

Trophic Transfer of Contaminants in the Lower Columbia River



SEDIMENT QUALITY WORKSHOP

U.S. Fish and Wildlife Service
Oregon Fish and Wildlife Office

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Topics

COCs, exposure, & effects in Fish and Wildlife

Sediment concerns & data gaps in a carbon-limited system

Salmonids: Implications for hazard assessment

Dredging and channel deepening concerns

Contaminants of Concern

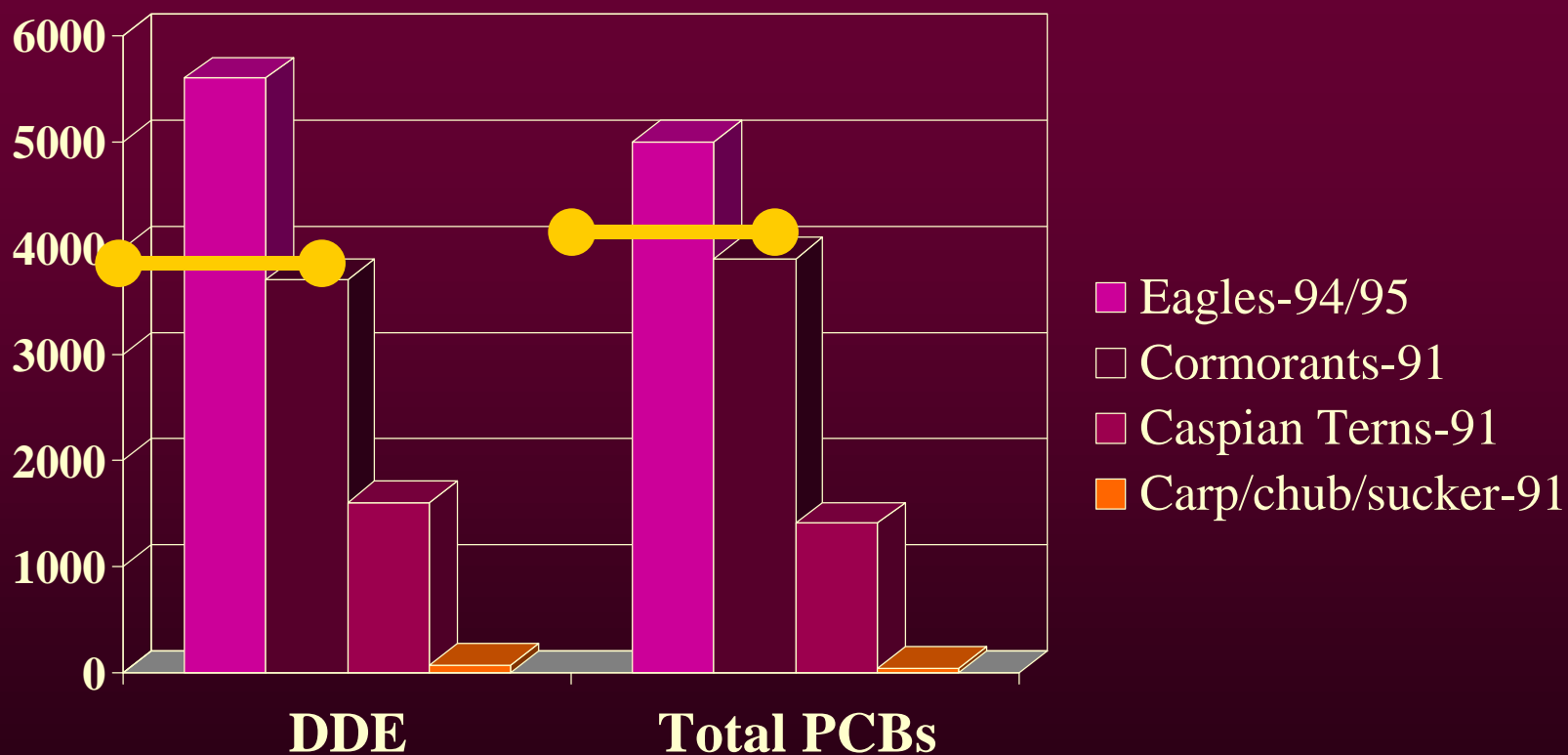
- DDE
- PCBs (total and planar PCBs)
- Dioxins (TCDD)
- Furans (TCDF)
- TEQs (additive model: dioxins+furans+planar PCBs)

