Evaluation of Endocrine Disrupting Potentials in Membrane Effluents Using Aquatic Toxicity Tests and Fish Bioassays

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South Florida Water Management District

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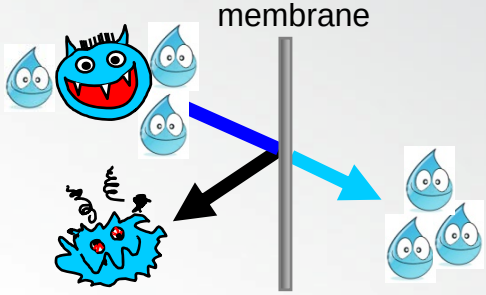
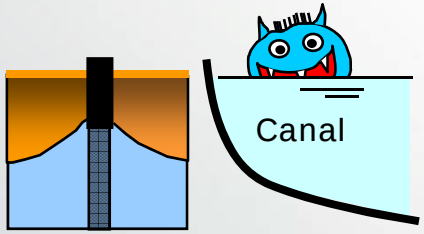
WateReuse Foundation Project 06-019 Addressed The Health Concerns of Microconstituents

Microconstituents

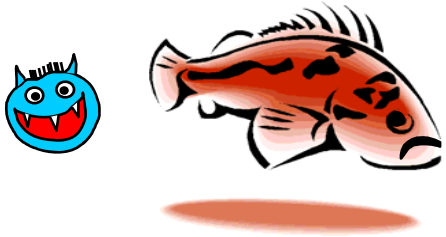
Plantation WWTP, FL



Removal of Microconstituents through Membrane



Recharge Modeling



Aquatic Organism Impact

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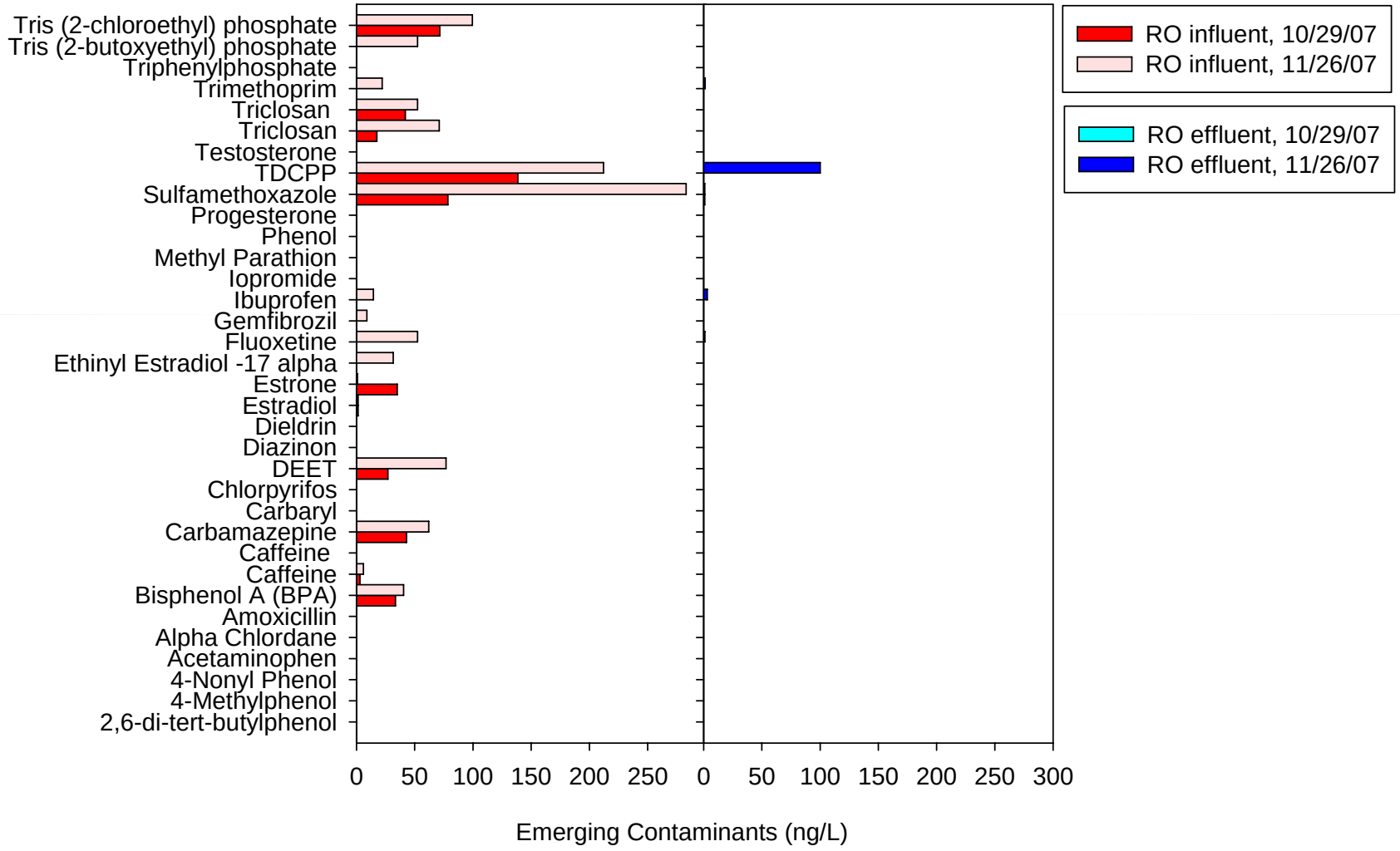
Microconstituents

Most Microconstituents Were Removed By MBR/RO System



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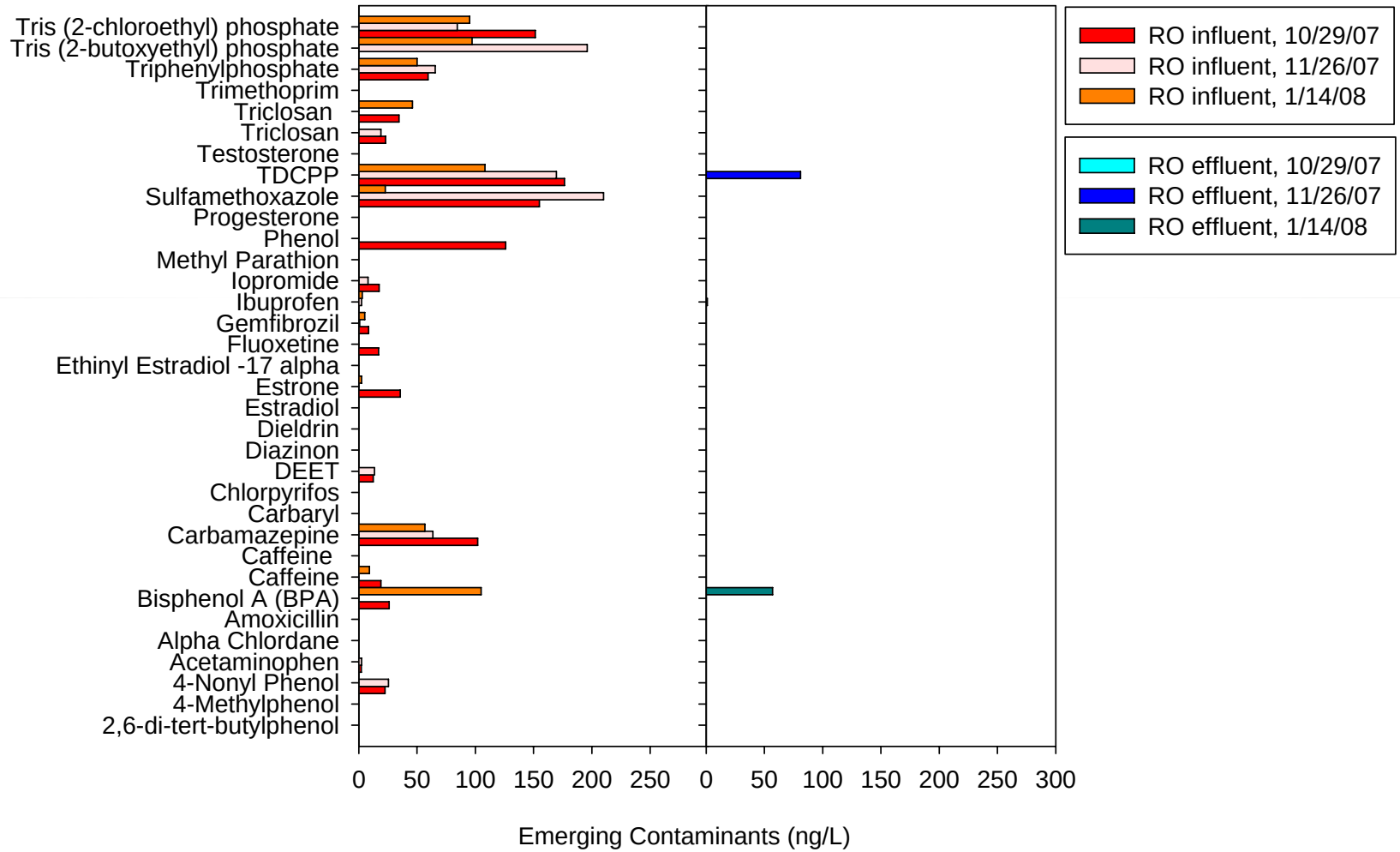
Most Microconstituents Were Removed By DNF/UF/RO System



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Toxicity and Hormonal Impact

Three Type of Tests Were Used To Evaluate Toxicity And Hormonal Impact Of Microconstituents

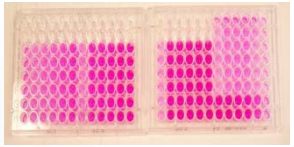
Toxicity Tests

Tissue Bioassays

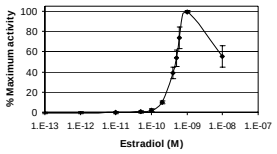
Live Fish Bioassays

Water Flea Toxicity Tests

Fathead Minnow Toxicity Tests



E-Screen (breast cancer cell)



