

**PERFORMANCE AND BEHAVIOR OF CHINOOK SALMON
NEAR A FISH SCREEN**

Joseph J. Cech, Jr.
Department of Wildlife, Fish, and Conservation Biology,
University of California, Davis, CA 95616
tel.: (530) 752-3103, FAX: (530) 752-4154,
email: jjcech@ucdavis.edu

Christina Swanson, and Paciencia S. Young
Department of Wildlife, Fish, and Conservation Biology,
University of California, Davis, CA 95616

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Introduction

In the Sacramento-San Joaquin watershed (California), chinook salmon (*Oncorhynchus tshawytscha*) parr and smolts are exposed to many small (e.g., 50 ft³/s) and large (e.g., > 5000 ft³/s) water diversions along their migratory path. Loss of these young fish at diversions, by entrainment and/or fish screen-related injuries and mortality, is thought to have contributed to the species' population decline. While some of these diversions are equipped with fish screens intended to protect fishes by excluding them from exported water, our understanding of optimal fish screen design and operational criteria is limited for this endangered species. As part of a large research program to improve fish screen criteria, we examined performance and behavior of fall-run chinook salmon parr and smolts in complex flow regimes similar to those near screened water diversions in a large annular flume equipped with a fish screen (the "Fish Treadmill").

Methods

Fish were tested for 2 h in ten flow regimes derived from combinations of an approach flow (through the screen, velocity range 0-15 cm/s) and a sweeping flow (past the

screen, velocity range 0-62 cm/s), two seasonal temperatures (12 and 19 C, winter/spring and summer/fall, respectively), and during the day (light conditions) and night (dark conditions). We measured screen contact rates, swimming velocity (through the water), rheotaxis, velocity past the screen, and post-experiment survival and injury.

Results and Discussion

Both parr and smolts experienced frequent flow-dependent temporary screen contacts (especially at night) but few fish became impinged on the screen. Survival was uniformly high but, for parr, injury rates were directly related to screen contact rates. Parr exhibited greater positive rheotaxis than smolts at intermediate flows, slowing downstream screen passage. For this species, optimal fish screen design would probably minimize screen contact and promote downstream passage.

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