**Tracy Research Technical Report Abstract**

* ***Ph.D. Dissertation***  
  Portz, D.E., 2007. Fish-holding-associated Stress in Sacramento River Chinook Salmon (Oncorhynchus tshawytscha) at South Delta Fish Salvage Operations: Effects on Plasma Constituents, Swimming Performance, and Predator Avoidance. Doctoral Dissertation, University of California, Davis, 161 pp.

Operations of fish salvage facilities at major diversions in the Sacramento-San Joaquin Delta require proper screening, daily collection, and holding of fishes, and their transport downstream. Exposure of fishes to environmental stressors, such as capture and handling, can be a great concern, in that extreme or prolonged stressors may plague fish performance and overall health. We assessed chemo-physiological changes and compromised performance over a functional continuum in juvenile Chinook salmon (Oncorhynchus tshawytscha) that were exposed to simulated salvage-tank-related stresses. These assessments covered biochemical (plasma constituents), performance (maximum swimming performance, burst swimming, and C-start responses), and ecological measurements (predator avoidance), in evaluating the physiological condition of control, standardized stress, and salvage tank treatment (oval holding tank with Pescalator® Archimedes screw lift and cylindrical holding tank with lift bucket) fish under five holding durations. Our goal was to determine whether collecting/holding tank designs, conveyance methods, and holding duration significantly contributed to the fishes’ direct or indirect mortality.

Results indicate that stress is functionally interrelated across biochemical, organismal, and ecological levels of organization. More specifically, treatment groups that demonstrated significant plasma constituent stress responses also showed a decreased maximum swimming performance and body bending in C-start startle responses, although no statistical differences were apparent among our control, standardized stress, and most treatments during burst swimming speed tests. Finally, striped bass (Morone saxatilis) predators captured stressed salmon disproportionately to unstressed salmon.

Comparing salvage tank treatments, salmon exposed to the cylindrical holding tank with lift bucket had plasma constituent levels that more closely resembled the control fish and performed better in our challenge tests than did those in the oval holding tank with Pescalator®, the most stressful component of the collecting-holding- conveyance process. Interestingly, we found no significant differences among holding durations. Our results provide a scientific basis for using a straightforward, inexpensive stress-assessment method (e.g., annular- racetrack maximum swimming performance) for salvaged, juvenile Chinook salmon. They also support the examination of stress responses across a functional continuum, rather than merely observing potentially isolated chemophysiological response alone, when attempting to understand a fish’s response to stress at ecological levels.