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for alkyl-phenanthrenes (AP), and a model combining the toxic units from narcosis, AhR, and AP models. Barron *et al.* (2004) used wet wt tissue PAH data for the herring egg study. As discussed earlier, wet wt/dry wt ratios in herring eggs vary widely during development and in eggs from different females, confounding interpretation of dose–response relationships. In addition, there was not a complete tissue data set available for the LWO experiment precluding equal comparison between the two experiments. Therefore, because the modeling of the herring data was compromised by both the wide variability in the wet weight-based tissue PAH data used and the absence of a complete data set, only the modeling results for the Heintz *et al.* (1999) salmon study will be discussed here.

Tissue PAH concentrations after 35 d of exposure in the salmon study (Heintz *et al.* 1999) were used for the modeling by Barron *et al.* (2004). Although, this tissue PAH concentration was not the peak concentration for all treatments based on the data in Figure 3 of Heintz *et al.* (1999) or based on the modeling of PAH in tissue that included accounting for biotransformation (Mathew *et al.* 2008), it provided a consistent exposure duration. The narcosis model at the highest concentration only yielded 0.243 toxic units and so narcosis was ruled out as the main driving force for

rants in the ranges fo
causality.

Overall, Barron *et*
phenanthrenes proba
toxicity in the salmon
because of the use of
toxic unit determinat
C_4-phenanthrene not present in crude oil), instead of compound specific potency information for toxic unit determination. However, these data clearly demonstrate that the use of TPAH, either as an aqueous concentration or tissue concentration, as a dose metric is not appropriate for evaluating oil toxicity.

CONCLUSIONS

The conclusions of Heintz *et al.* (1995, 1999) and Carls *et al.* (1997, 1999) that weathered oil is more toxic than unweathered oil and that such toxicity occurs at

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about 1 μg/L dissolved TPAH are not supported by the data, based on our analyses of their published and unpublished data. The toxicity to developing eggs and larvae of salmon and herring observed by these investigators cannot be ascribed solely to dissolved PAH, at least at the lower concentrations tested. Confounding factors, including oil droplets, microbial contamination and microbial toxins, and other unmeasured compounds in weathered oil likely contributed to observed effects in eggs and larvae. The salmon and herring egg studies have not demonstrated that crude oil toxicity increases as it weathers in the environment. Rice *et al.* (2001) are incorrect in describing, based on Heintz *et al.* (1999) and Carls *et al.* (1999), a "new paradigm" that weathered petroleum is more toxic than previously thought.

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