



Site-specific Model Development for the Great Salt Lake

Forecasting Selenium Concentrations: Foodweb Specific Modeling

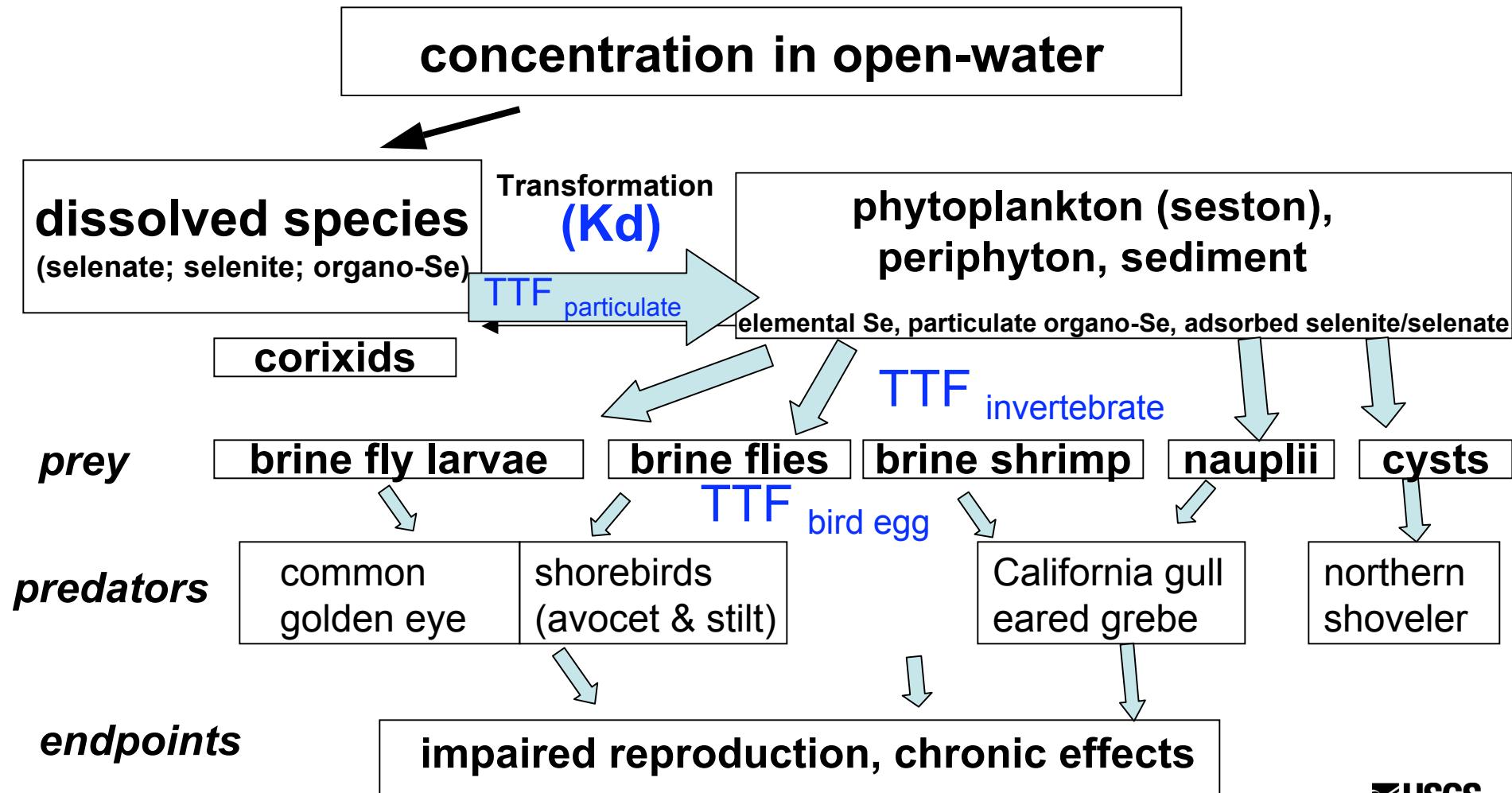
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Presentation to Science Panel
and Steering Committee
May 2, 2008

