



Acute toxicity of copper, ammonia, and chlorine to glochidia and juveniles of freshwater mussels

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Overview of project

- **Refine methods** for conducting toxicity tests with glochidia and juveniles of freshwater mussels (Poster PM140 by Wang et al.)
- **Evaluate the toxicity of copper, ammonia, and chlorine** to glochidia and juveniles using acute and chronic toxicity tests (topic of this presentation)
- **Develop standard method** through ASTM for conducting toxicity tests with freshwater mussels (start developing draft in fall 2004?)
- **Aquatic risk assessment** of these chemicals comparing toxicity results to ambient concentrations in important mussel habitats.

Overview of talk

- Compare relative sensitivity of mussels to copper, ammonia, or chlorine based on toxicity tests conducted with the following life stages:
 - Glochidia
 - Newly-released juveniles
 - Two-month-old juveniles
- Compare sensitivity of mussels to USEPA water quality criteria

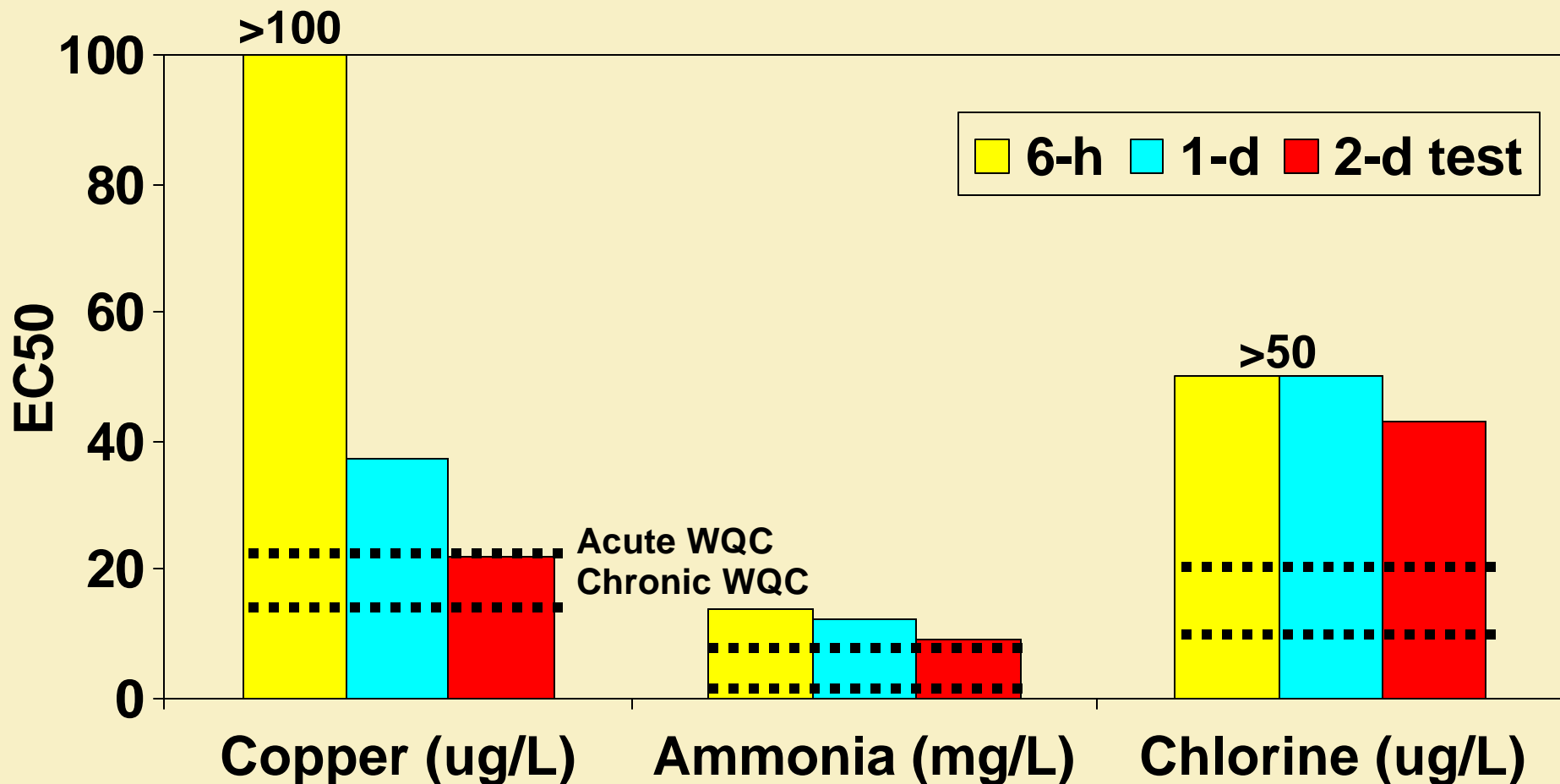
Toxicity tests conducted

Species	Glochidia	Newly-released juveniles	2-month-old juveniles
Oyster mussel (listed)	X	X	
Rainbow	X	2 X	X
Mucket	2 X		
Fatmucket	4 X		
Ellipse	X		
Wavy-rayed lampmussel	X	X	
Scaleshell (listed)	X	X	
Pink papershell	X		
Neosho mucket (candidate)	X	2 X	

