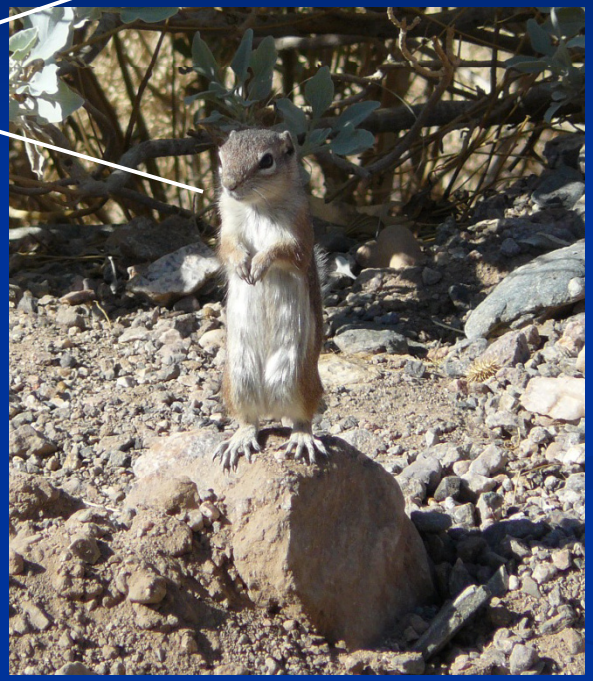
Endocrine disrupting compound studies in the Lake Mead aquatic ecosystem



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What is happening now?

- Round 6 SNPLMA work completed – some manuscripts still being written
- 3-year USGS-NPS study finishing in Sept.
- New study funded in 2012 – starts in 2013
- Purpose of the new study is to see how EDCs move through the food web. Mike Moran is project chief.

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New Publications

(14 total publications from this project)

- Goodbred, S.L., and others, in press, Potential for bias in using hybrids between common carp (Cyprinus carpio) and goldfish (Carassius auratus) in endocrine studies: A first report of hybrids in Lake Mead, Nevada, USA. The American Midland Naturalist Journal.
- Alvarez, D.A., and others, 2012, Bottom sediment as a source of organic contaminants in Lake Mead, Nevada, USA. Chemosphere, 88, 605–611.
- Patiño, R., and others, 2012, Patterns of metal composition and morpho-physiological condition and their association in male common carp across an environmental contaminant gradient in Lake Mead National Recreation Area, Nevada and Arizona, USA. Science of the Total Environment. 416, 215–224.
- Jenkins, J.A., and others, 2011, Sperm quality assessments for endangered razorback suckers Xyrauchen texanus. Reproduction 141:55-65.
- Blunt, S.M., 2011, Microbial Impacts on Endocrine Disrupting Contaminants: Las Vegas Wash and Lake Mead, Nevada. Unpublished Masters Thesis, University of Nevada – Las Vegas. 76 p.

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Current Papers in Preparation

- Jenkins, J.A., and others., in preparation, Bioassays on male gametes from common carp Cyprinus carpio reflects water quality conditions in Lake Mead, Nevada and Arizona. To be submitted to Journal of Aquatic Animal Health
- Echols, K.R., and others, in preparation, Timing of different PDBE isomer contamination in of Lake Mead. To be submitted to Science of the Total Environment
- Linder, G., and others, in preparation, Reconnaissance analysis of exposure and Risks potentially associated with polybrominated diphenyl ethers (PBDEs) detected in tissue residues of common carp (Cyprinus carpio). To be submitted to Lake and Reservoir Management Journal.
- Patiño, R., and others, Endocrine condition of male carp in Lake Mead, Nevada (USA), along a gradient of environmental contaminants. To be submitted to Journal of Aquatic Animal Health.
- Blunt, S., and others., in preparation, Estrogen-degrading organisms isolated from Las Vegas Wash and Lake Mead. To be submitted to Applied and Environmental Microbiology.
- Blunt, S., and others, in preparation, Microbial Degradation of pharmaceuticals and EDCs: chemical and microbiological considerations. To be submitted to Environmental Science and Technology.

