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Linking In Vitro Estrogenicity to Adverse Effects in the Inland Silverside (*Menidia beryllina*)

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ABSTRACT

High-throughput cell assays that detect and integrate the response of multiple chemicals acting via a common mode of action have the potential to enhance current environmental monitoring practices. Establishing the linkage between in vitro and in vivo responses is key to demonstrating that in vitro cell assays can be predictive of ecologically relevant outcomes. The present study investigated the potency of 17 β -estradiol (E2), estrone (E1), nonylphenol (NP), and treated wastewater effluent using the readily available GeneBLAzer1 estrogen receptor transactivation assay and 2 life stages of the inland silverside (*Menidia beryllina*). In vitro estrogenic potencies were ranked as follows: E2>E1>>NP. All 3 model estrogens induced vitellogenin and choriogenin expression in a dose-dependent manner in larvae and juveniles. However, apical effects were only found for E2 and E1 exposures of juveniles, which resulted in female-skewed sex ratios. Wastewater effluent samples exhibiting low in vitro estrogenicity (below the 10% effective concentration [EC10]), did not cause significant changes in *M. beryllina*. Significant induction of estrogen-responsive genes was observed at concentrations 6 to 26 times higher than in vitro responses. Gonadal feminization occurred at concentrations at least 19 to 26 times higher than the in vitro responses. These findings indicated that in vitro cell assays were more sensitive than the fish assays, making it possible to develop in vitro effect thresholds protective of aquatic organisms.

Full Text

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