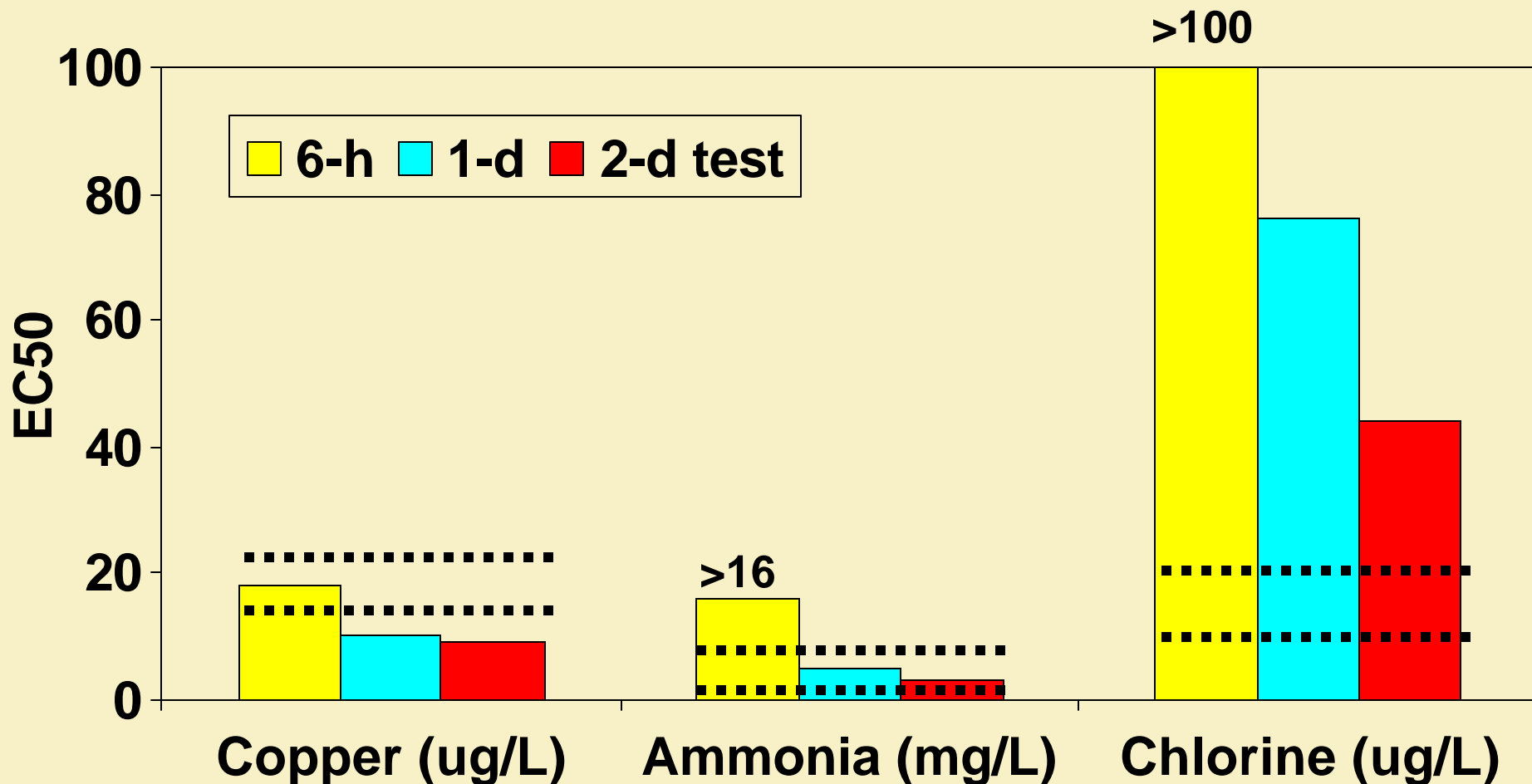
Test conditions	Glochidia	Newly-released juveniles	2-month-old juveniles
Test duration	6 h, 1 d, 2 d	2 d, 4 d, 10 d	2 d, 4 d, 10 d
Chemical	Copper, ammonia, chlorine		
Chamber (ml)	200 or 300	30 or 300	30 or 300
Water type	ASTM water (170 mg/L hardness, pH 8.3) at 20°C		
Water renewal	Static renewal or flow through		
Age	<2 h	4 to 6 d	>2 month
Organisms/replicate*	~1000	5	5
Feeding	None		
Endpoint	Shell closure w/NaCl	Survival (foot or shell movement)	
Acceptability (%)	>90		

