

U.S. Fish & Wildlife Service

HEALTH AND PHYSIOLOGY ASSESSMENT OF STEELHEAD FOR SIX-YEAR STUDY, 2016

Ken Nichols



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US Fish and Wildlife Service
California-Nevada Fish Health Center
24411 Coleman Fish Hatchery Rd
Anderson, CA 96007
(530) 365-4271 Fax: (530) 365-7150
<http://www.fws.gov/canvfhc/>

SUMMARY

As a component of juvenile steelhead survival studies in the south Delta (Six-Year Steelhead Study) the US Fish and Wildlife Service's California-Nevada Fish Health Center conducted a health and smolt physiology assessment. Health assessments were performed on dummy-tagged cohorts of study fish held at the Durham Ferry release site. Health and physiological condition of the steelhead can help explain their survival and migration performance during the survival studies. Three groups of 24 steelhead (72 total fish) were examined for the health assessment. None of the fish died during the 48 hour holding period, and overall condition of the fish was good with no evidence to suspect survival differences between release groups. No obligate bacterial or viral pathogens were detected in the 72 fish sampled. No difference was detected in gill Na⁺/K⁺-ATPase activity levels between the three release groups. Overall, the gill ATPase activity levels did not suggest differences in migration or survival between the steelhead release groups.

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Notice:

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STUDY DESIGN

As a component of juvenile steelhead survival studies in the south Delta (Six-Year Steelhead Study) the US Fish and Wildlife Service's California-Nevada Fish Health Center conducted a health and smolt physiology assessment. The larger survival study included control groups of dummy-tagged fish. The health assessments were performed on some of these dummy-tagged steelhead held at the release site for approximately 48 hours. The health and physiological condition of the study fish can help explain their survival and migration performance during the studies.

METHODS

STUDY FISH

The steelhead were from the California Department of Fish and Wildlife Mokelumne River Hatchery. Groups of 24 yearling steelhead were sampled on 27 February, 19 March and 30 April, 2016. All groups were dummy-tagged cohorts of the acoustic tagged release groups. Steelhead were tagged at the hatchery then held for approximately 48 hours at the Durham Ferry release site before sampling.

SAMPLE COLLECTION

Fish were euthanized, fork length was recorded, any abnormalities were noted and tissues were sampled for lab assays. A sample of kidney tissue was aseptically collected and inoculated onto brain-heart infusion agar for bacterial culture (USFWS and AFS-FHS 2014). A kidney tissue imprint was collected to screen for *Renibacterium salmoninarum* (the bacteria that causes bacterial kidney disease) by fluorescent antibody test (USFWS and AFS-FHS 2014). Kidney and spleen tissue were collected in 3 fish pooled samples for viral tissue culture (USFWS and AFS-FHS 2014). Gill tissue was collected to assess smolt development by gill Sodium/Potassium-Adenosine Triphosphatase (gill ATPase) assay (McCormick 1993). Samples of gill tissue were collected from 12 fish from each release group for histopathological examination (Humason 1979).

RESULTS AND DISCUSSION

FISH CONDITION

A total of 72 steelhead were examined, and no fish died over the 48 hour holding period (Table 1). The only significant abnormality observed was scale loss (>50% of body) observed in one fish from the 27 April sample group. Overall condition of the steelhead groups appeared good with no evidence to suspect survival differences between the groups.

Table 1. Fork length (FL), mortality, external abnormalities (Ext Abn), internal abnormalities (Int Abn), in Steelhead health assessment groups. The only significant abnormalities was scale loss (>50% of body).

Sample Date	FL \pm SE (mm)	Mortality	Ext Abn	Int Abn
27 February	235.6 \pm 3.1	0/24	1/24 (4%)	0/24
19 March	244.8 \pm 3.0	0/24	0/24	0/24
30 April	2258.1 \pm 2.4	0/24	0/24	0/24

PATHOGEN SCREENING

No obligate bacterial or viral pathogens were detected in the 72 fish sampled. Other bacteria isolates (presumptive environmental contaminants due to field sampling conditions) were observed in 15% (11/72) of the steelhead. The parasite *Capriniana piscium* (presumptive identification, formerly known as *Trichophrya*) was observed on 22% (7/32) of the gills examined by histopathology. No associated lesion or other signs of impairment was associated with these bacterial and parasite infections, and none of these infections were likely to cause differences in survival between steelhead release groups.

GILL Na^+/K^+ -ATPASE ACTIVITY

Gill ATPase activity levels ($\mu\text{mol ADP}\cdot\text{mg protein}^{-1}\cdot\text{hr}^{-1}$) ranged from 0.84 to 8.70 in all steelhead release groups (Figure 1). No difference was detected in activity levels between the three release groups (Kruskal-Wallis test, $P=0.058$). Higher gill ATPase activity levels are associated with migrating smolts relative to their residual cohorts (Hanson et. al. 2011). In our experience, steelhead ATPase activity levels may increase over a short time period. While high levels may indicate salt-water readiness, lower values may have little biological significance due to this ability to rapidly change. Overall, the gill ATPase activity levels did not suggest differences in migration or survival between the steelhead release groups.

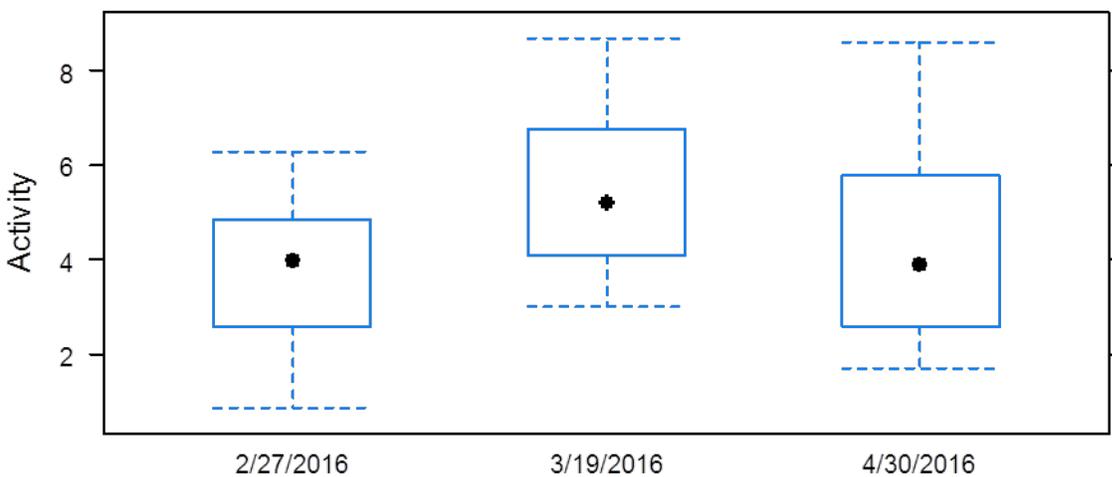


Figure 1. Boxplot of median gill ATPase activity in steelhead health assessment groups. No significant difference between release group was observed (Kruskal-Wallis, $P=0.058$). Number of fish sampled for each group was 16.

REFERENCES

Hanson KC, WL Gale, WG Simpson, BM Kennedy and KG Ostrand. 2011. Physiological characterization of hatchery-origin juvenile steelhead *Oncorhynchus mykiss* adopting divergent life-history strategies. *Journal of Fish and Wildlife Management* 2(1): 61-71.

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