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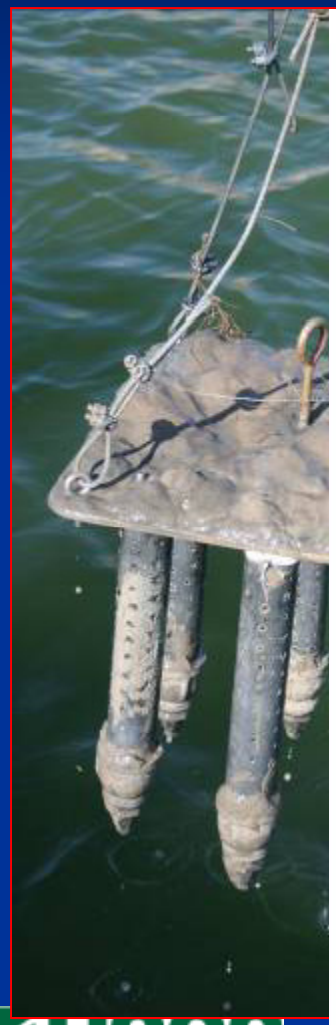
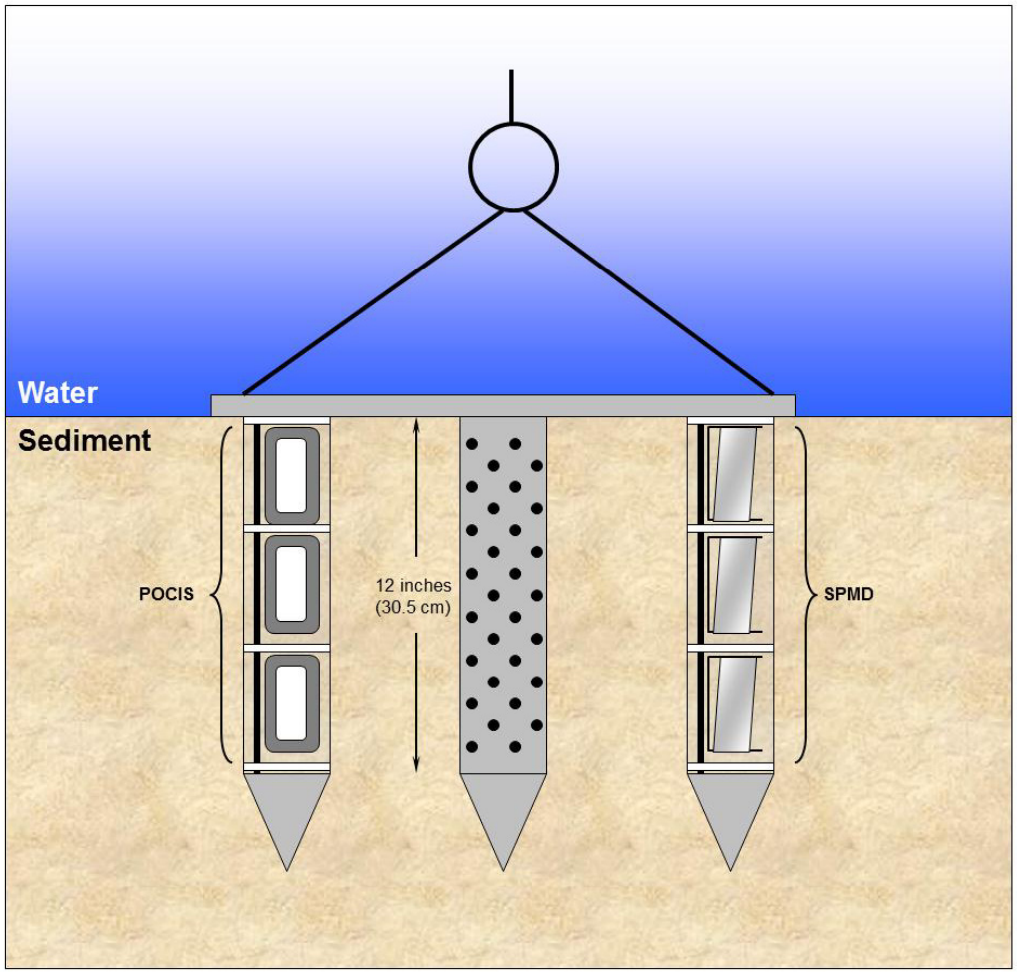
Sediment flux experiment in LVB using SPMD and POCIS



Mini-POCIS front view

Mini-POCIS side view



Mini-SPMD

Passive sampler support rack

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Flux Experiment Results

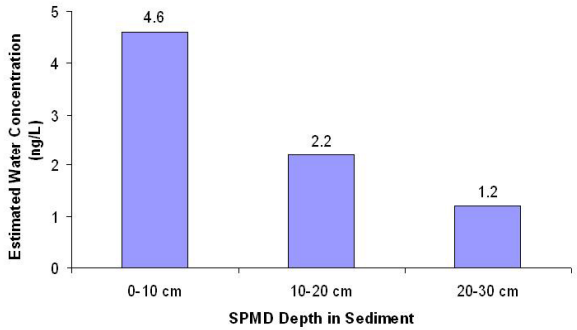


Figure 4. PAH concentrations in SPMDs buried in sediment.

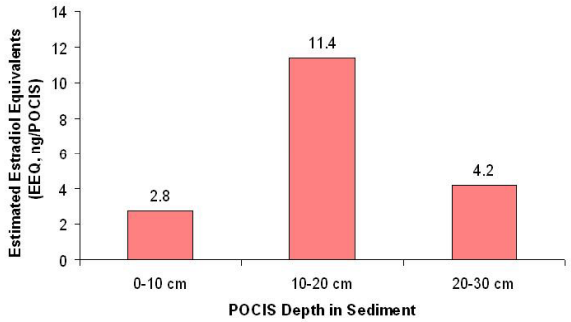
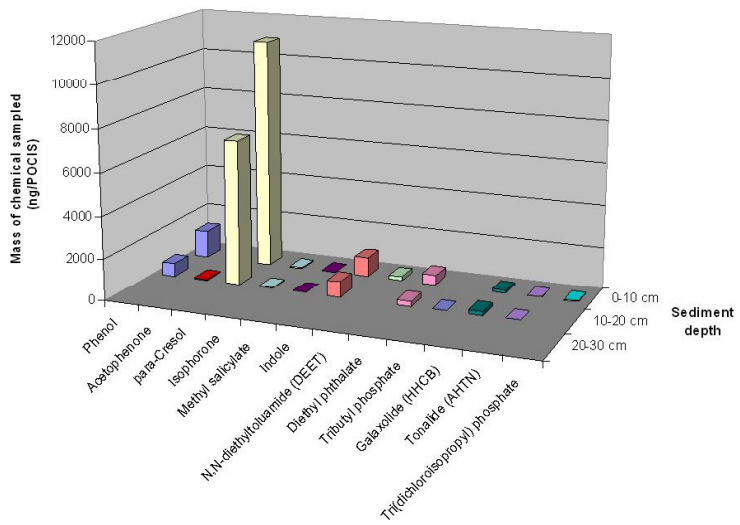


Figure 5. Estimated estradiol equivalents determined in POCIS buried in sediment.