Yeast Estrogen Screen

Fathead Minnow Vitellogenin Assay

Steroid Assay

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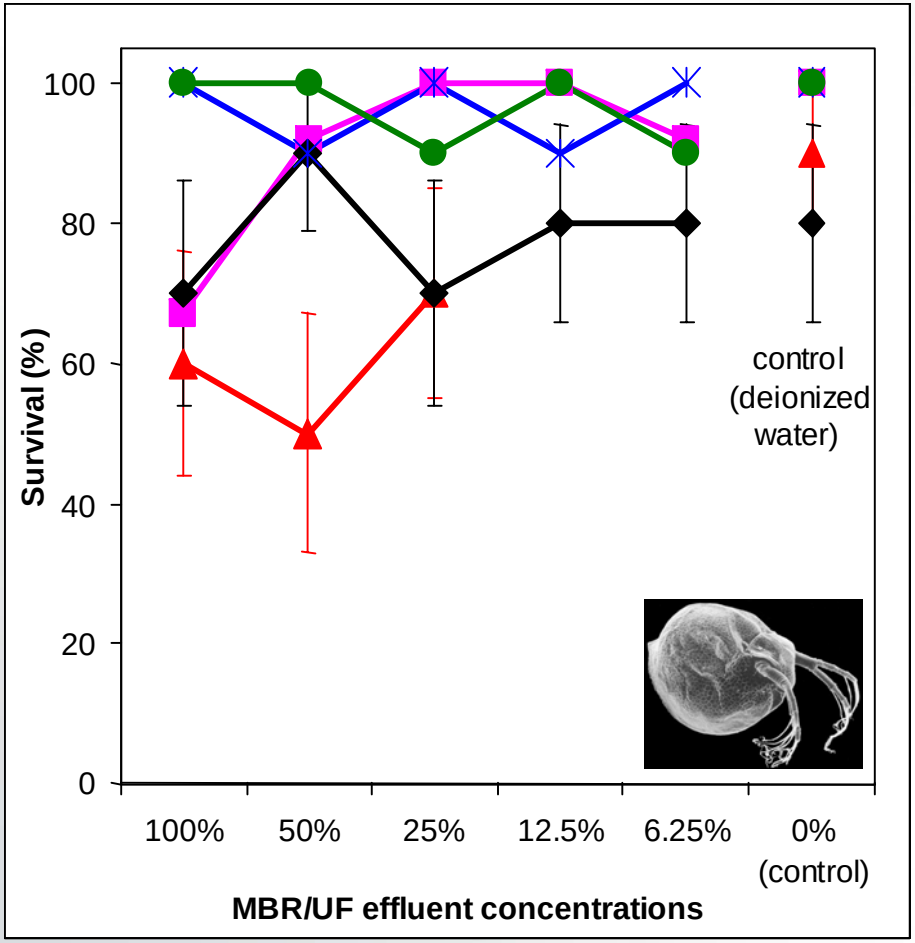
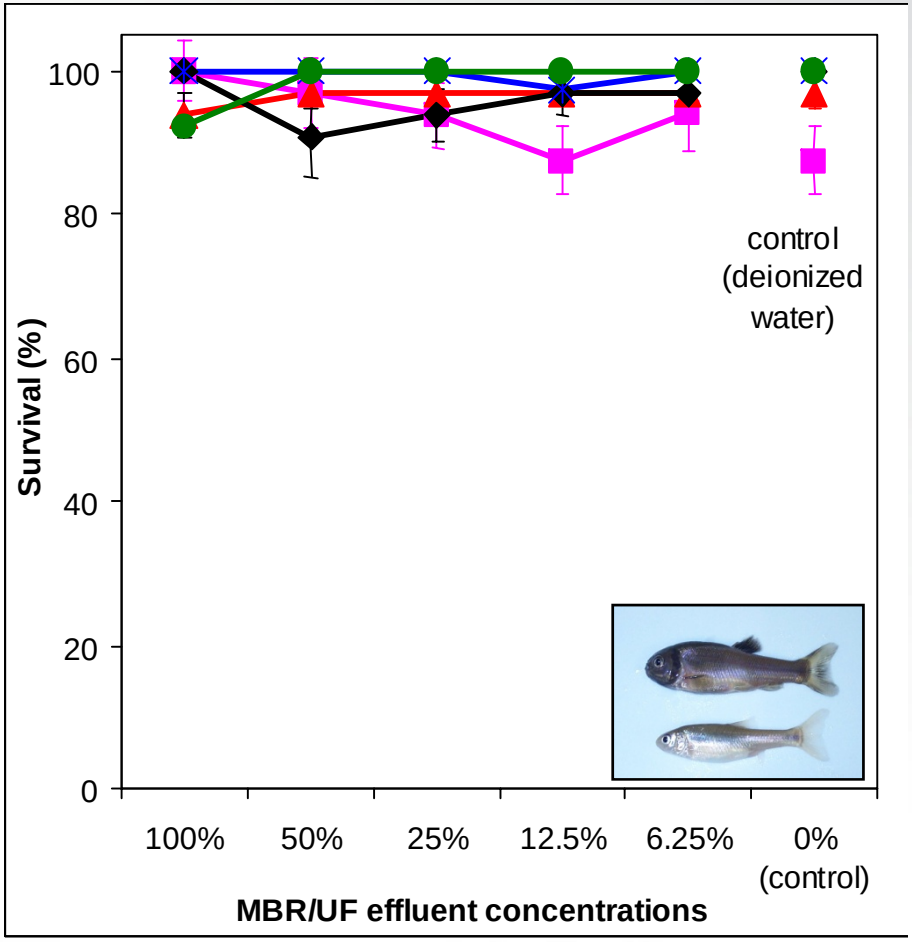
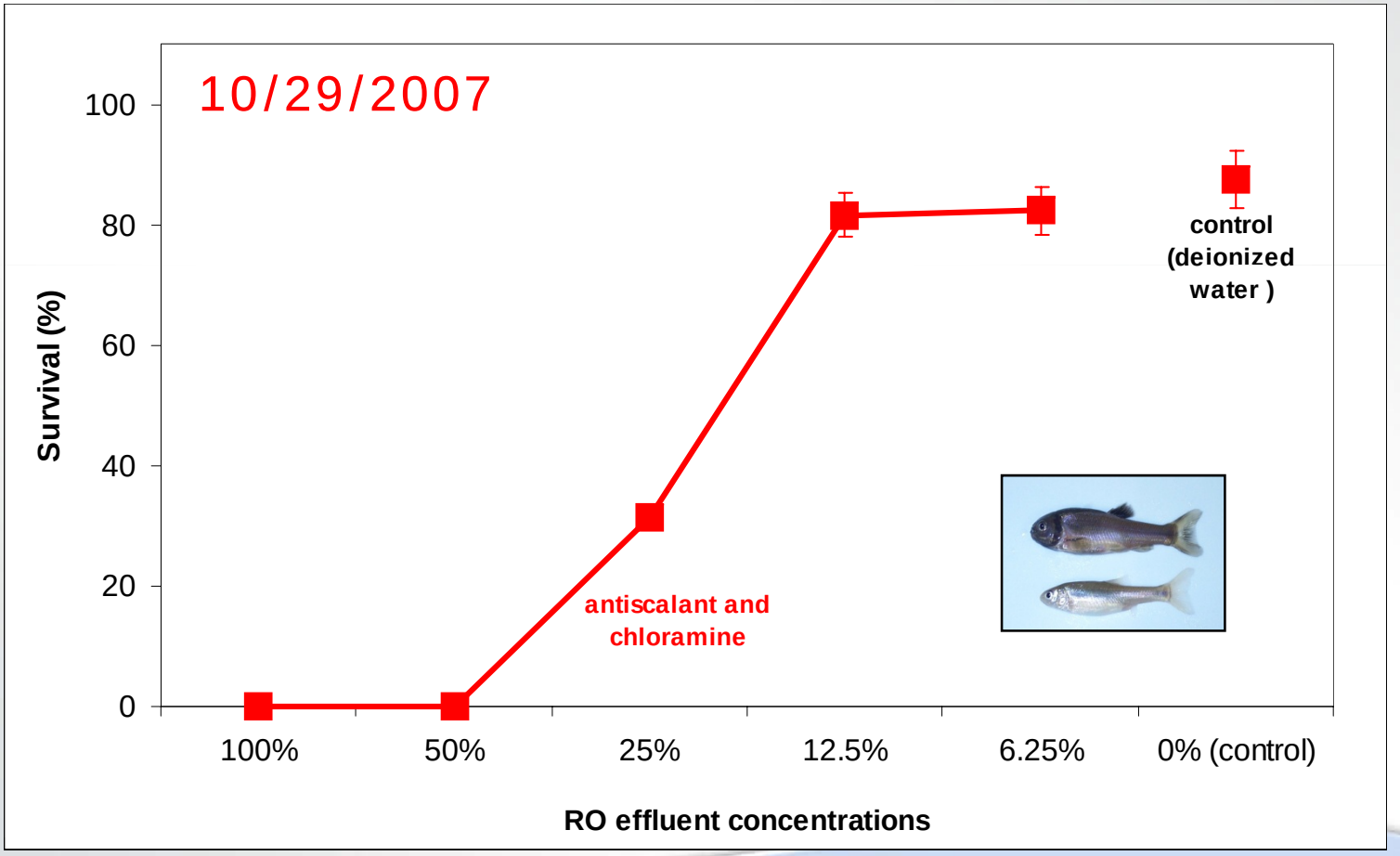
No Toxicity Was Observed In Most MBR And UF Effluent