*glochidia collected from about 3 to 9 females

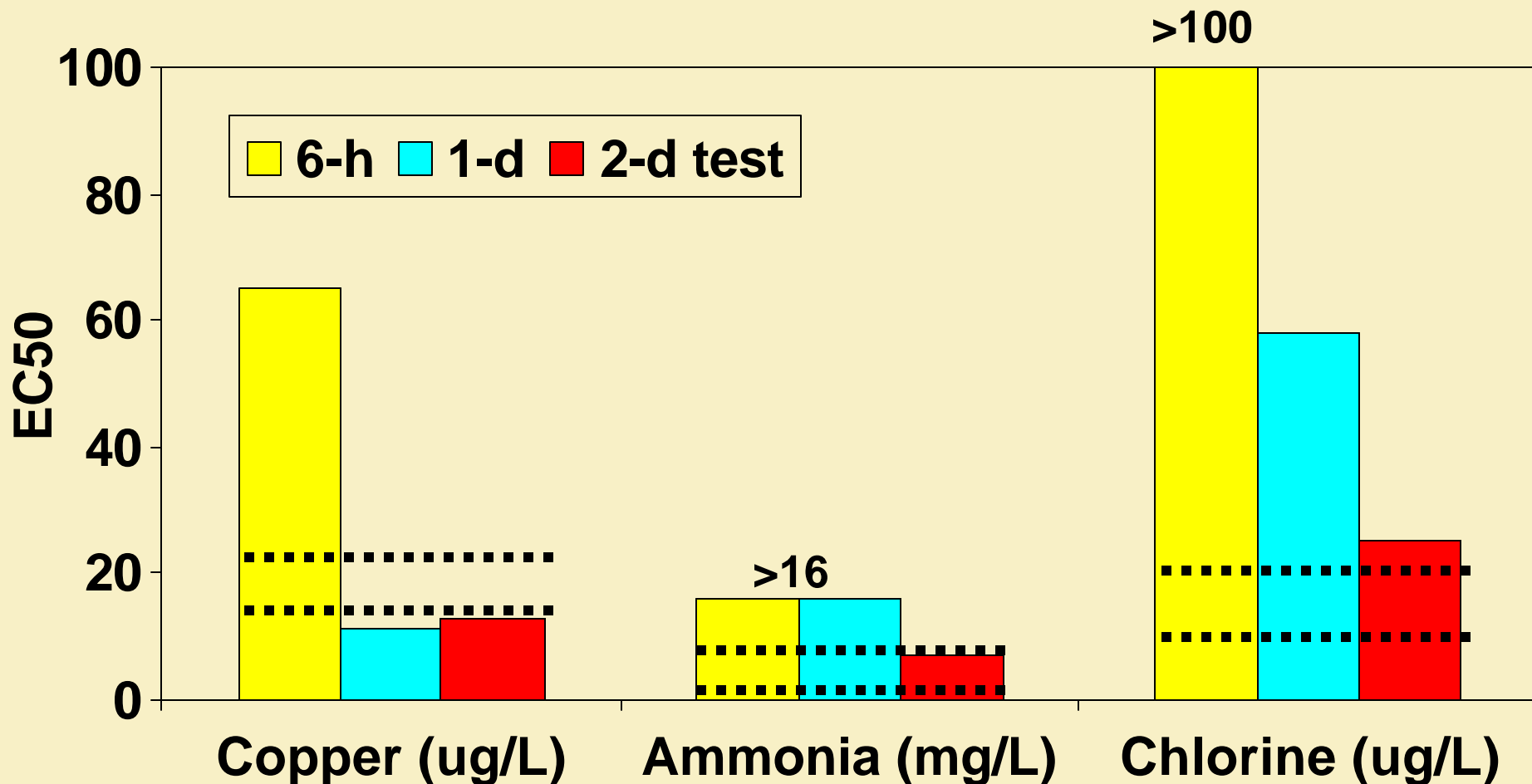
Glochidia: Rainbow



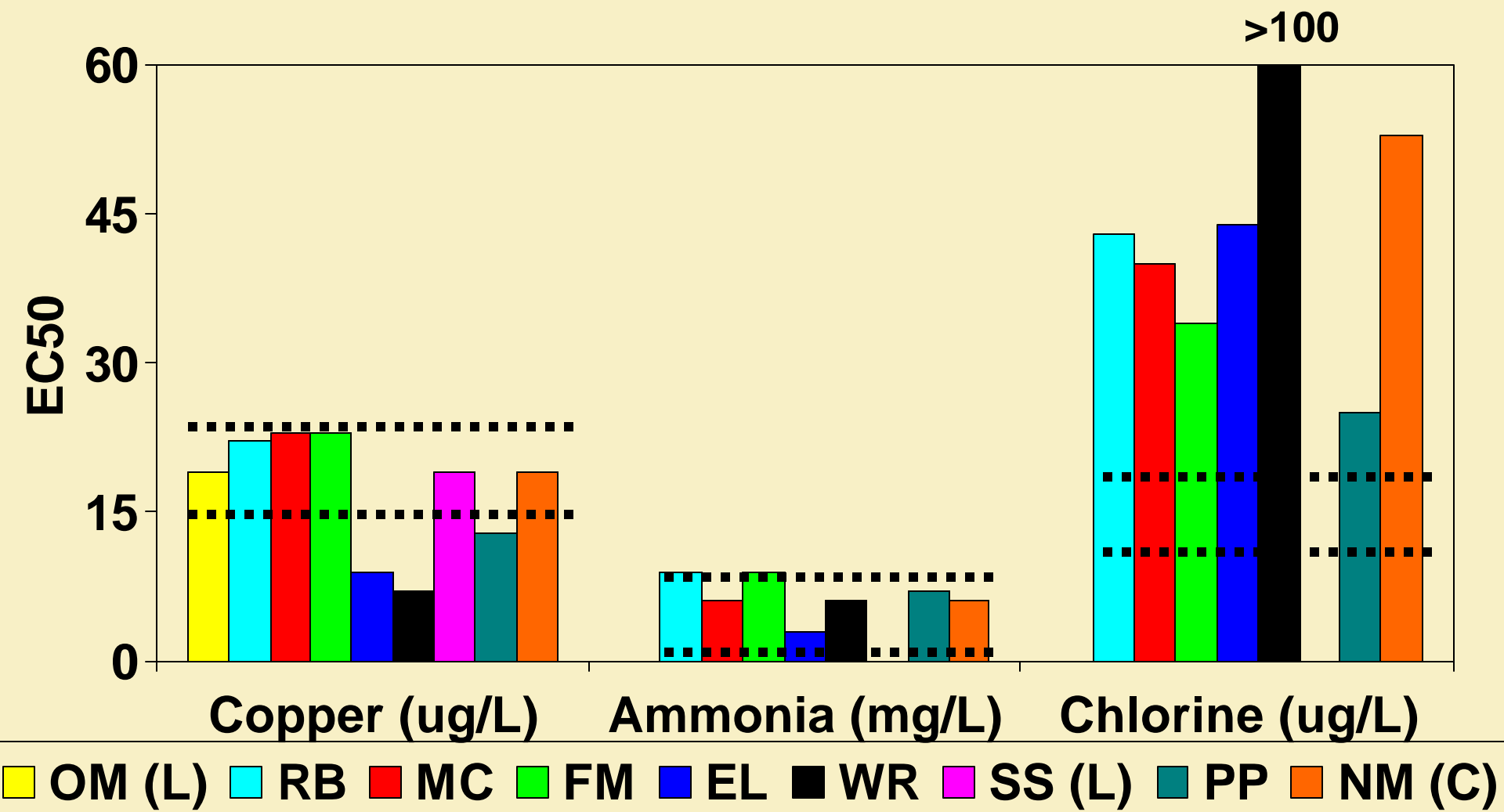