The greatest concentration of targeted chemicals are present at the 0-10 cm depth

The data in this portion of the study is in agreement with the data from the vertical gradient portion of the study

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Three new cores in LVB taken in 2007

- Shallow part of LVB
- Near Platform (middle)
- Deeper part of LVB
- Cores didn't penetrate to pre-reservoir sediments
- Age dated with Cs-137, but not long enough to get entire peak

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2007 core depths adjusted for 1998 core ^{137}Cs

(Core 4 could not be adjusted due to Cs non-detects)

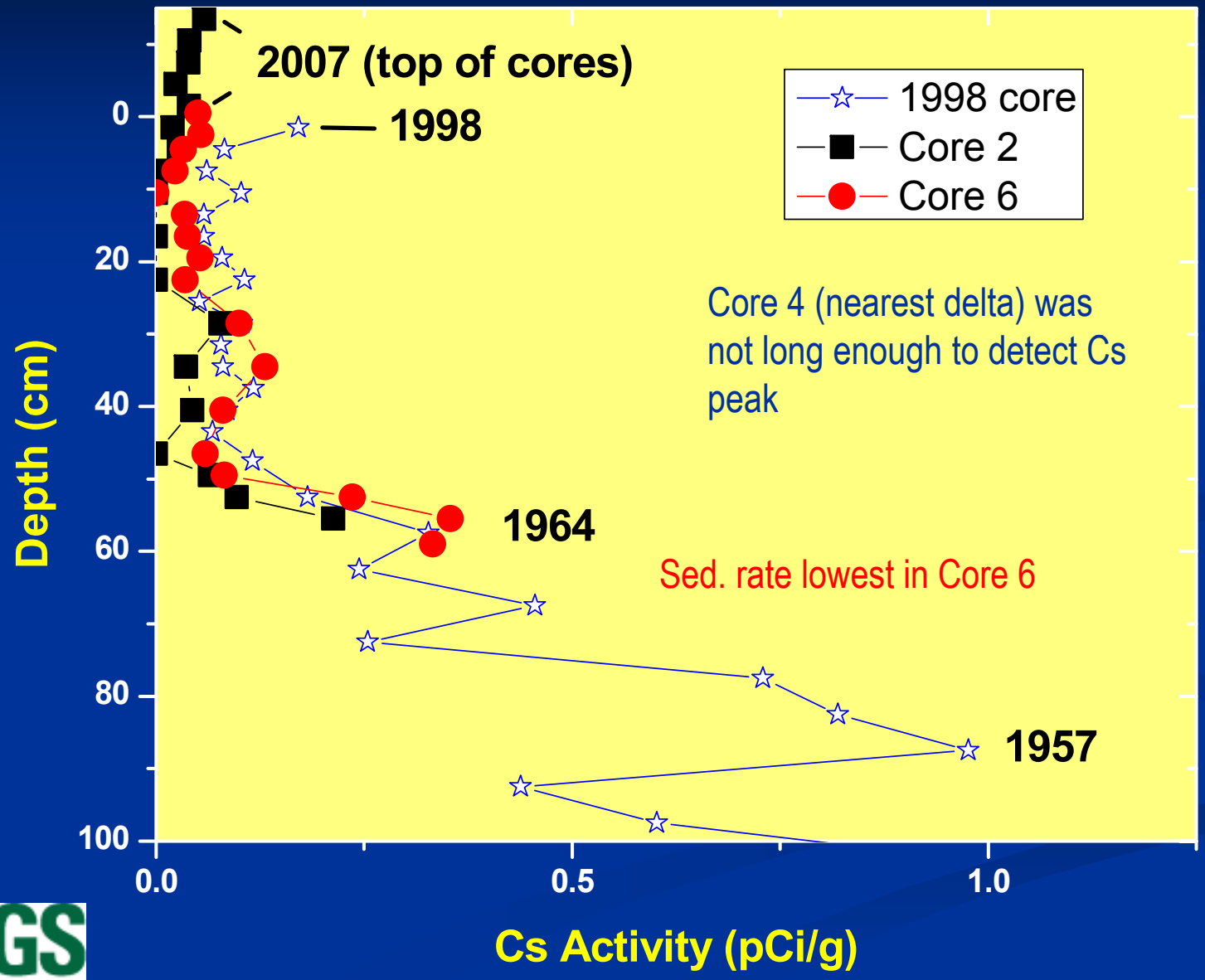

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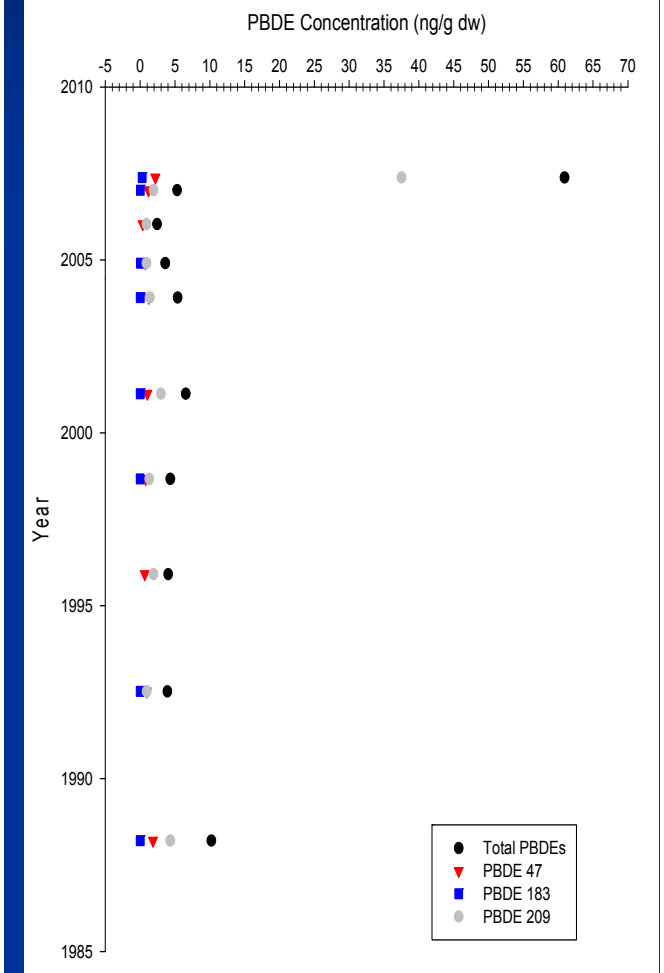
Figure 4. Histograms of all PBDEs in all cores compared to patterns in technical mixtures (*La Guardia 2006*)