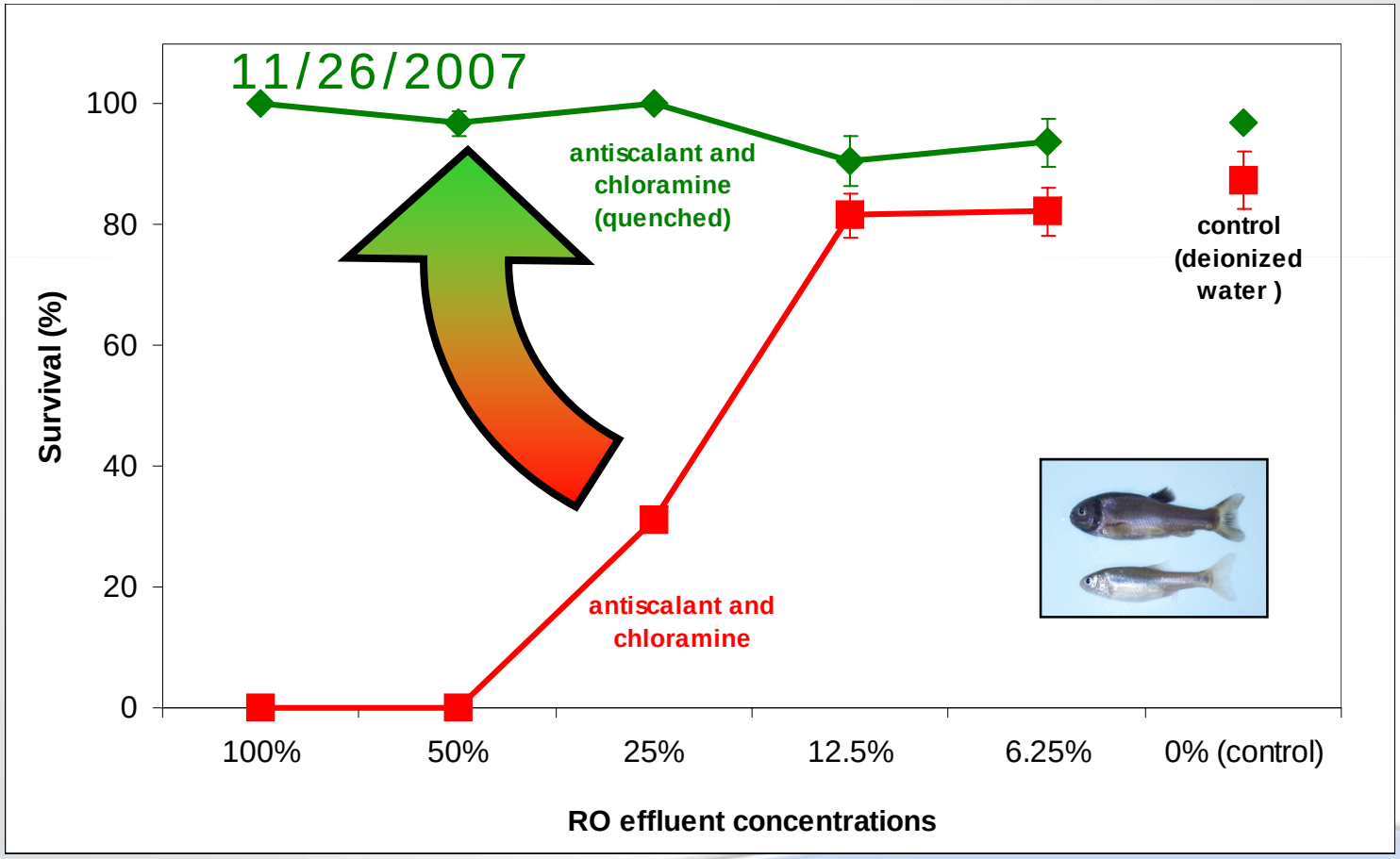




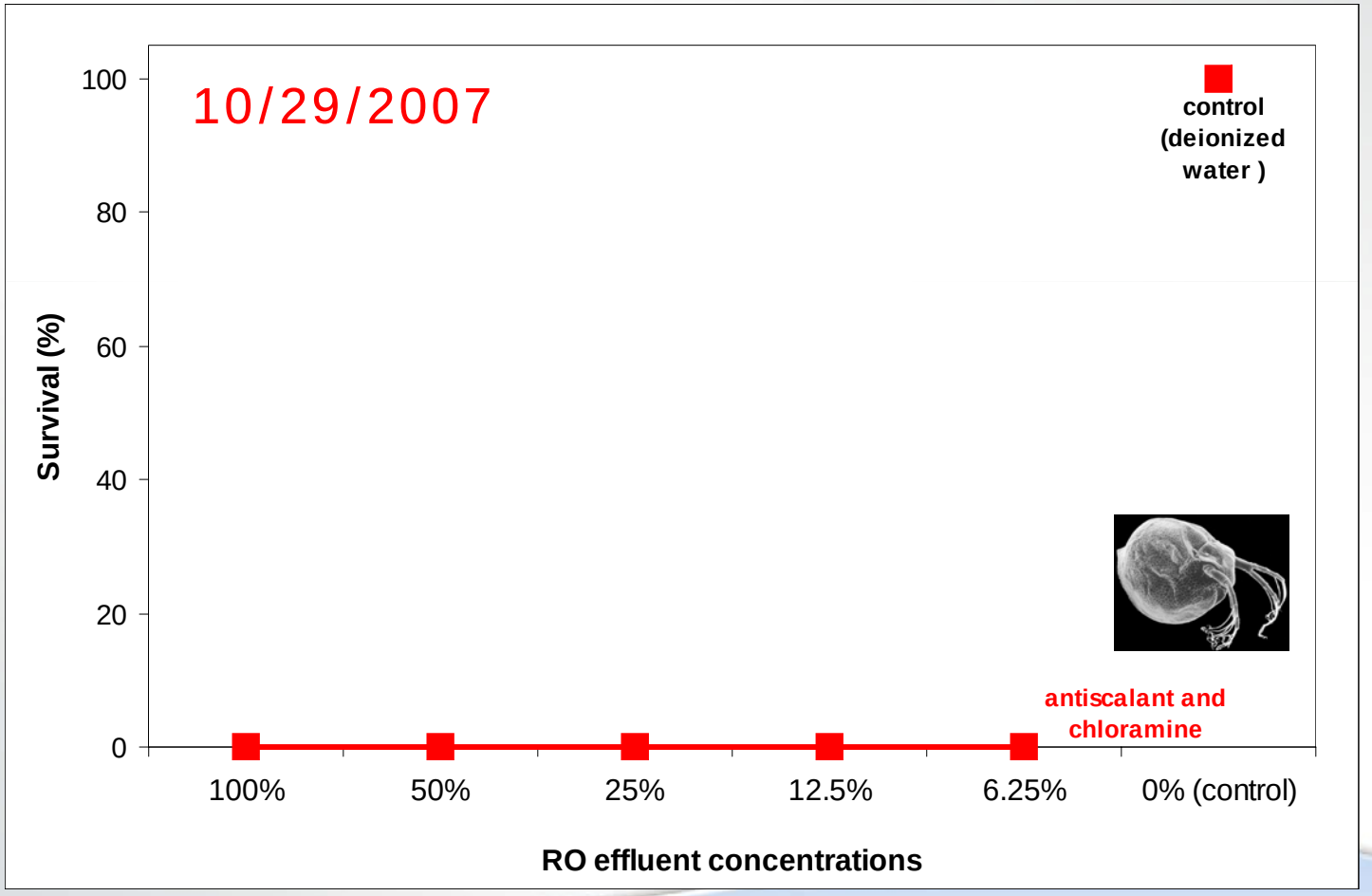
Strong Toxicity Of RO Effluent To The Fathead Minnow Was Observed During Normal Operation



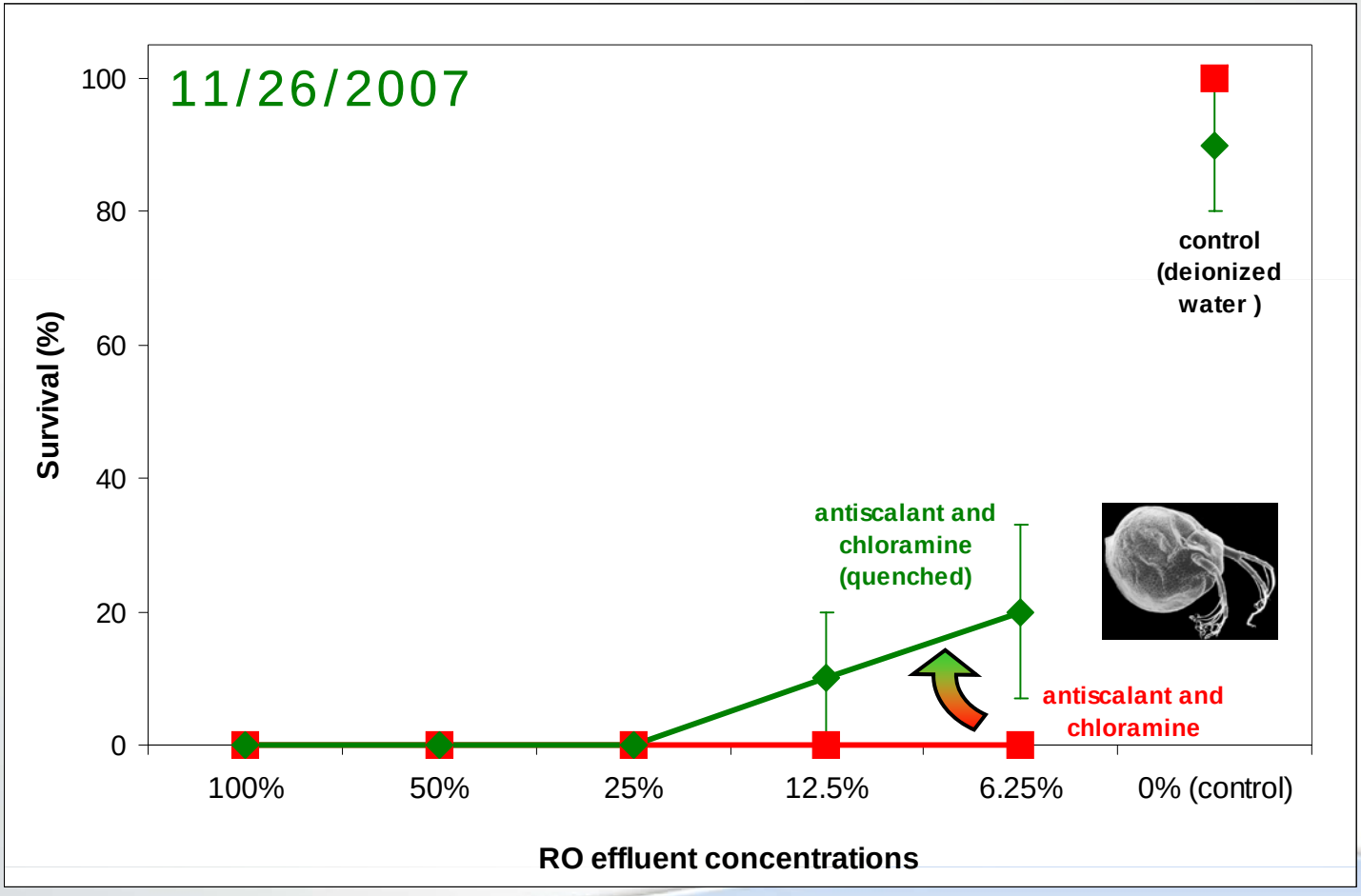
No Toxicity Of RO Effluent To The Fathead Minnow Was Observed After Chloramine Was Quenched