Glochidia: Ellipse



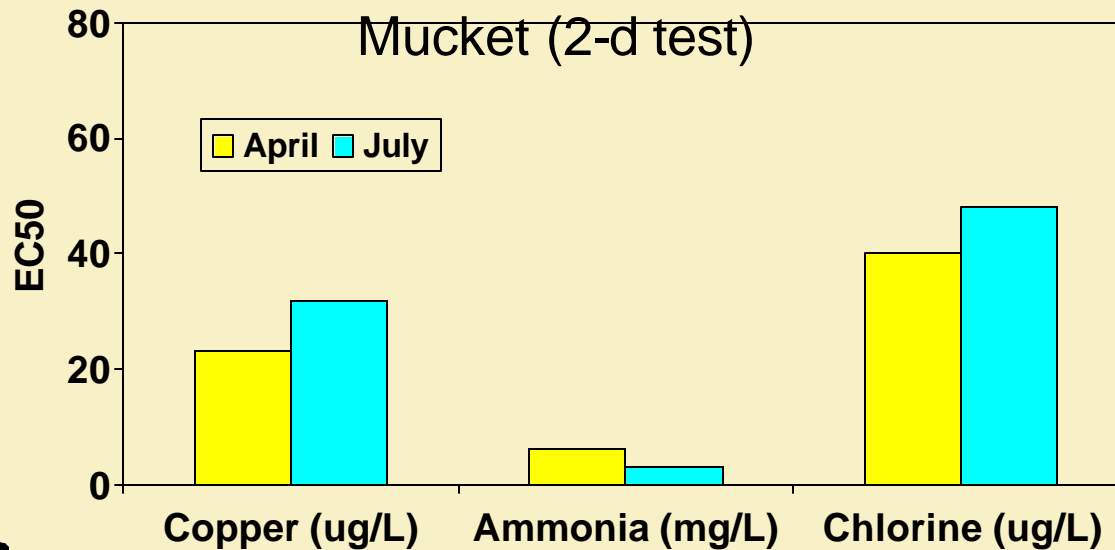
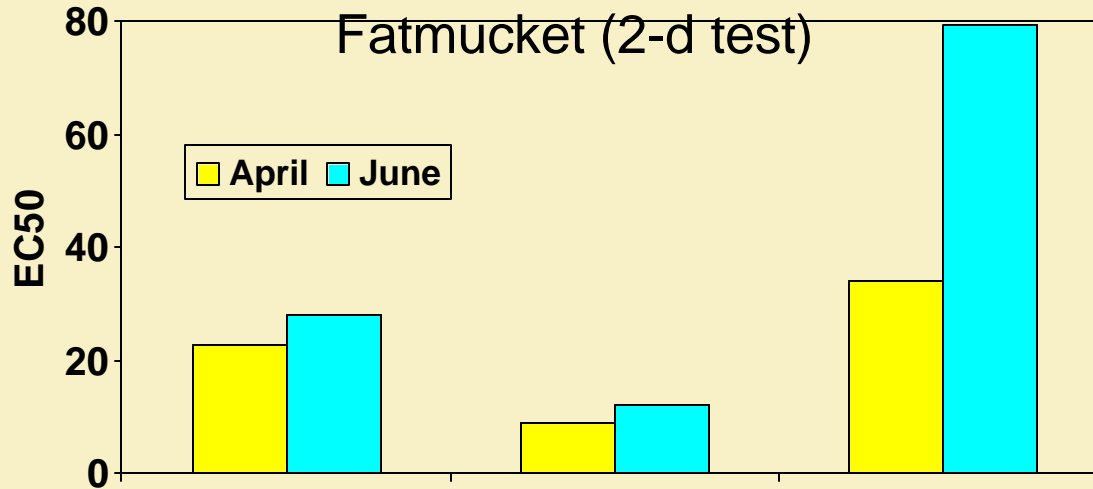
Glochidia: Pink papershell