Composition of PBDE Technical Mixtures

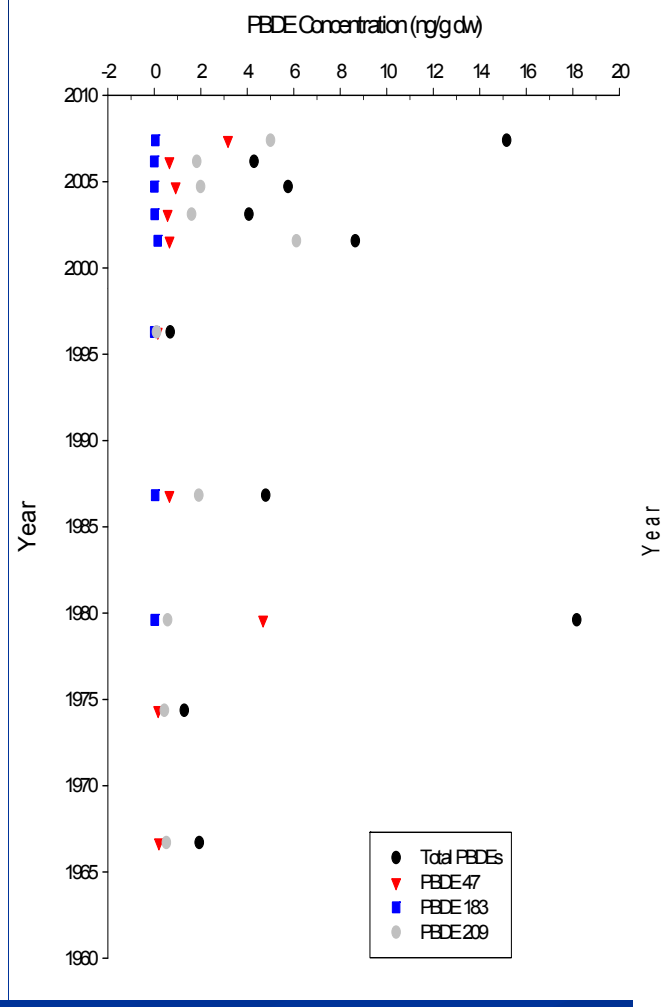
	DE-71 (% w/w) 'Penta-BDE'	DE-79 (% w/w) 'Octa-BDE'	Saytex 102E (% w/w) 'Deca-BDE'
BDE 1	nd	nd	nd
BDE 2	nd	nd	nd
BDE 3	nd	nd	nd
BDE 7	nd	nd	nd
BDE 15	nd	nd	nd
BDE 17	0.07	nd	nd
BDE 28	0.25	nd	nd
BDE 49	0.74	nd	nd
BDE 47	38.4	nd	nd
BDE 66	0.53	nd	nd
BDE 100	13.1	nd	nd
BDE 119	nd	nd	nd
BDE 99	48.6	nd	nd
BDE 85	2.96	nd	nd
BDE 154	4.54	1.07	nd
BDE 153	5.44	8.66	nd
BDE 139	0.8	nd	nd
BDE 140	0.17	< 0.02	nd
BDE 138	0.73	0.62	nd
BDE 184	< 0.02	< 0.02	nd
BDE 183	0.1	42	nd
BDE 191	nd	< 0.02	nd
BDE 180	nd	1.7	nd
BDE 171	nd	1.81	nd
BDE 201	nd	0.78	nd
BDE 204	nd	nd	nd
BDE 197	nd	22.2	nd
BDE 203	nd	4.4	nd
BDE 196	nd	10.5	nd
BDE 205	nd	< 0.02	nd
BDE 208	nd	0.19	0.06
BDE 207	nd	11.5	0.24
BDE 206	nd	1.38	2.19
BDE 209	nd	1.31	96.8

Figure 3. Plots of PBDEs in Sediment Cores Las Vegas Bay, Lake Mead: (A) Inner LVB, (B) Mid LVB, (C) Outer LVB

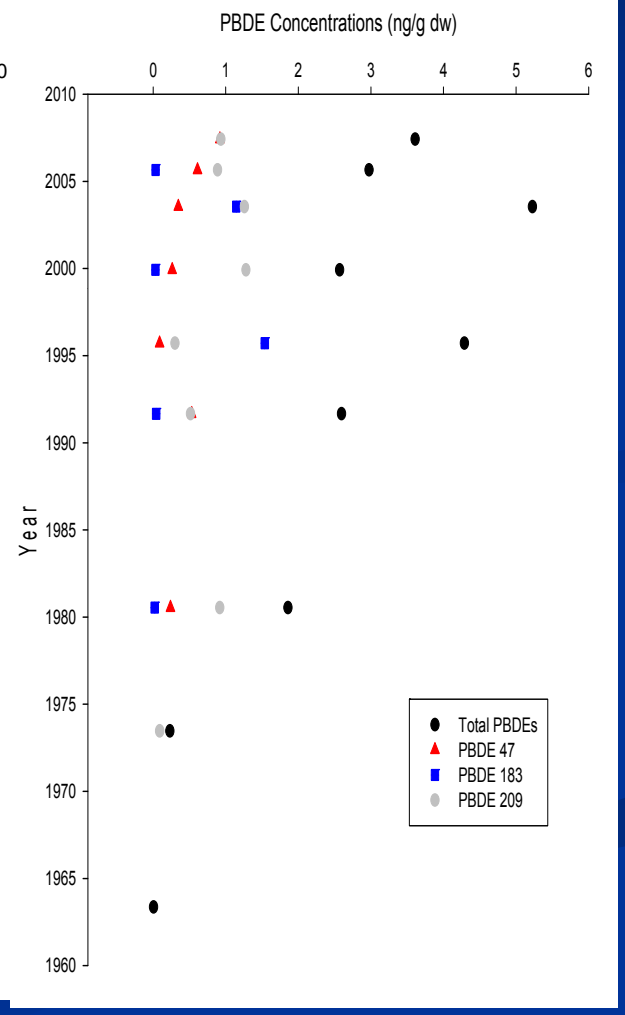
(A)



(B)



(C)