Great Salt Lake Selenium Model

$$\text{Composite Source Load} \div \text{Composite Volume}$$

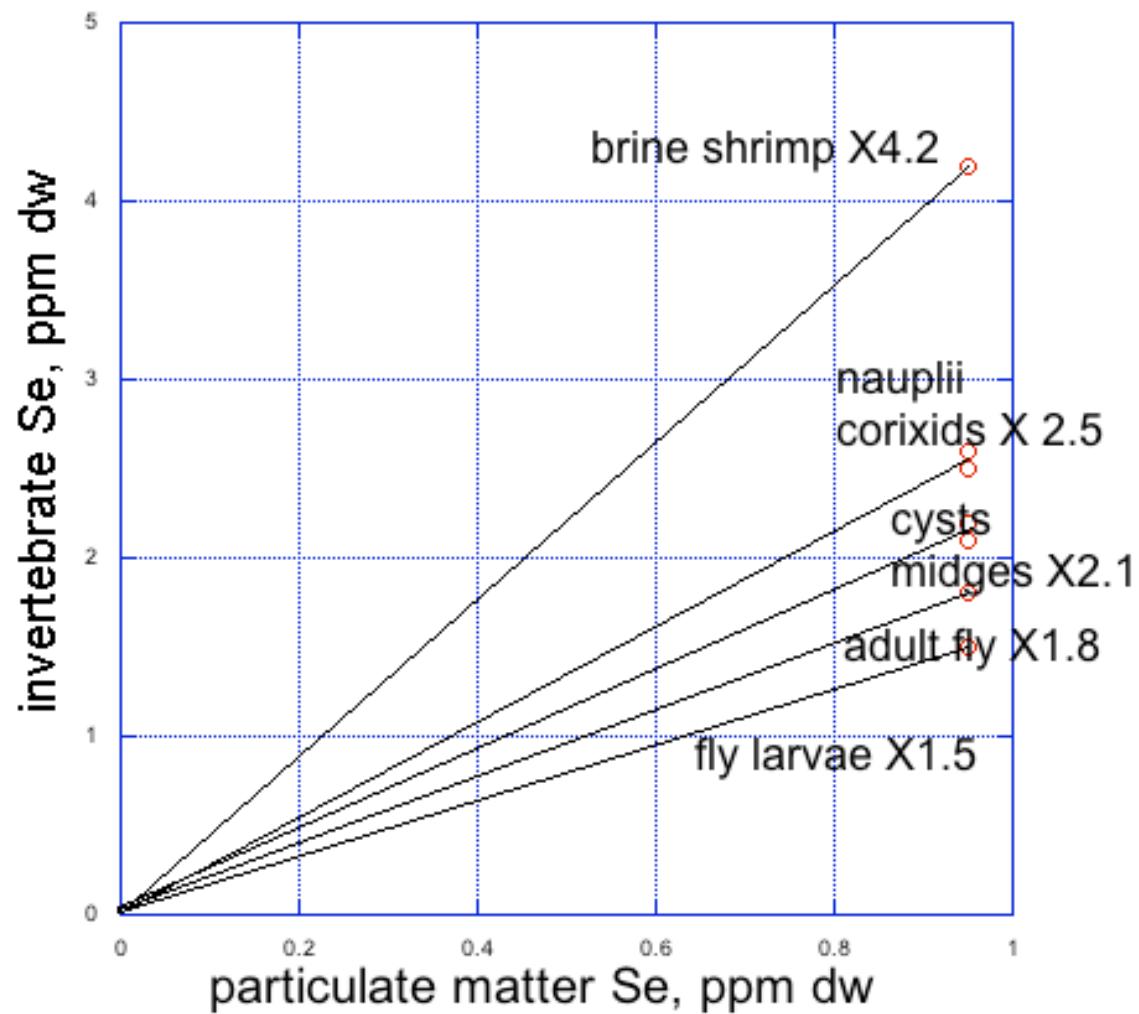


Site-Specific Trophic Transfer Factors

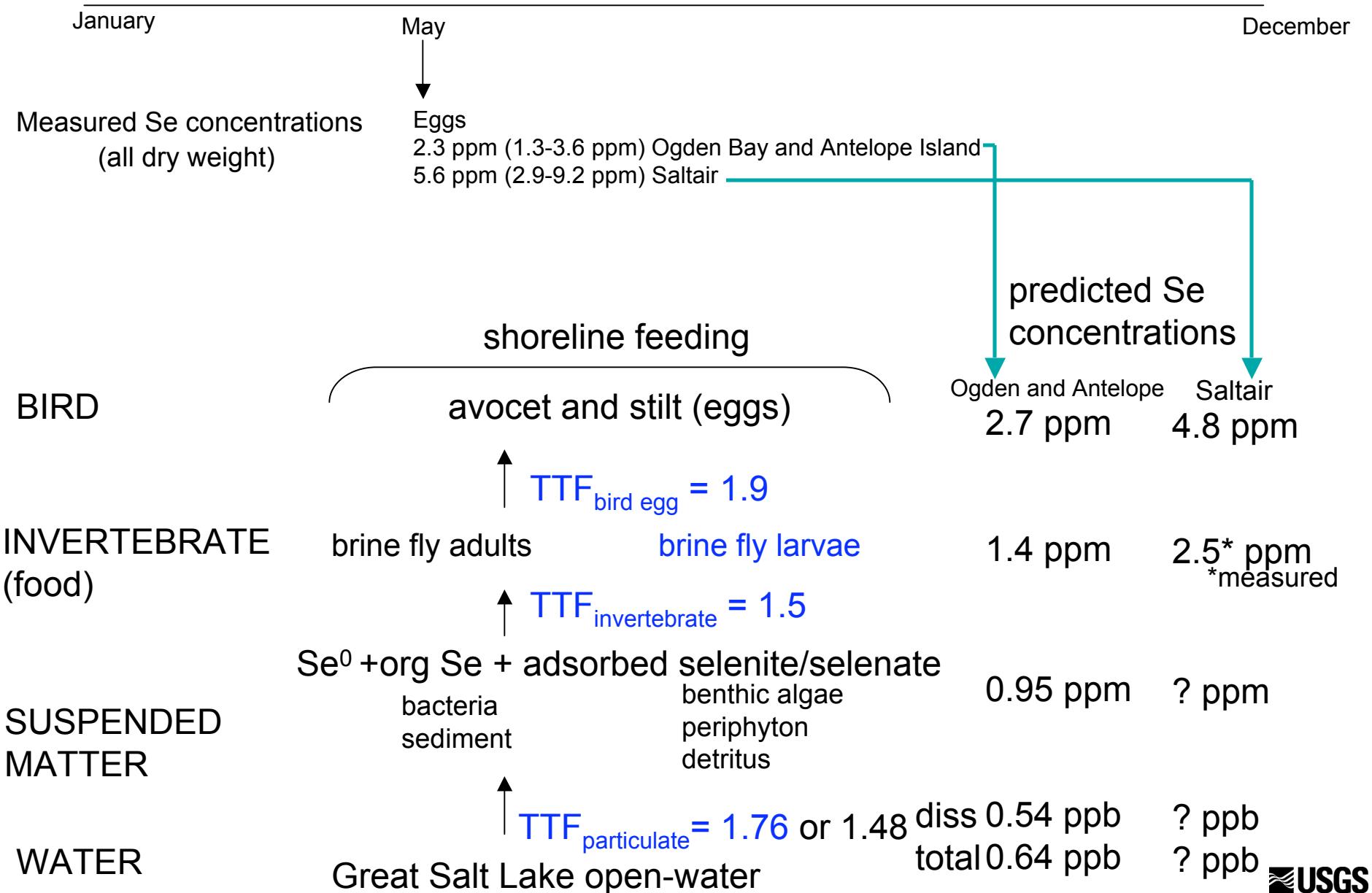
Measured concentrations	TTFs
Water-column =	0.64 ppb total 0.54 ppb dissolved
Seston=	0.95 ppm
Brine Shrimp =	3.97 ppm
Nauplius=	2.44 ppm
Cysts =	2.1 ppm
Brine fly adults =	1.7 ppm
Brine fly larvae =	1.4 ppm
Corixid =	2.4 ppm
Midge =	2.0 ppm
	Water to Seston= 1484 from total 1760 from diss
	Seston to Shrimp = 4.2
	Seston to Nauplius =2.6
	Seston to Cysts = 2.2
	Periphyton to Brine fly adult = 1.8
	Periphyton to Brine fly larvae = 1.5
	Seston to Corixid = 2.5
	Seston to midge = 2.1
	Diet to egg = 2.0 (1.8-2.55)

all dry weight, except water column

GSL trophic transfer factors (TTF_{invertebrate})

