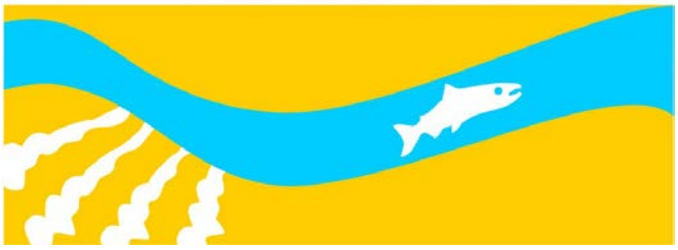
Report

2013 Juvenile Survival and Migration

2014 Mid-Year Technical Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM



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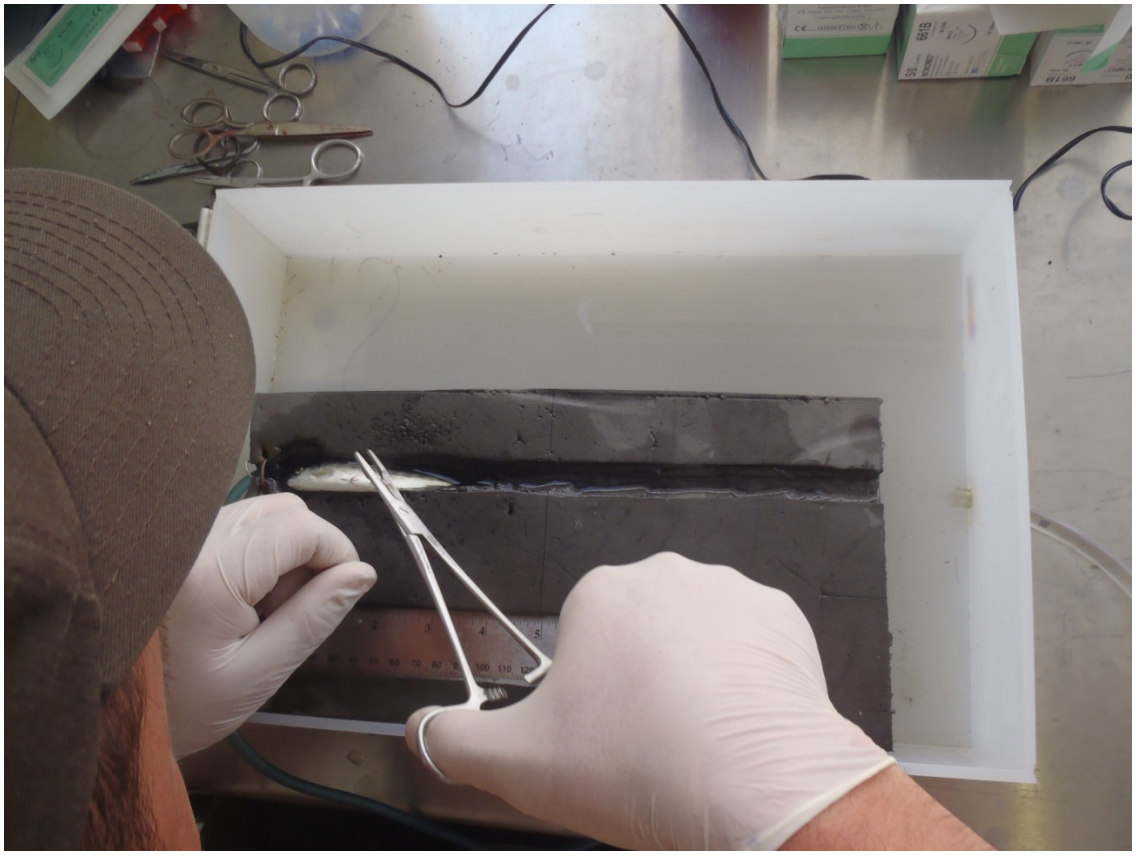

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SJRRP	San Joaquin River Restoration Program

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1.0 Juvenile Survival and Migration

1.1 Background

The Fisheries Management Plan of the San Joaquin River Restoration Program (FMWG 2010a) sets population goals for Chinook salmon (*Oncorhynchus tshwaytscha*) to achieve the Restoration Goal of the Program. The Fisheries Implementation Plan (FIP; FMWG 2010b) prioritized studies to address information needs to evaluate the Restoration Area for various fisheries needs. The FIP identified a study of juvenile salmonid migration and survival as a high priority for Interim Flows prior to the reintroduction of salmon, which is required by the Stipulation of Settlement by December 31, 2012 (NRDC vs. Rodgers 2006).