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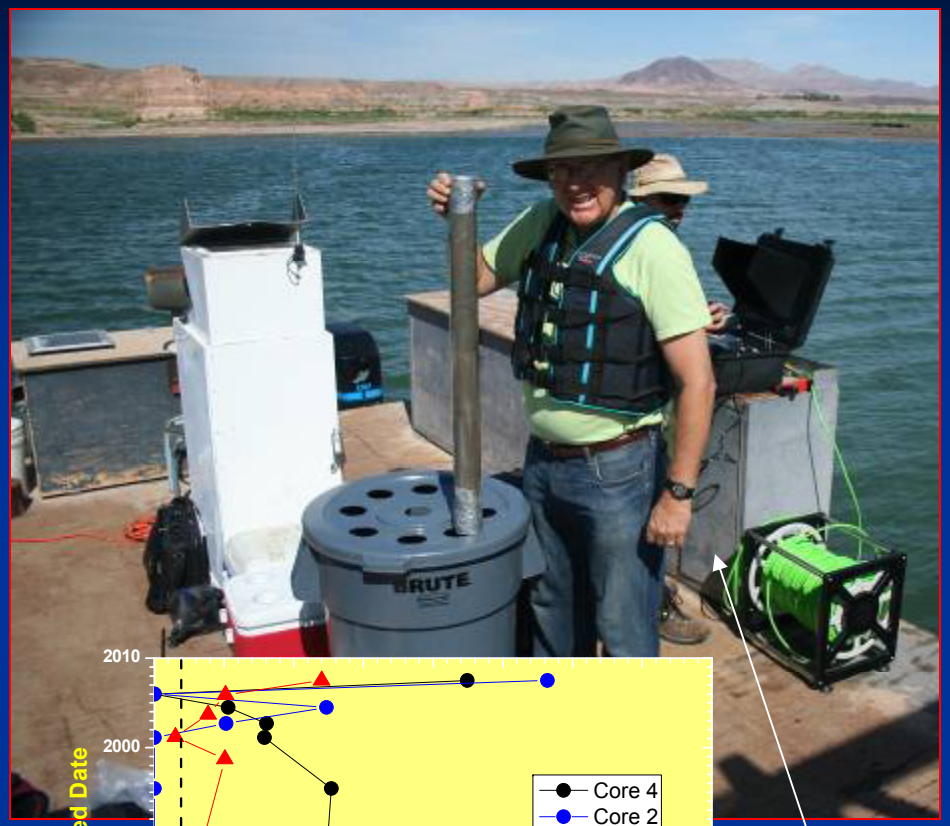
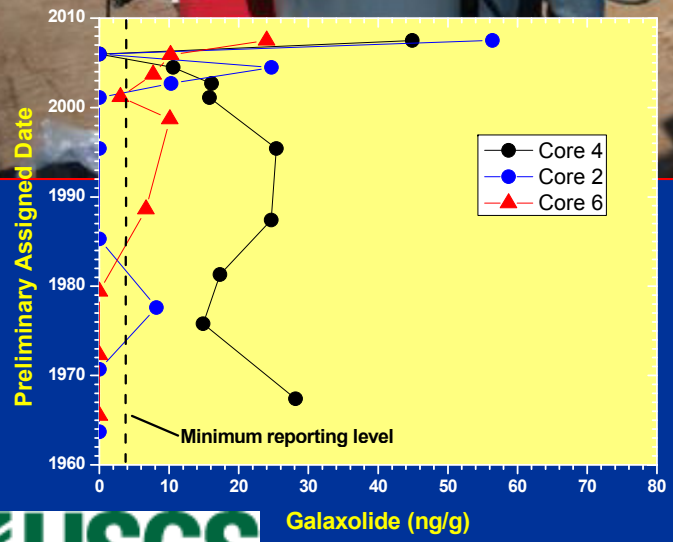
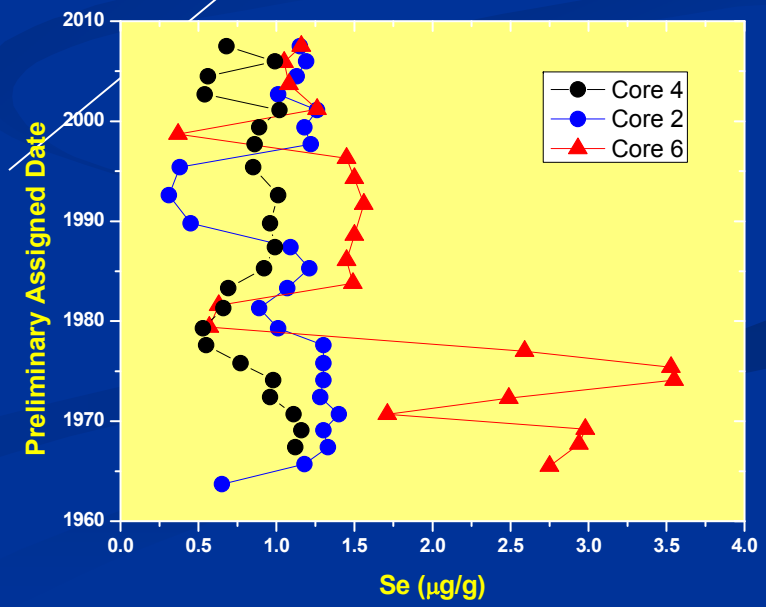
Other compounds in the cores