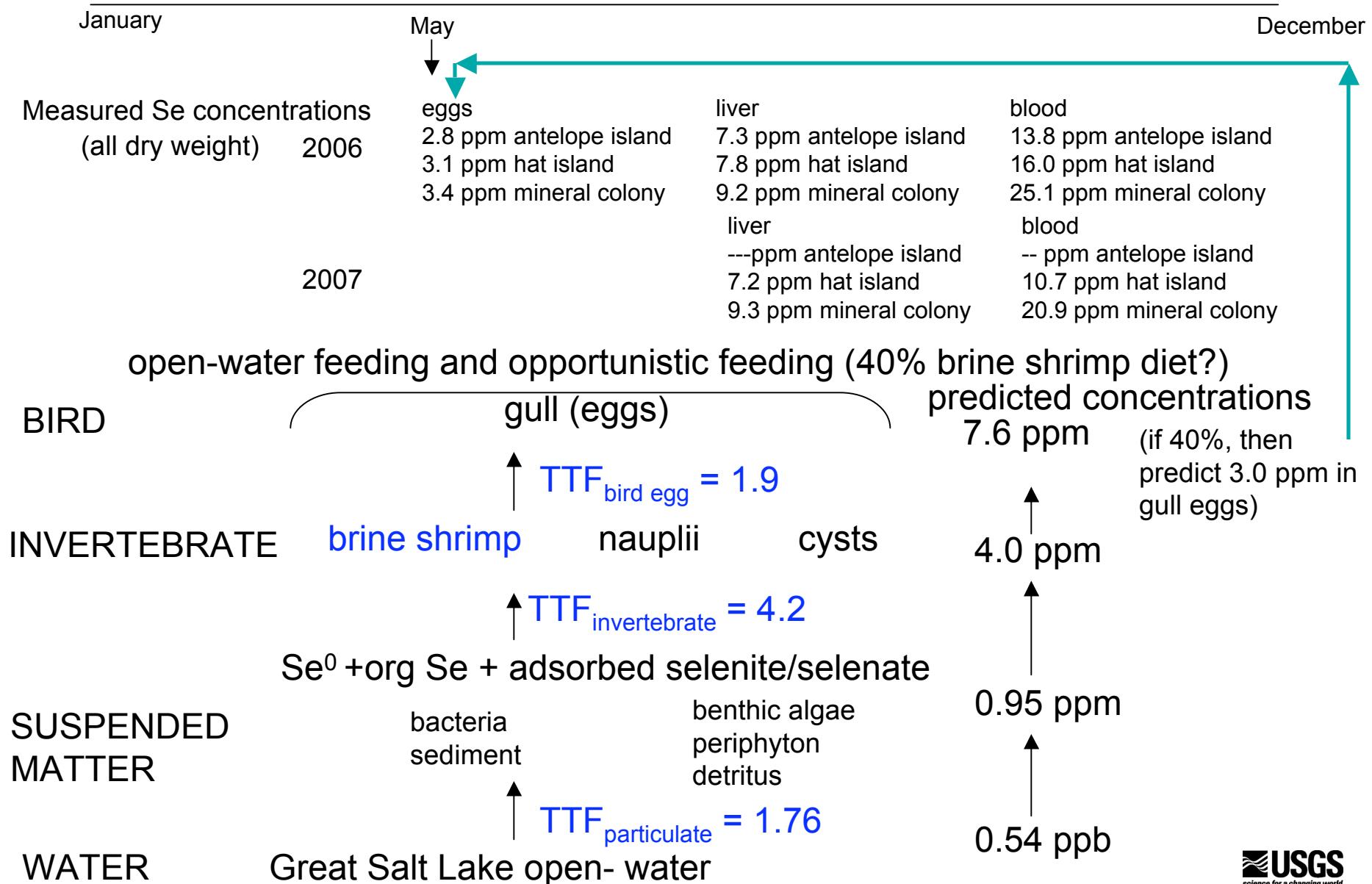


Shorebirds (American avocet and black-necked stilt) Breeding Residents



California Gull Breeding Residents

blood Se levels
are elevated



Eared Grebe
Migratory (staging)

blood Se levels
are elevated

2006 2006

January September November December

Measured Se concentrations
(all dry weight)

liver 9.4 ppm
blood 18.5 ppm

liver 14.5 ppm
blood 23.3 ppm

Locational Age

liver 8.6 ppm Antelope Island juvenile liver 8.5 ppm

15.2 ppm Stansbury Island adult liver 15.8 ppm

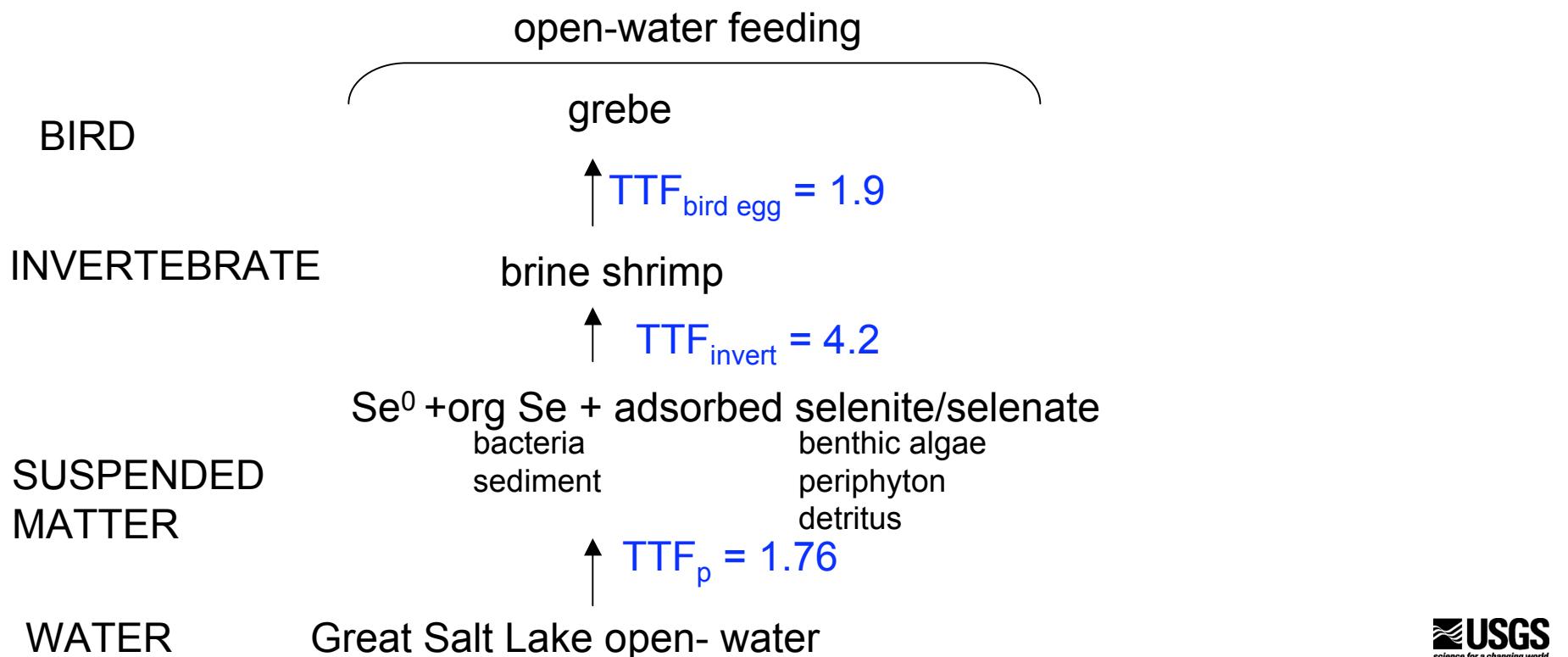
blood 16.8 ppm Antelope Island juvenile blood 15 ppm