The long-term objective of this acoustic tagging study is to test the hypothesis that the flow management objectives are adequate to sustain the survival of downstream migrating juvenile salmon and to identify physical features that impede downstream migration. The current flow management objectives are to meet water temperature targets at various locations in the river during specific time periods that are believed to be critical to the survival of juvenile salmon. Physical features that potentially impede downstream migration of juvenile salmon include flow control structures, road crossings, water diversions, inadequate water depth, and in-river mine pits and the predatory species of fish that are commonly associated with these features.

The 2014 acoustic tagging study report will describe predation and entrainment potential in these altered habitats and build upon previous data collections. This report will provide data on juvenile salmon mortality near passage impediments that can be used to inform reintroduction strategies, such as release number, timing, and location, for juvenile salmon. In addition, this data can be used to estimate project-wide smolt survival rates allowing for refinement of fish population models (e.g., ESHE and EDT).

At the time of submission, one final data download covering 2014 is still pending. These preliminary results do not include environmental data (e.g., temperature, streamflow) during the study period. A final report will be submitted in the December that will incorporate the environmental variables.

Objectives:

1. Determine reach-specific survival rates, migration rates, and route selection of fish released below Friant Dam, and San Mateo Crossing (if there is connectivity). If the river does not have connectivity, releases will be made at the uppermost end of the downstream connected river (e.g., release at the top of reach 5 or below Sack Dam, etc.).

2. Determine survival rates, and migration rates through the mine pit reach of the Restoration Area with specified releases above target mine pit complexes for short-term tracking of fish through a defined area with high predation potential.

3. Compare movement and survival rates of juvenile Chinook salmon through Mendota Pool and Sack Dam under variable operations scenarios to determine if movement rate can be influenced by operational changes, and if those changes translate into increased survival. Targeted releases will be made directly above target locations identified. These data can also be compared with data collected in 2011 from the Mendota Pool area. These data will be critical to inform near-term reintroduction strategies while construction projects are still pending. Prior to reach 2b construction the Service will be required to make management decisions regarding reintroduction numbers, timing, and location for both fall-run and spring-run Chinook salmon. Data on survival through these reaches as well as the need for imprinting during downstream migration will need to be analyzed to make the best decisions for Program success.

1.2 Methods

Receiver Deployment.—Stationary telemetry receivers were deployed to assess reach-specific migration patterns and survival through mining pits and the river channel in reaches 1 and 5 of the Restoration Area**.** Receiver deployment was determined by the potential to address appropriate limiting factors (e.g., predation, habitat), ability to access deployment sites, risk of vandalism, and river connectivity. Receiver deployment locations are shown in Figure 1 and Table 1. Receivers were cabled to existing woody vegetation or structures available on the bank using 3/8-inch stainless steel cable. Concrete blocks were used to anchor the receivers, buoys were attached to the anchors using approximately 3 feet of cable. The receiver was attached to the cable using hose clamps and suspended vertically in the water column to maximize detection of tagged fish.