Key Indicators: Effects to LCR Bald Eagles

- DDE, PCBs, dioxins & furans in eggs exceed values protective of embryos (embryo death)
- Low productivity, worst between RM 13-31
- Turbidity maximum between RM 8-28



Geo. Means of DDE & PCBs: Fish and Fish-eating Birds



ng/g fresh wt (eggs) or wet wt (fish)

LCR Sediment Results: Bi-State

	<u>Number of detections</u>	<u>Range (ng/g)</u>	<u>Detection limits</u>
<i>Tot PCBs-1254</i>			
1991 Sampling	1/54	85	25-250
1993 Backwater	0/15	--	10

“Total PCBs were widely distributed in fish tissue samples collected throughout the lower Columbia River...In contrast, there was infrequent detection of PCBs in the sediment” - Tetra Tech 1993

Lower Columbia River Sediment

- Organochlorines generally linked to organic matter/total organic carbon (TOC) content
- High TOC can reduce availability (greater affinity)
- Low TOC can increase potential for greater contaminant availability (weaker affinity) and toxicological effects
- Low TOC in LCR- primarily $< 2\%$

Lower Columbia River Sediment

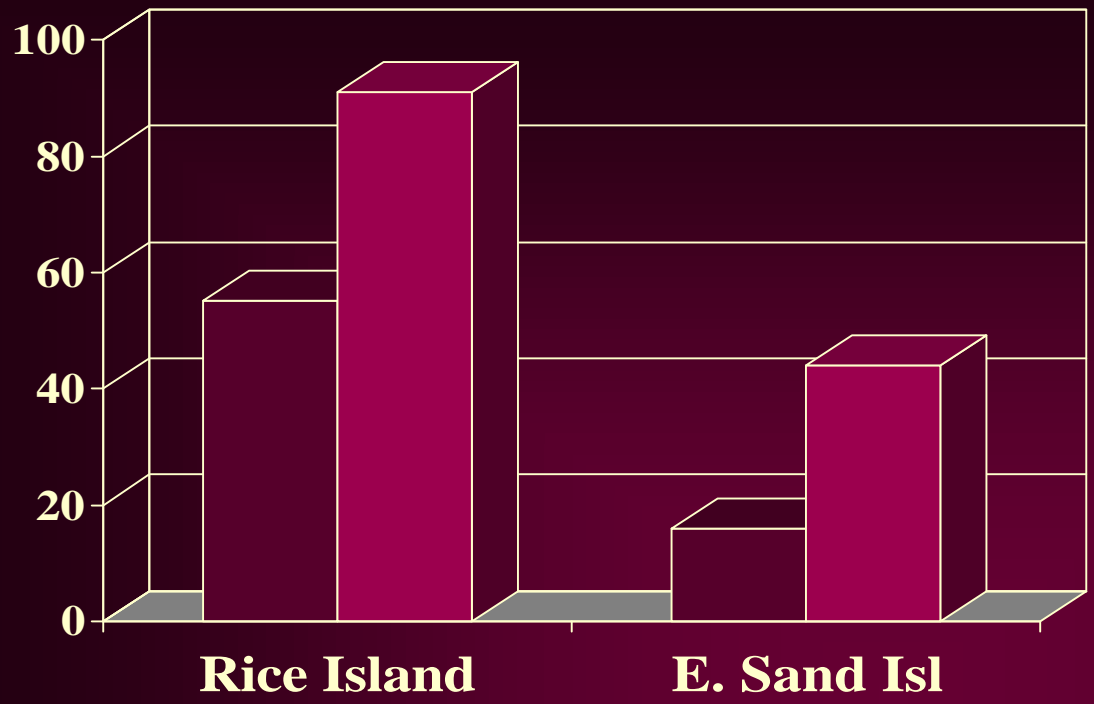
- High [tissue] with undetectable [sediment] indicate contaminants highly available to organisms in LCR
- Bioaccumulation may depend more on carbon type, amount & distribution within grain size than bulk [sediment]
- For ESA sp., screening guidelines may not be protective or appropriate to evaluate potential bioaccumulation in this system: Additional information needed on OM/OC

