

***Boundary Hydroelectric Project (FERC No. 2144)***

***Study No. 13  
Recreational Fishery Study  
Interim Report***

**Prepared for  
Seattle City Light**

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# **Study No. 13 – Recreational Fishery Study**

## **Interim Report**

### **Boundary Hydroelectric Project (FERC No. 2144)**

#### **1 INTRODUCTION**

Recreational fishing (boat and bank) is one of the activities enjoyed at the Boundary Hydroelectric Project (Project) reservoir (Federal Energy Regulatory Commission [FERC] No. 2144). Information on the current level of recreational fishing activity in the Project reservoir is sparse, and additional information is needed to characterize recreational fishing resources and demand for recreational fishing opportunities at the Project. Sterile triploid trout have been planted at the Project to increase sport fishing harvest while minimizing the risk of hybridization with native species. Planting triploid trout as part of a recreational fish planting program can help balance the demands for both consumptive fishing opportunities and conservation of native stocks. Information on the distribution and abundance of sport fish species is being developed through the Fish Distribution, Timing, and Abundance Study (Study 9). The Recreational Fishery Study (this study) is designed to obtain information about the level of effort and harvest in the recreational fishery and the level of angler satisfaction. Because the Recreation Resource Study (Study 21) includes similar information and data collection methods, components of the two studies have been closely coordinated. The Recreational Fishery Study is also designed to obtain information regarding the movements, growth, and survival of stocked triploid trout and their contribution to the sport fishery in Boundary Reservoir.

Study 13 is being conducted in support of the relicensing of the Project, as identified in the Revised Study Plan (RSP; SCL 2007) submitted by Seattle City Light (SCL) on February 14, 2007, and approved by the FERC in its Study Plan Determination letter dated March 15, 2007.

To meet the goals and objectives of Study 13, three separate components to the study are being conducted: 1) recreational creel and angler surveys, 2) triploid trout biotelemetry, and 3) triploid trout management. The following discussion will center on presentation of data collected and analyzed under these three study components, generally through September to November 2007 (but varying by component).

#### **1.1. Recreational Creel and Angler Surveys**

As noted above, information on the level of recreational fishing activity in the Project reservoir is sparse, and additional information is needed to characterize recreational fishing resources, use, and demand for recreational fishing opportunities at the Project.

Boundary Reservoir currently supports a recreational fishery that targets planted triploid rainbow trout and naturally reproducing populations of non-native warm and cool water species such as smallmouth bass and yellow perch. A baseline fisheries assessment conducted in 2000 indicated that most of the fish in Boundary Reservoir are non-sport species, as less than 9 percent were found to be trout or bass (McLellan and O'Connor 2001).

Access to Boundary Reservoir for recreational fishing occurs primarily from three boat ramps. SCL operates one boat ramp located at the Forebay Recreation Area in the Forebay Reach (the reach from Boundary Dam to Z Canyon). Other boat ramps are located at Metaline Waterfront Park (operated by the Town of Metaline) and near Box Canyon Dam at Campbell Park (operated by the Pend Oreille County Public Utility District [PUD]). Access for bank fishing occurs at these boat ramps and at other locations where roads provide access to or near the shoreline. Most of the shoreline access for bank fishing occurs in the upper reach of the reservoir.

Creel surveys are a useful method for understanding what species and how many fish are being captured in the sport fishery and where sport fishing effort is expended. During the summer of 1997, creel surveys indicated the Upper Reservoir Reach (the reach from Metaline Falls to Box Canyon Dam) was the most heavily fished area of the reservoir (R2 Resource Consultants 1998). Over 92 percent of the fishing effort in Boundary Reservoir was expended in the Upper Reservoir Reach on the 17 days surveyed over a 6-week period. Northern pikeminnow were the most commonly caught sport fish (1.4 fish per hour) in the 1997 summer recreational fishery, although northern pikeminnow are not considered a popular catch. Rainbow trout were the second most commonly captured fish in the recreational fishery, but at a much lower frequency (less than 0.1 fish per hour) than northern pikeminnow. Excluding northern pikeminnow, combined sport fish catch rates in the Upper Reservoir Reach during the summer of 1997 were less than 0.2 sport fish per hour and 1.2 sport fish per angler (R2 Resource Consultants 1998). In contrast, creel surveys at Box Canyon Reservoir between 1948 and 1969 yielded an average of approximately 3.5 sport fish per angler hour (FERC 2004). No information is available from the 1997 survey on whether northern pikeminnow were killed and discarded, kept, or released unharmed after capture. Presumably, most legal-sized trout were retained by anglers, but records for triploid trout suggest that some anglers release a substantial number of captured triploid trout (A. Solonsky, SCL, personal communication, 2005).

Since 2002, the 2-day annual springtime Bassin' Assassin Derby, hosted by the Western Star Bar and Grill (in Metaline), has been held in Boundary Reservoir. Only smallmouth bass caught by anglers are counted in the derby results. During 2006, SCL took advantage of the event to collect information on recreational fishing. SCL staff developed a questionnaire and used it to interview 59 anglers from 24 boats. A total of 135 anglers entered the derby, and 55 fish were weighed in over the two-day event. The size of smallmouth bass recorded ranged from less than 1 pound to 4.1 pounds. Anglers reported catching 93 smallmouth bass during the derby and submitted 55 fish to be weighed for potential derby prizes. Fish lengths were available for 54 of the smallmouth bass weighed-in at the derby. Based upon length categories in Anderson and Neuman (1996), 1 fish (2 percent of measured submitted fish) would have been considered trophy-sized, 19 memorable (35 percent), 17 preferred (32 percent), and 14 (26 percent) quality-sized. Anglers reported catching several other species, including largemouth bass, walleye, triploid rainbow trout, whitefish, northern pikeminnow, peamouth, and sucker. River flows through the reservoir were relatively high during the derby (in the range of 50,000 cubic feet per second), so reservoir velocities were relatively high and, according to anglers, fishing was difficult. Mean catch rate was about 0.2 smallmouth bass per angler per hour, based on interviews. A common comment by anglers interviewed during the 2006 derby was that high currents and the lack of a dock at the Metaline Waterfront Park boat ramp made access challenging.

The preceding summary describes the existing base of information about the level of effort and harvest in the recreational fishery and the level of angler satisfaction. The Recreational Creel and Angler Survey component of this study is designed to expand and update that information.

## **1.2. Triploid Trout Biotelemetry**

The objectives, limitations, and rationale for biotelemetry monitoring for this study are discussed in the biotelemetry portion of the Study 9 Fish Distribution, Timing, and Abundance Interim Report (SCL 2008b). Movement and habitat use information for triploid rainbow trout is reported in this study similarly to the information reported for other species in Study 9 and Study 7, respectively, and the current study has some of the same limitations as described in those studies. However, because availability of fish is not a major problem, sample sizes are larger for this component of the program.

## **1.3. Triploid Trout Management**

The triploid trout management component of Study 13 is addressed by two major categories of information. The first category addresses what is currently known about the status and behavior of stocked triploid trout in the reservoir and their movement within the reservoir based on external tags, growth, survival rates, and information from anglers on catch locations. The second category is information about general and specific issues relating to triploid trout management and how it may relate to options to consider for the Project reservoir. The information below supplies some background on common issues relating to triploid trout management that will be relevant to the Project reservoir.

Stocking as a fisheries management practice can have many objectives, including compensation for lost or reduced fisheries from an environmental disturbance such as a dam, maintenance of stocks to offset overfishing, stock enhancement to increase harvests, and conservation to retain species threatened with extinction (Welcomme 1998). Accordingly, stocking results can be evaluated in multiple ways: achieving a self-sustaining natural population or maintaining the continued presence of an endangered species, meeting economic or political goals in commercial fisheries, or angler satisfaction in recreational fisheries (Cowx 1998).

Species introductions and stocking are distinct concepts. To be clear on terminology, introductions are movements outside of a species' or population's present range, and stocking generally refers to multiple placements of fish into an ecosystem from one external to it (Welcomme 1998). Thus, the triploid rainbow trout at the Boundary Dam are both an introduction and a stocking. Where a stocked species is already native to the receiving waters, concerns often remain about introducing a non-local sub-population, introduction of disease, genetic effects, and ecological imbalance and changes to community structure (Cowx 1998, Hindar et al. 1991).

The purpose of the triploid management study is to determine if a triploid trout stocking program can be an effective protection, mitigation, and enhancement measure to pursue during the new license term. For this program to be effective, it must provide benefits to anglers and stakeholders and not adversely impact native fish species or other important fisheries in the area.

The following is a summary of current triploid rainbow trout stocking practices in Washington State, based on an interview with Jim Uehara of the Washington Department of Fish and Wildlife (WDFW) in November 2007. Mr. Uehara manages the WDFW triploid rainbow trout stocking program in Washington State and the policies and procedures internally reflect the regulatory policies applied to stocking by private hatcheries, such as the ongoing stocking program in Boundary Reservoir. Stocking of triploid trout by private parties into public waters requires a permit from WDFW, and the harvest of stocked trout is regulated by WDFW.

The majority of triploid rainbow trout stocking in Washington State is in lakes, although a few streams are also stocked when there are no concerns about effects on native fish populations. Approximately 43 lakes are stocked each year, with typically about 50,000 triploid rainbow trout averaging 1.5 pounds (about one year old). The triploid rainbow trout stocked have been females; this is not the specific intent of WDFW but rather a function of what private fish hatcheries have been providing (Uehara, personal communication, November 2007).

WDFW's triploid trout stocking densities are determined by catch per unit of effort (CPUE), with a goal of 3.5 fish per angler. Mr. Uehara said WDFW generally does not have enough fish to reach a lake's carrying capacity and, in any case, most fish are caught by anglers. He said the returns to creel are very high for triploids, because they are easily caught. WDFW workers conduct creel surveys on opening day of the fishing season through exit surveys with anglers; all fish combined average about 3.5 fish per angler. The limit for retaining trout (other than bull trout) is typically five fish of any size per angler, which is consistent with the WDFW 2007/2008 regulations for Boundary Reservoir. The triploids are identifiable by fin clips, or by their consistent size (about 1.5 pounds), and rounded fins (from hatchery conditions). Lakes on the west side of the Cascades tend to have fewer fish surviving beyond the season in which they are stocked, whereas lakes on the east side tend to have a higher overwinter rate (Uehara, personal communication, November 2007).

WDFW also stocks triploid rainbow trout fingerlings in lakes. The timing and the size at stocking varies according to available supply, and other factors. Many different combinations of triploid fingerling stocking have occurred — some fingerlings are released in late spring for fishing about 1 year later, and some larger-than-fingerlings are stocked in lakes in the fall for fishing the following spring. Interestingly, WDFW has observed better return-to-creel with the fingerling plants (Uehara, personal communication, November 2007).

Some research suggests some triploid males may exhibit spawning behavior (though they would not have viable gametes) and displace wild males. According to Mr. Uehara of WDFW, the Idaho Department of Fish and Game studied the risk of stocked triploid males displacing wild males, especially in light of concern over hatchery workers possible exposure to hormones used to convert juvenile fish to all females. The study concluded that triploid males had a very low probability of displacing wild males. Mr. Uehara also mentioned the use of triploid females for stocking for recreational fishing in Canada, but said that was because of superior growth and the desire for a "trophy" fishery (Uehara, personal communication, November 2007).

WDFW buys the triploid trout from private facilities that are on an approved list of suppliers. The disease section in Appendix 1 includes discussion of policy for fish transfers from hatcheries.

A summary of the history of triploid planting in Boundary Reservoir is included in Section 5. Because triploids released in Boundary Reservoir have been catchable size, overwinter survival as carry-overs is not essential to maintain a sport fishery. However, if individuals survive for multiple years there is the potential for higher growth rates by triploids relative to diploids, because energy is not expended on gamete production.

## **2 STUDY OBJECTIVES**

### **2.1. Overall Study Objectives**

The overall goals for Study 13 are to obtain information regarding the recreational fishery that can aid SCL and relicensing participants in understanding the effects of the Project on recreational fisheries, understand potential interactions between planted fish and native salmonids, and determine whether opportunities to enhance the existing triploid trout stocking program are considered desirable and appropriate. The study objectives are to:

- Conduct recreational creel surveys (creel survey and angler survey components) that identify current recreational fishing activity and success rates (boat and bank) on the reservoir.
- Determine angler opinions and values regarding maintaining or improving recreational fishing opportunities in the future at Boundary Reservoir, addressing both native salmonids and non-salmonids.
- Use biotelemetry to identify movements of newly released and carry-over triploid rainbow trout in Boundary Reservoir.
- Identify potential positive and negative effects of the triploid trout stocking program.
- Evaluate habitat-use characteristics of triploid rainbow trout.
- Evaluate stocked triploid trout patterns of dispersal, growth, survival, and susceptibility to angling.

Objectives for the three components of Study 13 are discussed in the following sections.

### **2.2. Recreational Creel and Angler Surveys**

As noted in objectives 1 and 2 above, the creel and angler surveys are intended to provide information about angling effort and catch rates and angler opinions about the fishing opportunities. Little existing information is available to discern the level of satisfaction by anglers for fishing in Boundary Reservoir or the desirability for expanded fishing opportunities (e.g., by increasing the abundance of specific sport fish species). In some cases, the desire of the recreational angler community for harvestable fish stocks may be in conflict with state and federal fish management objectives. Existing information about angling effort and catch rates and angler opinions about the fishing opportunities, which is summarized in Section 1.1, comprises primarily the results from a season-long survey conducted in 1997 and a brief

weekend survey during the 2006 smallmouth bass derby. The creel and anglers surveys for Study 13 will provide current data for a complete recreation season.

### **2.3. Triploid Trout Biotelemetry**

The objectives for the Triploid Trout Biotelemetry component of Study 13 are as follows:

- Identify temporal and spatial movements of newly-released and carry-over triploid rainbow trout in Boundary Reservoir.
- Evaluate habitat-use characteristics of triploid rainbow trout based on recorded habitat use data and positional data recorded, as part of the biotelemetry component of Study 9, and identify differences between newly released triploids and carry-over triploids.
- Analyze spatial or temporal movement patterns of tagged triploid trout and correlate with Box Canyon and/or Boundary operations.
- Based on habitat use data recorded as part of the biotelemetry component of Study 9, compare the habitat use data from radio- and combined acoustic and radio transmitter (CART)-tagged triploid and native salmonids (bull trout, westslope cutthroat trout, and mountain whitefish) and identify overlaps in habitat utilization. This implication of habitat overlap between triploids and native salmonids will be addressed in the Triploid Management component.

### **2.4. Triploid Trout Management**

#### **2.4.1. Triploid Trout External Tagging Program**

The objectives for the Triploid Trout External Tagging Program of Study 13 are as follows:

- Summarize movement and distribution of triploid trout released in spring 2007, based on external tag recoveries data and data provided by Study 9.
- Based upon length and weight data provided as a result of tag returns (the angler outreach program of Study 13), creel surveys, and Study 9, describe the post-stocking growth rate of stocked triploid trout.
- Summarize catch and harvest rate of triploid trout, based on tag returns and creel survey data.
- Summarize the temporal and spatial catch-per-unit-effort (CPUE) rate of triploid trout as recorded during Study 9.
- Summarize habitat use data associated with external tag recoveries

#### **2.4.2. Triploid Trout Management Issues and Options**

The objectives for the Triploid Trout Management Issues and Options portion of Study 13 are as follows:

- Compare the triploid movement and distribution of triploids based on external tag recoveries to biotelemetry movement data recorded as part of Study 9.
- Analyze the spatial distribution patterns of triploid trout captures and compare habitat use information developed from Study 9. Describe potential spatial and temporal

habitat overlaps between triploid trout and bull trout, cutthroat trout, and smallmouth bass.