UNLV, NPS, USGS



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Fish

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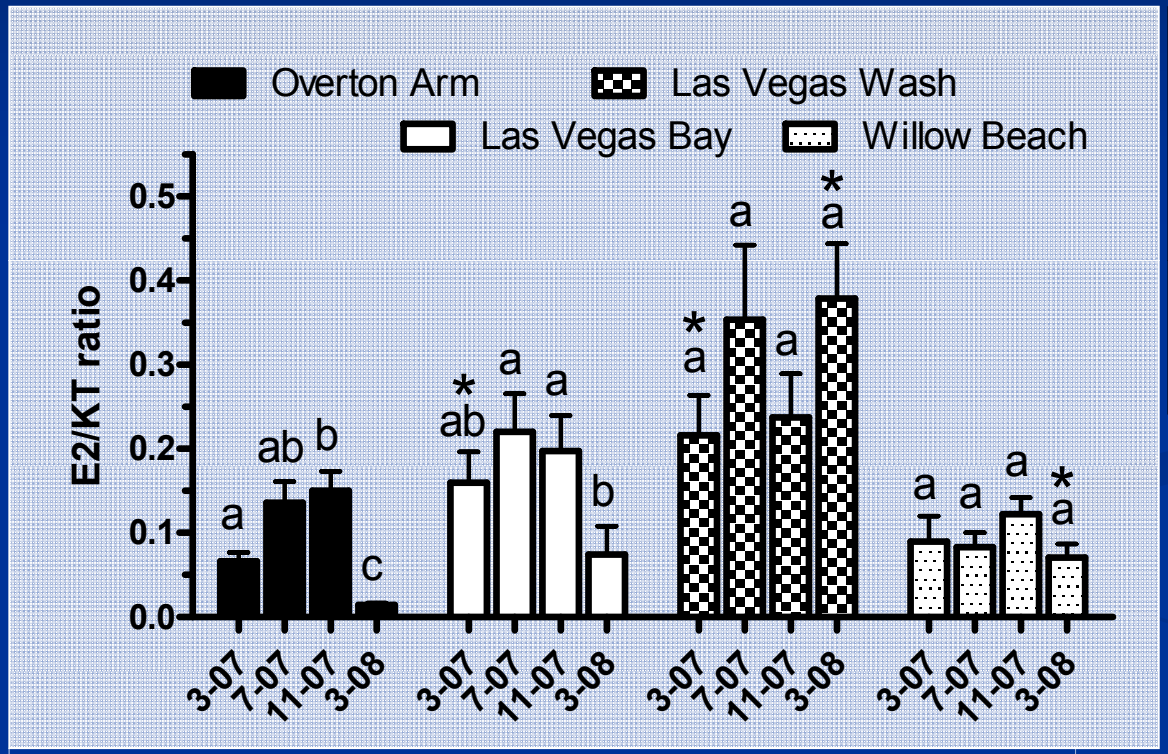
Current Studies of Endocrine Disruption in Lake Mead

- E2/KT Ratio



•Within a site, columns with same letter are not different
•Asterisk - different from corresponding date in reference site (OA)

Highlights:

1. E2/KT levels generally lower in OA than other sites, except WB.
2. Seasonality absent in LVW and WB.

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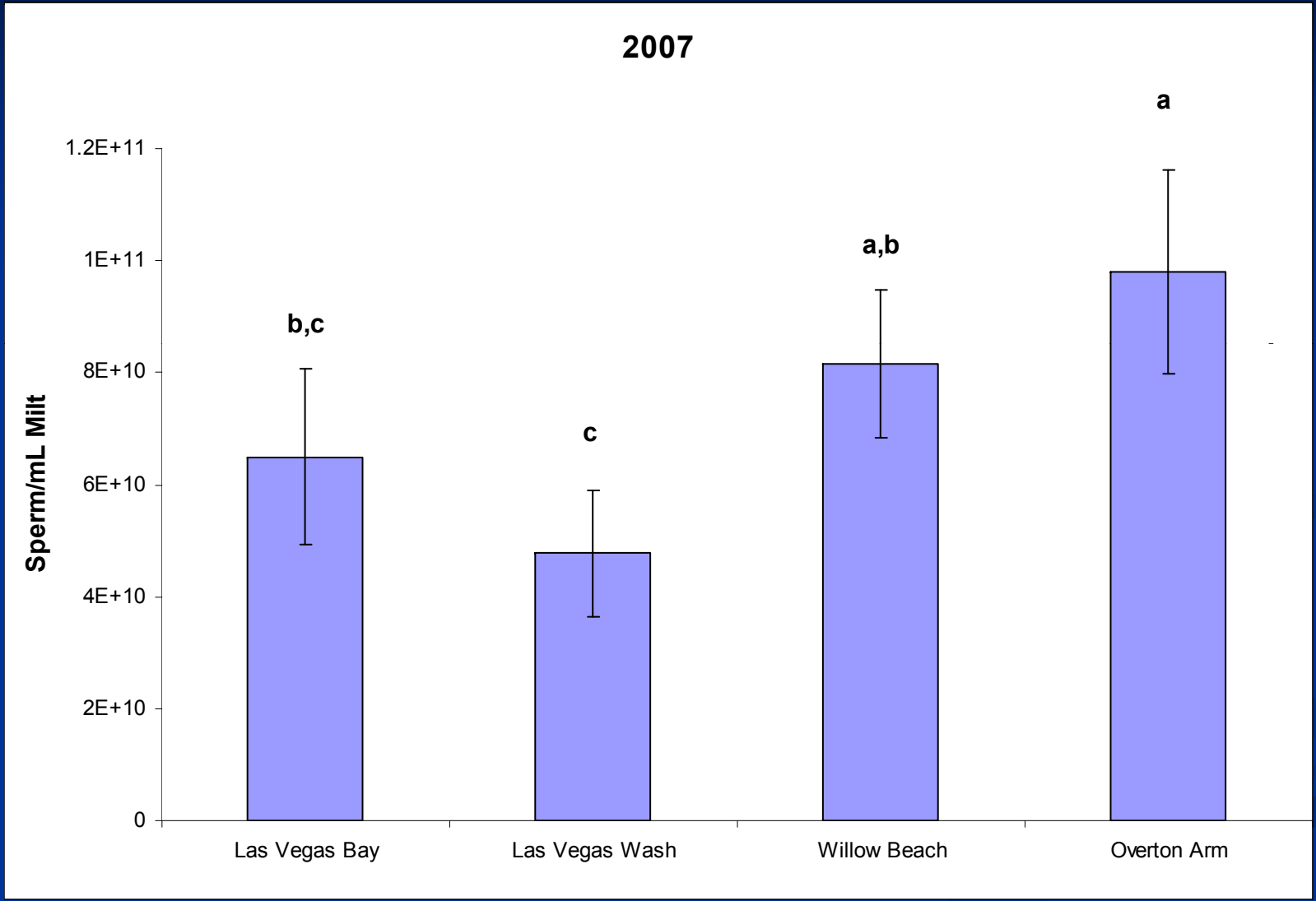
Sperm Counts: 2007