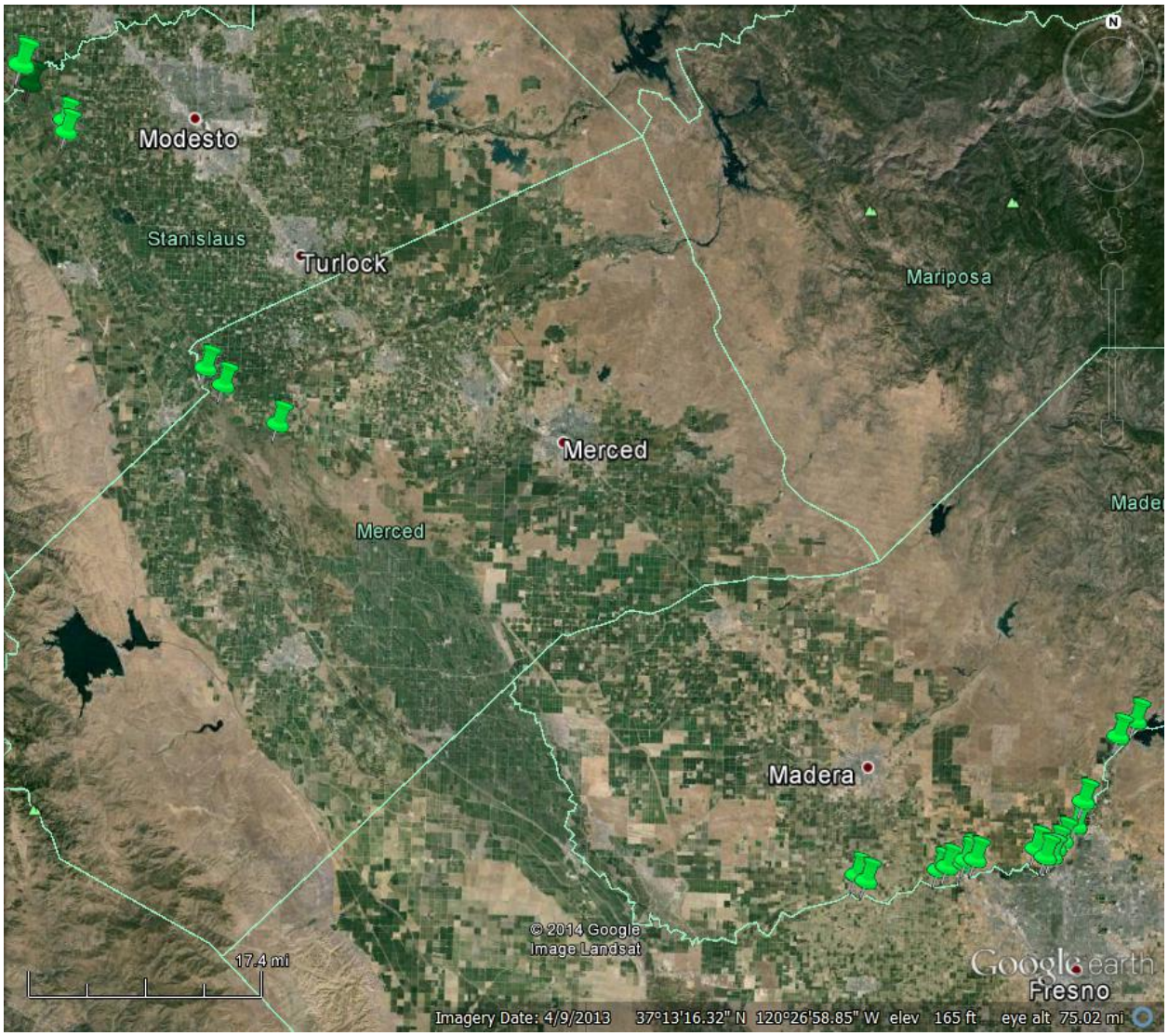

Figure 1.
Receiver Locations for Acoustic Tracking of Juvenile Chinook Salmon During 2014

Table 1.
Receiver Locations for Acoustic Tracking of Juvenile Chinook Salmon During 2014