- In combination with the available scientific literature, use the results of the external tagging, recreation creel survey, biotelemetry, and the reservoir fish distribution and abundance studies to develop a range of alternative triploid trout management options for Boundary Reservoir. Discussion will include the potential benefits and drawbacks of alternative strategies.

### 3 STUDY AREA

The study area for the Recreational Fishery Study is focused primarily on the reservoir surface, shoreline, and access points to Boundary Reservoir, with the reservoir area being characterized into three reaches: 1) the Upper Reservoir Reach, 2) Canyon Reach, and 3) the Forebay Reach (Figure 3.0-1). A fourth reach, the Tailrace Reach, is also part of the study area. The extent of all four reaches is defined as follows:

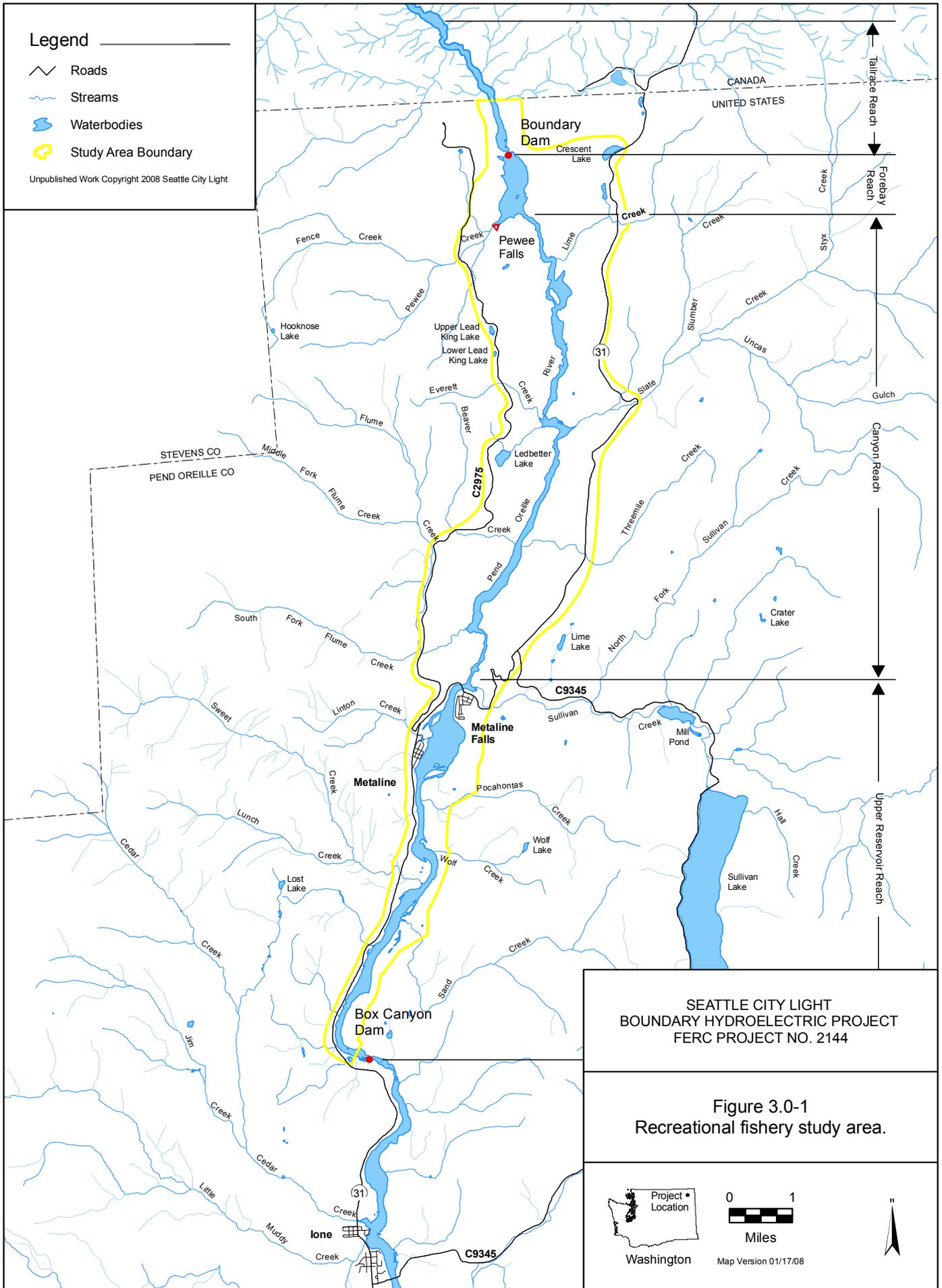
- Upper Reservoir Reach — Box Canyon Dam downstream to Metaline Falls (Project river mile [PRM] 34.5 to PRM 26.8)
- Canyon Reach — Metaline Falls to downstream end of Z-Canyon (PRM 26.8 to PRM 18.0)
- Forebay Reach — downstream end of Z-Canyon to Boundary Dam (PRM 18.0 to PRM 17.0)
- Tailrace Reach — Boundary Dam to Redbird Creek, British Columbia (PRM 17.0 to PRM 13.9)

Because the Recreational Fishery Study was implemented in conjunction with the Recreation Resource Study (Study 21), the study area for the recreational creel and angler survey component of Study 13 was the same as the study area for the recreation surveys component of Study 21; this study area included some nearby areas beyond Boundary Reservoir, as indicated in Figure 3.0-1. The joint study area encompassed the reservoir and adjacent areas within which recreation use might be associated with the Project, as identified through SCL's study planning effort with the relicensing participants. The study area defined for the recreation survey components of Study 21 included the area from the reservoir west to Pend Oreille County Road 2975, and from the reservoir east to State Route 31. Therefore, the study area for the creel and angler survey components of Study 13 included segments of tributary streams near the reservoir and Crescent Lake.

**Legend**

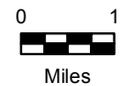
-  Roads
-  Streams
-  Waterbodies
-  Study Area Boundary

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SEATTLE CITY LIGHT  
BOUNDARY HYDROELECTRIC PROJECT  
FERC PROJECT NO. 2144

Figure 3.0-1  
Recreational fishery study area.



Washington

Map Version 01/17/08

## 4 METHODS

### 4.1. Recreational Creel and Angler Surveys

#### 4.1.1. Creel Survey

The RSP identified needs and objectives for creel survey work to be conducted at the Project. These included the need to identify the target species sought by anglers and to estimate the spatial and temporal level of effort, catch rate (i.e., kept or released), and harvest rate (i.e., fish kept). The recreation surveys component of Study 21 includes the same types of information and the same data collection method (i.e., surveys of recreational users in the field). Therefore, the scope of the creel survey work for Study 13 was coordinated with the Boundary Project Relicensing Recreation, Land Use, Aesthetics and Socioeconomics Work Group, which developed guidance for the recreation surveys component of Study 21. The recreation survey tasks included an extensive field sampling program involving visitor counts and observations and administration of a questionnaire to Project-area recreational visitors during the 2007 recreation season. The Fish and Aquatics Work Group was given the opportunity to review and comment on the angling-related portions of the visitor questionnaire developed for Study 21 and on the survey approach. An additional recreation survey task under Study 21 was administration of another questionnaire that was distributed to area residents by mail. Questions about angler effort and success were incorporated in the visitor and resident surveys administered as part of Study 21.

The design of survey questions and methodology for Study 21 incorporated needs and objectives identified in the RSP for a creel survey. The RSP indicates the creel survey work is to be conducted during the 2007 and 2008 recreational fishery seasons at Boundary Reservoir and its tributaries. The recreation surveys for Study 21 were conducted during the 2007 recreation season. Because SCL does not plan to repeat this recreation survey program in 2008, the creel survey effort indicated in the RSP will be conducted as a stand-alone effort during the 2008 season.

##### 4.1.1.1. *Field Sampling Program for 2007 Recreation Surveys*

The Study 21 Interim Report (SCL 2008c), primarily Section 4.1 and Appendix 1, provides a complete description of the methods used to conduct the recreation surveys (incorporating creel and angler survey study objectives) during the 2007 season. The following is a summary derived from the Study 21 report.

Staff from Tetra Tech EC, Inc. (TtEC) implemented the visitor count and questionnaire components of the recreation surveys through a single, integrated field sampling program. The field program was initiated on May 19, 2007, and continued through the end of October 2007. The field program employed a multistage cluster sampling method to determine when and where sampling would occur at a given time. The first stage of the sampling design involved selecting a random sample of weekdays and a complete census of weekends and holidays to ensure extensive coverage of the main recreation season. Because the staff required to sample the entire study area during a given day would be prohibitively large, the sampling plan included a second stage with randomly selected combinations of sectors (geographic clusters) by day period (time

clusters) to cover the various recreation sites and the early and late portions of each sampling day.

Based on study area geography (see Figure 4.1-1), access considerations, and the types and locations of recreational use, the study area was divided into six sectors for scheduling and execution of cluster sampling in the field. Two-person survey crews conducted sampling activities within a specific sector each time the sampling calendar required sampling to occur there on a given date and period of the day. For all six sectors, crews recorded visitor counts on standard forms and contacted visitors to distribute questionnaires. The crews attempted to contact all visitors encountered at each sampled sector during the corresponding time of day. Visitors who were willing to participate were handed a questionnaire, a pencil, and a self-addressed, postage-paid envelope. Visitors were instructed to return their completed survey directly to one of the crew members, deposit it in one of several drop boxes installed at recreation sites, or return it by mail. A copy of the survey is provided in Appendix 2.

The cluster sampling program used to implement the visitor count and questionnaire sampling provided comprehensive sampling coverage of developed and dispersed sites (including all three boat launches that provide water access to Boundary Reservoir), overnight and day users, and water-based and land-based activities within the study area. Sampling in the field was scheduled based on standard 6-hour blocks of time for sampling activity (including travel time and related activity, such as launching and trailering boats), divided between the a.m. and p.m. hours of the day. Because extended daylight hours occur during most of the summer, sampling was conducted from 1800 to 2000 hours (6 p.m. to 8 p.m.) during July and August. This was achieved by extending the work day from 12 to 14 hours (that is, two 7-hour periods) for July and August. Based on the number of sectors defined for the Project area, two daily time blocks, and the number of days in the season, 274 sampling sessions were scheduled to yield adequate coverage of the variability of recreational use at the Project.

Because overnight camping and multiple day-use activities at the Forebay Recreation Area make it a key recreation site, this sector received a level of sampling effort slightly larger than what would result from an even distribution among the six sectors. Likewise, Metaline Waterfront Park also had a larger sampling effort because it is highly accessible to visitors and appears to be a popular site. Based on indications of quite limited roaded dispersed use within the study area, effort allocated to sampling this sector of the study area (Sector 4) was reduced accordingly.

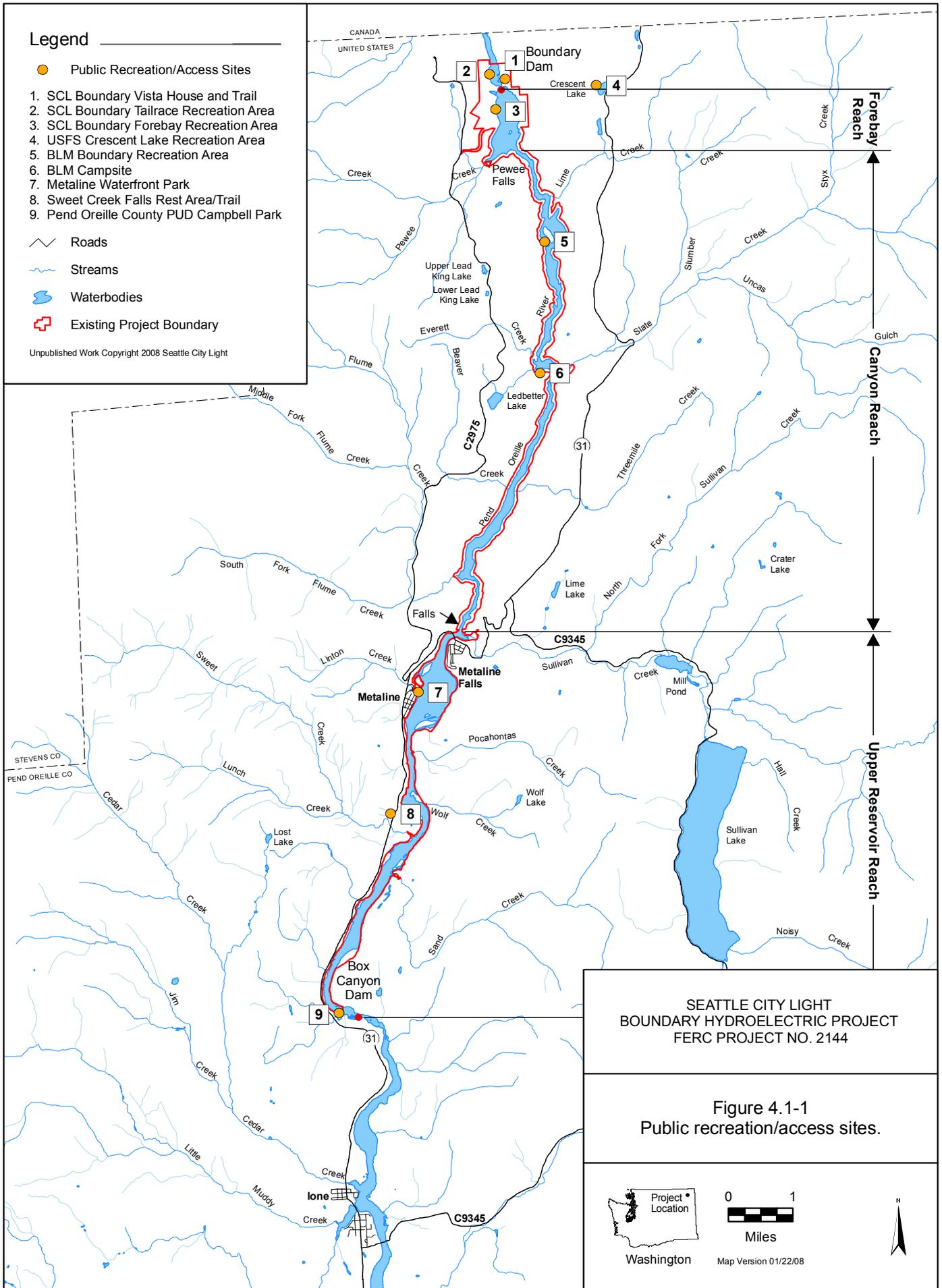
TtEC staff collected completed visitor questionnaires directly from visitors, from drop boxes at several key locations, or through the mail throughout the study period. TtEC processed the returned questionnaires, entered the survey responses, and tabulated and analyzed the responses using the Statistical Package for the Social Sciences (SPSS).