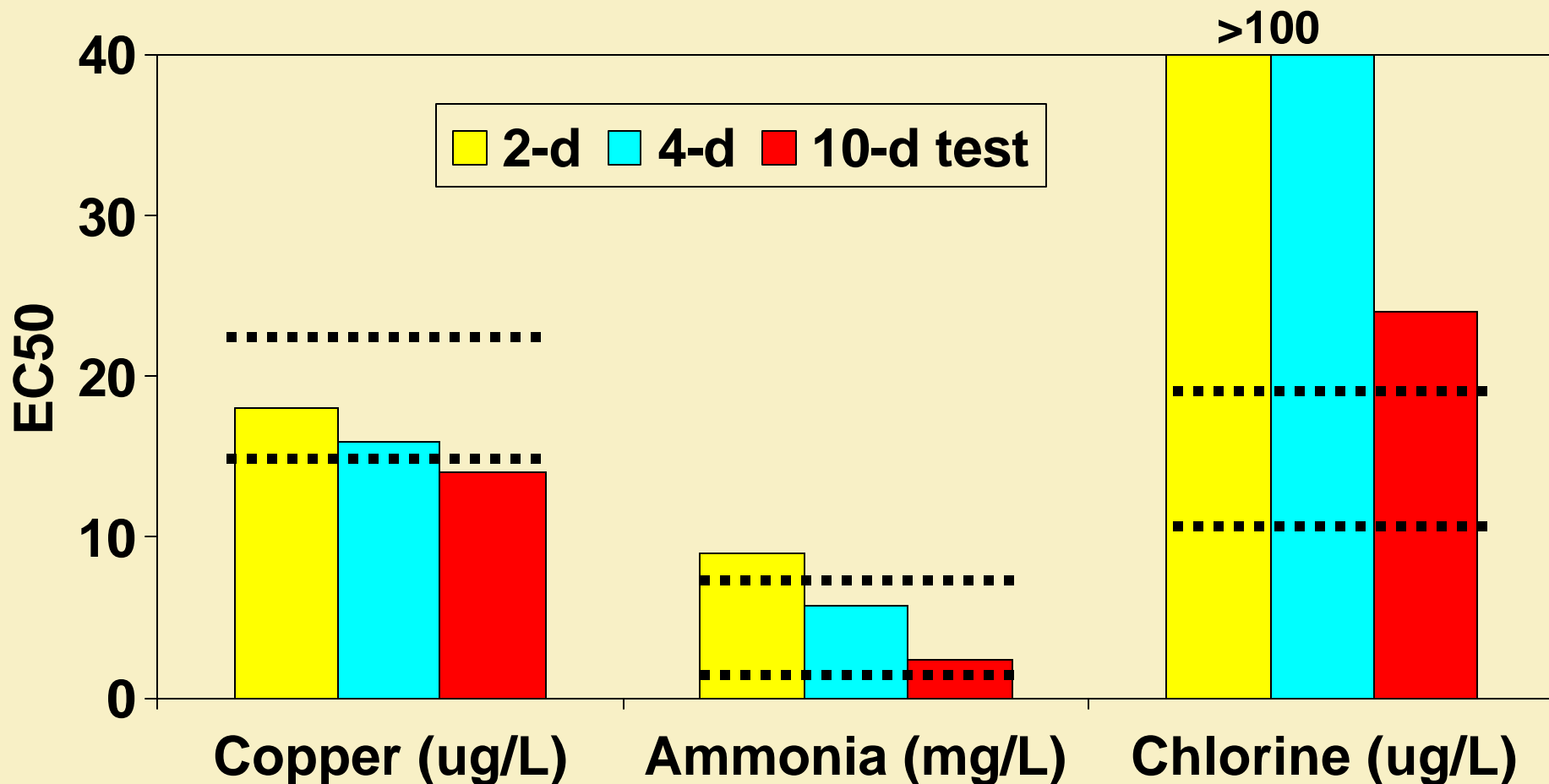
Glochidia: 2-d tests



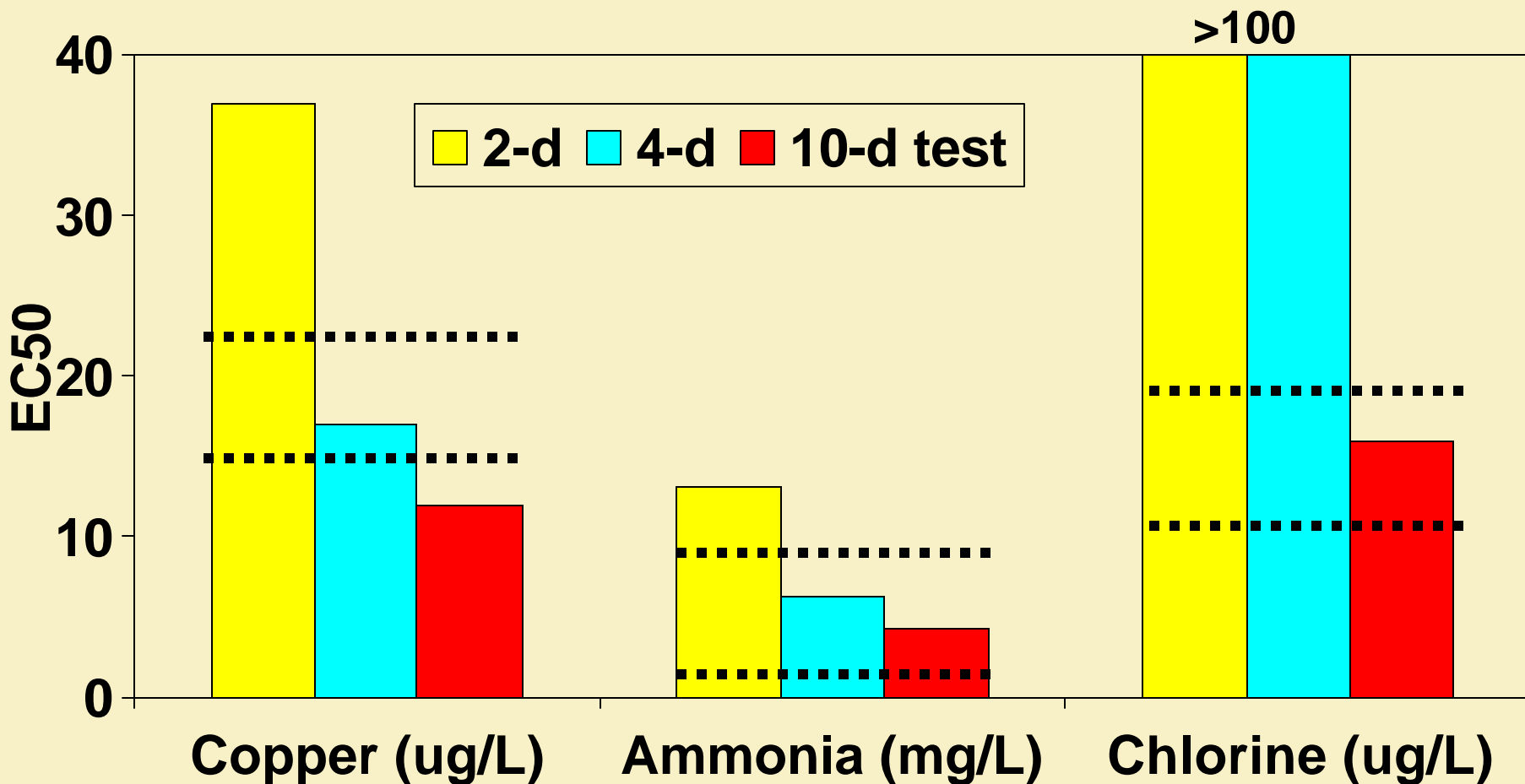
Glochidia: Repeated sampling of the same females