Deployment Location Name	Northing	Westing	Receiver #
Friant Dam UP	36° 59' 51.3"	-119° 42' 26.7"	300719
Friant Dam DN	36° 59' 49.6"	-119° 42' 27.5"	300570
Lost Lake UP	36° 58' 50.2"	-119° 43' 49.4"	300726
Lost Lake DN	36° 58' 47.8"	-119° 43' 52.7"	300632
Vulcan UP	36° 50' 36.33"	-119° 46' 27.63"	300724
Vulcan DN	36° 54' 35.1"	-119° 46' 31.2"	300575
Cobb Ranch UP	36° 53' 0.20"	-119° 47' 5.4"	300953
Cobb Ranch DN	36° 52' 56.99"	-119° 47' 5.31"	300948
Above Sycamore UP	36° 52' 06.1"	-119° 48' 09.3"	300950
Above Sycamore DN	36° 52' 3.8"	-119° 48' 9.4"	300572
Pit 19 UP	36° 51' 31.8"	-119° 48' 42.8"	300065
Pit 19 DN	36° 51' 33.3"	-119° 48' 41.6"	300956
Pit 25 UP	36° 51' 00.0"	-119° 48' 59.3"	300712
Pit 25 DN	36° 50' 59.2"	-119° 49' 00.5"	300958
Below Sycamore Island UP	36° 50' 55.4"	-119° 49' 29.5"	300568
Below Sycamore Island DN	36° 50' 56.1"	-119° 49' 31.0"	300063
Scout Island UP	36° 51' 28.0"	-119° 50' 17.4"	300955
Scout Island DN	36° 51' 30.4"	-119° 50' 18.9"	300722
Above Pashain UP	36° 50' 41.4"	-119° 55' 10.7"	301452
Above Pashain DN	36° 50' 42.8"	-119° 55' 14.5"	300558
Below Pashain UP	36° 50' 51.76"	-119° 55' 46.29"	300944
Below Pashain DN	36° 50' 48.24"	-119° 55' 50.09"	300084
Rotary Screw Trap	36° 50' 37.9"	-119° 55' 56.75"	300571
Below Hwy 99 UP	36° 50' 24.1"	-119° 56' 02.6"	300062
Below Hwy 99 DN	36° 50' 22.3"	-119° 56' 03.8"	300732
Above Donnie UP	36° 50' 11.1"	-119° 57' 25.9"	300718
Above Donnie DN	36° 50' 10.2"	-119° 57' 31.2"	300713
Below Donnie UP	36° 49' 56.4"	-119° 58' 08.6"	300730
Below Donnie DN	36° 49' 57.6"	-119° 58' 11.0"	300728
Above Skaggs UP	36° 49' 9.3"	-120° 3' 57.7"	300561
Above Skaggs DN	36° 49' 8.8"	-120° 4' 00.0"	300723
Below Skaggs UP	36° 49' 30.7"	-120° 4' 46.2"	300154
Below Skaggs DN	36° 49' 30.4"	-120° 4' 48.7"	300954
Below Hwy 165 UP	37° 17' 35.1"	-120° 52' 36.9"	300720
Below Hwy 165 DN	37° 17' 38.0"	-120° 52' 40.3"	300574
Above MR UP	37° 19' 58.9"	-120° 57' 10.0"	300731
Above MR DN	37° 19' 58.8"	-120° 57' 8.9"	300952
Below MR UP	37° 21' 2.6"	-120° 58' 37.6"	300727
Below MR DN	37° 21' 6.0"	-120° 58' 37.0"	300714
Above Tuol UP	37° 36' 2.4"	-121° 10' 45.4"	300560
Above Tuol DN	37° 36' 4.0"	-121° 10' 43.1"	300729
Below Tuol UP	37° 36' 47.4"	-121° 10' 56.0"	300565
Below Tuol DN	37° 36' 51.0"	-121° 10' 59.8"	300061
Above Stan UP	37° 39' 5.2"	-121° 13' 50.2"	300717
Above Stan DN	37° 39' 9.7"	-121° 14' 0.6"	300715
Below Stan UP (buried)	37° 40' 14.4"	-121° 14' 45.6"	300716
Below Stan UP (replacement)	37° 40' 17.2"	-121° 14' 45.3"	300064
Below Stan DN	37° 40' 06.1"	-121° 14' 43.6"	300721

Key:
DN = downstream
Hwy = Highway
Tuol = Tuolumne
UP = upstream

Technology.—We used VEMCO VR2W-180 kHz receivers, which have a detection range of approximately 75 meters; this provides good coverage within the existing geography of the San Joaquin River. The transmitters used were Vemco V-5 (0.65 g in air), and V-4 (0.42 g in air) models set to ping once every 45 seconds.