### Legend

- Public Recreation/Access Sites
1. SCL Boundary Vista House and Trail
  2. SCL Boundary Tailrace Recreation Area
  3. SCL Boundary Forebay Recreation Area
  4. USFS Crescent Lake Recreation Area
  5. BLM Boundary Recreation Area
  6. BLM Campsite
  7. Metaline Waterfront Park
  8. Sweet Creek Falls Rest Area/Trail
  9. Pend Oreille County PUD Campbell Park

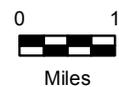
- Roads
- Streams
- Waterbodies
- Existing Project Boundary

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FERC PROJECT NO. 2144

Figure 4.1-1  
Public recreation/access sites.



Washington

Map Version 01/22/08

#### 4.1.1.2. Area Resident Questionnaire Administration

The Study 21 Interim Report (SCL 2008c), primarily Section 4.1.3 and Appendix 4, provides a complete description of the methods used to conduct the area resident survey (incorporating creel and angler survey study objectives) during the 2007 season. In summary, the area resident questionnaire was developed using the same formatting guidelines discussed for the Project visitor questionnaire. The questionnaire focused on recreation-related issues and needs that apply specifically to area residents. It replicates many of the items in the visitor questionnaire, so that data from the two respondent groups can be compared, and includes some questions applicable specifically to area residents and not Project area visitors.

Following guidance from Salant and Dillman (1994) for conducting surveys by mail, TtEC used a four-step mailing process to administer the area resident questionnaire. They included distribution of 1) a short pre-survey notice to tell people that the survey was coming; 2) a survey packet including a cover letter, the questionnaire, and pre-paid return envelope, mailed 1 week after the first mailing; 3) a postcard to thank those who had responded and remind those who had not responded to please return the questionnaire, sent 8 to 10 days after the survey packets were mailed; and 4), a new survey packet, sent approximately 4 weeks after the second mailing to all remaining valid addresses on the mailing list from which a survey had not been returned. TtEC distributed the area resident questionnaire to a list of approximately 1,500 addresses in the British Columbia portion of the local area and 465 addresses in the Washington communities of Ione, Metaline and Metaline Falls. TtEC processed the returned questionnaires, entered the survey responses, and tabulated and analyzed the responses using the SPSS.

#### 4.1.2. Tagged Fish Reward Program

The second task for this portion of Study 13 was to implement, in coordination with Study 9 and the Triploid Trout Management and Biotelemetry components of Study 13, a reward program for the reporting of tagged fish caught by recreational anglers. Activities for this study component included an outreach program to inform anglers about the program and provide directions for reporting harvest of tagged fish, and the reward program itself.

##### 4.1.2.1. Outreach Program

The outreach program employed four main tools to convey information about the Tagged Fish Reward Program: posters, fliers, and a toll-free telephone line. Development and deployment for these items are summarized below.

**Posters.** TtEC prepared laminated color posters with the following contents:

- A bold “Attention Anglers” heading and “REWARD for Reporting Catch of 2007 Yellow Floy-Tagged Fish” subheading
- A brief explanation why SCL was studying fish movement
- A large picture of a fish with a yellow Floy tag
- A picture of a fish with a red streamer tag, indicating the fish contained a radio transmitter
- A request to release and report on any red-tagged fish caught

- A request to return tags and report on yellow-tagged fish, with instructions on how to return tags and the type of harvest information requested
- The toll-free hotline number (1-866-712-0067)
- A brief description of the \$10 reward per tag and the seasonal prize drawings

Posters were placed in prominent locations at the key water access sites for boaters and bank anglers, specifically the boat ramps at the SCL Forebay Recreation Area, Metaline Waterfront Park, and Campbell Park (Pend Oreille County PUD, at Box Canyon Dam). The condition of the posters was checked periodically during the 2007 season, and posters were replaced as necessary. A copy of the poster is included in Appendix 3.

**Fliers.** TtEC prepared color 8 ½ x 11-inch fliers with the same information (condensed in size) as on the posters for placement at key public, commercial, or social facilities in the local area. Locations included local post offices in all three communities—Metaline, Metaline Falls and Ione; the Western Star Bar and Grill and the Metaline Mini Mart in Metaline; the Box Canyon Motel; and the Riverview Inn, Los Sanchos Restaurant, Food Court, Country Hardware Store, and the Airport Kwikstop in Ione.

**Toll-free telephone line.** At the end of March 2007, TtEC established a toll-free telephone number (1-866-712-0067) for anglers to use to report catches of tagged fish and/or obtain information about the tag reward program. The toll-free number was used exclusively for the tagged fish reward program. Calls on the toll-free number were routed to a phone in the TtEC offices, where a staff member was assigned to answer calls, regularly check voicemail messages on the line and respond as needed, and record any information reported in the messages.

#### 4.1.2.2. *Reward Program*

The purpose of the Tagged Fish Reward Program was to provide anglers with an incentive to report catch information for tagged fish. The incentive had to be attractive enough to entice anglers to provide the requested information, without being either cost-prohibitive or labor-intensive. TtEC instituted a reward program in April 2007 through which each angler reporting a catch of a yellow Floy-tagged fish received a reward of \$10 per tag. To ensure the reports could be validated, anglers were required to submit the tag to TtEC, either by mail or by depositing the tag and their catch information in a drop box at the SCL Forebay Recreation Area or Campbell Park at Box Canyon Dam. In addition, the tag reports for each angler were entered into a quarterly drawing for all tag report during that quarter, in which three tags were selected for cash prizes of \$100, \$75, and \$50. Through November 2007, prizes had been distributed for drawings based on all tags reported through May 31 and for tags reported between June 1 and August 31. There will be a final drawing at the end of December 2007 for tags reported from September through December 2007.

#### 4.1.3. **Angler Survey**

The RSP provides a separate description of the angler survey component of Study 13, which was designed to estimate angler values and opinions regarding:

- Potential reduction, maintenance, or enhancement of the triploid rainbow trout stocking in Boundary Reservoir;

- Potential reduction, maintenance, or enhancement of non-native sport fish (especially smallmouth bass, largemouth bass, and yellow perch) in Boundary Reservoir sport fishery;
- Potential opportunities to catch native trout and less popular native fish, such as northern pike minnow and mountain whitefish in the sport fishery;
- Potential reservoir pool level fluctuations and boat ramp access under operations scenarios;
- Potential future fishery management goals at Boundary Reservoir; and
- Concerns about exotic macrophyte distribution and density.

As discussed in Section 4.1.1, the Recreational Creel Survey and Angler Survey components of Study 13 were conducted in tandem as a combined element of the recreation visitor survey component of Study 21, because these study components involved the same data collection method within the same geographic area. The survey administration content of Section 4.1.1 also applied to the angler survey work. Through other elements of the recreation visitor survey, additional information was also collected from anglers (and other survey participants) including their origin, party size, watercraft type, whether they fished from a boat or the bank, where they launched their boat, other activities enjoyed while in the Project area, where they were staying the night, other alternative fishing locations compared to the Project, and perceptions of crowding or conflicts encountered. This creel and angler survey component of Study 13 was conducted during the 2007 recreational fishing season at Boundary Reservoir and some adjacent areas.

#### **4.1.4. Smallmouth Bass Derby Monitoring**

The scope for this task was to collect information on angler catch, effort, and approximate fishing location during the annual smallmouth bass derby that occurs at the Project under the sponsorship of local community interests. As described in the RSP, SCL planned to use this derby as an opportunity for public outreach to inform anglers about tagging and other fishery-related studies being conducted as part of relicensing, and the need to recover tags from harvested fish or tag information from fish captured and released. The general approach for this task was for SCL to distribute survey questions during the derby and/or interview anglers.

The 2007 smallmouth bass derby occurred on May 5 and 6. SCL staff was present at key reservoir access locations and contacted derby participants to obtain information related to their derby activities.

## **4.2. Triploid Trout Biotelemetry**

Approximately 30 triploid trout were obtained from the 4,100 fish delivered as part of the 2007 triploid trout spring release, and of these fish, 20 of the largest and healthiest fish were selected for internal tagging with radio tags. These fish were transported to the Pend Oreille County PUD fish laboratory at Box Canyon Dam.

#### **4.2.1. Equipment**

Telemetry monitoring of triploid trout was conducted as part of the biotelemetry component of Study 9. A full description of the telemetry equipment used and deployed during Study 13 is provided in the Study 9 Interim Report (SCL 2008b).

#### **4.2.2. Internal Radio Tagging of Spring Released Triploid Trout**

The 20 fish selected for tagging were implanted with NTC-6-2 radio tags. The basic surgical tagging procedure is described in the Study 9 Interim Report (SCL 2008b). Based on a review of the initial tagging procedures by SCL and their consultants, minor modifications to the spring-time surgical procedures were incorporated into the summer and fall tag implant protocol. The changes included use of a foam surgical tray and ensuring that the exit point of the antenna was on the ventral surface of the fish and parallel with the lateral axis of the fish. Each radio-tagged fish was also marked with an external red streamer tag inserted at the base of the dorsal fin.

The radio-tagged fish were kept overnight at the Pend Oreille County PUD lab in continuous flow through fresh water holding tanks. After the holding period, the health of all fish was evaluated prior to release of the fish. A fish was judged to be healthy if it appeared energetic and was able to maintain its position and orientation in the water column. Ten of the fish were released in the tailrace of Box Canyon Dam and ten of the fish were transported to Boundary Dam and released in the Forebay Reach. At each release, the health of each fish was re-assessed and the tag numbers and release times were recorded.

#### **4.2.3. Internal CART Tagging of Carry-over Triploid Trout**

Up to 20 carry-over triploid trout captured during Study 9 were planned for implantation with CH-TP11-18 CART tags. Carry-over triploid trout were identified based on physical criteria, which included total length, deformed or missing fins, and general body form. The classification of a rainbow trout-like fish as a triploid was subjective, consequently, some of the fish identified as carry-over triploid could be resident rainbow trout. Typically, fish that were not clearly identified as carry-over triploid were captured in the Tailrace Reach and could potentially have been native rainbow trout from the Salmo River drainage. Based upon the aforementioned physical characteristics, native rainbow trout were generally absent from the Reservoir reaches and if present, were in low densities.

Surgical tag implantation procedures were identical to procedures outlined in the Study 9 Interim Report (SCL 2008b). At water temperatures in excess of 18°C, fish selected for tagging were placed within the influence of a cold water tributary until the fish recovered from the tagging procedure and were actively swimming. The recovery period ranged from several hours to overnight, after which fish were released within the influence of a tributary.

#### **4.2.4. Shore-based Telemetry Stations**

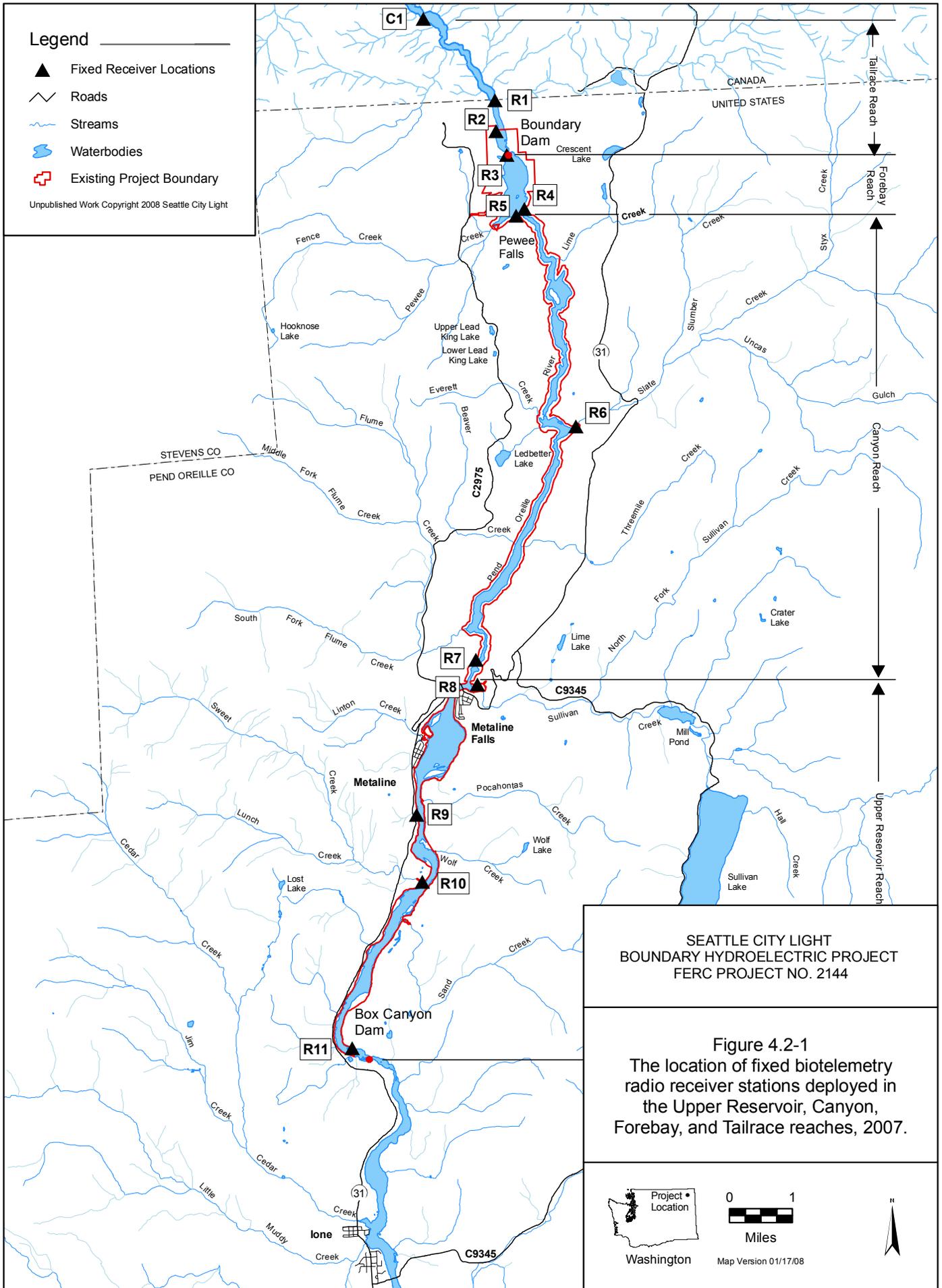
Telemetry stations were installed as part of the Study 9 Biotelemetry component (SCL 2008b). The station locations are identified in Figure 4.2-1.

#### **4.2.5. Mobile Tracking, Intensive Tracking, and Habitat Data Collection**

Mobile tracking of radio- and CART-tagged spring 2007 triploids and carry-over triploids was conducted concurrently with the tracking of other fish species following procedures outlined in Study 9 (SCL 2008b). Positional data recorded included the recording time, date, tag code, and Universal Transverse Mercator coordinates at the representative fish location.

Incidental intensive tracking of triploid trout was performed during the Study 9 intensive tracking component. During these monitoring sessions, CART tag sensor data from carry-over triploid trout were recorded if these fish were in the vicinity of the monitored westslope cutthroat trout (fish 24). Intensive monitoring procedures were summarized in the Study 9 Interim Report (SCL 2008b).

Habitat data recorded for located triploid trout were limited to habitat data from two fish, one in the Upper Reservoir Reach and one in the Canyon and Forebay reaches, during each bi-weekly (i.e., every two weeks) tracking session to maximize time to locate and record habitat data for native salmonids and smallmouth bass. When recorded, the environmental parameters and data collection methods used to measure triploid habitat attributes were identical to the Habitat Suitability Indices methodology outlined in the Study 9 Interim Report (SCL 2008b).