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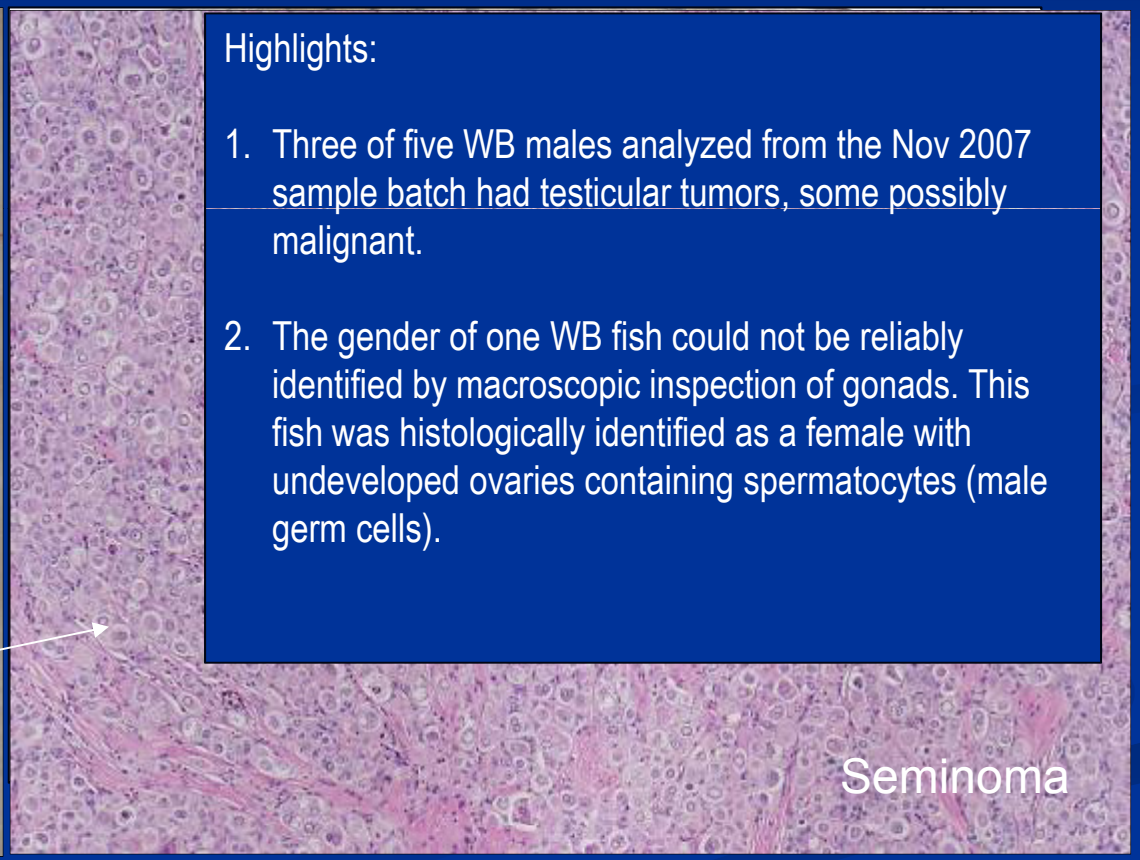
Current Studies of Endocrine Disruption in Lake Mead

- Testicular Histopathologies (November 2007)



Highlights:

1. Three of five WB males analyzed from the Nov 2007 sample batch had testicular tumors, some possibly malignant.

2. The gender of one WB fish could not be reliably identified by macroscopic inspection of gonads. This fish was histologically identified as a female with undeveloped ovaries containing spermatocytes (male germ cells).

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Current Studies of Endocrine Disruption in Lake Mead

- Summary of field-based studies on Common Carp

  - ✓ The reproductive and endocrine condition of male carp in LMNRA differed among sampling sites and can be classified from higher to lower as follows:

    OA > LVB > LBW > WB.

    - ➢ Especially notable were
      - The weak seasonality in the reproductive physiology of male fish from LVW and WB;
      - The poor condition of fish from WB including the incidence of gonadal tumors and other reproductive organ anomalies.

  - ✓ Currently ongoing analyses include:

    - ➢ Levels of chemical contaminants in fish tissues and their association with biomarker differences among sites; and
    - ➢ Levels of non-chemical environmental factors, such as seasonal profiles of water temperature, and their association with biomarker differences among sites.