Implications for Salmonids

LCR tissue data and sediment characteristics indicates potential for salmonid exposure is high

- high contaminant availability even though short exposure period
- Need a field-derived or verified BSAF (e.g, Corophium-salmonid transfer model)

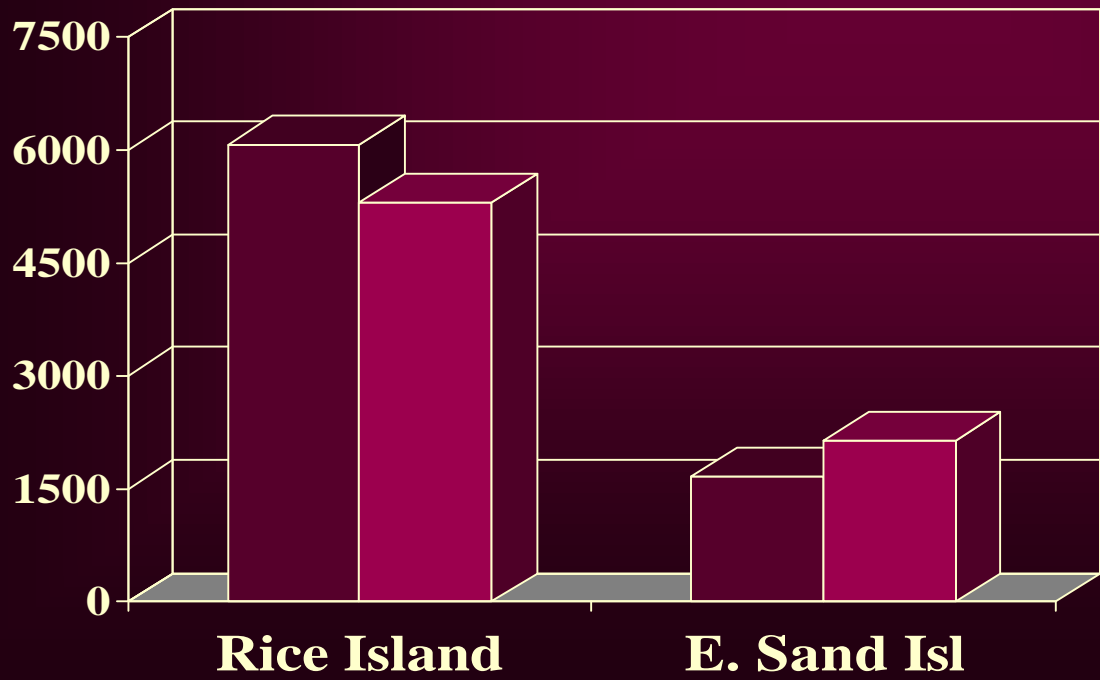
Cormorant and tern eggs implicate salmonids as a contaminated food source for fish-eating birds



Salmonid Consumption
(% biomass)

- DC corms
- Casp Terns

Collis et al. 1998



DC Cormorant egg concentrations

- Total PCBs
- DDE

Dredging Process & Carbon Distribution

- Resuspension during dredging, commercial shipping
- Inwater disposal material from Columbia R
 - 4 MCY disposed (2-years) just above ETM (fines up to 40K yds³)
 - 24 MCY disposed (20-years) just above ETM (fines up to 240K yds³)
- Increased dredging side channels and Ports
- Fuhrer and Horowitz (1989)- Found “critical bands” or clay lenses in the navigation channel in sediment cores (0.5m)

Conclusions & Data Gaps

- LCR tissues contaminated- [Sediment] low but likely highly available when contaminants present
- Contaminants in fish-eating birds indicate salmon are exposed to and carry organochlorine burdens in LCR-alternative risk assess
- Turbidity maximum may have highest accumulation potential
- Transfer/mobilization of OM/TOC during dredging & disposal of main and side channels vs. suspended sediment load
- Site-specific models (e.g., BSAFs) to better understand the tissue-sediment connection for estuary portion LCR

