Lake Mead Studies 1995-2001: Evidence of Reproductive Dysfunction in Fish Exposed to Pharmaceuticals and Health-Care Byproducts in Wastewater

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An initial survey of fish health was conducted during 1995 and 1998 for multiple sites in Lake Mead. Results suggested potential effects on reproductive function for fish exposed to wastewater effluents in Las Vegas Bay and Wash, which receives the wastewater discharge for the Las Vegas greater metropolitan area. A year-long survey of fish health and reproductive function was conducted during 2000-2001 to assess exposure to and effects of wastewater contaminants in Las Vegas Bay. Las Vegas Bay and multiple sites within the Overton Arm of Lake Mead were utilized for these efforts. Common carp were collected bimonthly (n=12 per sex) and largemouth bass and razorback suckers were collected during the spring reproductive season (n=15 per species and sex). Carp and bass were sacrificed for collection of plasma and tissues. The endangered Razorback sucker specimens were captured and released following the collection of plasma. Samples were analyzed for sex steroids (estradiol, testosterone and 11-ketotestosterone), vitellogenin, gono-somatic index, thyroid hormones (T3 and T4) and sperm quality (motility and morphology). Tissues were analyzed for chemical contaminants. Results indicated significant exposures to a wide variety of chemical contaminants in Las Vegas Bay, including exposure to potential endocrine disruptors, including ethinyl estradiol, triclosan, perchlorate, and brominated fire retardants. Reproductive health biomarkers were (adversely affects) adverse effects for all three species; however, the magnitude of defects was much greater for male fish. Male fish from Las Vegas Bay had decreased concentrations of plasma androgens and thyroid hormones, as well as decreased sperm quality, regardless of species. Concentrations of chemical contaminants were analyzed for correlations to biomarker effects. Significant correlations were indicated for multiple contaminants, including correlations between decreased sperm quality and plasma hormones for both ethinyl estradiol and triclosan. These results indicate endocrine disrupting effects for fish exposed to wastewater effluents. Significant exposure to chemical components of wastewater, such as those of pharmaceutical and health care product origins, are potentially involved in these effects on fish. Future efforts should utilize paired field and laboratory approaches to assess cause-and-effect relationships to wastewater effluents and specific components.