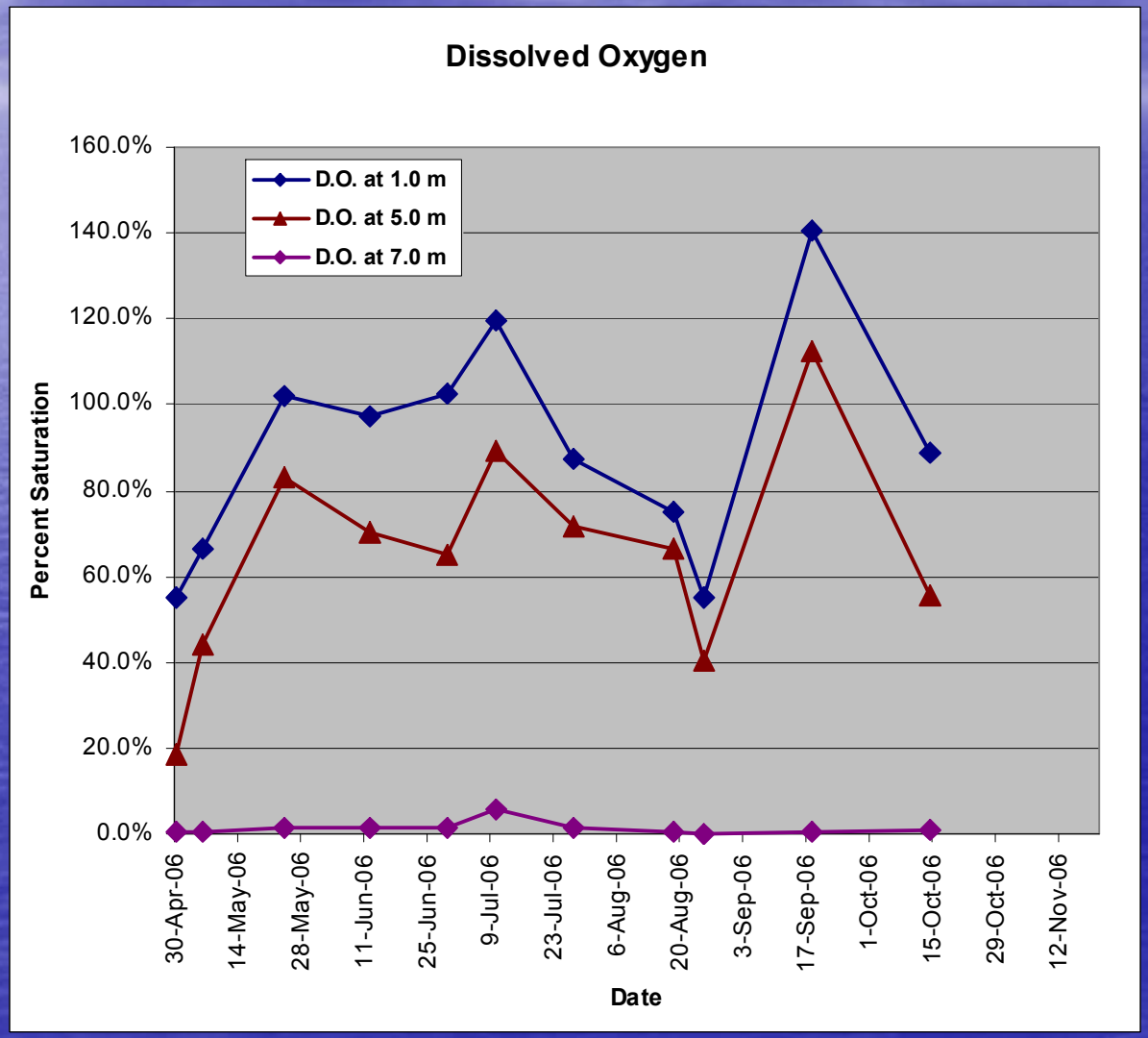
RESULTS
Dissolved Oxygen



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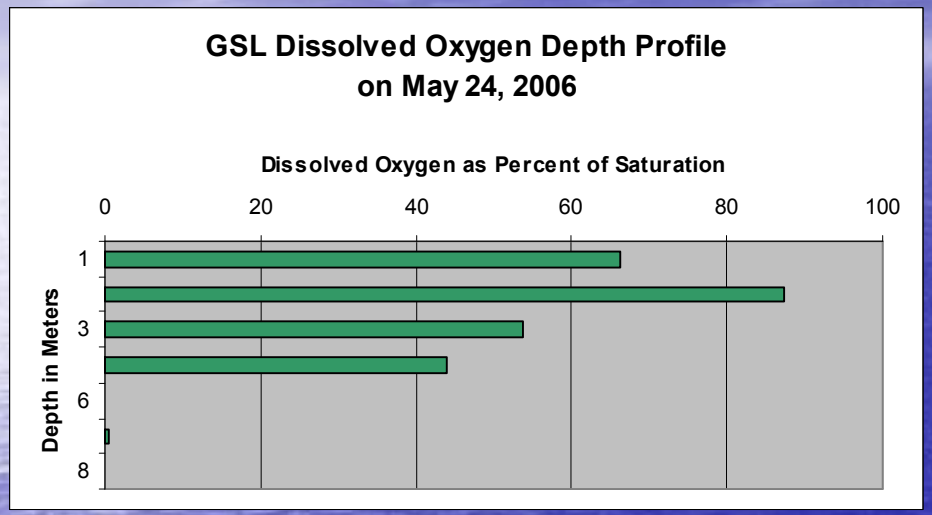