**Legend**

- ▲ Fixed Receiver Locations
  - ∩ Roads
  - ~ Streams
  - Waterbodies
  - Existing Project Boundary
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**Figure 4.2-1  
The location of fixed biotelemetry  
radio receiver stations deployed in  
the Upper Reservoir, Canyon,  
Forebay, and Tailrace reaches, 2007.**

Project Location

Washington

0 1  
Miles

Map Version 01/17/08

### **4.3. Triploid Trout Management**

Triploid trout management methods involved two elements: 1) a review of the external triploid trout tagging field component, and 2) an introductory discussion of the management issues and options based on results of field information and literature. The methods for these two elements are presented in this section.

#### **4.3.1. External Tagging of Spring 2007 Triploids**

Approximately 4,100 triploid trout were delivered from the Soap Lake Fish Hatchery, located near Moses Lake, Washington, on March 29, 2007. The external tagging objective was to tag 1,000 of these fish to be released in two groups of 500, one group in the Forebay Reach and one in the tailrace of Box Canyon Dam in the Upper Reservoir Reach. Upon arrival of the fish from the hatchery, a total of 2,000 untagged fish were released directly into the tailrace of Box Canyon Dam and the Forebay Reach of Boundary Dam in groups of 1,000 at each location. The remaining 2,000 fish were transferred into one-half of a 20- by 20-foot floating net pen positioned adjacent to the Boundary Forebay boat dock. The first 500 fish were tagged with T-bar anchor tags manufactured by Floy Tag and Manufacturing Inc. Each tag was imprinted with a unique identification number, the words “Seattle City Light” and “Reward”, and a phone number to call to report the tag information. The tags were inserted with MARK II needle applicator guns on the left side of the fish at the base of the dorsal fin. Once tagged, the fork length of each fish was measured and the tag number and length recorded. The first 50 fish tagged were also measured for weight. After tagging, the first 500 tagged fish were released directly into the Forebay Reach. An additional 500 untagged fish were also released at the same time to facilitate mixing of tagged and untagged fish. The following day, 500 of the remaining 1,000 fish were tagged, measured for fork length, and released into the empty half of the net pen. Again, the first 50 fish of this group were measured for weight. Once tagged, the 500 tagged fish and the 500 untagged fish were transferred by dipnet into a holding tank and were transported by truck to the Box Canyon Dam tailrace where they were released.

#### **4.3.2. Triploid Trout Management Issues and Options**

The evaluation of alternative triploid trout management procedures was preliminarily assessed by literature review, interviews with the WDFW triploid program manager, and reviewing results of the data collection efforts conducted on triploid trout. The key factors are summarized in the results section of this report followed by discussion of potential future management options. Most of the interview and literature review results are presented in Appendix 1.

### **4.4. Data Processing, Entry, and Verification**

Telemetry tracking data recorded for radio- and CART-tagged triploid trout were processed identically to and concurrently with telemetry data recorded during Study 9. Datasheets printed on water-resistant paper were developed for each aspect of the project where data were recorded in the field. All hardcopy field data recorded during surgical tag implantation, external tag release, mobile tracking, habitat use, and CART tag monitoring were entered manually into Microsoft<sup>®</sup> Excel<sup>®</sup> spreadsheets, followed by entry verification by a second person. Following verification, these data were imported into an Access<sup>®</sup> database. Details of how telemetry data were screened and summarized are provided in the Study 9 Interim Report (SCL 2008b).

#### **4.4.1. Data Analysis Methods**

##### **4.4.1.1. *Movement Data Comparison with Environmental Variables***

Data analysis was limited to the telemetry data recorded from shore-based stations, mobile tracking, and intensive tracking surveys conducted between March 30 and September 27, 2007. Available telemetry movement data for each tagged fish were plotted as time series in relation to environmental variables. Capture location of triploid trout based on anglers tag-return data and Study 9 fish capture efforts were plotted in relation to the triploid release location.

Due to an apparent high loss rate of radio-tagged fish and low recapture rates of externally tagged triploids, parametric and non-parametric statistical analysis of movement data in response to environmental variables was not possible. The possible causes of the high triploid mortality rate, low externally tagged recovery rates, and study design limitations are discussed later in the report. Due to these limitations, analysis of the telemetry, angler tag return, and the recapture data was descriptive and relied on interpretation of the data to identify potential trends. These trends may be analyzed in the 2008 report pending a substantial increase in the number of samples from relocations of live radio- and CART-tagged triploid trout, and increased numbers of recaptures of externally tagged fish.

##### **4.4.1.2. *Triploid Trout and Native Salmonid Habitat Use Comparison***

Due to low numbers of tagged native salmonids, combined with high mortality rate of radio- and CART-tagged triploid trout, the amount of data recorded was insufficient to identify habitat use requirements of both triploid trout and native salmonids. Consequently, meaningful comparison of habitat and identification of potential habitat overlap was not possible. A substantial increase in the number of live CART-tagged triploid trout and native salmonid relocations would be required to address this issue. The Study 9 Interim Report (SCL 2008b) recommended modifying the study design, specifically in relation to the internal tagging procedure, to potentially increase the survival of CART-tagged carry-over triploid trout whose positional and habitat parameters will be recorded and then compared to the same parameters recorded from CART-tagged native salmonids.

##### **4.4.1.3. *Triploid Growth Rates***

The overall growth rate of spring released triploid trout was estimated based upon length at capture provided by angler tag-return data and triploid recapture data. The length measurement from angler returns was assumed to be total fish length, with relatively poor accuracy. Recapture length data, recorded during the Study 9 fish capture program, were also recorded as fork and total length. Growth rates were calculated by dividing the difference between total length (for angler data) or fork length (from Study 9) at initial release to recapture, by the number of days at large since release.

##### **4.4.1.4. *Triploid Abundance and Survival***

Quantitative and qualitative methods were used to estimate triploid abundance and survival. A coarse quantitative estimate of survival of spring 2007 triploids was based on the ratio of

remaining live radio tagged fish to radio tagged fish either dead or suspected of being dead. The relative survival of the fall 2005 and spring 2006 triploids was also evaluated based on the length frequency of March 2006 captures, which included two size classes from fall 2005/spring 2006 triploids, and from fall 2006 plants. The relative rate of loss of spring 2007 triploid plants compared with carry-overs through the summer of 2007 was estimated using tag recovery growth rates applied to monthly catch length frequency information taken from Study 9.

#### **4.4.1.5. Intensive Tracking Data Comparison with Environmental Variables**

A limited amount of CART tag sensor data from triploid trout were recorded near the mouth of Sweet Creek during the August 3, 2007, intensive tracking session. These data were graphically compared with environmental parameters. Due to the limited amount of data, statistical analysis of movement data and CART sensor data in response to environmental variables was not possible, and analysis of the intensive tracking data was descriptive.

## **5 PRELIMINARY RESULTS**

### **5.1. Recreational Creel and Angler Surveys**

#### **5.1.1. Creel Survey**

As discussed in Sections 4.1.1 and 4.1.3, the recreational creel and angler survey components of Study 13 were implemented jointly as part of the recreation survey effort for Study 21. Questions based on the creel and angler survey objectives were included in the Project-area visitor questionnaire about angling activity and opinions. A similar set of questions was included in the area resident survey conducted as part of Study 21. Results for all of the angling-related survey questions are presented below.

##### **5.1.1.1. Visitor and Area Resident Survey Response Summary**

###### **5.1.1.1.1. Project-Area Visitor Survey**

Among the 969 visitor questionnaires distributed during the 2007 field season, TtEC received 600 returned usable surveys as of November 2, 2007. (Because sampling of visitors to the Boundary Reservoir Area concluded on October 31, it is possible that a few additional surveys may be returned in the mail). The sample size of 600 completed questionnaires is large enough to allow researchers to make inferences about the visitor population within approximately a 5 percent margin of error at the 95 percent confidence level. (That is, if the survey analysis reported that 60 percent of the sample population selected response “a” to a specific survey question, researchers could be 95 percent confident that the true response from the entire population would be within 5 percentage points of that response from the sample population, or that the true response would be between 55 and 65 percent.) The 600 completed surveys represent an overall response rate of 62 percent of the total surveys distributed, which is considered a good response rate for a drop-off/mail-back survey. The Study 21 Interim Report (SCL 2008c) provides additional text and tables documenting distribution and return information for the Project-area visitor questionnaire.

The Project-area visitor questionnaire used in the 2007 sampling season included 42 specific questions addressing 10 categories of information (a blank copy is included as Appendix 2). The questions generally asked visitors to provide responses specific to this particular visit to the Boundary Reservoir Area. A map distributed with the questionnaire indicated the extent of the Boundary Reservoir Area, which is the same as the study area identified on Figure 3.0-1. Questions 10 through 15 addressed respondents' fishing activity and opinions, and Questions 16 through 19 related to boating and reservoir use. The analysis of the results involved tabulating the responses to develop the frequency for each possible response to each question, and calculating measures of central tendency (for instance, mean and standard deviation) for the responses to question for which those measures are meaningful. Most of the survey questions included "Other" as the final possible response, with space provided for the respondents to write in specific information. Lists of these open-ended responses are included in Appendix 3 to the Study 21 Interim Report (SCL 2008c).

#### 5.1.1.1.2. *Area Resident Survey*

Through November 5, 2007, TtEC received 558 resident survey forms via return mail. Some of the returned surveys were blank (an option identified in the instructions to the recipients), but the large majority were either completed or the respondents indicated that they do not recreate in the study area (another option made available to the recipients). The 558 returned surveys represented an overall response rate of nearly 31 percent. The returns included 331 surveys from British Columbia residents and 227 from Washington residents. The response rate from the Washington communities within the sample area was 54 percent, more than double the response rate from the British Columbia portion of the sample area. The Study 21 Interim Report (SCL 2008c) provides additional text and tables documenting distribution and return information for the area resident questionnaire.

The content of the area resident questionnaire is very similar to the visitor questionnaire described previously. (Therefore, a copy of this questionnaire is not included in Appendix 2; Appendix 4a to the Study 21 Interim Report is a full copy of the area resident questionnaire.) Questions 10 through 16 addressed respondents' fishing activity and opinions, and Questions 17 through 22 related to boating and reservoir use. Question 1 in the area resident questionnaire asked respondents if they had visited the Boundary Reservoir Area (defined as the area including the Pend Oreille River between Boundary and Box Canyon Dams and some of the lands next to the river, as indicated for the visitor questionnaire) for the purpose of recreation. Those who answered "Yes" to this question were directed to skip to Question 3 and the remainder of the survey. Respondents who answered "No" were directed to Question 2, which asked why they had not visited the Boundary Reservoir Area for recreation. Following Question 2, respondents who do not use the area for recreation were directed to skip to Question 41, where they could answer several questions about themselves and their companions. The returned questionnaires indicated that a substantial proportion of the area resident population had not visited the Boundary Reservoir Area for recreation, and therefore provided responses for only a few questions at the beginning and end of the form. Sample sizes varied by question, as discussed in Sections 5.1.1.4 and 5.1.1.5.

The analysis process for the area resident questionnaire results was the same as described previously for the visitor questionnaire. Most of the survey questions included "Other" as the final possible response, with space provided for the respondents to write in specific information.

Lists of these open-ended responses are included in Appendix 4 to the Study 21 Interim Report (SCL 2008c). The results that are provided below for the area resident questionnaire are based on analysis of 400 surveys that had been entered through approximately November 15, 2007. The results will be updated following completion of the analysis, and will be documented in the Study 13 and 21 final reports of the Updated Study Report.

**5.1.1.2. Visitor Survey Fishing Responses**

Questions 10 through 15 of the visitor questionnaire addressed fishing activity in the study area. Respondents were requested to answer these questions only if they fished or planned to fish on their current visit to the Boundary Reservoir Area. The number of respondents for specific items in this part of the survey ranged from 150 to 227.

**Question 10: Group Size for Visitors Fishing.** Table 5.1-1 summarizes results for the number of people fishing per party for visitors who reported fishing during their visit to the Boundary Reservoir Area. This table is based on combined results for respondents indicating that they fished on the trip and the group-size information from survey Question 3. Group sizes reported by angler respondents ranged from 1 to 14 people. Groups of 2 anglers were most frequent response (the mode), reported by 35 percent of the sample. On average, about 3 people fished together in a group (mean = 2.9, standard deviation = 1.9).

**Table 5.1-1.** Number of people fishing per visitor party at Boundary Reservoir Area.

Fishing Group Size	Frequency	Percent of Sample <sup>1</sup>
1	39	17.4
2	79	35.3
3	41	18.3
4	36	16.1
5	16	7.1
6 or more	13	5.8

Notes:

1 Based on 224 respondents.

**Question 10: Number of Days and Average Hours per Day Fished.** Table 5.1-2 summarizes results for the amount of time visitors spent fishing during their visit to Boundary Reservoir Area. The question asked the visitors who reported fishing to identify both the number of days fished per party and the number of hours per day spent fishing. The number of days fished per party ranged from 1 to 15 days. Over 40 percent of this sample reported fishing with their group for only 1 day. On average, visitors fished with their parties for 2.5 days (mean = 2.5, standard deviation = 2.4, median = 2.0). The amount of time fished per party per day ranged from 30 minutes to 12 hours. Nearly 40 percent of this sample reported fishing with their group for an average of 2 to 3 hours per day.

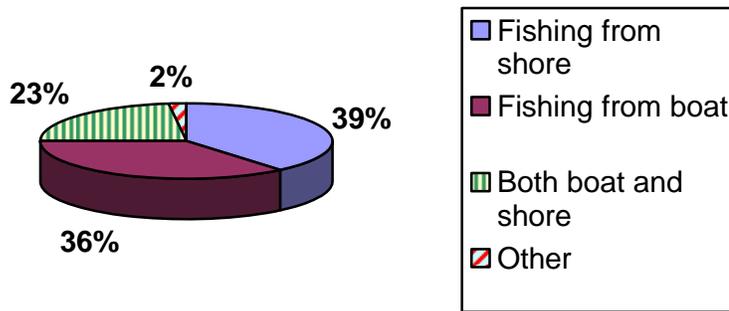
**Table 5.1-2.** Visitors’ fishing frequency and duration.

Fishing Days	Frequency	Percent of Sample <sup>1</sup>
1	86	41.1
2	48	23.0
3	37	17.7
4	16	7.7
5	10	4.8
6 or more	12	5.7
Average Hours Fished/Day	Frequency	Percent of Sample <sup>2</sup>
1	20	9.2
2 – 3	82	37.8
4	37	17.1
5	16	7.4
6	34	15.7
8	10	4.6
Other <sup>3</sup>	12	5.5

Notes:

- 1 209 respondents.
- 2 217 respondents.
- 3 Other = 30 minutes (1 party), 1.5 hours (3 parties), 3.5 hours (3 parties), and > 8 hours (5 parties).