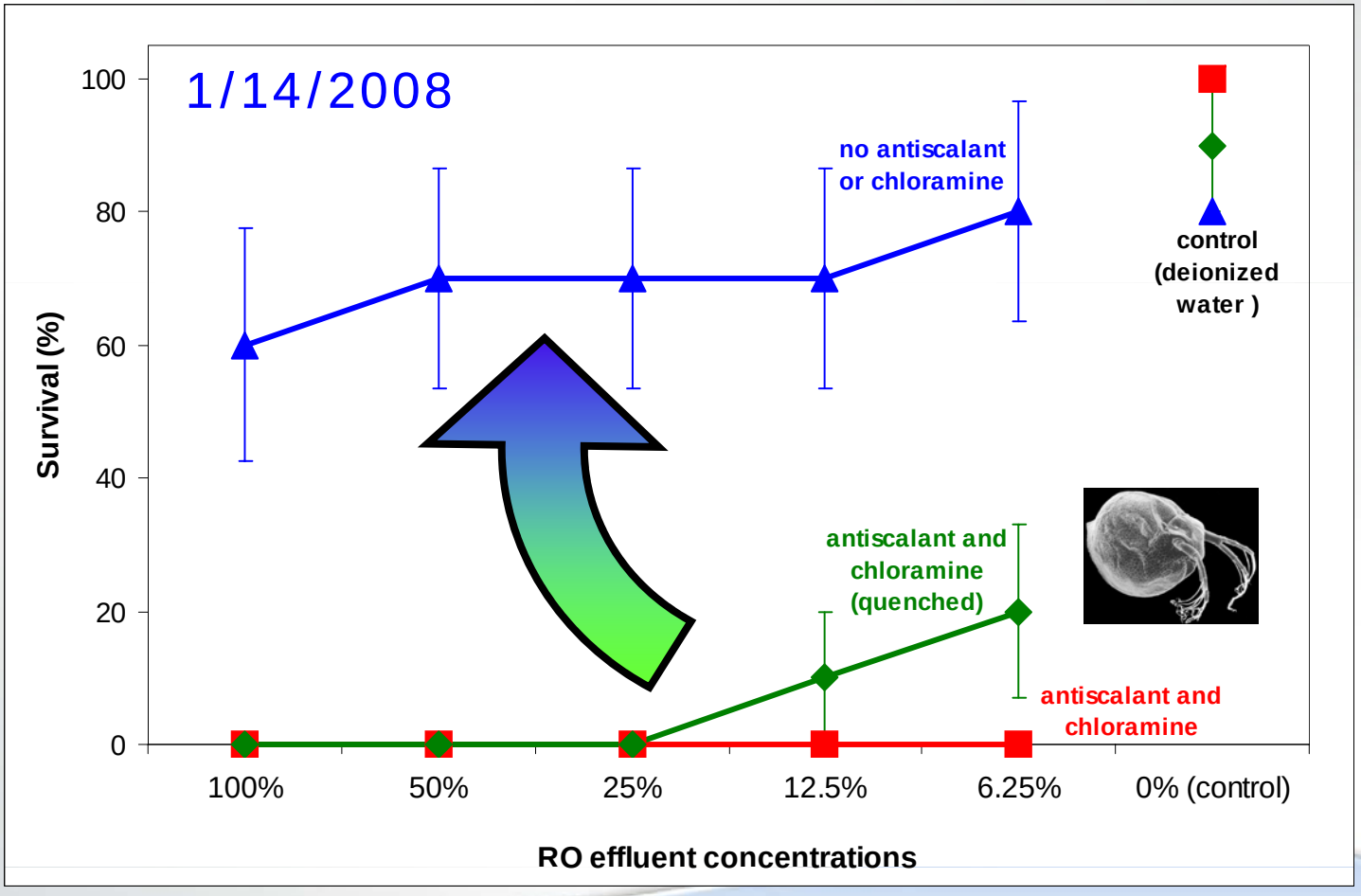
Strong Toxicity Of RO Effluent To The Water Flea Was Observed Under Normal Operation Of MBR/RO System



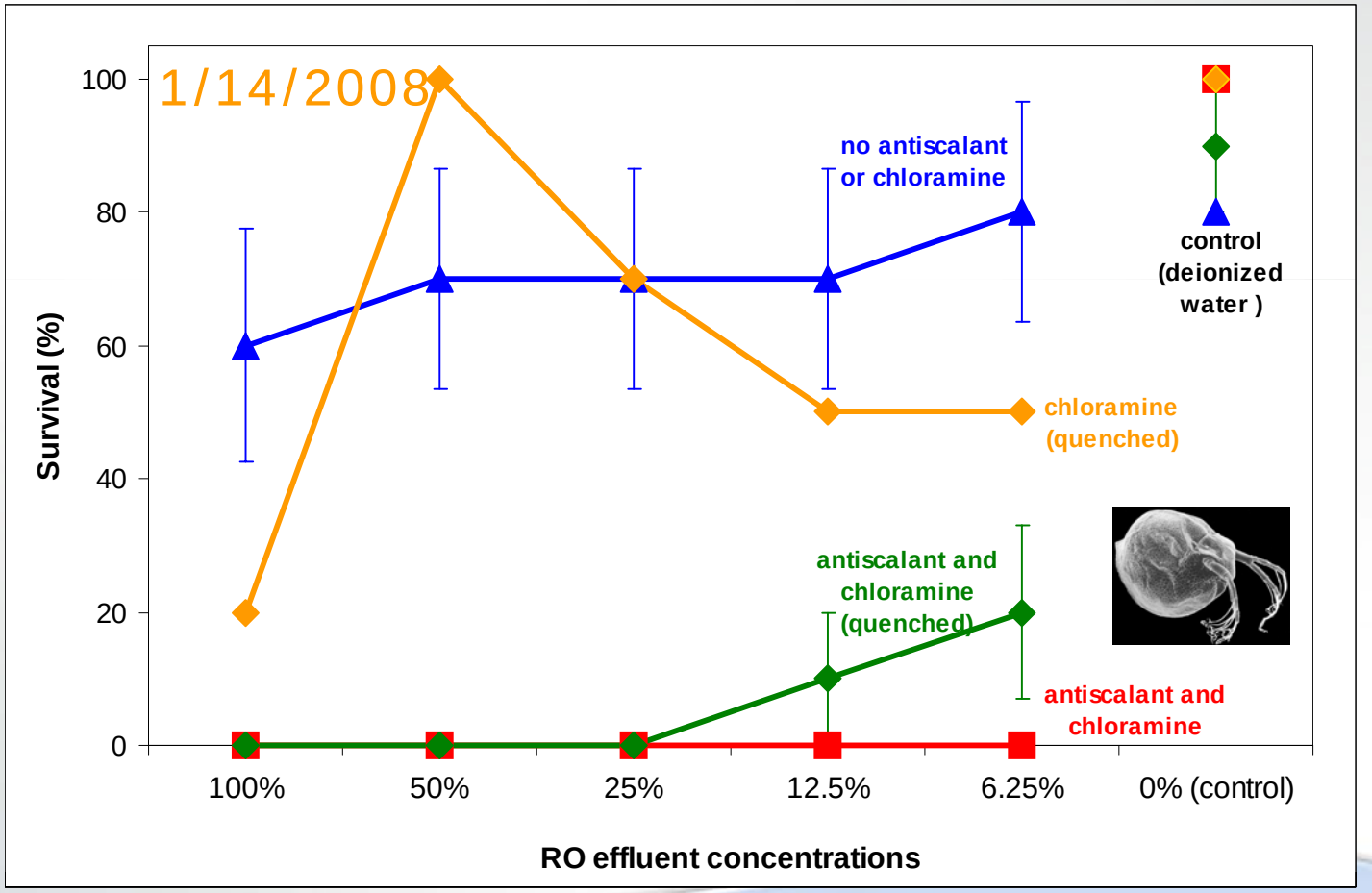
Toxicity Of RO Effluent To The Water Flea Was Reduced After Chloramine Was Quenched