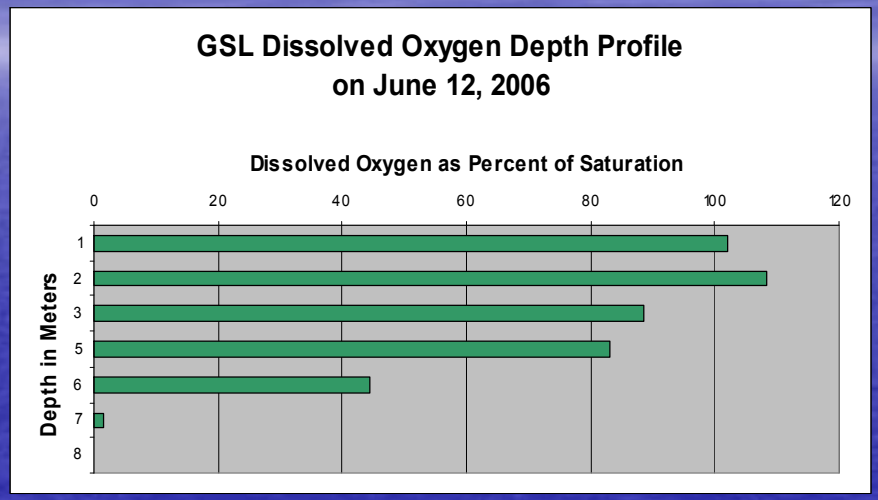
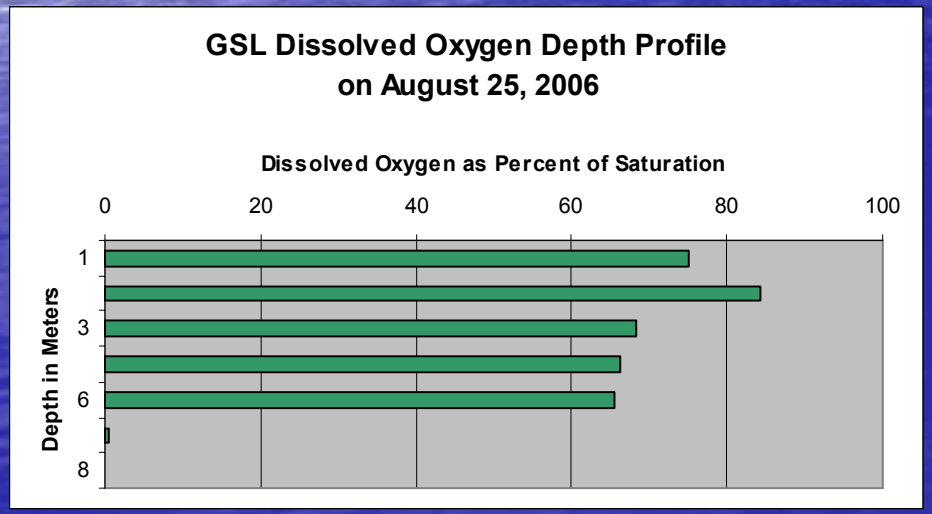
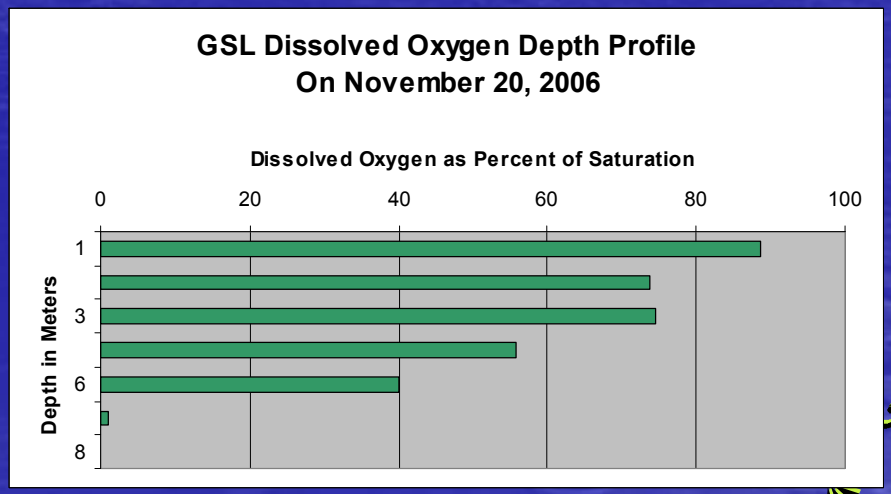
RESULTS
Dissolved Oxygen: Water Column Profiles