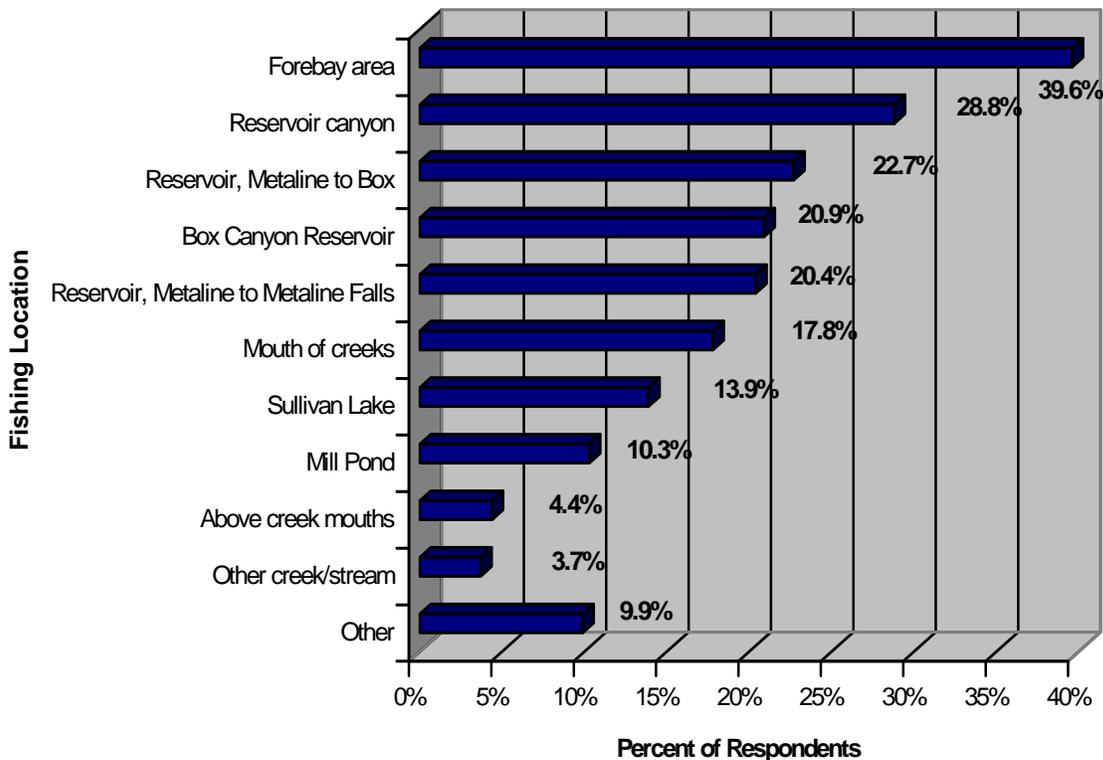
**Question 11: Means of Fishing.** Visitors who reported fishing were asked how they went fishing during their visit to the Boundary Reservoir Area. Nearly the same percentage of anglers reported that they fished from shore as from a boat. Figure 5.1-1 summarizes the results for this survey item. Seven anglers failed to respond.



**Figure 5.1-1.** Responses to Question 11: How did you go fishing? (227 respondents)

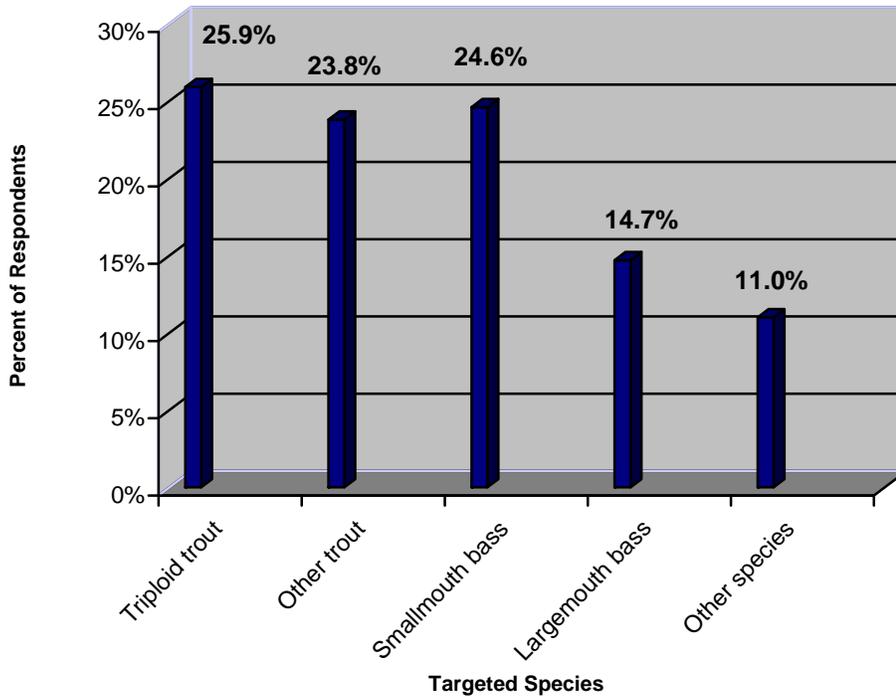
**Question 12: Fishing Locations.** All survey respondents were provided with a map of the Boundary Reservoir Area and asked to report where they fished and/or intended to go fishing during their visit. The anglers who responded (n=225) to this item provided 432 total responses, indicating that some anglers fished in multiple locations during this particular visit. Nearly

40 percent of the sample reported that they fished in the Forebay Reach of Boundary Reservoir, between Boundary Dam and the north end of the canyon. The second most frequent location reported for fishing was in the canyon area of Boundary Reservoir. Figure 5.1-2 summarizes the results of this question by reporting percentages of respondents indicating the respective locations.



**Figure 5.1-2.** Responses to Question 12: In what places did/will you go fishing during this visit? (432 responses)

**Question 13: Preferred Species of Catch.** Anglers were asked to identify the species of fish they wanted to catch while fishing in the Boundary Reservoir Area. There were five choices listed in the questionnaire item, and respondents were instructed to circle all that applied. This sample (n = 218 respondents) provided 491 total responses, indicating that some anglers are interested in catching more than one species while fishing in the area. Figure 5.1-3 summarizes the results of this item. The most common response (26 percent of the total) was a desire to catch triploid rainbow trout. The response percentages for other trout and smallmouth bass were very similar, however, at approximately 24 percent and 25 percent, respectively.



**Figure 5.1-3.** Responses to Question 13: What species of fish do you want to catch? (491 responses)

**Question 14: Description of Fish Caught.** Anglers were asked to report the numbers and size of fish caught by species during this particular visit to the Boundary Reservoir Area. Reported results are summarized below for triploid trout, other trout, smallmouth bass, and largemouth bass (Table 5.1-3). Because species composition varies among the water bodies available locally to anglers (for example, Box Canyon Reservoir has a higher density of largemouth bass than does Boundary Reservoir, whereas Boundary has a higher density of smallmouth bass), to some degree these results may reflect effort directed to local waters other than Boundary Reservoir.

**Number of Fish Caught.** The anglers sampled in this survey caught between 0 and 15 triploid trout, with the responses representing a combined total of 271 fish. Most anglers (61 percent) reported catching zero triploid trout on their visit. Similarly, the anglers sampled in this survey caught between 0 and 15 other trout, with the responses representing a combined total of 136 fish; 68 percent of the sample indicated they did not catch any other trout on their visit. The anglers sampled in this survey caught between 0 and 30 smallmouth bass during their visit, for a total of 595 fish. Nearly half of the sample reported no smallmouth bass harvest, whereas 30 percent caught either one to two fish or three to four fish. Only 18 respondents (12 percent of the total) indicated they caught largemouth bass on the visit. Those respondents caught between 0 and 6 largemouth bass during the visit, for a total of 34 fish.

**Table 5.1-3.** Numbers of fish caught for all species by anglers.

Species	Number of Fish Caught	Frequency	Percent of Sample <sup>1</sup>
Triploid trout	0	100	60.6
	1	19	11.5
	2	10	6.1
	3	12	7.3
	4 - 6	9	5.4
	8 - 10	11	6.7
	>10	4	2.4
Other trout	0	102	68.0
	1	18	12.0
	2	11	7.3
	3	8	5.3
	4	5	3.3
	>4	6	4.1
Smallmouth bass	0	82	48.8
	1 - 2	29	17.3
	3 - 4	22	13.1
	5 - 10	19	11.3
	12 - 30	16	9.5
Largemouth bass	0	128	87.7
	1	10	6.8
	2 - 6	8	5.5

**Notes:**

1 165 respondents for triploid trout, 150 respondents for other trout, 168 respondents for smallmouth bass, and 146 respondents for largemouth bass.

**Size of Fish Caught.** Anglers reported various ranges in size for the fish that they caught. Because standardized size classes were not specified on the survey form, anglers reported fish sizes in a variety of ways (e.g., “6 to 20 inches”) that often made it difficult to categorize fish length. Overall, triploid trout ranged in size from 4 to 27 inches, and other trout from 3 to 24 inches. Thirty-six different sizes and ranges were reported for triploid trout, of which 64 percent fell between 10 and 20 inches. Twenty-four different sizes and ranges were reported for other trout, with 67 percent between 10 and 20 inches.

Anglers reported sizes ranging from 1 to 20 inches for both smallmouth bass and largemouth bass. Forty-seven different sizes and ranges were reported for smallmouth bass, of which 45 percent of the responses (the largest group) fell between 8 and 16 inches. Fifteen different sizes and ranges were reported for largemouth bass, with 67 percent falling between 6 and 16 inches. Fish size information from these responses is summarized in Table 5.1-4.

**Table 5.1-4.** Size of fish caught for all species by anglers.

Species	Size	Frequency	Percent of Sample <sup>1</sup>
Triploid trout	Less than 10 inches	6	3.7
	10-12 inches	8	4.9
	12-14 inches	15	9.3
	14-16 inches	18	11.1
	Over 16 inches	4	2.5
	Other	11	6.8
Other trout	Less than 10 inches	6	4.7
	10-12 inches	4	2.7
	12-14 inches	15	10.0
	14-16 inches	6	4.7
	Over 16 inches	3	2.0
	Other	8	5.3
Smallmouth bass	Less than 10 inches	17	10.1
	10-12 inches	24	14.3
	12-16 inches	13	7.7
	Over 16 inches	2	1.2
	Other	29	17.3
Largemouth bass	Less than 10 inches	5	3.4
	10-12 inches	4	2.7
	Over 12 inches	6	4.1
	Other	2	1.4

Note:

1 165 respondents for triploid trout, 150 respondents for other trout, 168 respondents for smallmouth bass, and 146 respondents for largemouth bass.

**Question 15: Fishing Satisfaction.** Table 5.1-5 summarizes results for the question that asked anglers to rate their satisfaction with the fishing opportunities at Boundary Reservoir (in this instance, the question was specific to Boundary Reservoir, rather than the Boundary Reservoir Area). The most common rating reported (the mode) was average (5 on the numbered scale), which was selected by 24 percent of the sample. Approximately 14 percent of the respondents rated their satisfaction as below average (ratings of 1 to 4), whereas 62 percent considered their experience to be above average (ratings of 6 to 9).

**Table 5.1-5.** Visitors’ ratings for satisfaction with fishing opportunities at Boundary Reservoir Area.

Rating <sup>1</sup>	Frequency	Percent of Sample <sup>2</sup>
1 (Very Poor)	10	4.6
2	3	1.4
3	10	4.6
4	7	3.2
5 (Average)	52	24.1
6	23	10.6
7	47	21.8
8	27	12.5
9 (Excellent)	37	17.1

Notes:

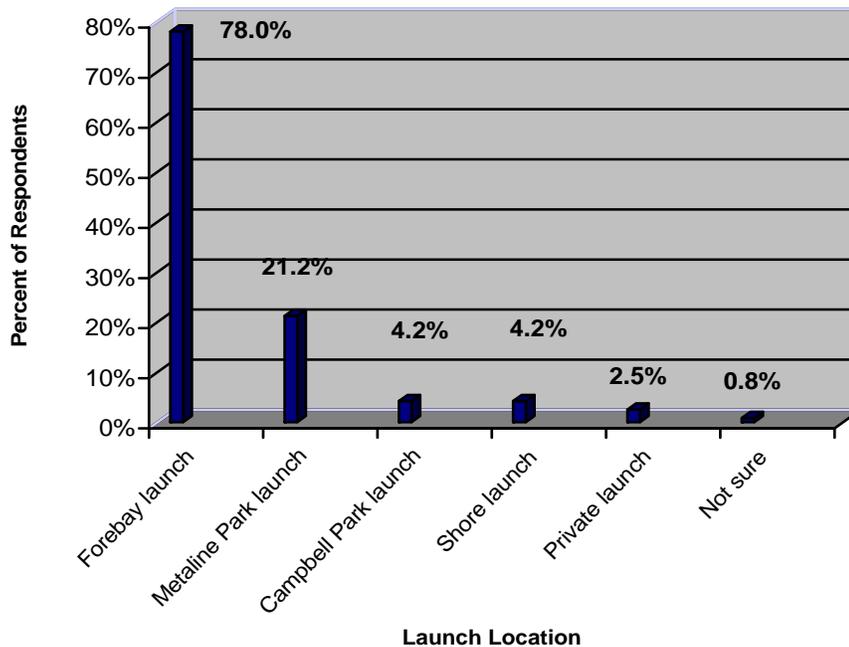
1 mean = 6.3, standard deviation = 2.1, median = 7.0, mode = 5.0.

2 216 respondents.

5.1.1.3. Visitor Survey Boating and Reservoir Use Responses

**Question 16: Boat Use.** Respondents were asked if they operated or rode in a boat or other watercraft during this particular visit to the Boundary Reservoir Area. The number of respondents for this question was 548. Approximately 43 percent of the sample reported using or operating a boat or other watercraft during their visit, whereas 57 percent indicated they did not use a boat.

**Question 17: Location of Boat Launch Used.** Visitors who reported using a boat or other watercraft on this visit were asked to identify the boat launch they used, and were instructed to circle all choices that applied. Of those who answered this question (n=236), 78 percent said that they launched at the SCL Forebay Recreation Area. Figure 5.1-4 summarizes the results for boat launch use in the Boundary Reservoir Area for the 2007 visitor survey. The values in Figure 5.1-4 are the percentages of respondents, who could select more than one choice.

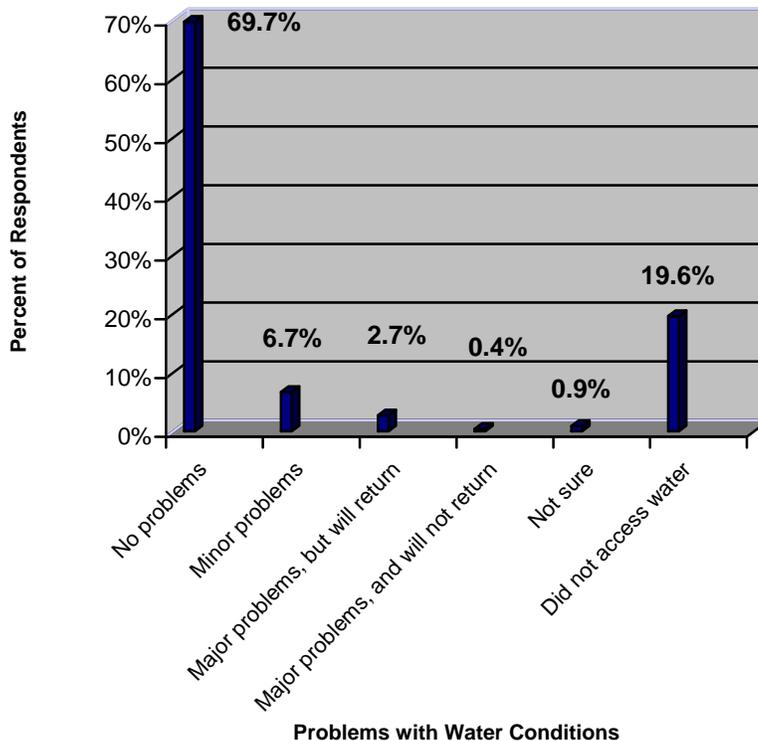


**Figure 5.1-4.** Responses to Question 17: Which boat launch did you use during this visit? (236 respondents)

**Question 18: Boat Launch Adequacy.** Visitors who used a boat launch were asked if the launch adequately met their needs for this particular visit. Over 90 percent of this sample of boaters (228 respondents) responded affirmatively that their needs had been met while using a launch, whereas 9 percent indicated the launch did not meet their needs.