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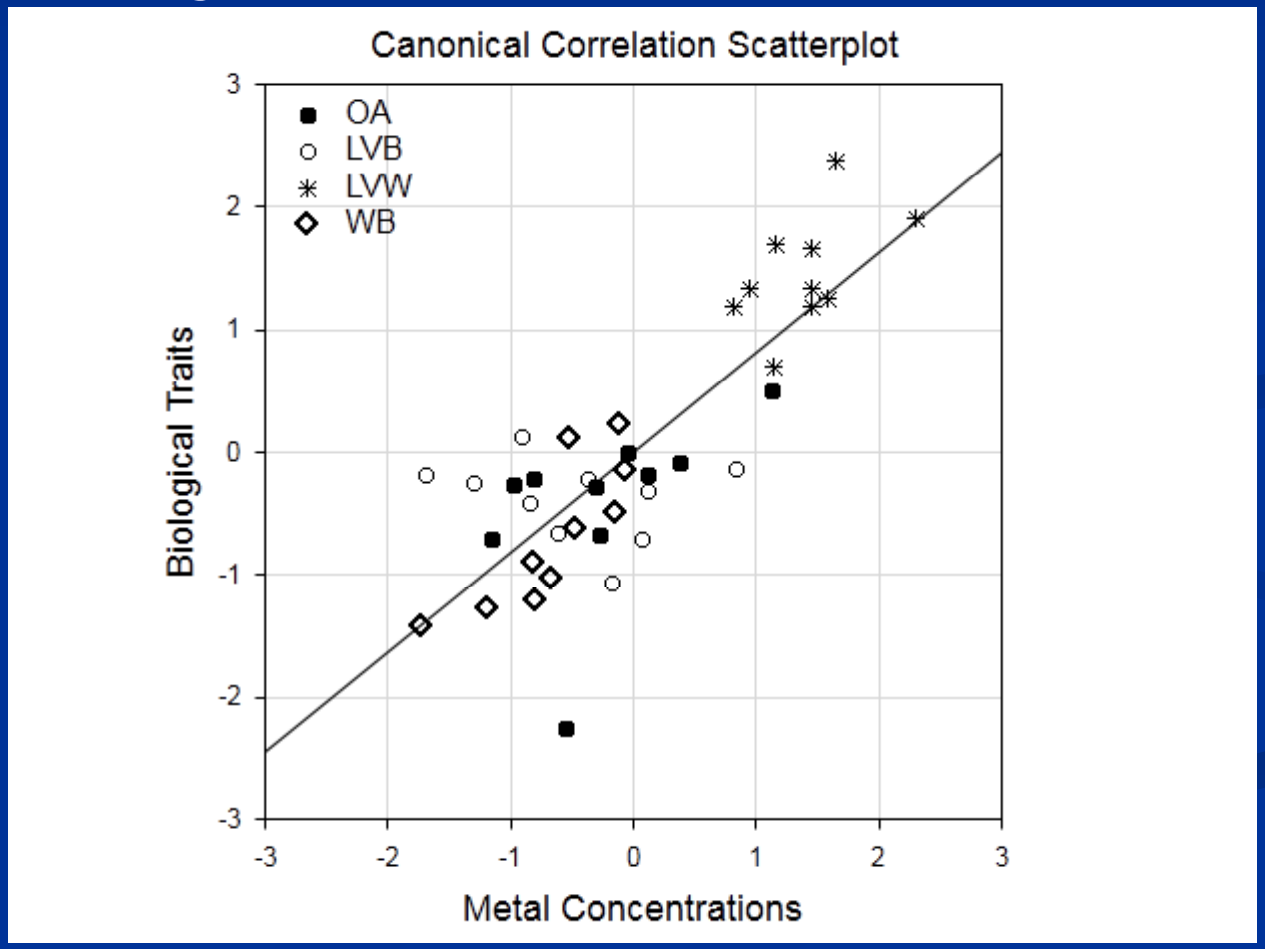
Metals in Common Carp

Nearly one quarter of the variance in biological traits was explained by the variance in the metal composition of the fish: Ag, As, Ba, Hg, Pb, Se and Zn most important



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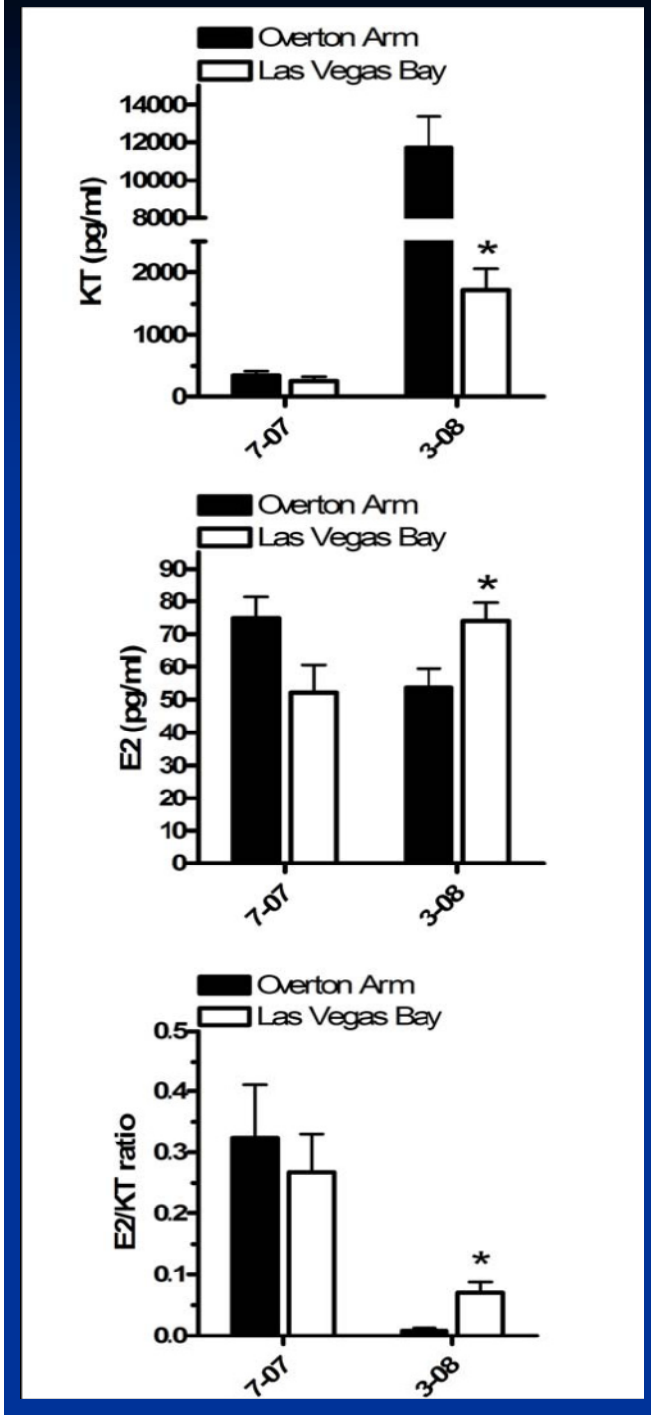

Effects in Male Largemouth Bass

Only two sites have bass present
No chemical data available yet

The differences between sites were most evident just prior spawning period (March 2008)

Relatively low KT levels and high E2/KT ratios in Las Vegas Bay males are consistent with reduced health and reproductive condition

Circular almost complete

- Summarize all Aquatic work in Lake Mead National Recreation Area in a USGS Circular

A Synthesis of Aquatic Science for Management of Lakes Mead and Mohave

Due to be completed by December 31, 2012

Questions?

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