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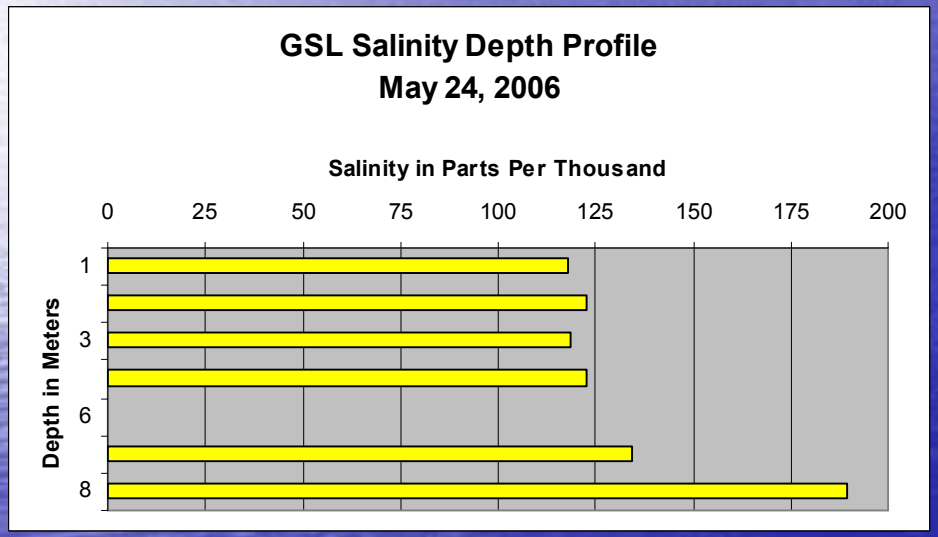
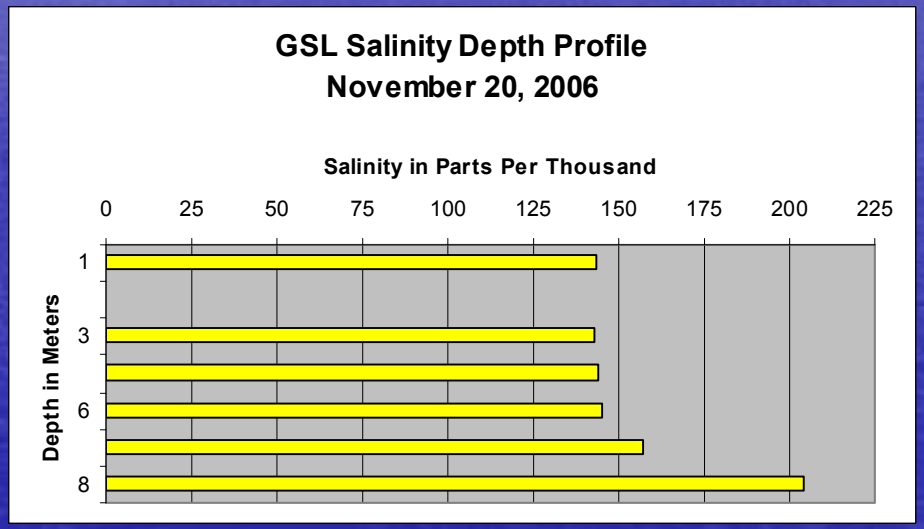
RESULTS
Salinity: Water Column Profile