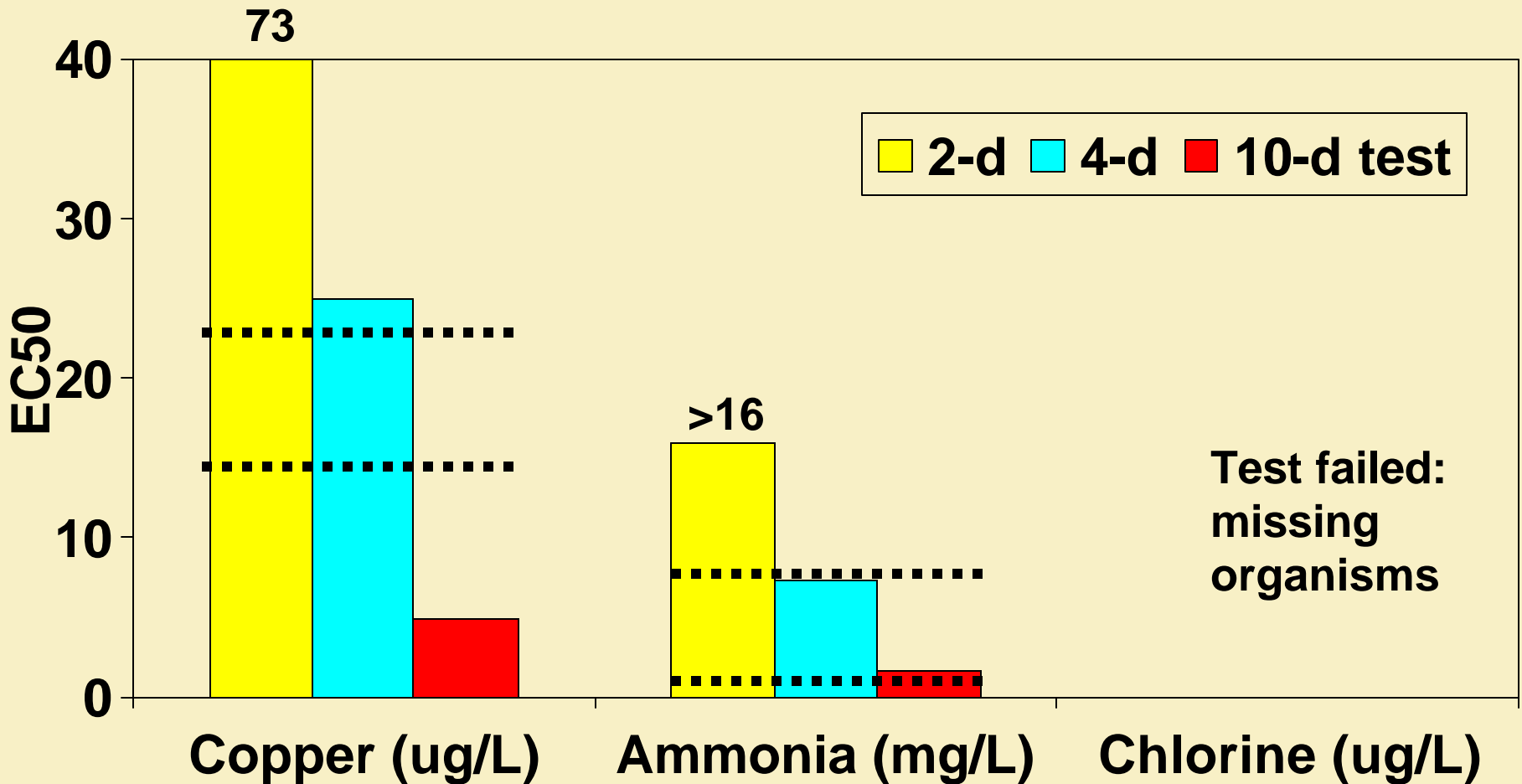
Newly-released juveniles: Oyster mussel



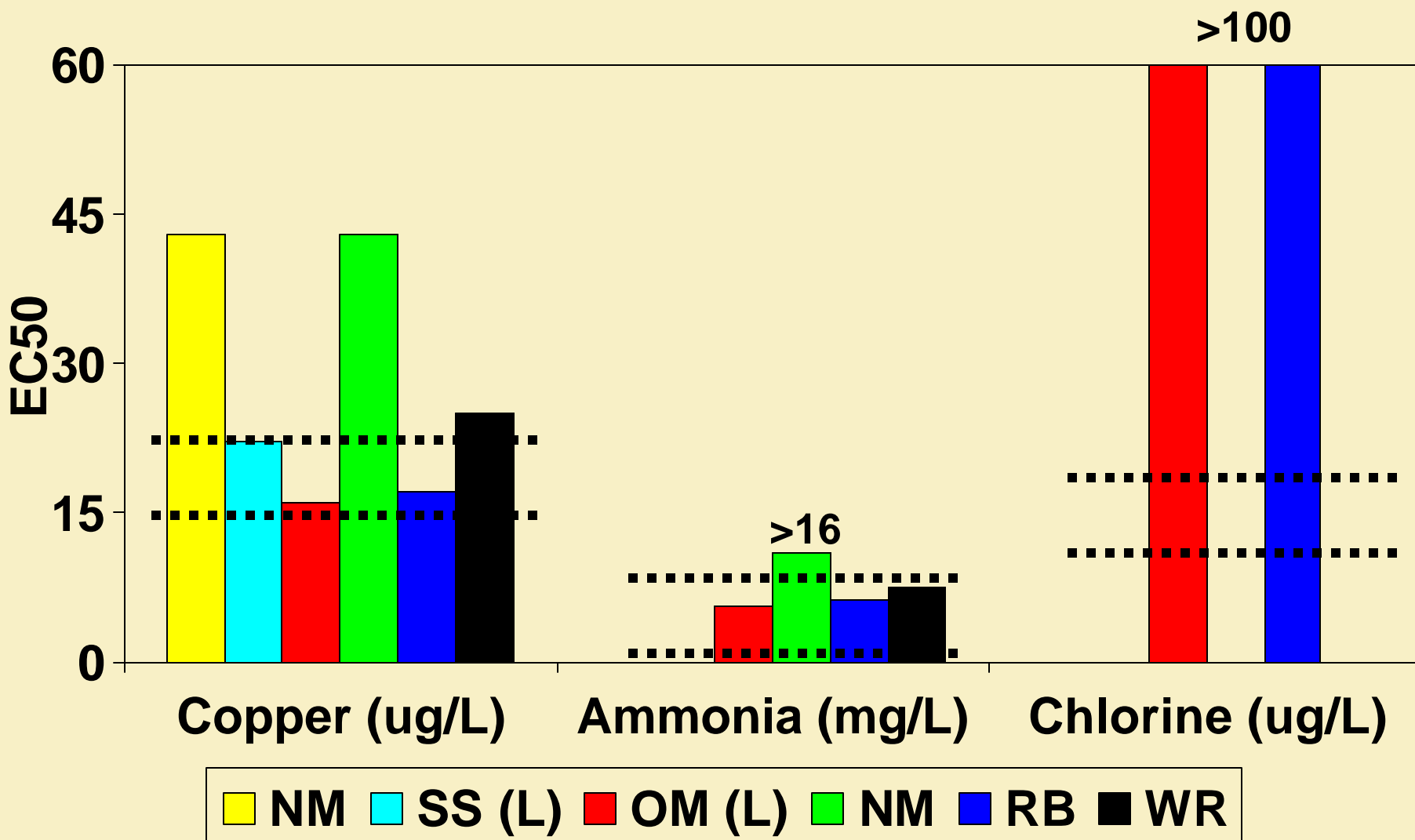