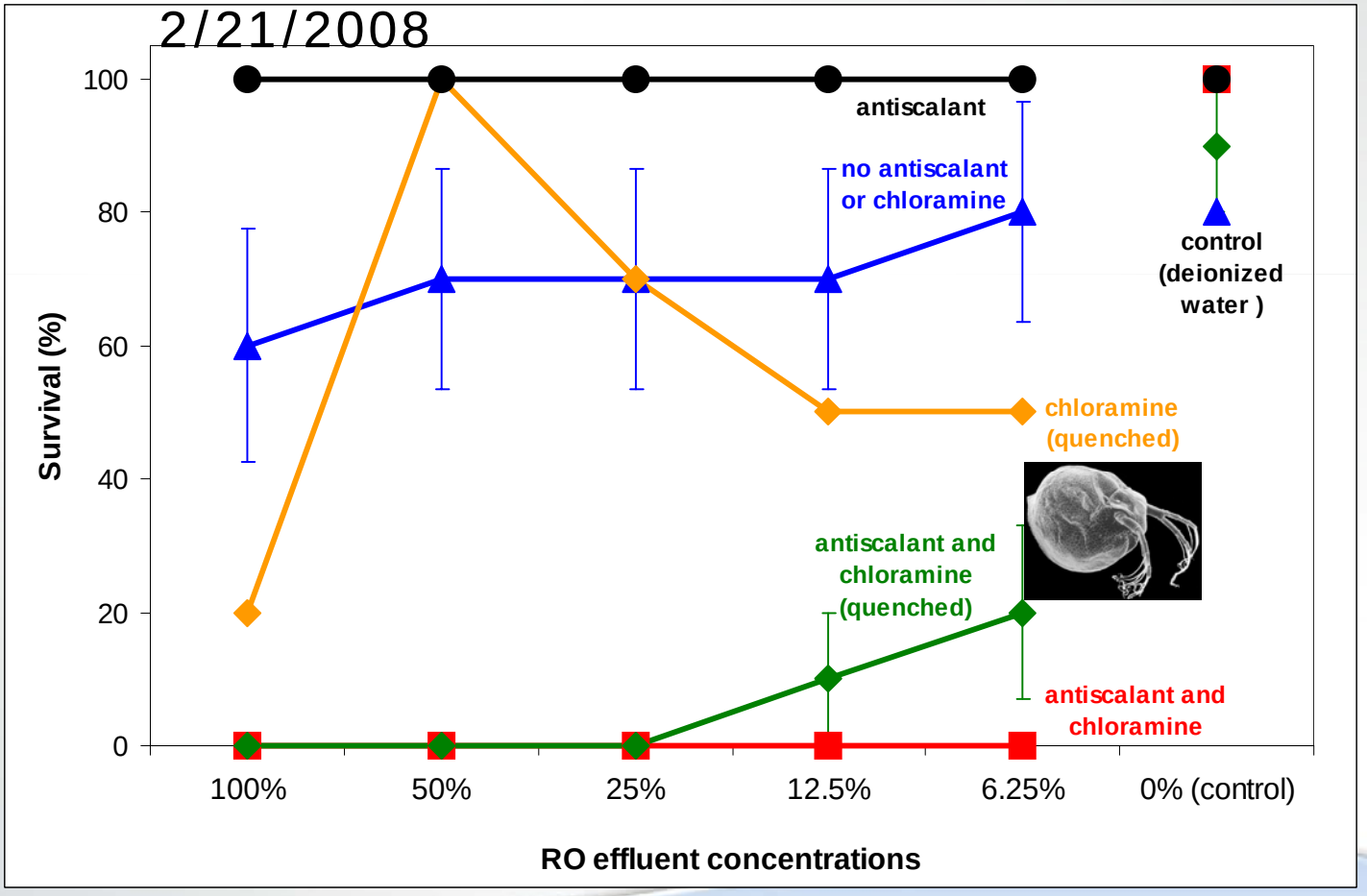
No Toxicity Of RO Effluent To The Water Flea Was Observed Without Chloramine Or Antiscalant



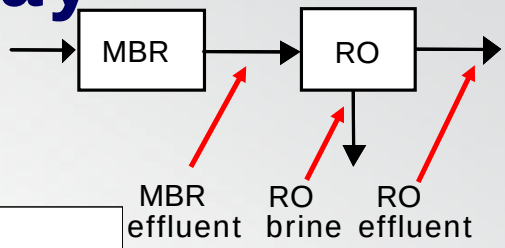
Some Toxicity Of RO Effluent To The Water Flea Was Observed With Quenched Chloramine (No Antiscalant)

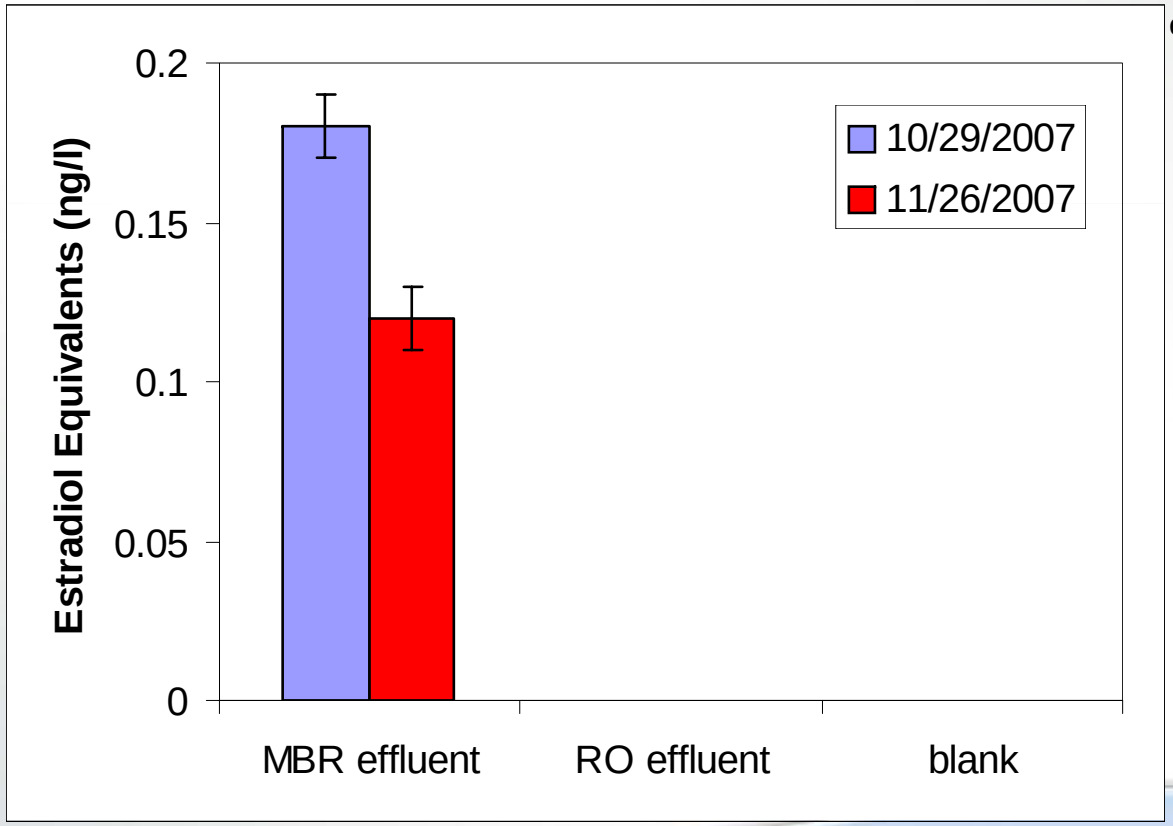


No Toxicity Of RO Effluent To The Water Flea Was Observed With Antiscalant (No Chloramine)

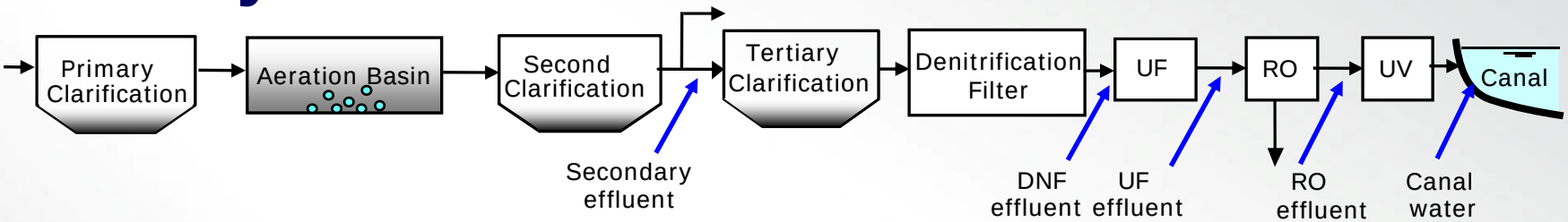


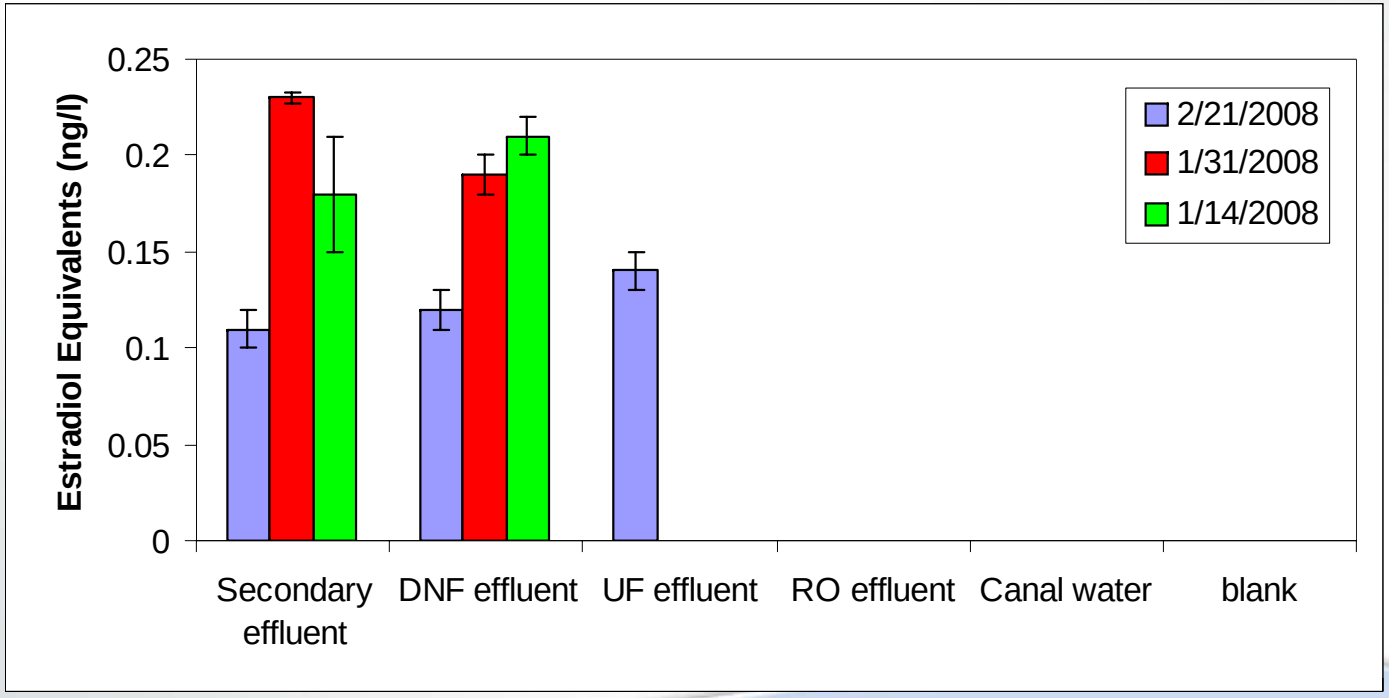
No Hormonal Impact In RO Effluent Was Observed With E-Screen Bioassay



