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THE OCCURRENCE AND FATE OF STEROIDAL HORMONES IN SURFACE WATERS IMPACTED BY CATTLE GRAZING AND ANIMAL AGRICULTURE

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ABSTRACT: Cattle and other livestock excrete endogenous steroid hormones, including estrogens, androgens, and progestins; therefore, allowing grazing livestock direct access to surface waters can result in the release of steroid hormones in agricultural watersheds. The introduction of steroid hormones to receiving waters in agricultural areas is problematic because numerous studies have demonstrated that low concentrations of certain steroid hormones can affect reproductive output in fish. To assess the occurrence and transport of steroid hormones arising from grazing cattle, gas chromatography-tandem mass spectrometry (GC/MS/MS) was used to quantify a suite of estrogens, androgens, and progestins in small creeks in California impacted by rangeland grazing. Steroid hormones were detected in 86% of samples from rangeland creeks where cattle often had direct access to the water, with concentrations as high as 44 ng/L observed shortly after rain events at the beginning of the winter wet season. Estrogens were present at concentrations above the predicted no-effect concentrations for fish in 10 – 20% of the samples, indicating that fish living in these particular watersheds may be at risk for effects associated with estrogenic endocrine disruption. Additionally, the pheromonal steroid androstenedione was detected at concentrations higher than response thresholds for pheromonal communication in fish, indicating a potential for pheromonal communication in fish to be disrupted by agriculturally derived steroid hormones. The results suggest that in certain cases, measures such as stream fencing in rangeland areas to limit direct discharge of animal wastes to surface waters or better manure management practices might be merited to protect ecosystem health.

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