Source Fish.—Juvenile fall run Chinook salmon from the Salmon Conservation and Research Facility (SCARF) were used in this study. SCARF fish provided the best opportunity to obtain fish large enough for tagging as early as possible that had also reared and imprinted on the San Joaquin River. All fish were coded-wire tagged and adipose fin clipped by California Department of Fish and Wildlife staff.

Surgery and Fish Release.—Fish were held in aluminum plate holding pens suspended using rotary screw trap pontoons in the pool below Friant Dam. Fish were held until they were large enough that the tag burden did not exceed 5% of body weight (Adams et al. 1998). On March 20th, the first fish were sorted and fish large enough were implanted with a V-4 acoustic tag. Fish were anaesthetized using Aqui-s 20-E in a 30 mg/L solution for initial sedation and 12 mg/L solution for maintenance during surgery. Fish were anaesthetized for approximately 60 to 100 s in the 30 mg/L solution, and then transferred to the maintenance solution for the remainder of procedure. Recovery times were less than 2 min. Transmitters were inserted through an approximately 1.5-cm incision into the peritoneal cavity of each fish, just off the midline and anterior to the pelvic fins. The incision was made using a number 12 surgical scalpel blade and closed with two interrupted stitches using 5-0 nylon braided sutures. Fish were separated into release groups and kept in 3-foot-diameter x 2-foot-deep 106-gallon circular fiberglass flow-through tanks operated at 3–4 gal per min to provide fish for each release location. Post-surgery fish were held overnight, and released the next day. We continued this process of weekly checking, tagging, and releasing fish until the last group was released on April 11 (Table 2). Due to limited availability of V-4 tags they were only used on the March 21 release all other surgery fish were implanted with V-5 tags.

Juvenile Chinook salmon were released at two sites in Reach 1A (Friant Dam and Highway 41), one site at the transition between reaches 1A and 1B (Highway 99), and one site in Reach 5 (below Highway 165; Figure 2). Fish were transported to the release sites using a divided 150-gal transport tank equipped with manual aerators. The transport tank was filled with water from Friant Dam, recovered surgery fish were loaded, and then the pilot fish were added from the floating cage pens. Oxygen levels and water temps were recorded at loading time and checked at least hourly during transport. River water temperature of the release site was checked upon arrival and the fish were tempered at a maximum rate of 1°C every 15 minutes. Fish releases and associated water temperatures are summarized in Table 2.