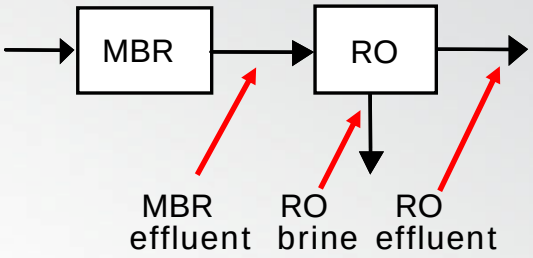


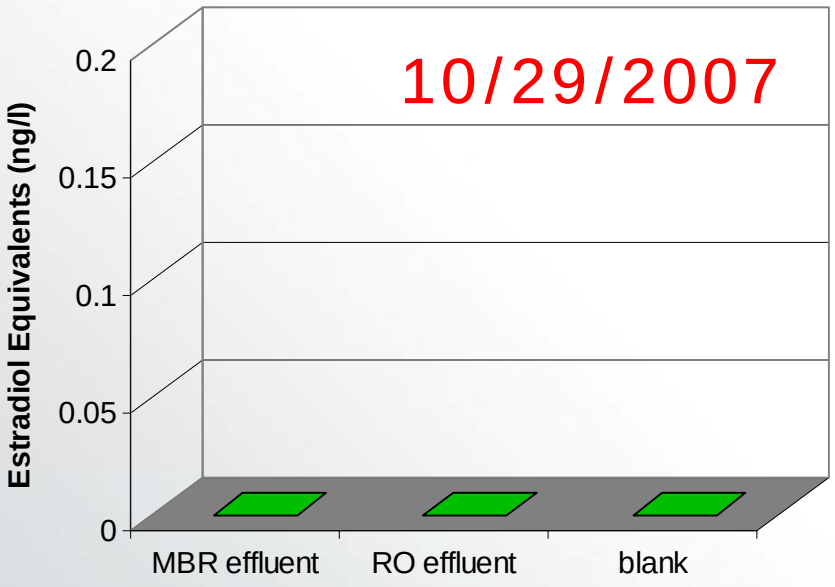
No Hormonal Impact In RO Effluent and Canal Water Were Observed With E-Screen Bioassay

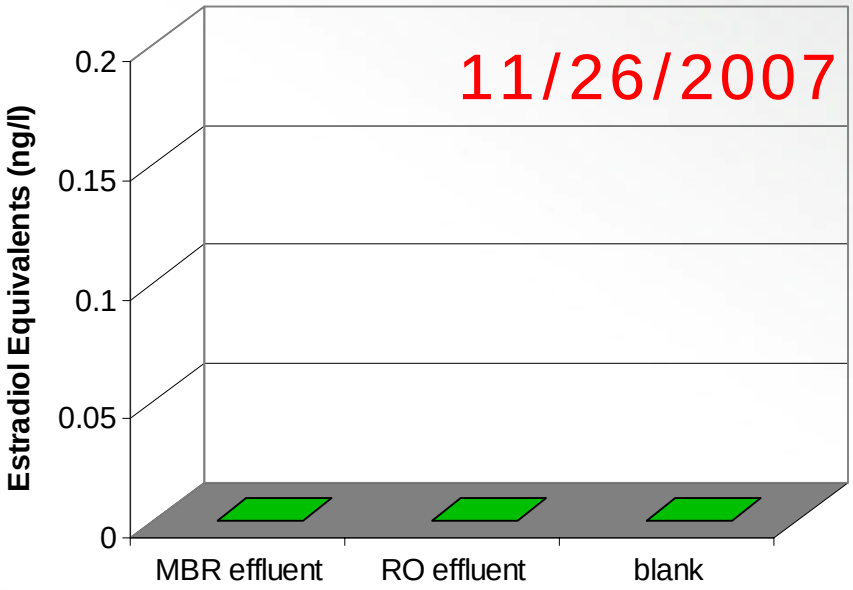




No Hormonal Impact In MBR and RO Effluent Was Observed With YES Assay







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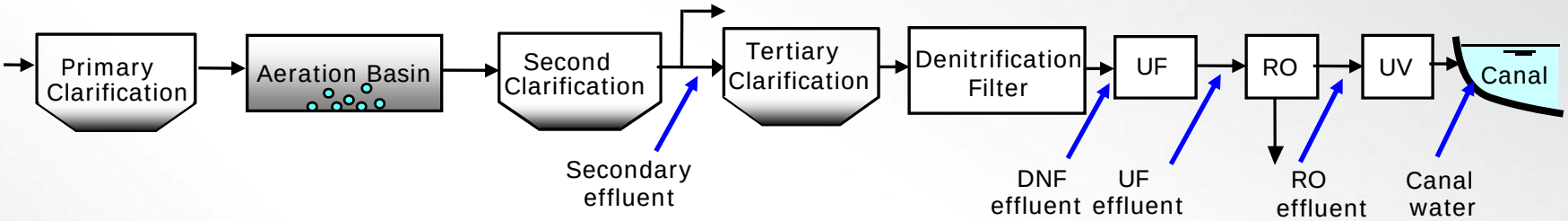
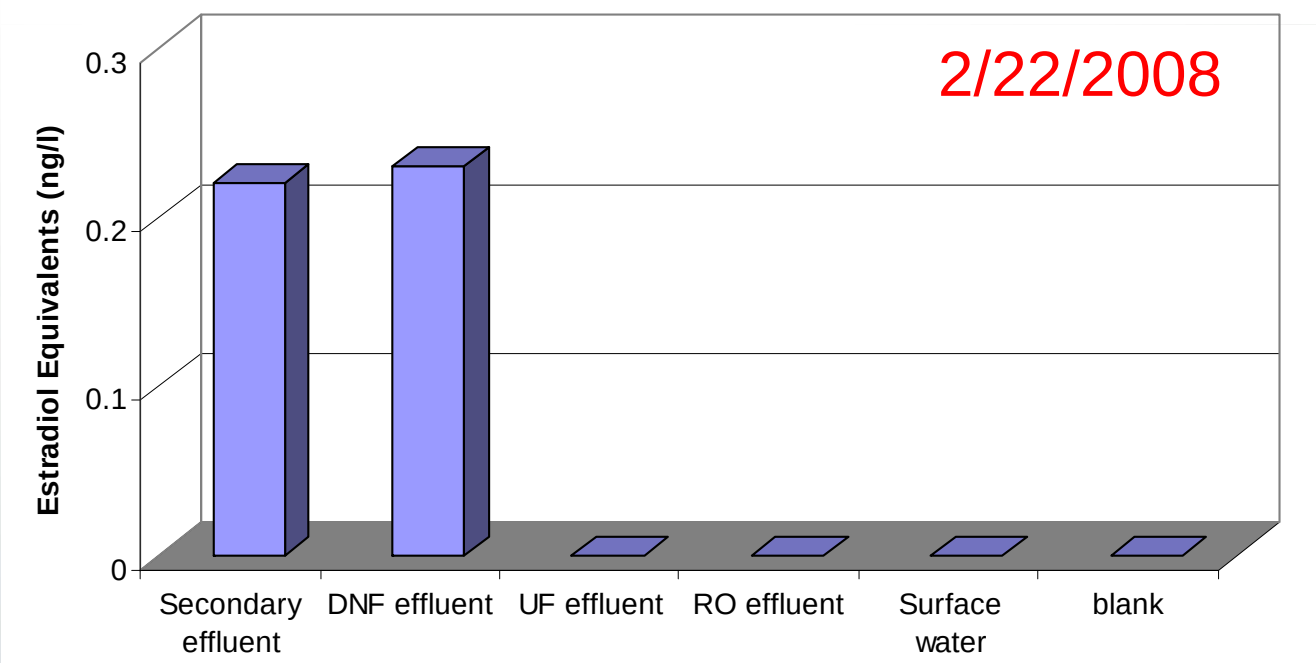
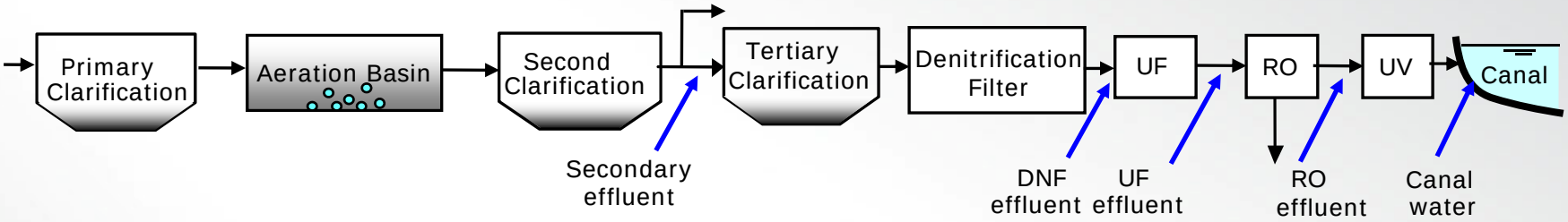
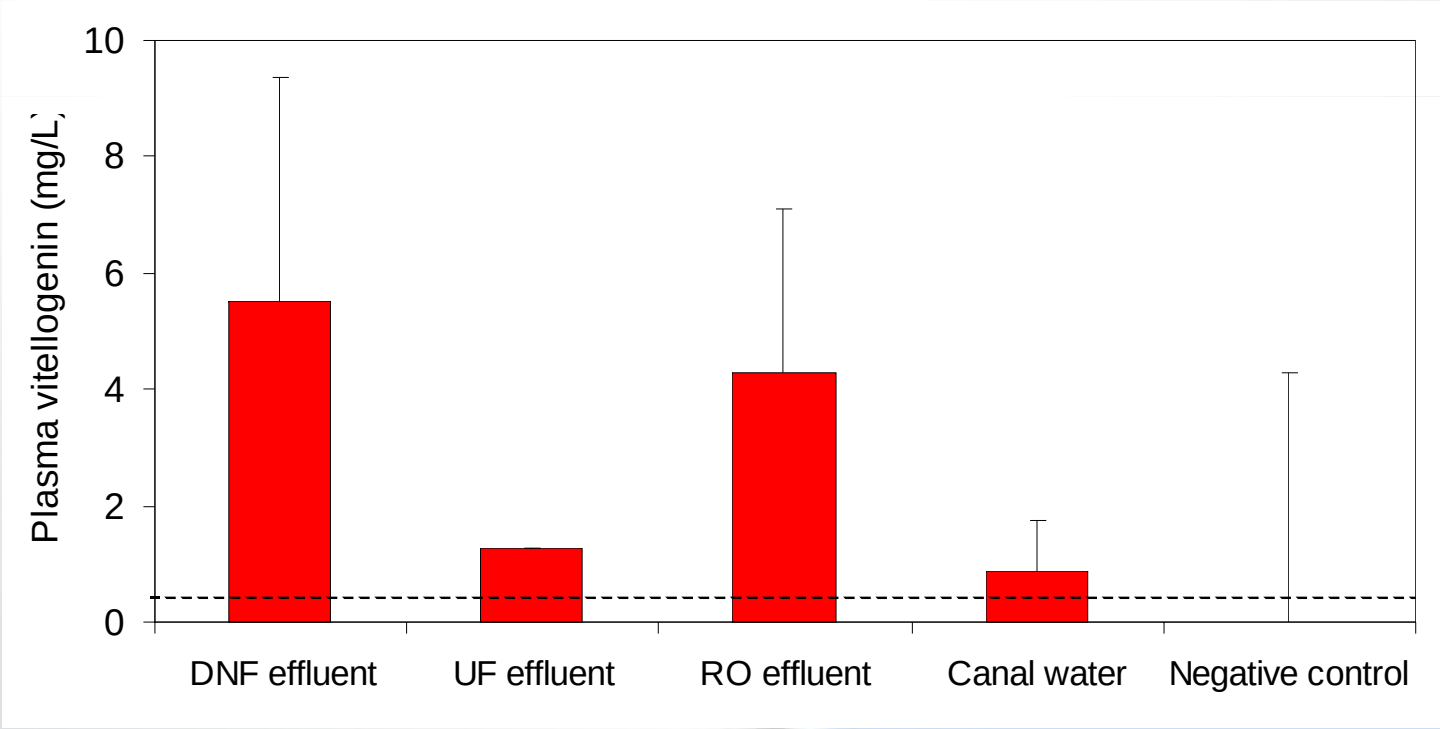
No Hormonal Impact In RO Effluent And Canal Water Was Observed With YES Assay