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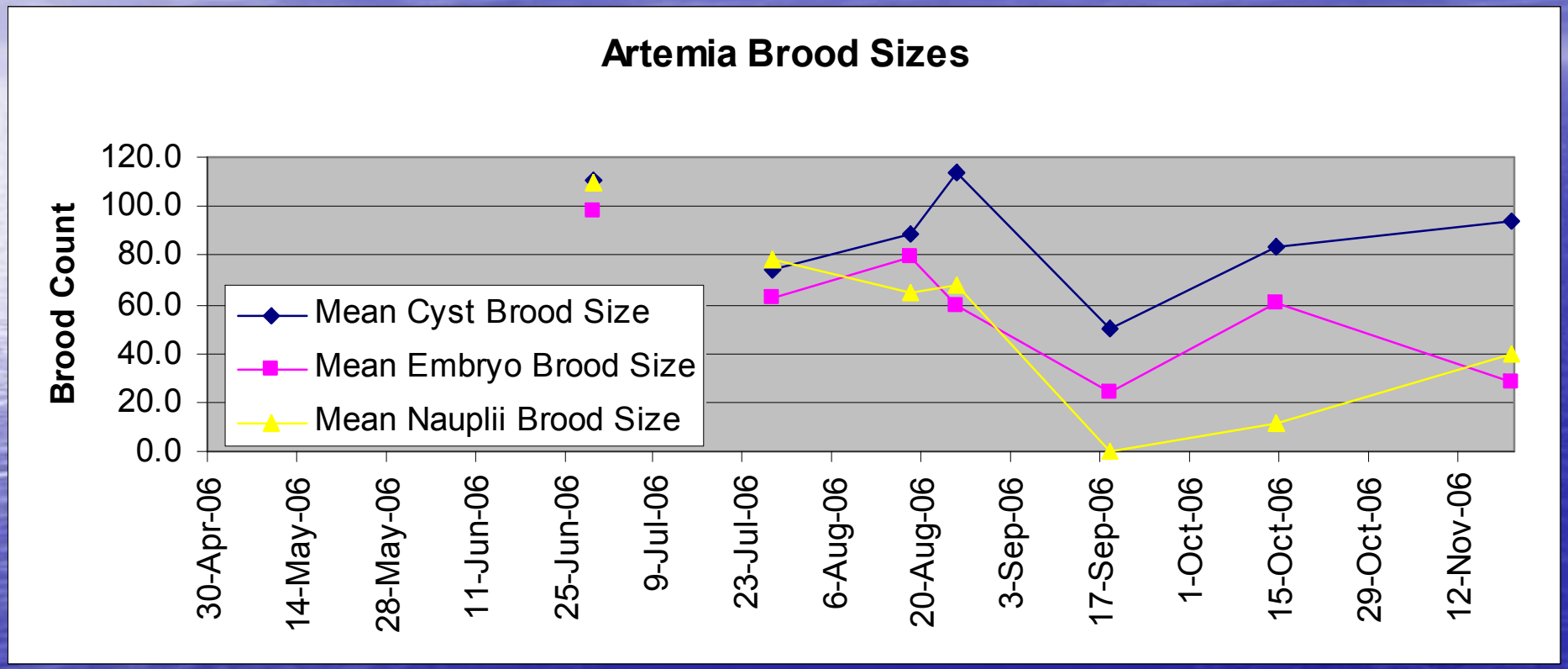
RESULTS
Artemia Reproduction