Visitors who reported that their needs were not met were asked to describe any problems that they encountered launching their boats. These open-ended comments are listed in Appendix 3e of the Study 21 Interim Report (SCL 2008c). Although these responses have not been formally categorized, they indicate that most boat launch problems were of two types. The most common type of issue among these open-ended comments involved the type or conditions of facilities present (or lacking) at the boat launches. At least 19 of the 31 comments included references that docks were either missing or needing repair, and/or that boat ramps were rough, too steep, too narrow, or in need of repair or resurfacing. At least 10 comments included some reference to low, high, or fluctuating water levels in the reservoir that made launching difficult or unreliable.

**Question 19: Water Conditions.** All respondents (not just those reporting use of a boat) if the water conditions on the river or the reservoir caused them any problems during this particular visit. Figure 5.1-5 summarizes the results for this question. About 20 percent of the sample selected the response option that they did not access the river or the reservoir shoreline during this visit (and by inference had no problems with water conditions). Nearly 70 percent of the sample reported no problems. Approximately 10 percent of the sample reported that they had experienced minor or major problems with water conditions during their visit. Forty-five respondents failed to answer this item.



**Figure 5.1-5.** Responses to Question 19: Did the water conditions cause any problems for you during this visit? (555 respondents)

Visitors who reported that they had experienced any problems with water conditions were asked to provide describe those problems. Forty-one visitors (7.4 percent of this sample) wrote open-ended responses to this part of the question, which are listed in Appendix 3e of the Study 21 interim report. In general, the most frequent problem described (in approximately 25 comments) related in some way to low and/or fluctuating water levels. Several of these comments suggested some prior knowledge of daily fluctuation patterns (specifically lower water levels later in the day), and some associated water levels with fishing difficulties. Three open-ended comments referenced problems or uncertainty associated with the rapids at Metaline Falls, and five comments identified milfoil as a problem.

**5.1.1.4. Area Resident Survey Fishing Responses**

Some of the area resident questionnaires returned in the mail were blank and a sizable proportion was from people who did not use the Boundary Reservoir Area for recreation, and therefore did not provide responses for most of the questions. Among those who reported using the area for recreation and identified their recreational activities, nearly 50 percent indicated they participated in fishing while in the area. Overall, 84 area residents (based on surveys processed through approximately November 15, 2007) answered questions regarding fishing in the Boundary Reservoir Area. The area residents who provided an address allowed researchers to determine that Washington residents accounted for 92.6 percent (n=63) of the area residents who indicated they fished in the Boundary Reservoir area, while the remaining 7.4 percent were Canadian residents.

**Question 10: How Long Have Area Residents Been Fishing in the Boundary Reservoir Area.** Table 5.1-6 summarizes results for the number of years area residents reported they had been fishing in the Boundary Reservoir Area. The mean number of years across all respondents was just over 15 years. Nearly 27 percent of this sample reported they had been fishing in the area for more than 20 years, while 31 percent had been fishing in the Boundary Reservoir Area for 5 years or less.

**Table 5.1-6.** Number of years area residents have been fishing in the Boundary Reservoir Area.

Years Fishing	Frequency	Percent of Sample <sup>1</sup>
0-5	31	37.8
6-10	11	13.4
11-15	8	9.8
16-20	10	12.2
> 20	22	26.8

Notes:

1 n = 82 respondents. Mean = 15.06 years, standard deviation = 10.0, median = 13.97, mode = 2 (6-10 years).

**Question 11: Number of Days Per Year Fished.** Question 11 asked area residents to identify how many days per year they fished in the Boundary Reservoir Area, by season. Table 5.1-7 summarizes these results. The number of days fished per respondent ranged from 0 to 60 for the spring, summer and fall seasons. The mean number of days fished was highest in the summer, at 6.9 days, decreasing to 4.1 days in the fall and less than 0.4 in the winter.

**Table 5.1-7.** Number of days area residents fished, by season, in the Boundary Reservoir Area.

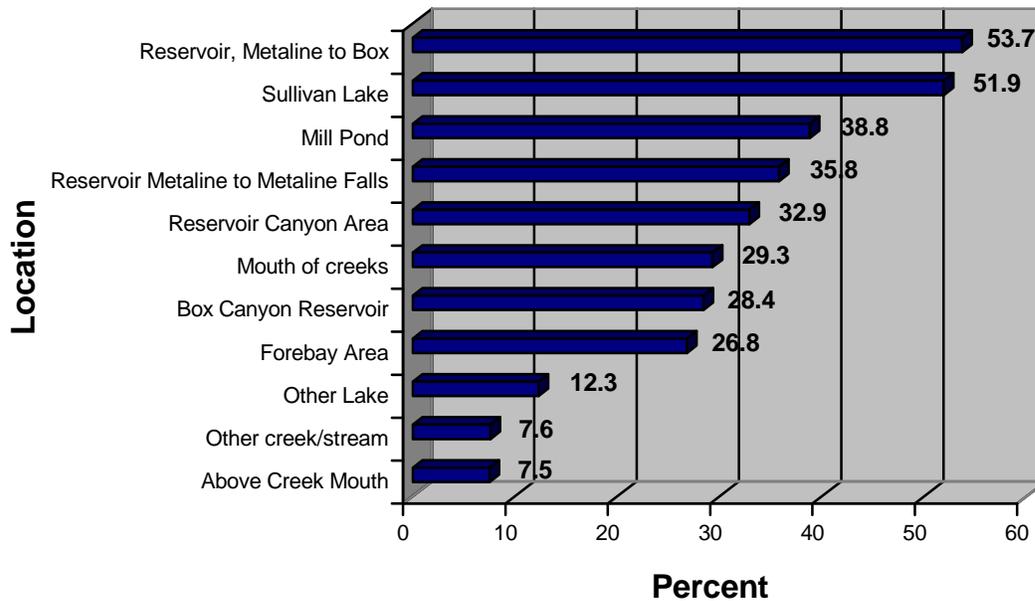
Season	Minimum	Maximum	Mean	Median	Mode	SD
Spring <sup>1</sup> (Mar-May)	0	60	5.29	2.50	0	9.09
Summer <sup>2</sup> (Jun-Aug)	0	60	6.90	5.00	0	8.67
Fall <sup>1</sup> (Sep-Nov)	0	60	4.12	2.00	0	8.22
Winter <sup>3</sup> (Dec-Feb)	0	15	.36	.00	0	1.80

**Notes:**

- 1 n = 82 respondents.  
 2 n = 84 respondents.  
 3 n = 81 respondents.  
 SD – standard deviation.

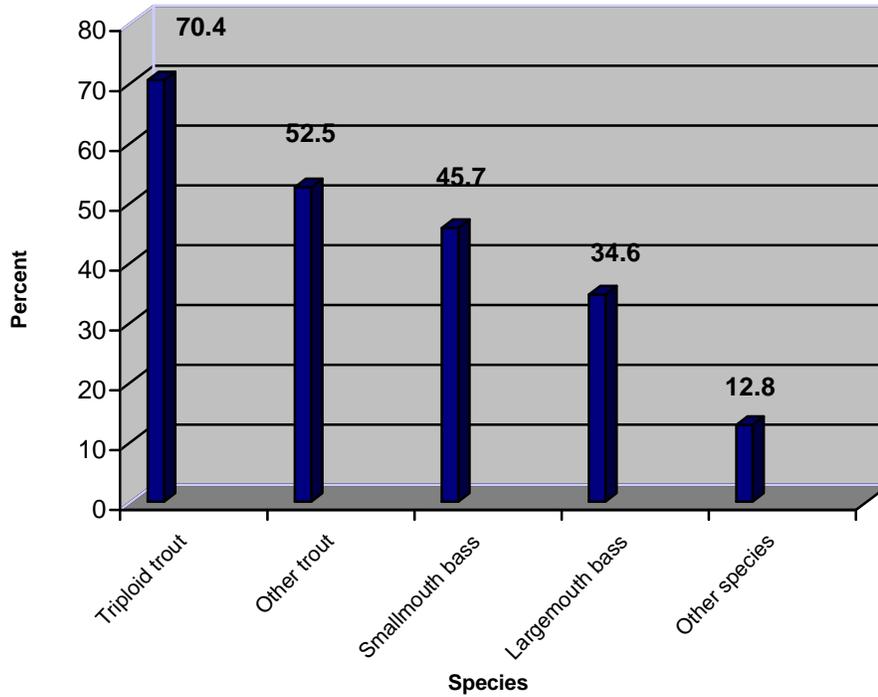
**Question 12: Means of Fishing.** Area residents who reported fishing were asked how they usually fish in the Boundary Reservoir Area. Nearly half (48.8 percent) of the anglers reported that they fished from a boat, while a third usually fished from shore and 18 percent fished both from a boat and from shore. Respondents who reported fishing from a boat were asked to identify the type of boat they used for fishing. The answers varied in specificity and included canoes, row boats, Zodiacs, pontoon boats, and motorboats.

**Question 13: Fishing Locations.** A map of the Boundary Reservoir Area was included in the questionnaire and area residents were asked to report where they usually went fishing in the area. The most common response, identified by nearly 54 percent of this sample, was the upper reach of Boundary Reservoir between Metaline and Box Canyon. Sullivan Lake and Mill Pond were the second and third most frequently identified areas. Figure 5.1-6 summarizes the results of this question, showing the percentages of respondents selecting the various locations.



**Figure 5.1-6.** Area resident angler responses to Question 13: In what area(s) do you usually fish when you visit the Boundary Reservoir Area? (81 respondents)

**Question 14: Preferred Species of Catch.** Area resident anglers were asked what species of fish they usually tried to catch while fishing in the Boundary Reservoir Area. There were five choices (including “Other species”) listed in the question, and respondents were instructed to circle all that applied. This sample (81 respondents) reported 174 total responses, indicating that many anglers are interested in catching more than one species while fishing in the area. Triploid trout were the most popular fish to try to catch (selected by 70 percent of the respondents), followed by other trout (53 percent). Figure 5.1-7 summarizes the results for this item.



**Figure 5.1-7.** Area resident angler responses to Question 14: What species of fish do you usually try to catch? (81 respondents)

**Question 15: Description of Fish Caught.** Question 15 asked area residents to report the numbers and size of fish they typically catch by species during a fishing trip in the Boundary Reservoir Area. Reported results are summarized in Table 5.1-8. The anglers in this sample reported catching from 0 to 24 fish on a single trip, with the maximum figure reported for both triploid trout and other trout. The most common response for the number caught per trip (the mode) was 2 fish for all species except “other trout.” The median reported harvest per trip was also 2 fish for triploid trout, largemouth bass and smallmouth bass, and 2.5 fish for other trout. Species reported in the “other fish” category included northern pikeminnow, pike, walleye, and tench.

**Table 5.1-8.** Number of fish typically caught by area residents on a fishing trip at the Boundary Reservoir Area.

Species	Minimum	Maximum	Mean	Median	Mode	SD
Triploid Trout	0	24	4.34	2.00	2	4.68
Other Trout	1	24	4.58	2.50	1	5.74
Smallmouth Bass	0	20	3.93	2.00	2	4.23
Largemouth Bass	0	9	2.82	2.00	2	2.79
Other Fish 1	1	12	4.09	3.00	2	3.21
Other Fish 2	2	4	3.00	3.00	2	1.16

**Notes:**

Table entries are based on data from 82 respondents.

SD – standard deviation.

Table 5.1-9 summarizes the fish size component of the Question 15 responses. Based on the range of the responses, the survey analysts established four different size categories. Across all species, the most common sizes reported were in the 10- to 18-inch size class; this category accounted for a combined 55 percent of all responses to this question. Among responses for triploid trout that fit into the size categories (i.e., discounting the “Other size” responses), 68 percent were in the 10- to 18-inch size range and 18 percent were in the over-18-inch category.

**Table 5.1-9.** Size range of fish typically caught by area residents in the Boundary Reservoir Area.

Species	Size Range of Fish (Inches)									
	Under 6		6-9		10-18		Over 18		Other Size <sup>1</sup>	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Triploid	1	1.0	3	2.9	19	18.4	5	4.9	7	6.8
Other Trout	2	1.9	0	0.0	15	14.6	1	1.0	7	6.8
Smallmouth Bass	1	1.0	2	1.9	14	13.6	1	1.0	6	5.8
Largemouth Bass	0	0.0	0	0.0	6	5.8	0	0.0	1	1.0
Other Fish	1	1.0	1	1.0	3	2.9	3	2.9	4	3.9

Notes:

n = 103 responses.

1 Other Size of fish are responses that were not numbers (i.e., small) or sizes that did not fit into the size categories.

**Question 16: Fishing Satisfaction.** Table 5.1-10 summarizes results for the question that asked area resident anglers to rate their satisfaction with the fishing opportunities in the Boundary Reservoir Area. The responses were based on a scale ranging from 1 to 9, with 1 representing “Very Poor” and 9 representing “Excellent.” The most common rating reported among the nine classes (the mode) was 5, “Average,” which was selected by 17 respondents (22 percent of this sample). Approximately 23 percent of the respondents rated their satisfaction as below average (combining all ratings of 1 to 4), whereas 55 percent rated their satisfaction as above average (ratings of 6 to 9).