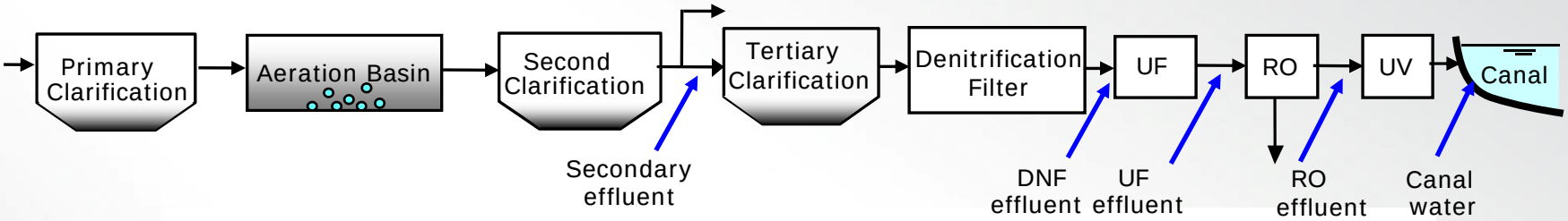


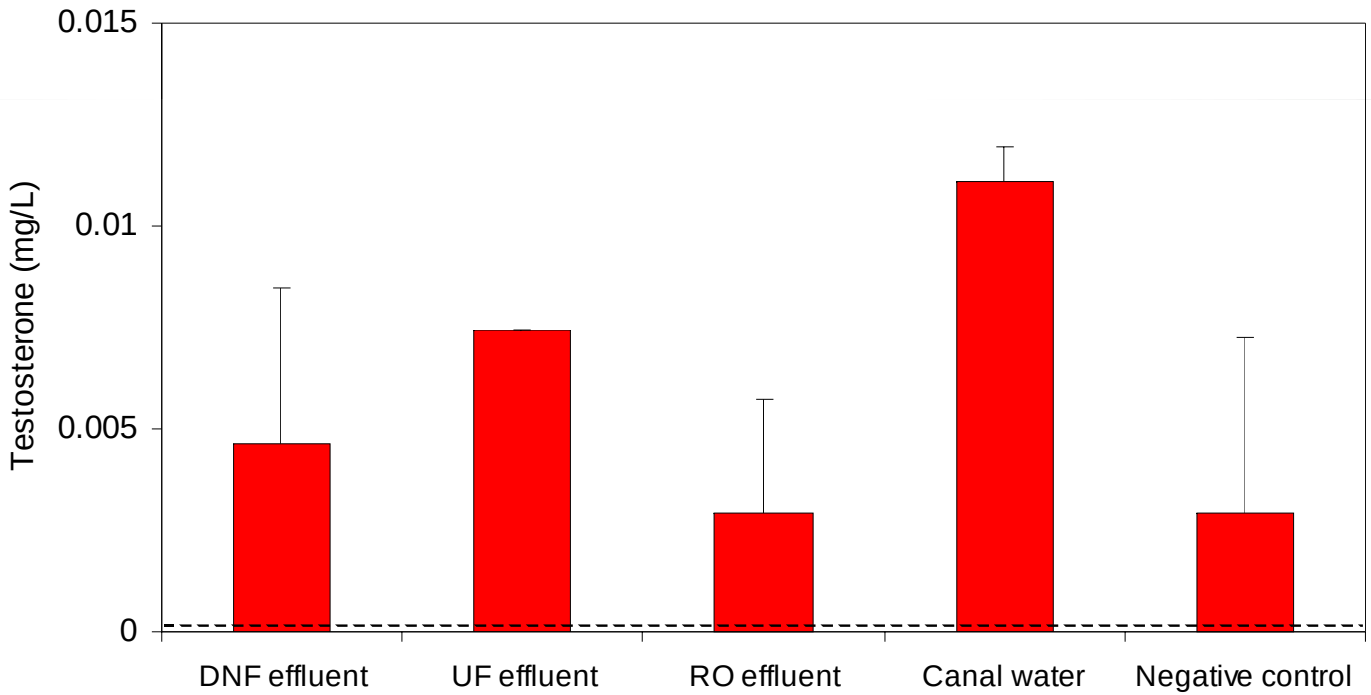
UF And RO Effluent Did Not Provoke Substantial Vitellogenin Response