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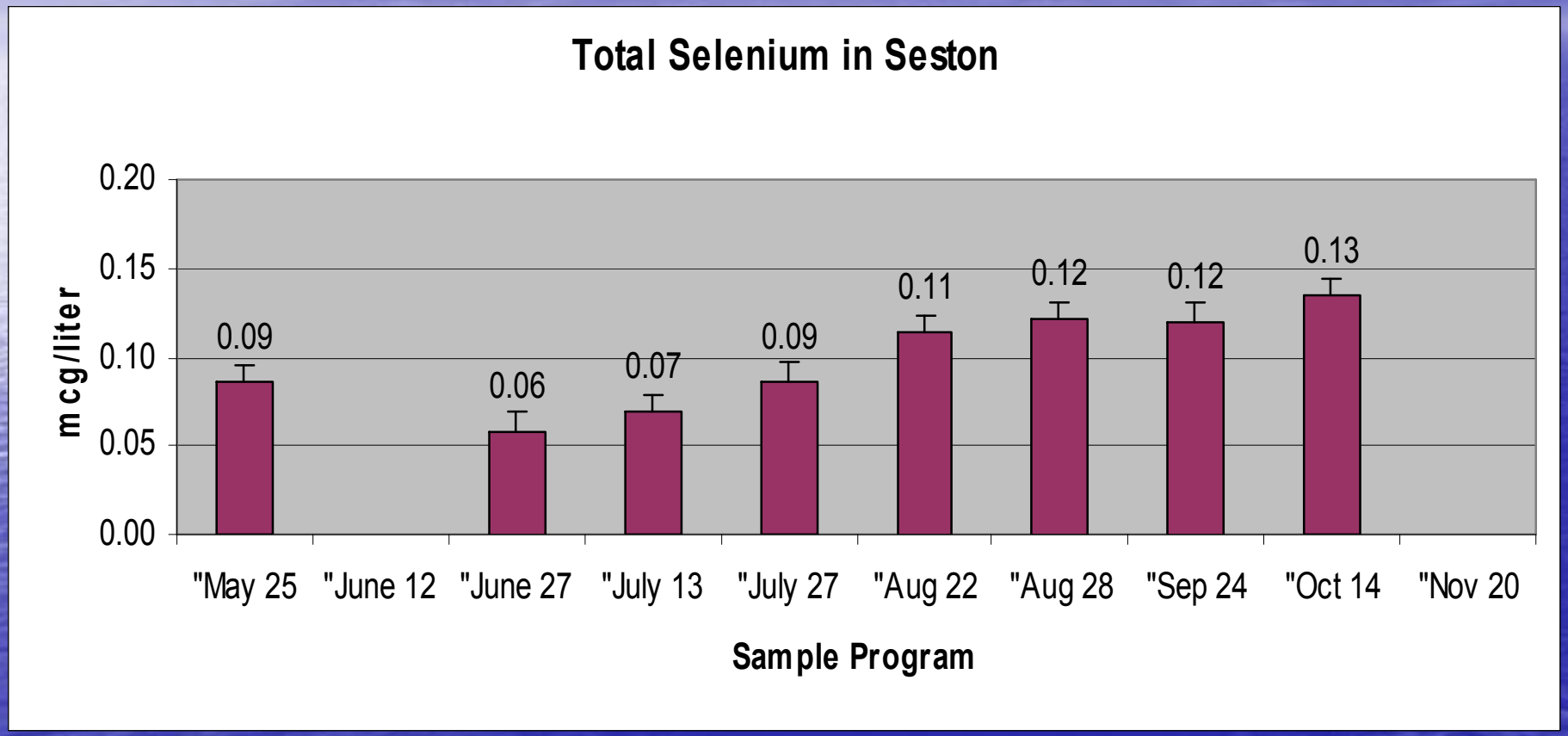
RESULTS
Selenium in Seston per Liter Filtered



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Seston Filter Experiment

METHOD

3 Filters:

- **0.45 micron cellulose acetate**
- **0.8 micron cellulose acetate**
- **0.45 micron polycarbonate**

GSL water pumped through filter until clogged.
Filtrate to be analyzed for Total Selenium

RESULTS

Average Volume Filtered:

- **O.45 CA: 0.675 liters**
- **0.80 CA: 1.320 liters**
- **0.45 PC: 0.247 liters**