Newly-released juveniles: Rainbow



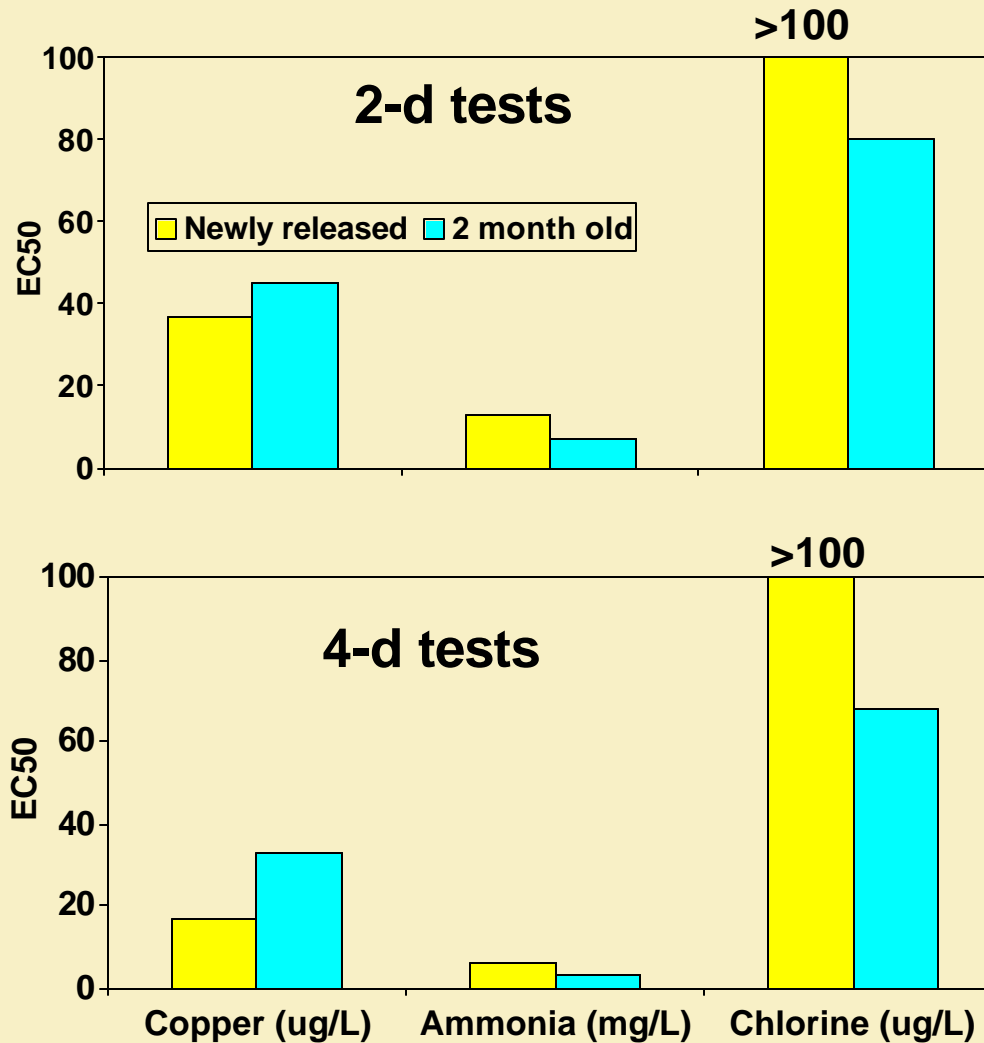
Newly-released juveniles: Wavy-rayed lampmussel