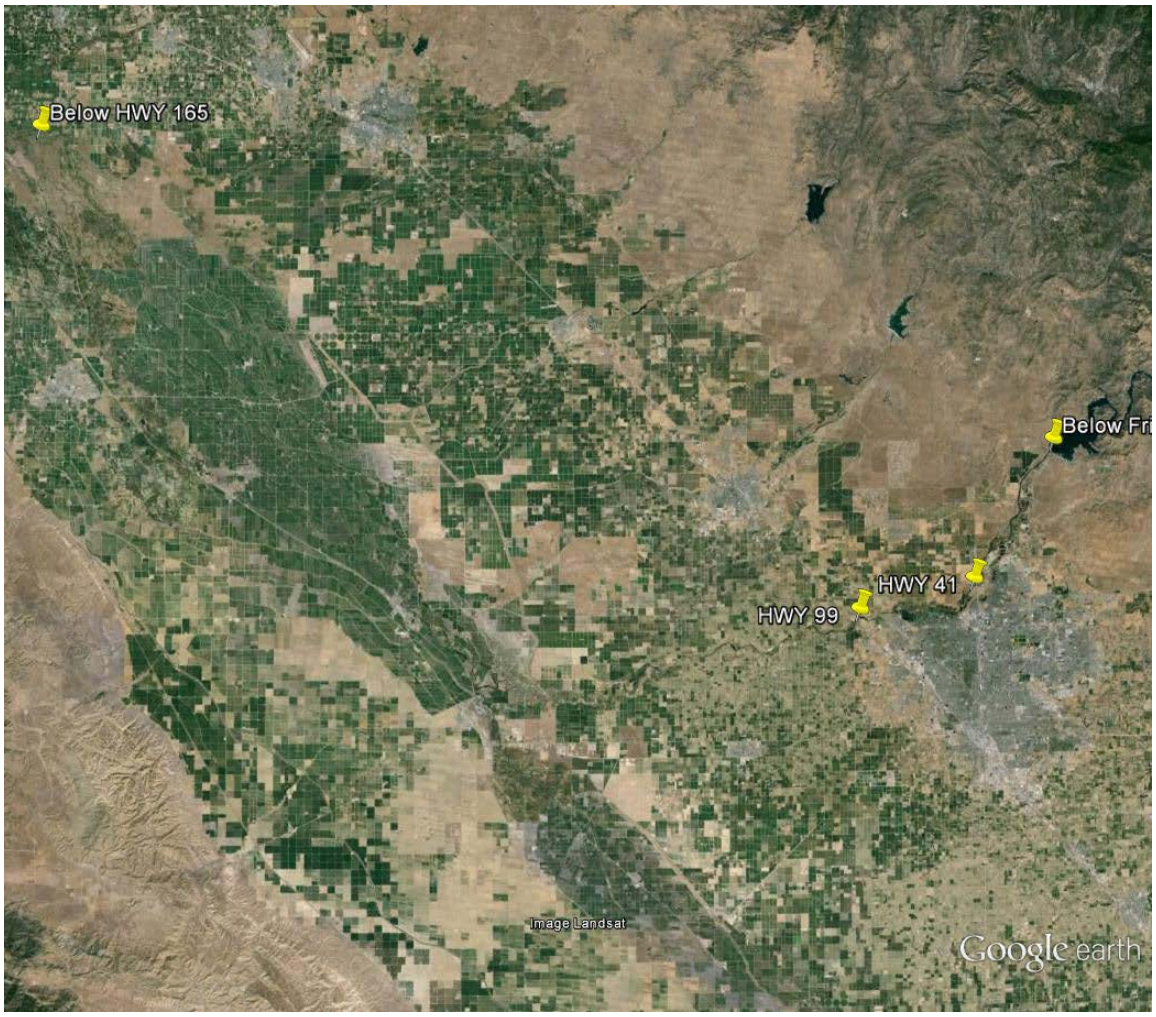

Figure 2.
Chinook Release Site Locations in Reach 1A, 1B and 5

Receiver Downloads.—Deployed receivers recorded the identification number and time stamp from the coded acoustic transmitters as tagged fish traveled within the detection range. Data was downloaded in the field using a wireless personal computer interface in May and July. Receivers were removed during July downloads.

Data Summary.—Receiver downloads are not yet complete. Data will be summarized by release date and release location. Temperature and streamflow will be evaluated in conjunction with survival and movement rates throughout the system.

1.3 Results

A total of 724 juvenile Chinook salmon were implanted with acoustic transmitters and released along with 12,316 pilot fish (Table 2). A total of 48 receivers were deployed throughout the study.

Table 2.
Tag/Release Dates and Locations for 2014 Chinook Salmon Survival Studies in the SJRRP

Number Pilot Fish	Number Acoustically Tagged fish	Release Date	Release Site	Release Site Temperature (°Celsius)
1209	23	3/21/2014	Friant Dam	11.6
1210	23	3/21/2014	Below Hwy 165	18.5
500	53	3/27/2014	Friant Dam	11.9
500	47	3/27/2014	Hwy 41	17.3
500	55	3/28/2014	Hwy 99	17.7
500	55	3/28/2014	Below Hwy 165	17.2
500	60	4/2/2014	Friant Dam	11.8
1877	38	4/2/2014	Hwy 99	17.4
500	60	4/3/2014	Below Hwy 165	16.9
500	59	4/3/2014	Hwy 41	14.3
1240	64	4/10/2014	Hwy 41	21.5
1280	67	4/10/2014	Friant Dam	12.7
1000	60	4/11/2014	Hwy 41	18.2
1000	60	4/11/2014	Hwy 99	21.9

Key:
Hwy = Highway
SJRRP = San Joaquin River Restoration Program

1.4 Discussion

To be completed for December ATR.

1.5 References

Adams, N.S., D. Rondorf, S. Evans, J. Kelly, and R. Perry. 1998. Effects of surgically and gastrically implanted radio transmitters on swimming performance and predator avoidance of juvenile Chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 55:781–787.

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