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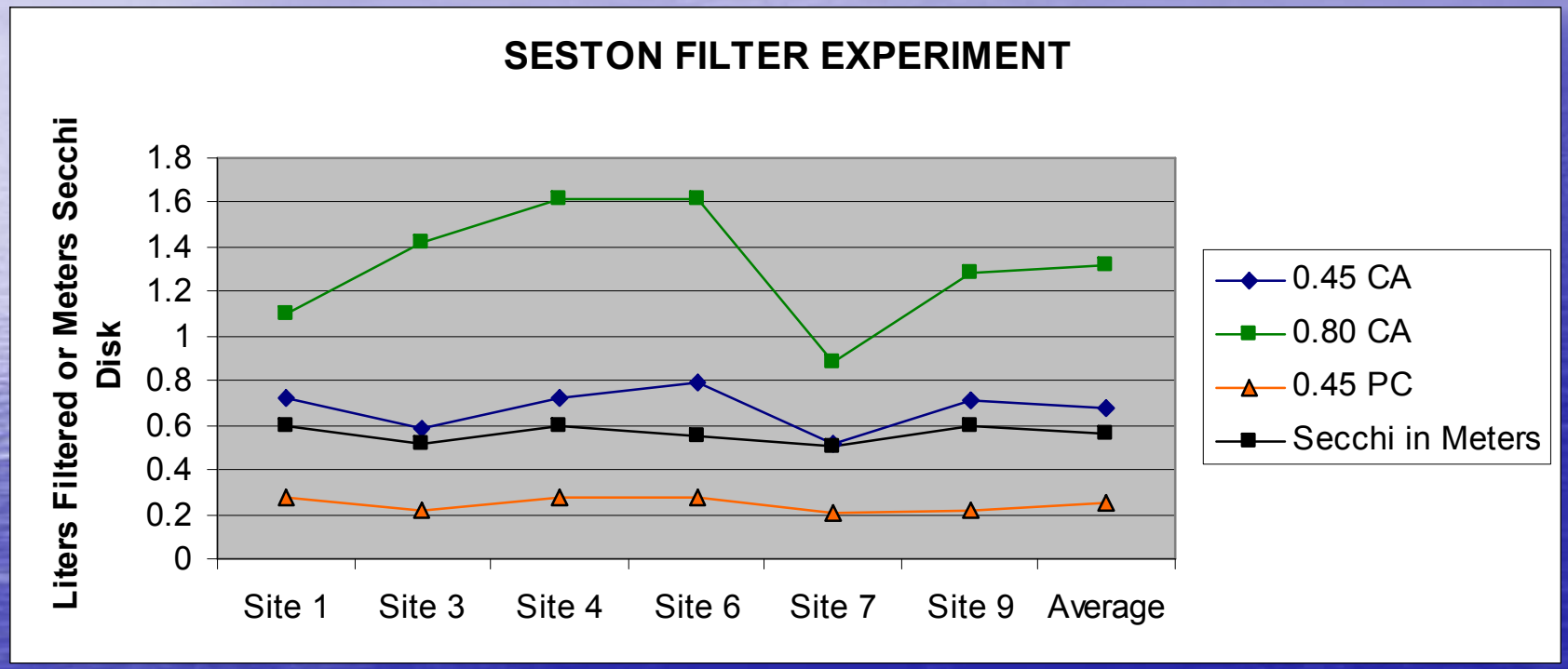
Seston Filter Experiment