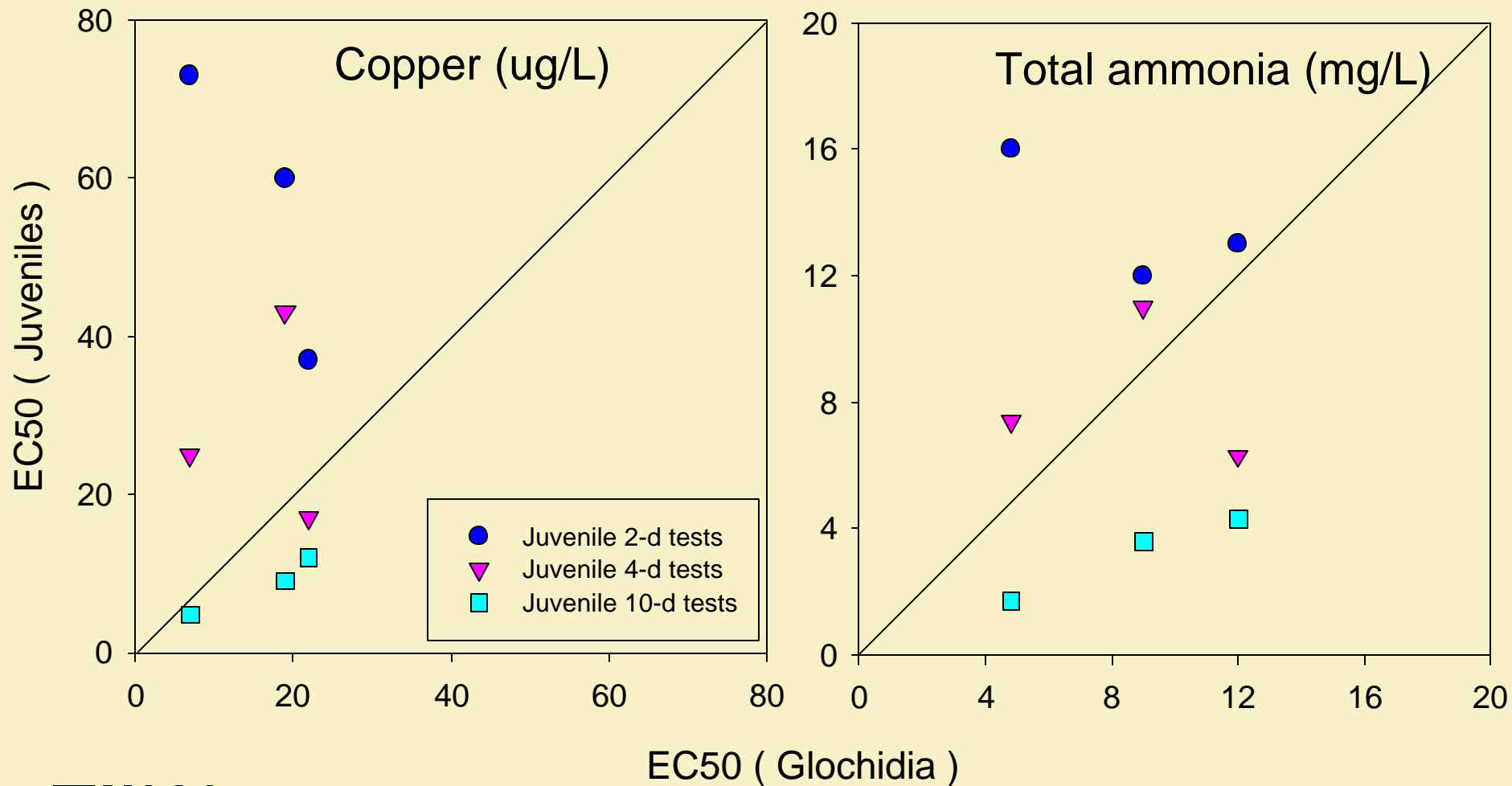
Newly-released juveniles: 4-d tests



Newly-released vs. 2-month juveniles: Rainbow 2- or 4-d tests



EC50s for glochidia (2-d tests) vs. newly-released juveniles (2-, 4-, or 10-d tests)



Conclusions

- Toxicity of copper, ammonia, and chlorine increases with increasing exposure time.
- 2 days is a reasonable duration for toxicity tests with glochidia, although shorter exposures may be needed based on the life history and survival time of glochidia.
- EC50s for 2-d glochidia tests are lower than EC50s for 2-d juvenile tests and are higher than EC50s for 4- to 10-d juvenile tests (e.g., difficult to predict toxicity observed with juveniles with results of glochidia tests).

Conclusions (cont.)

- 2-month-old juvenile rainbows exhibit similar sensitivity to newly-released rainbow juveniles.
- EC50s for copper and ammonia frequently at or below acute EPA water quality criteria for glochidia or juveniles.
- Protecting most sensitive mussels would be protective of listed mussels (scaleshell and oyster mussel)
- Future studies: Long-term toxicity testing with juveniles (e.g., 28-d tests).