COMPARATIVE VULNERABILITY OF ENDANGERED FISHES

TO A FISH SCREEN

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Introduction

In California's Sacramento-San Joaquin estuary, >2000 water diversions extract 4-6 million acre feet of water each year. Some of the larger diversions are equipped with fish screens intended to reduce entrainment losses of resident and migratory fishes. We evaluated the protection offered by a fish screen by comparing the vulnerability of three local endangered fishes, splittail (*Pogonichthys macrolepidotus*), chinook salmon *(Oncorhynchus tshawytscha*), and delta smelt *(Hypomesus transpacificus*), to entrainment, injury, and mortality at a simulated screened water diversion in the Fish Treadmill, a unique annular flume equipped with a fish screen.

Methods

The Fish Treadmill is a large annular flume incorporating a 3-m diameter inner fixed fish screen (vertical wedgewire, 2.3 mm spacing) and a 4.3-m diameter rotatable outer screen to enclose a 0.67-m wide test channel. Fishes were tested for 2 h at 10 combinations of approach (perpendicular flow through the screen, velocity range 0-15 cm/s) and sweeping velocities (parallel flow past the screen, velocity range 0-62 cm/s) at two temperatures (12 and 19ºC) during the day (light conditions) and night (dark

conditions). During the exposure, fish performance and behavior, including fish-screen contact events, swimming velocity (through the water), velocity and direction of travel past the screen, and survival, were measured. Short term survival and injuries were assessed 48 h post-exposure.

Results and Discussion

Delta smelt (preliminary data only) were the most sensitive species, suffering significantly greater flow- and screen contact-related mortality rates and, because of strong positive rheotaxis, potential prolonged entrainment near the screen at moderate sweeping flow velocities. Chinook salmon were susceptible to screen contact related non-lethal injuries. Younger parr were more likely to be entrained than older smolts. Splittail were the least vulnerable, insensitive to flow and, apparently, screen contact.

Results of these studies will be applied to develop fish screen flow and adaptive operational criteria that improve protection for these species and others.

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