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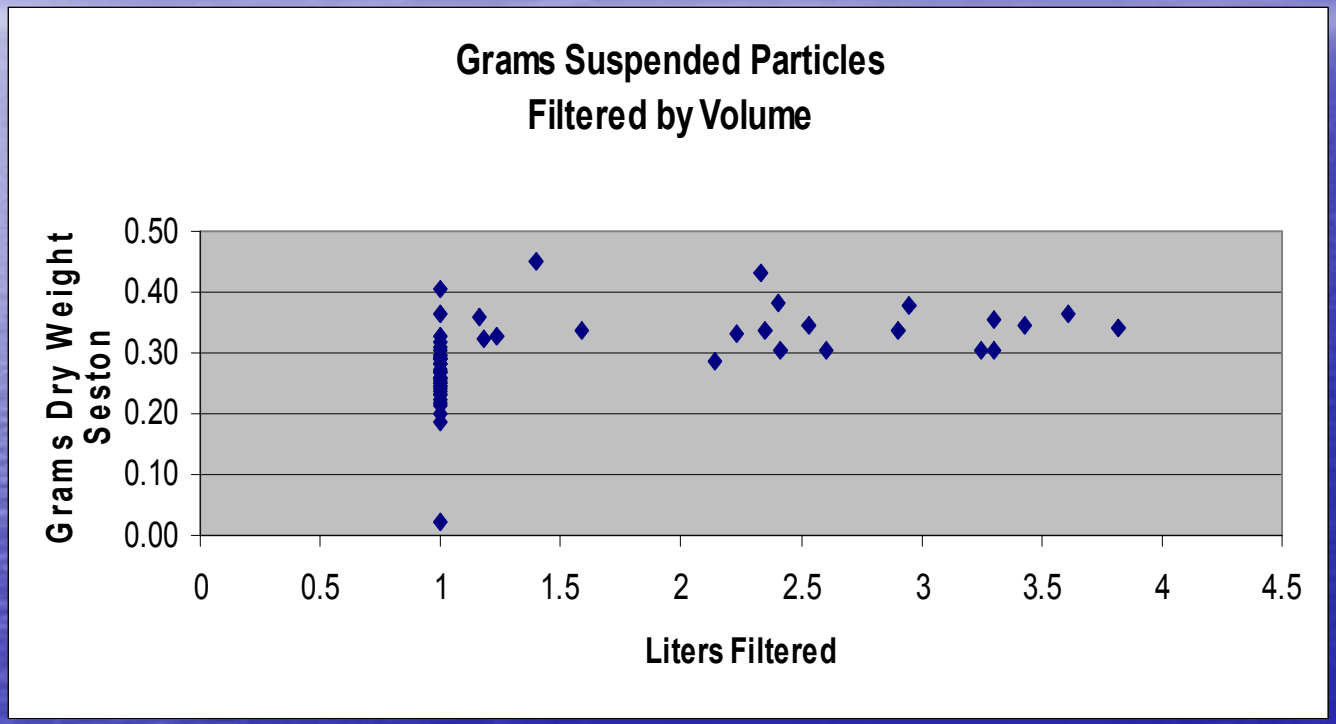
0.45 micron Cellulose Acetate Filter



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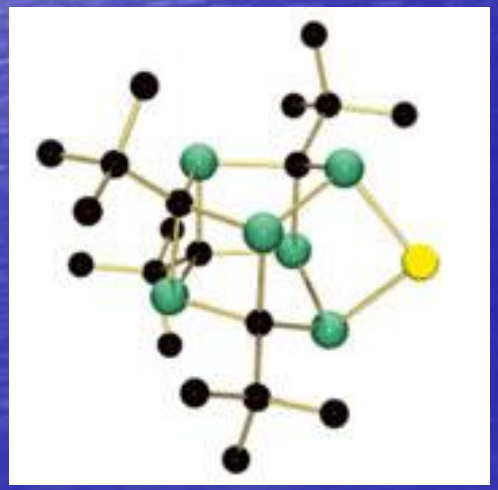
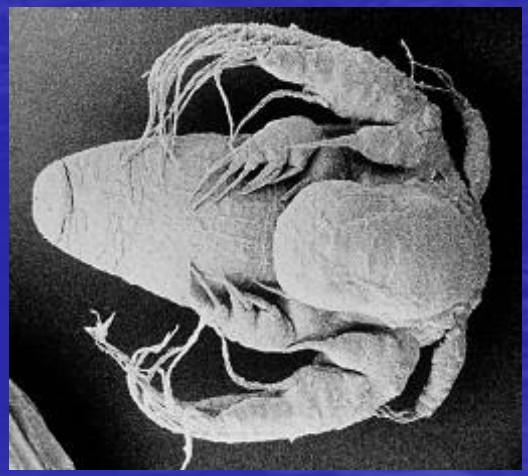
Next Steps

- Sampling programs in December and January.
- Send samples from Program 12 to labs.
- Analyze selenium results
- Recommend April-June 2007 pelagic sampling program





QUESTIONS?

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