**Table 5.1-10.** Area residents’ satisfaction with fishing opportunities in the Boundary Reservoir Area.

Rating	Frequency	Percent of Sample <sup>1</sup>
1 Very Poor	1	1.3
2	5	6.4
3	5	6.4
4	7	9.0
5 Average	17	21.8
6	16	20.5
7	12	15.4
8	11	14.1
9 Excellent	4	5.1

Notes:

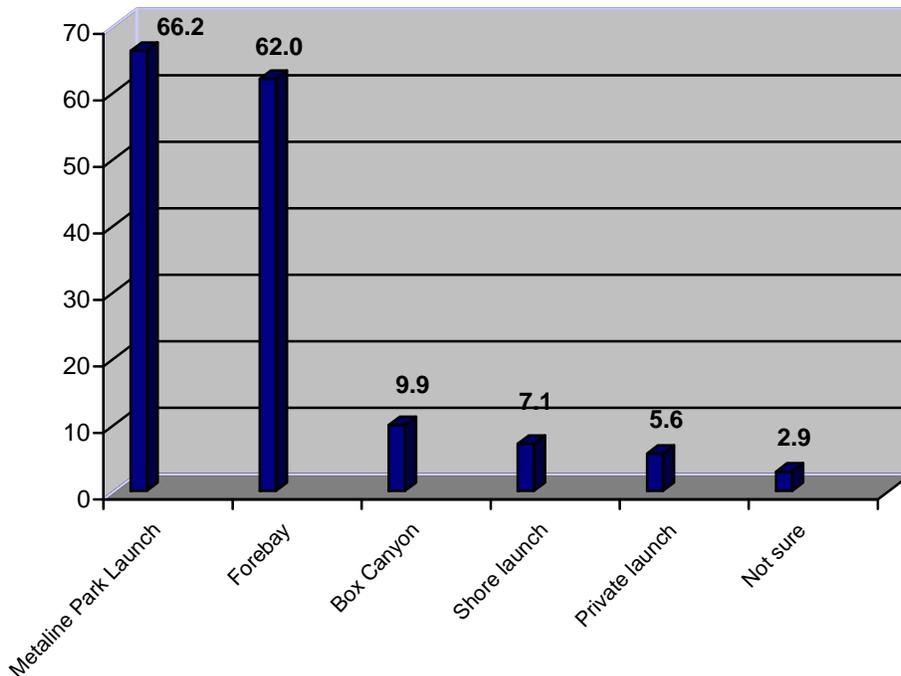
1 n = 78 respondents; mean = 5.68, standard deviation = 1.9, median = 6.0, mode = 5.

5.1.1.5. Area Resident Survey Boating Responses

The area resident survey included a series of questions similar to those in the visitor survey concerning use of a boat, boat launch locations and adequacy, and problems encountered with water conditions. The area resident responses to those questions are summarized below.

**Question 17: Boat Use.** Area residents were asked if they often operated or rode in a boat or other watercraft for pleasure or travel on Boundary Reservoir when they visit the area for recreation. Approximately 44 percent of the area resident respondents reported that they often operated or rode in a boat or other watercraft on Boundary Reservoir, while 56 percent reported no such boat use.

**Question 20: Location of Boat Launch Used.** Of the area residents who reported using a boat or other watercraft, 66 percent said that they often launched at Metaline Waterfront Park, whereas 62 percent identified the SCL Forebay Recreation Area as a common launch location (respondents were directed to circle all responses that applied, and many identified multiple launch locations). In addition, 10 percent of the area residents reported that they often launched at Box Canyon Dam, and 7 percent often launched directly from shore. Figure 5.1-8 summarizes the results for boat launch use on Boundary Reservoir by area residents.



**Figure 5.1-8.** Area resident angler responses to Question 20: Which boat launch do you usually use at Boundary Reservoir? (71 respondents)

**Question 21: Boat Launch Adequacy.** Those who reported using a boat launch were asked if the boat launch adequately met their needs. Approximately 68 percent of the resident respondents to this question reported that the boat launch they used adequately met their needs, whereas 32 percent indicated that it did not. The area residents who reported that their launching needs were not met provided 20 open-ended comments about problems they encountered. These entries included nine comments that specifically mentioned some aspect of the facilities at the Metaline Waterfront Park launch, and three comments referencing problems with launching a boat at Box Canyon Dam. Some area residents discussed problems with low or fluctuating water levels, such as returning to a launch in the afternoon and having difficulty taking out their boat.

**Question 22: Water Conditions.** Approximately 47 percent of the area resident sample reported they had not encountered problems with the water conditions while boating on Boundary Reservoir, and 33 percent indicated water conditions had caused them minor problems. Twelve respondents (16 percent of the area resident sample) selected one of the responses characterizing problems with water conditions as major. Table 5.1-11 summarizes the area resident responses to this question. This sample provided 19 open-ended responses describing specific problems encountered. These responses included some specific problems, such as difficulty passing through the falls area near Metaline due to water fluctuations (four responses) or difficulty launching or retrieving boats due to low or changing water levels (four or five responses). Some of the open-ended responses were more general statements such as “low water” or “water levels change daily.”

**Table 5.1-11.** Area residents who reported problems with water conditions while boating on Boundary Reservoir.

Response	Frequency	Percent of Sample <sup>1</sup>
No problems	34	47.2
Minor problems	24	33.3
Major problems, but would not keep me from returning	11	15.3
Major problems, that would keep me from returning	1	1.4
I'm not sure	2	2.8

Note:

1 72 respondents

#### 5.1.1.6. Comparison of Visitor and Area Resident Survey Fishing and Boating Responses

A brief comparison of the visitors’ and area residents’ responses to survey questions about fishing and boat use is summarized below. In-depth analysis of similarities and differences in these two sets of results has not been performed for the interim report.

**Question 10/11: Number of Days Fished.** The visitors’ responses to Question 10 represent a mean of 2.5 days of fishing activity per respondent on their current visit. The mean for the residents who reported fishing amounted to 16.7 days per year per respondent.

**Question 11/12: Means of Fishing.** Area residents appear to be somewhat more likely than visitors to fish from a boat. Among visitors, 39 percent reported fishing from shore, 36 percent from a boat and 23 percent from boat shore and boat. Corresponding figures for area residents were 33 percent, 49 percent, and 18 percent, respectively.

**Question 12/13: Location Fished.** Visitor responses showed a considerably greater tendency to fish the northern reaches of Boundary Reservoir. Forty percent of visitors reported fishing in the Forebay Reach, compared to 27 percent for area residents. By contrast, 23 percent of visitors reported fishing between Metaline and Box Canyon, whereas 54 percent of area residents fished that area (the most frequent location indicated by residents). Area residents also showed a strong tendency to fish water bodies other than Boundary Reservoir, with reported figures of 52 percent for Sullivan Lake, 39 percent for Mill Pond, and 28 percent for Box Canyon Reservoir.

**Question 13/14: Preferred Species.** Species preference among visitors was evenly divided between triploid trout, other trout, and smallmouth bass. Although high percentages of area residents also selected those species, residents indicated a greater tendency to fish for triploid trout (70 percent, versus 53 percent for other trout and 46 percent for smallmouth bass).

**Question 14/15: Fish Caught.** For each species, large percentages of visitors reported catching zero fish on their visit, and the mean harvest number was one fish or less in each case. By contrast, the catch reports for area residents represented a mean of about four triploid trout, other trout, or smallmouth bass per outing.

**Question 15/16: Fishing Satisfaction.** Approximately 62 percent of the visitors responding to this question assigned ratings of above average (6 or higher) to their satisfaction with the fishing opportunities, whereas 50 percent of area residents reported above-average satisfaction. Five percent of residents rated their satisfaction as excellent, compared to 17 percent of visitors.

**Question 16/17: Boat Use.** The results for the question on boat use are nearly identical for visitors and area residents; 43 percent of the visitor respondents and 44 percent of the area residents reported using a boat on their visit(s) to the area.

**Question 17/20: Location of Boat Launch Used.** Of the area residents who reported using a boat or other watercraft, 66 percent said that they often launched at Metaline Waterfront Park, whereas 62 percent identified the SCL Forebay Recreation Area as a common launch location. The corresponding responses from the 2007 visitor survey were 78 percent for the Forebay launch and only 21 percent for Metaline. In addition, 10 percent of the area residents reported that they often launched at Box Canyon Dam (compared to 4 percent for visitors), and 7 percent often launched directly from shore (versus 4 percent for visitors).

**Question 18/21: Boat Launch Adequacy.** Area residents appear to be less satisfied with the conditions at the local boat launches than are visitors. Approximately 68 percent of the resident respondents to this question reported that the boat launch they used adequately met their needs, whereas 32 percent indicated that it did not. In comparison, only 9 percent of the visitor sample indicated the launch they used did not meet their needs.

**Question 19/22: Water Conditions.** Approximately 47 percent of the area resident sample reported they had not encountered problems with the water conditions while boating on Boundary Reservoir and 33 percent indicated water conditions had caused them minor problems. Among visitors, nearly 70 percent of the sample reported no problems and 7 percent reported minor problems. Over 16 percent of the area resident sample selected one of the responses characterizing problems with water conditions as major, compared to 3 percent for the visitor sample.

### 5.1.2. Tagged Fish Reward Program

The tagged fish reward program was operated for the spring, summer, and fall seasons of 2007. TtEC established the toll-free phone line for the program on March 30, 2007. Posters were installed at access points and fliers were distributed to key community locations in the first week of April. The first tags submitted by anglers were received on approximately April 20, 2007. TtEC continued to receive tags intermittently through early December 2007.

#### 5.1.2.1. Tag Return Summary

Table 5.1-12 summarizes the activity in the tagged fish reward program on a monthly basis during 2007. Appendix 3 provides a complete listing of the individual angler reports received during the season; this table includes information about reporting and catch dates, tag numbers, fish length, and catch locations. Through December 2007, anglers submitted 67 reports accounting for 130 tags. Most of the angler reports involved single tags, but a few included multiple tags. One angler submitted 11 tags in a single report, although the catch dates spanned a full month. Fully 70 percent of all tags returned for the year were received in May, June, and July 2007, with 30 or 31 tags returned in each month.

**Table 5.1-12.** 2007 tagged fish reward program activity summary, by month.

Month	Number of Reports/Anglers	Number of Tags
April	2	2
May <sup>1</sup>	21	30
June <sup>2</sup>	12	30
July	15	31
August	9	17
September	6	9
October	1	6
November	0	0
December	1	5
<b>Season Total</b>	<b>67</b>	<b>130</b>

Notes:

1 May total includes 14 tags from 12 Bassin' Assassin Derby anglers.

2 June total includes 7 tags from one angler in drop box.

#### 5.1.2.2. Angler Information

Anglers returning tags to TtEC reported their addresses so they could be mailed their tag rewards. Of the 67 tag reports received during the season, 36 (54 percent of the total) came from

the nearby communities of Metaline, Metaline Falls, and Ione. There were 22 tag reports from anglers with Ione addresses, representing by far the largest single source of tag returns from any community. Anglers from other Pend Oreille County communities (Cusick, Usk, and Newport) accounted for another nine tag reports, and eight were from Spokane County addresses. The distribution of angler origins is summarized in Table 5.1-13.

**Table 5.1-13.** Distribution of angler origins for tag returns.

Location	Number of Reports
Ione	22
Metaline	9
Metaline Falls	5
Cusick	4
Usk	2
Newport	3
Spokane County	8
Other Northeast Washington	5
Other Eastern Washington	3
Western Washington	3
Idaho	2
British Columbia	1

### 5.1.2.3. *Harvest-related Information*

Triploid rainbow trout accounted for 124 of the 130 tags (95 percent) returned during 2007, with the remaining 6 tags from smallmouth bass. (As indicated in Section 4.3.1, 1,000 Floy-tagged triploid trout were released in Boundary Reservoir at the end of March 2007. The smallmouth bass reported by the reward program represent harvest of 6 of a total of 151 game fish [102 smallmouth bass] tagged and released in Boundary Reservoir during Study 9 fish distribution and abundance sampling.) Anglers reporting catches of tagged fish included information on fish length for 87 of the 130 tags returned. Four of those reports involved tags from smallmouth bass, of which two were reported as 10-inch fish and two as 11-inch fish. Fish length reported for 83 triploid trout ranged from 9 inches to 20 inches. The most common length reported for triploids was 13 inches, as indicated in 26 tag reports (31 percent of the total). Another 22 tags (26 percent) came from fish reported as 11 inches long. Fish reported as 15 inches or longer accounted for 11 tags (13 percent). The median fish length reported for triploid trout in this sample was just over 12 inches. The entries in Appendix 3 show that the tag returns from larger fish all occurred later in the season, and there was an evident pattern of generally increasing fish length as the season progressed. Table 5.1-14 summarizes the fish length data reported, on a monthly basis.

**Table 5.1-14.** 2007 tagged fish reward program fish length summary, by month.

Month <sup>1</sup>	Number of Tags	Tags with Length Reported	Size Range (inches)	Average Length (inches)
April	2	2	11	11
May	30	20	9–14	11.0
June	30	12	8.5–16	11.5
July	31	25	10–17	12.7
August	17	10	10–14	12.1
September	9	7	11–15	13.4
October	6	6	19–20	19.5
November	0	0	--	--
December	5	5	13	13
<b>Season Total</b>	<b>130</b>	<b>87</b>	<b>8.5 - 17</b>	<b>12.6</b>

Notes:

1 Entries based on month report submitted, from running log during the season.

Anglers reported catch locations for 123 of the 130 tags returned (see Appendix 3). Those location statements were interpreted to represent 27 different locations, virtually all of which referenced specific locations in Boundary Reservoir or its tributary streams (e.g., reports for eight tags mentioned simply “Boundary Reservoir”). Box Canyon Dam at the upper end of Boundary Reservoir was the most common location identified, associated with 20 of the tags (16 percent of the total). Boundary Dam (or sites in the immediate vicinity) was identified as the catch location for 12 tagged fish. Tributary creeks or creek mouths (Slate, Sweet, Lime, Sullivan, and Flume Creeks) accounted for 24 of the reported catch locations, and another 6 locations were identified as “near Slate Creek). Locations downstream from Boundary Dam were reported for three tags, including one reported as “below Boundary Dam” (possibly in the tailrace area), one as Seven Mile Reservoir, and one from Lake Roosevelt (the Columbia River behind Grand Coulee Dam). Additional discussion of fish location is provided in Section 5.3.

The tag reports provided little information concerning fishing effort and whether anglers kept or released the tagged fish they caught. Twelve reports representing 14 tagged fish indicated the amount of time spent fishing. Those reports indicated a total effort of 24.5 hours, or an average of approximately 1.8 hours per fish caught. In 19 of the reports the anglers indicated that they released the tagged fish, whereas in seven cases they reported keeping the fish.

#### 5.1.2.4. Toll-free Phone Line Operation

TtEC staff recorded 40 calls or voicemail messages on the toll-free telephone line established for the tagged fish reward program. Virtually all of the calls were from anglers reporting catches of tagged fish who subsequently submitted tags by mail. The line was somewhat active during April and May, received few calls in June, and was most active in July, with 25 calls or messages during the month. As of December 13, 2007, the last activity on the line was recorded on August 1. More than half of the calls were repeat calls from a previous caller, typically with new reports on tagged fish catches. The relatively low level of activity on the phone line is likely in response to the requirement that anglers still needed to submit their tags to confirm a catch and receive the reward, rather than confirm a catch just with a phone report.

### 5.1.3. Angler Survey

Results for all of the angling-related questions in the Project-area visitor questionnaire and the area resident questionnaire are provided in Section 5.1.1.

### 5.1.4. Smallmouth Bass Derby Monitoring

SCL staff visited the SCL Forebay Recreation Area, Metaline Waterfront Park, and Campbell Park (Box Canyon Dam) boat launches during the May 5-6, 2007 Bassin' Assassin Derby (smallmouth bass derby) at Boundary Reservoir. Contacts with derby participants provided several types of information concerning fishing effort and success, anglers' opinions and perceptions, water and access conditions, and related considerations. Angler catches of tagged fish reported in these contacts were recorded.

SCL contacts during the 2007 derby included 12 anglers who had caught a total of 14 tagged fish. One of these fish was a smallmouth bass and the remaining 13 were triploid trout. The length of the fish caught was indicated for six of the tagged fish; length was reported as 11 inches for five fish and 12 inches for the sixth. Catch location was reported for 13 of the fish, with 8 caught in the Upper Reservoir and 5 in the Canyon Reach. The most common catch location was near Box Canyon Resort (five fish), followed by the old powerhouse below Metaline Falls (three fish). Data on hours fished and whether fish were kept or released were not recorded from these contacts.