25.4 ppm Stansbury Island adult blood 27 ppm

October December

liver 13.4 ppm

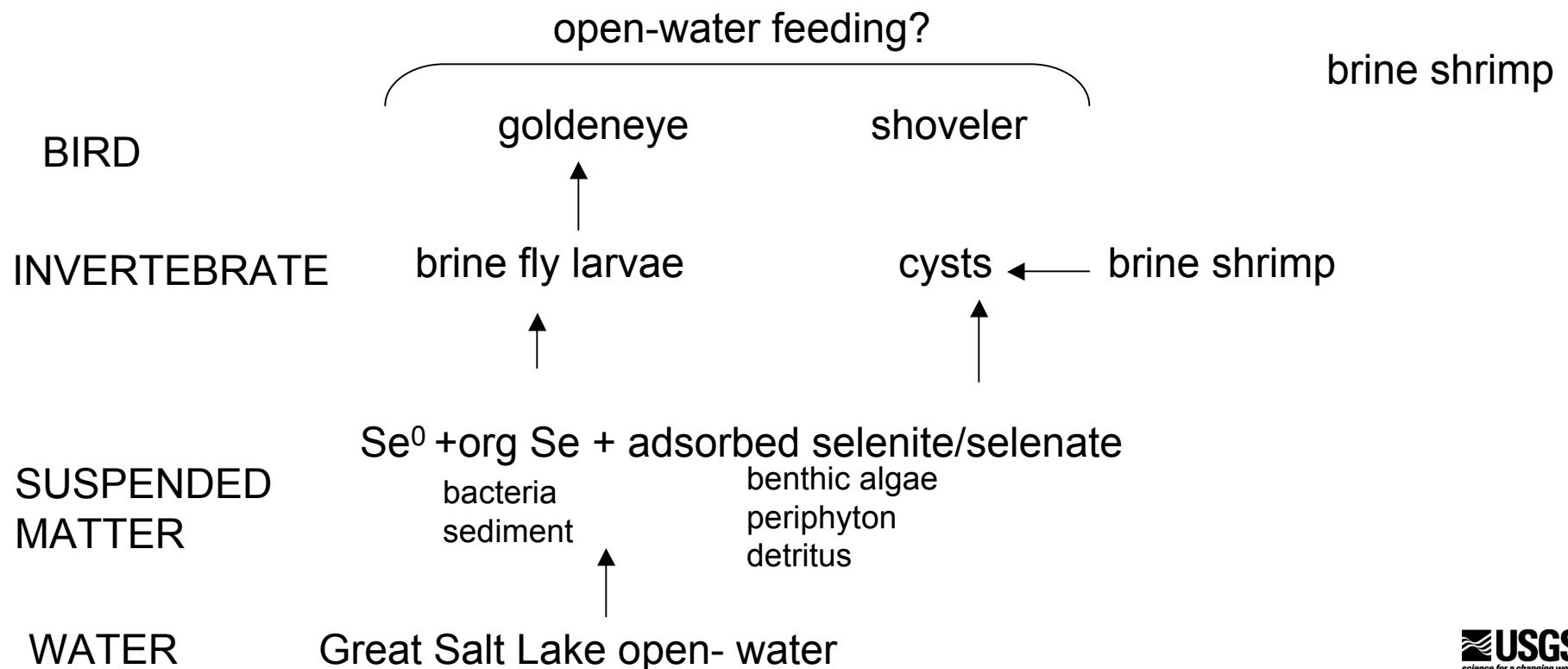
Dec 4 liver 25.4 ppm
Dec 20 liver 23.2 ppm



Common goldeneye
Northern shoveler
Migratory (over-wintering)

blood Se levels
are elevated

January		December	
Measured Se concentrations (all dry weight)			
Locational	Age	Nov 2005-Jan 2006	
liver 12.6 ppm Fremont Island	juvenile liver 12.7 ppm	early	late
18.0 ppm Stansbury Island	adult liver 17.2 ppm	liver 12.2 ppm	18.7 ppm
blood 16.3 ppm Fremont Island	juvenile blood 14.8 ppm	blood 15.9 ppm	17.6 ppm
17.1 ppm Stansbury Island	adult blood 18.1 ppm		



Wilson's phalarope
Red-necked phalarope
Migratory

Need body weight
adjustment ?