UF And RO Effluent Did Not Provoke Substantial Testosterone Response

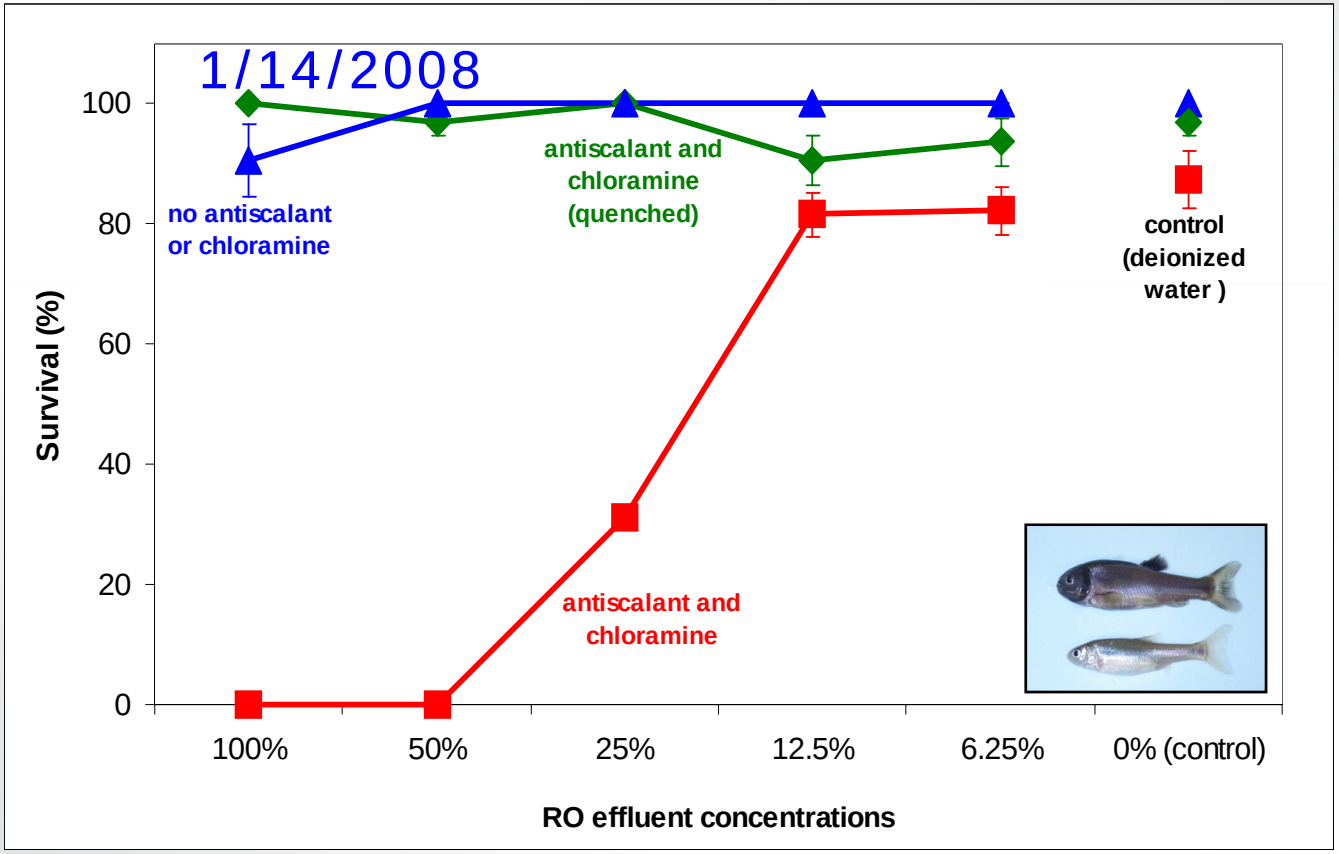




Conclusions

1. Most microconstituents removed by RO.
2. RO effluent posed no hormonal threat to tissue cultures and live fish.
3. The observed toxicity to aquatic organisms was likely caused by chloramines used for maintaining RO membranes.

No Toxicity Of RO Effluent To The Fathead Minnow Was Observed Without Chloramine Or Antiscalant



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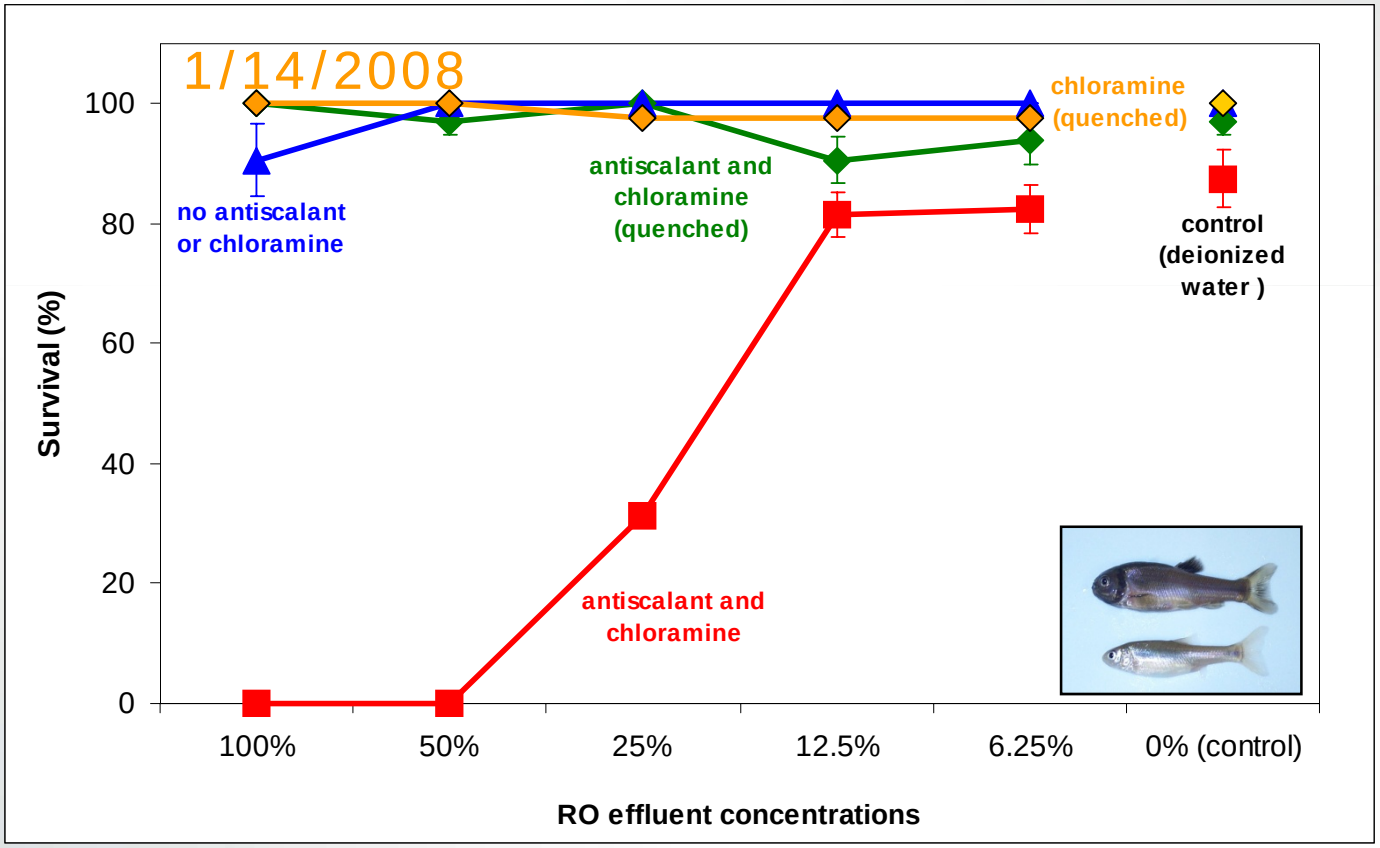
No Toxicity Of RO Effluent To The Fathead Minnow Was Observed With Quenched Chloramine (No Antiscalant)



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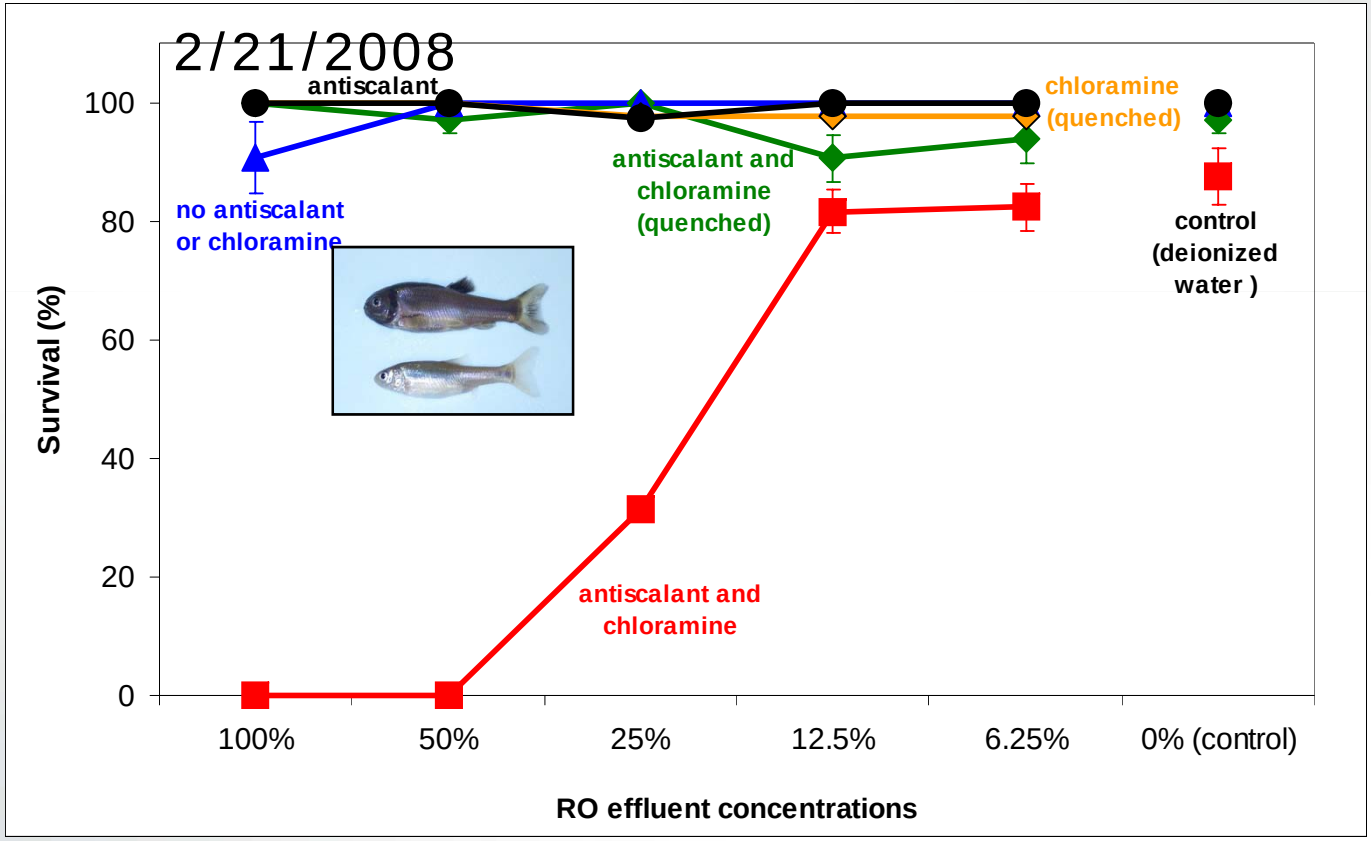
No Toxicity Of RO Effluent To The Fathead Minnow Was Observed With Antiscalant (No Chloramine)



MBR And RO Effluent Did Not Provoke ANY Vitellogenin Response