January

June

August

December

→
staging?

open-water feeding?

BIRD

phalarope

INVERTEBRATE

brine shrimp (nauplii)
(cysts)

brine fly adults
brine fly larvae

????

SUSPENDED
MATTER

$\text{Se}^0 + \text{org Se}$ + adsorbed selenite/selenate
bacteria
sediment
benthic algae
periphyton
detritus

WATER

Great Salt Lake open- water

Levels of Protection Based on Diet or Egg Selenium Concentration)

Table 1 95 % confidence interval for reduced hatchability in mallard eggs—laboratory derived

Se diet, ppm dw	Best case	Maximum likelihood	Worst case
3.6	EC <1	EC 3	EC 10
4.9	EC 4	EC 10	EC 24
5.7	EC 10	EC 18	EC 32
Se egg, ppm dw			
6.4	EC <1	EC 1.5	EC 10
12	EC 3.5	EC 10	EC 26
16	EC 10	EC 21	EC 38

Scenario Table: Forecasting Water-Column Selenium Concentrations

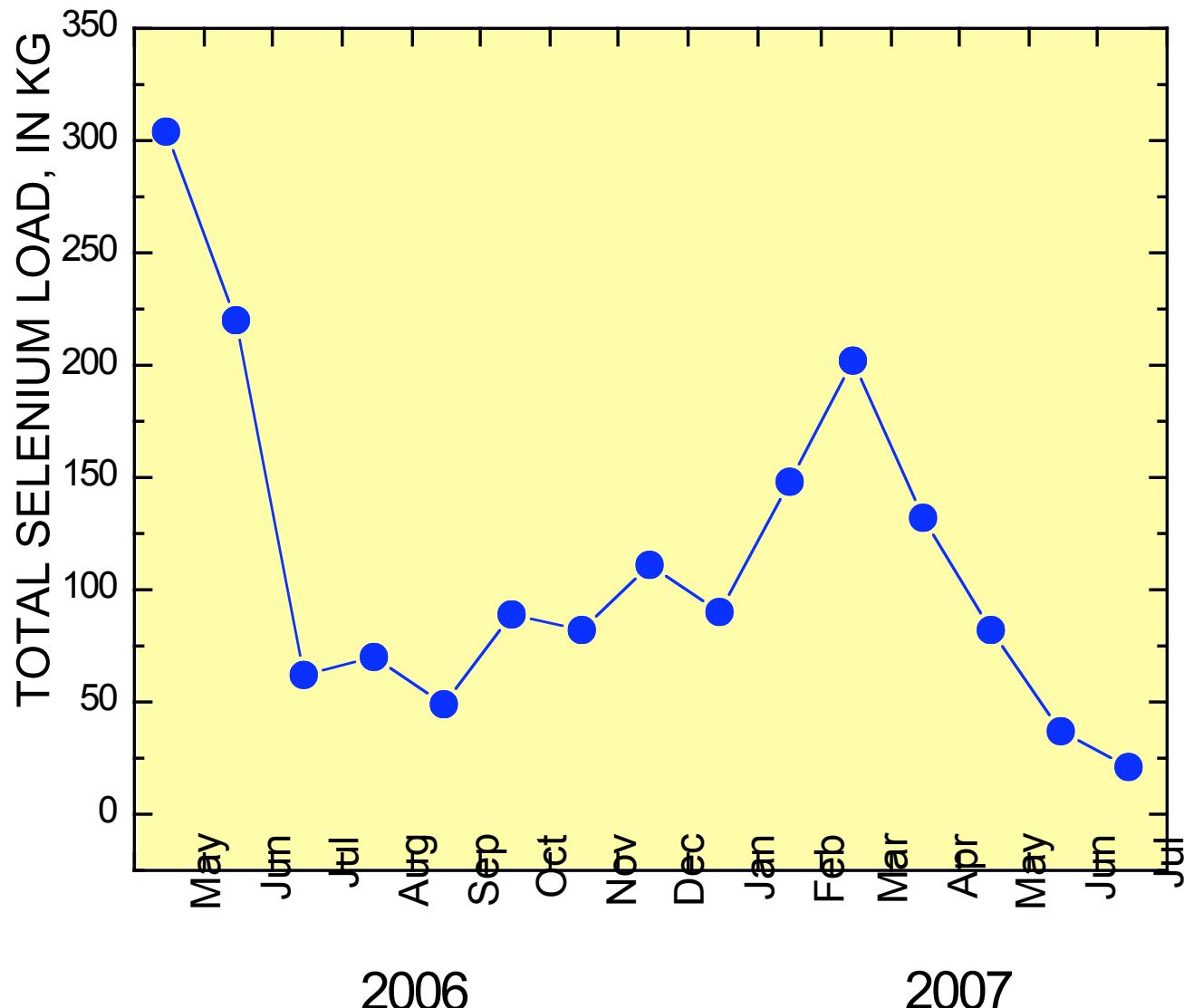
Scenario Level of protection?	bird egg ppm	TTF _{bird} factor	invertebrate ppm	TTF _{invert} factor	seston ppm	TTF _{seston} (Kd) factor	Water- column ppb
→ brine shrimp (adults)							
	6.4	1.8	3.6	4.2	0.86	1.76	0.49
	12.5	2.55	4.9	4.2	1.17	1.76	0.66
	16.5	2.9	5.7	4.2	1.36	1.76	0.77
→ brine shrimp (nauplii)							
	6.4	1.8	3.6	2.6	1.4	1.76	0.80
	12.5	2.55	4.9	2.6	1.9	1.76	1.1
	16.5	2.9	5.7	2.6	2.2	1.76	1.25
→ brine fly adult							
	6.4	1.8	3.6	1.8	2.0	1.76	1.1
	12.5	2.55	4.9	1.8	2.7	1.76	1.5
	16.5	2.9	5.7	1.8	3.2	1.76	1.8
→ brine fly larvae							
	6.4	1.8	3.6	1.5	2.4	1.76	1.4
	12.5	2.55	4.9	1.5	3.3	1.76	1.9
	16.5	2.9	5.7	1.5	3.8	1.76	2.2

(all dry weight, except water-column)

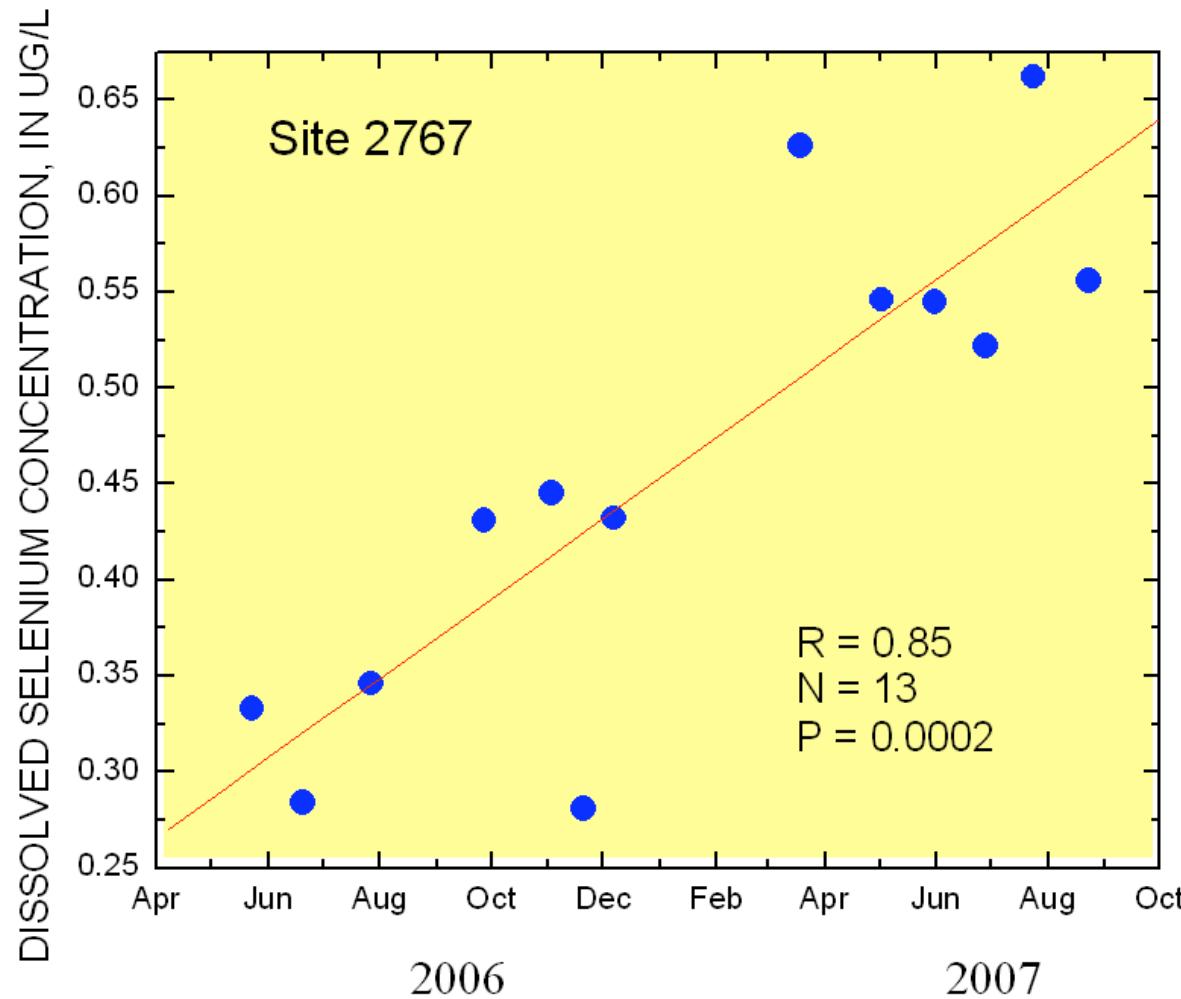
Variability in measured Se concentrations

	Brine shrimp (adult) ppm dw Se	Seston ppm dw Se	Water-column ppb dissolved	Water- column ppb total
2006	2.3 - 6.8 (Apr-Dec)	0.44 - 3.1	0.39 - 0.61	---
2007	3.4 - 5.2 (May-Aug)	0.57 - 1.9	0.50 - 0.58	0.59 - 0.68

MONTHLY LOAD TRENDS



Se INCREASE IN OPEN WATER

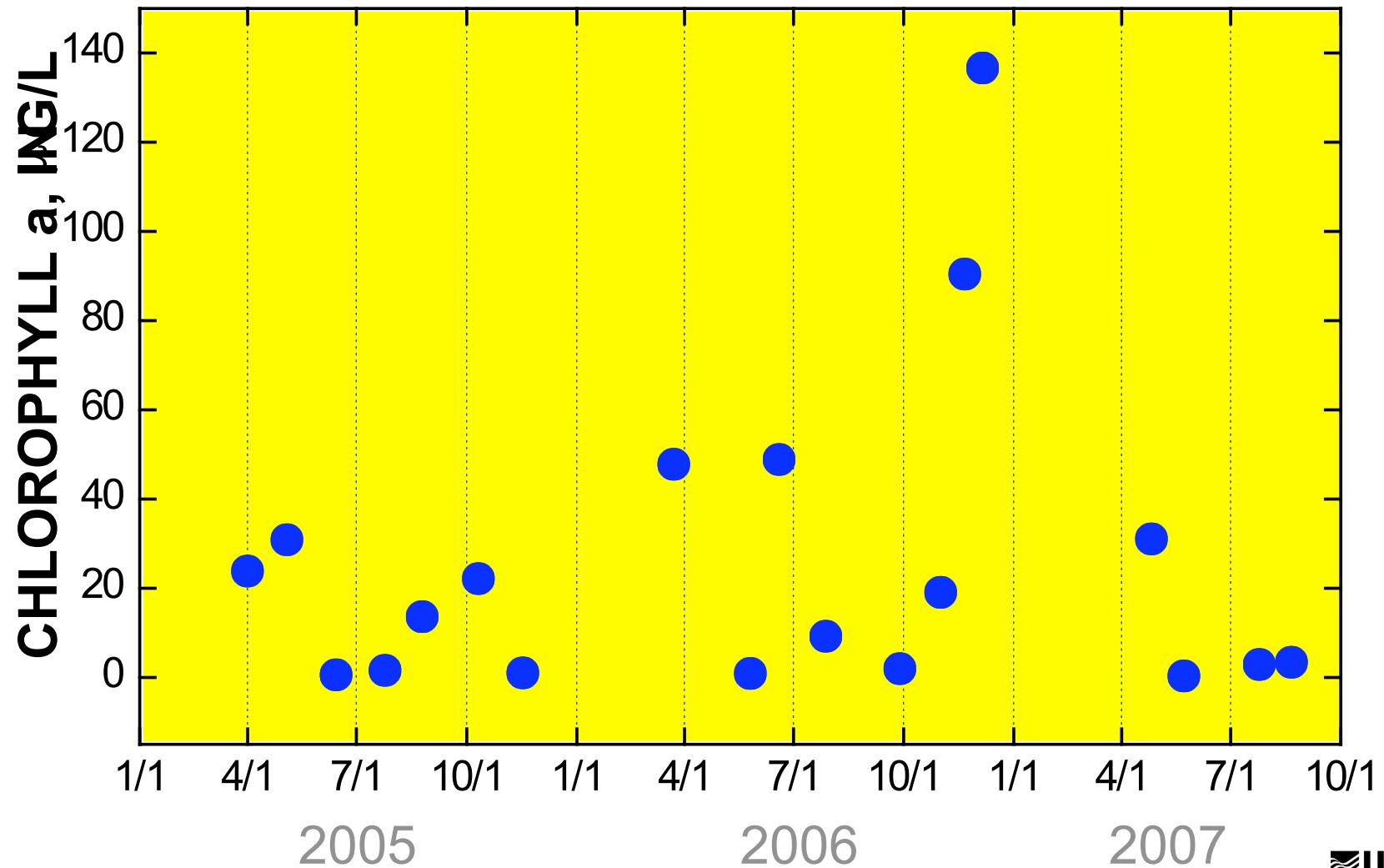


Mann-Kendall
Trend analysis

Site identification	Occurrence of upward trend in concentration at 90 percent confidence level
2267	Yes
2767	Yes
3510	Yes
2565	Yes

CHLOROPHYLL a (2565)

(as a representation of monthly changes in seston abundance)



Se INCREASE IN SEDIMENT CORES