Additional data were collected from several anglers on their knowledge of fish-spawning areas, distribution of game species, and potential stranding and trapping areas, as part of the Study 7 Habitat Mapping component. The details of these queries are presented in the Study 7 Mainstem Aquatic Habitat Modeling Interim Report (SCL 2008a).

## 5.2. Triploid Trout Biotelemetry

This section presents the preliminary results of the Triploid Trout Biotelemetry component.

### 5.2.1. Tag Implantation Survival and Post-Release Survival

In addition to the 20 hatchery triploid trout implanted with radio tags and released on March 30, 2007, 16 carry-over triploid trout were implanted with CART tags from May 25 to September 26, 2007. Telemetry data recorded during mobile tracking and at shore-based stations were used to determine the status of each fish based on the following criteria:

- Alive, movement recorded
- Tag recovered from river, above high water mark
- Tag recovered from river, below high water mark
- Tag not recovered, stationary, above high water mark
- Tag not recovered, stationary, below high water mark
- Location unknown, no or very few valid detections

- Continual downstream movement
- Tag returned by angler

During mobile tracking, fish routinely found in the same location or that were tracked to a position above the high water mark were designated as either suspect or as dead. Tagged fish were also deemed suspect if data from the shore-based stations indicated that the fish moved continuously downstream immediately after release. Furthermore, the health of a tagged fish was also suspect if the tags were not detected or very rarely detected after release. Absolute confirmation of mortality was confirmed by either tag recovery or if the tag was turned in by an angler.

In total, four fish of 36 tagged triploids (11 percent survival) were assumed to be alive as of September 26, 2007 (Table 5.2-1). Although the low survival rate is significantly lower than studies on rainbow trout in other areas (e.g., RL&L [2000] investigations on Brilliant Reservoir where 22 of 29 survived 1 year), this value is consistent with the low proportion of triploid carry-overs observed in Boundary Reservoir (see Figure 5.3-5.). A complete summary of survival of tagged triploids and surgical tag implantation records are provided in Appendix 4, Tables A.4-1 and A.4-2, respectively. A summary of the total number of days at large when each fish was alive is provided in Appendix 4, Table A.4-4.

**Table 5.2-1.** Estimated number of dead and suspect tagged triploid trout during telemetry monitoring from March 30 to September 26, 2007.

Tag Type	Total Number Released with Tags	Total Number Dead or Suspect Tagged Fish	Survival (%)
NTC-6-2 radio tags	20	20	0
CH-TP11-18 CART tags	16	12	25
All tags	36	32	11

The most conclusive evidence of mortality was the recovery of the tag, sometimes from within the remains of the fish. Following a search of the shoreline, during a period of low reservoir level in late August, two radio tags (fish 79 and 80) deployed in the spring 2007 release triploids were recovered from below the high water mark immediately downstream of the Box Canyon Dam Tailrace Reach release location. A third radio tag (fish 81) deployed at the same time was tracked to a localized area of riprap downstream of Box Canyon Dam tailrace, but could not be recovered. In the Canyon Reach, two CART tags (fish 34 and 61) were recovered at, or slightly above, the high water mark downstream of Slate Creek. Tag 34 was associated with fish remains and other evidence that suggested avian predation or scavenging. A single radio tag (fish 95) was also in the vicinity of Slate Creek and located well-above the high water mark, possibly in an eagle or osprey nest. In the Boundary Forebay Reach, another radio tag (fish 96) also was located above the high water mark and likely in a bird nest. Other tagged fish were classified as either dead or suspect based on the high fidelity of the fish to a specific location, where the fish was tracked to essentially the exact same location over several mobile tracking sessions. Fish that were alive but with high fidelity were identified by occasional small movements, either upstream or movements relative to the shoreline as reservoir depths varied. Tags were also classified as dead or suspect if only a minimal number of detections had been recorded since release or if the signals recorded were sporadic and intermittent. Several CART-tagged triploid

trout at depth were only detectable with the acoustic receiver. When detected, depth data indicated that these fish remained deep in the water column and at a constant depth.

One of the four fish assumed to be alive was based on upstream movement and detected at a BC Hydro shore-based station in the Salmo River, 1 mile upstream of the Pend Oreille River-Salmo River confluence. Telemetry data initially supported upstream movement of a second tagged fish in the Salmo River; however, a subsequent comparison of these data with data recorded at other stations suggested an alternative explanation (see Section 5.2.2.2). The other two fish assumed to be alive were released in late September and the minimal amount of data recorded suggested these fish were still alive. A more detailed description of fish movement and the fate of each tagged fish is provided in Section 5.3. Possible factors related to mortality are discussed in Section 5.3.6.

### **5.2.2. Triploid Movement and Distribution Data Correlation with Environmental Variables**

Due to the low survival of the tagged triploids, correlations of fish movement in relation to environmental variables could not be conducted. Movement of all spring 2007 fish and carry-over triploid trout was plotted in relation to reservoir water temperature, discharge, and water level elevation. These figures are presented in Appendix 5.

Environmental variable data representative of any of the reaches (Upper Reservoir, Canyon, Forebay, or Tailrace) were selected for examining fish movement in relation to variation in these environmental variables (e.g., water level elevation, total river discharge). Data from a particular reach were selected for the comparisons based on the initial release location and the location of the primary residence of the fish. For fish located upstream of Metaline Falls, movement data were compared with smoothed Box Canyon Dam total discharge and water level elevations recorded at the U.S. Geological Survey gage station 1.2 miles downstream of Box Canyon Dam. Movement data from fish downstream of Metaline Falls were compared to estimated Boundary Dam inflows and water elevation data as measured in the Forebay Reach. For all reservoir fish, movement data were also compared to the inverse reservoir residence time in days (e.g., 2 days residence time = 0.5 inverse residence time), which served as an analog of reservoir water velocity and was calculated based on the discharge storage curve, Forebay Reach elevations, and total Boundary Dam outflows. Movement data of fish in the tailrace of Boundary Dam were compared to reservoir water temperature, total Boundary Dam discharge, total spill, and Boundary tailrace elevation. A summary of the range of environmental parameters against which fish movement was compared is provided in the Study 9 Interim Report (SCL 2008b).

#### **5.2.2.1. Spring 2007 Release Movement in Relation to Environmental Variables**

The general movement of the spring 2007 release triploids was highly variable, based on whether released in the Box Canyon Dam tailrace or in the Boundary Forebay Reach.

Five of the 10 of fish released in the Box Canyon tailrace moved downstream immediately after release (fish 76, 77, 78, 83, and 84), and of these fish, fish 78 (Figure A.5-3) was entrained through the Boundary powerplant on May 12 at approximately 0330 hours and was last detected at the Red Bird Creek station in Canada on May 15. Fish 77 and 83 moved downstream and

were detected primarily in the canyon section immediately downstream of Metaline Falls (Figure A.5-2 and A.5-8). After water temperature increased to above 20°C by mid-July, fish 77 was detected consistently at the mouth of Flume Creek while fish 83 remained in the canyon. After August 1, both fish 77 and 83 were detected during mobile tracking in almost the same location for several sessions; consequently, the health of both fish was suspect. Fish 76 moved downstream after release and was detected consistently near Sweet Creek for approximately 16 days and then moved downstream to Pocahontas Creek where it was briefly detected on May 2 (Figure A.5-1). This movement downstream by fish 76 appears to correspond to an increase in total river discharge and velocity. Fish 84 also moved downstream from the Box Canyon Dam tailrace and was consistently detected near Pocahontas Creek until April 25 and downstream of Metaline Falls until May 16, after which the fish was no longer detected (Figure A.5-9).

Four of the 10 radio-tagged fish (fish 79, 80, 81, and 82) released in the Box Canyon Dam tailrace remained in the general tailrace area or moved slightly downstream. Out of these fish, fish 79 and 80 died after release and the tags later recovered from the exposed river bed during low reservoir level on September 11 (Figures A.5-4 and A.5-5). Fish 81 also died or lost its tag, likely during high flow (Figure A.4-6). At lower flow levels, fish 81 was tracked to a location out of the water within the riprap bank immediately downstream of the Box Canyon Dam tailrace launch; the tag could not be recovered. During mobile tracking and as early as April 26, fish 79, 80, and 81 were tracked to generally the same locations where their tags were eventually found and it was assumed these fish died relatively soon after release because of the lack of subsequent detectable movement. Due to the increase in signal strength when the tags are in air, signals from tag 81 are continuously detected by the receiver in the Box Canyon tailrace and interfere with reception of other tags in the area.

Fish 82 was detected consistently in the tailrace until July 14 and then moved rapidly downstream to Sweet Creek (Figure A.5-7). This fish was detected at Sweet Creek and then at Pocahontas Creek until July 16, after which the fish was no longer detected. Fish 85 was not detected after release.

Out of the 10 fish released in the Forebay Reach on March 30, 2007, two fish (fish 88 and 89) were entrained through the Boundary powerplant and were detected in the Tailrace Reach. Fish 88 was likely entrained near noon on April 18, after which the fish move immediately downstream and was last detected at the International Border on April 18 at approximately 1339 hours (Figure A.5-11). Fish 89 was entrained on March 30 at approximately 2130 hours, after which this fish was consistently detected during mobile tracking of the Tailrace Reach in the same location immediately downstream of generation plume on the left downstream bank (Figure A.5-12).

At least four tagged fish (fish 87, 94, 95, and 96) were likely captured or scavenged by birds soon after release (see Figures A.5-10 and A.5-17 through A.5-19). Fish 87, 95, and 96 were deposited somewhere on shore within range of shore-based receivers, possibly in a nest or on a cliff ledge, where they were continuously detected and recorded by the receivers in the Forebay Reach and at Slate Creek. As with fish 81, signals from these tags occasionally interfere with signals from other tags in the area and make mobile tracking in the Forebay Reach and vicinity of Slate Creek more difficult.

Out of the remaining four fish, fish 90 remained in the Forebay Reach after release and was detected by the three receiver stations at the Forebay Reach, Canyon opening, and at Pewee Falls until April 6, and was not detected again until it was sporadically detected in the Forebay Reach from June 6 to July 13 when it was last detected (Figure A.5-13). Reservoir water temperature at the time of last detection was approximately 23°C. Fish 91 was consistently detected in the Forebay Reach until May 8, after which the fish was no longer detected (Figure A.5-14). Fish 92 and 93 were detected consistently in the Forebay Reach until April 1, after which the fish moved upstream. Fish 92 was last detected near Slate Creek on April 26 (Figure A.5-15). The tag code for Fish 93 was detected sporadically at upstream locations after April 1; however, these upstream detections were assumed to be false signals from other electronic interference (Figure A.5-16).

Due to the limited amount of data recorded and a high proportion of dead and suspect fish, correlation of movement data with environmental changes was not possible. Qualitatively, the data suggest that as reservoir temperature increases, the spring 2007 release triploids moved into cold water refugia (i.e., fish 77 and possibly fish 82). A consistent pattern of movement in response to changes in other environmental parameters was not evident. Notably, 3 of the 20 triploid trout released during the spring were entrained at Boundary Dam. Fish 88 and 89, which were released in the Boundary forebay, passed the dam on April 18 (19 days at large) and March 30 (zero days at large), respectively. Fish 88 was also detected at the International Border on April 18. Fish 89 was continually detected at the approximately same location during mobile tracking over several sessions and was assumed to be dead. Fish 78, which was released in the Box Canyon tailrace, was detected passing the dam on May 12 after 43 days at large and was subsequently detected at the Red Bird Creek Station on May 15.

#### 5.2.2.2. *Triploid Carry-Over Movement in Relation to Environmental Variables*

Carry-over triploid trout implanted with CART tags demonstrated two general types of movement behavior after tag implantation. The first type of movement behavior was that the fish remained generally in the same area it was captured for a period of time. The second type of movement behavior demonstrated was relatively rapid downstream movement almost immediately after tagging.

Of the 16 triploid implanted with CART tags, the following 11 fish remained at or near the release location:

- Fish 34 was tagged on June 22 and released near Slate Creek (Appendix 6, Figure A.6-13). After release, the fish died or was killed and tag placed on shore downstream of Slate Creek where it was recovered by field crews on September 25.
- Fish 37 was tagged on June 20 and released in the Forebay Reach (Figure A.6-5). Temperature and depth data from the CART tag recorded on July 31 suggested that the fish was likely dead based on constant depth readings of approximately 7 meters and an ambient water temperature of almost 25°C.
- Fish 40 was tagged on May 25 and generally remained in the Forebay Reach, with occasional upstream movement into the Canyon as far upstream as Slate Creek (Figure A.6-7). Mobile tracking indicated that fish 40 used the cold water refuge at the base of Pewee Falls during the period of peak reservoir water temperature in late

- July. After August 6, fish 40 moved rapidly upstream and resided nearshore between the Metaline Fall boat launch and Pocahontas Creek. Positional and depth data from the CART tag that indicated the fish was continually at the surface suggested that the health of fish 40 may be suspect.
- Fish 49 was tagged on July 28 near Sweet Creek and has been continually detected in the same area near its release location over multiple mobile tracking sessions; the health of fish 49 was suspect (Figure A.6-8).
  - Fish 55 was tagged on June 13 near Sweet Creek and remained in the immediate area and was consistently detected for most of the summer (Figure A.6-9). Sensor data from this fish were also recorded during intensive monitoring of a westslope cutthroat trout on August 3. After August 10 the fish was no longer detected.
  - Fish 62 was tagged and released near Sullivan Creek on July 28; the fish was not detected after July 30 (Figure A.6-11).
  - Fish 35 was released in the Forebay Reach on June 22 and was rarely detected after release. The limited data recorded were not plotted. The health of the fish was assumed to be suspect.
  - Fish 38 was released in the Forebay Reach on June 20 and was detected only once after release. The limited data recorded were not plotted. The health of the fish was assumed to be suspect.
  - Fish 33 was tagged and released near Flume Creek on August 30 and was not detected after release. The health of the fish was assumed to be suspect.
  - Although based on limited data, a carry-over triploid trout tagged in mid-September (fish 11) and released in the Forebay Reach was detected and was assumed to be alive (Figures A.6-1).
  - As in the bullet above, a second carry-over triploid trout tagged in mid-September (fish 39) and released near Sweet Creek was detected and assumed to be alive (Figures A.6-1 and A.6-6).

The following 5 of 16 CART-tagged carry-over triploids moved rapidly downstream after release:

- Fish 36 was tagged and released near Slate Creek on June 22 where it was consistently detected until June 24. The fish was detected by mobile tracking on July 4 in the Forebay Reach maintaining a constant depth of 24.1 meters (79 feet) (Figure A.6-4).
- Fish 61 was tagged and released on July 28 near Sweet Creek. The fish moved or floated rapidly downstream to Slate Creek by August 1, after which the fish was either captured or scavenged by an osprey or eagle and the tag deposited on shore downstream of Slate Creek (Figure A.6-10). This tag was recovered by field crews on September 25 near the same location where tag 34 was recovered.
- Fish 70 was tagged and released on July 27 (Figure A.6-12). This fish moved continuously downstream and was last detected with the acoustic receiver upstream of Slate Creek.
- Fish 28 was tagged and released in the Box Canyon Dam tailrace on June 13 (Figure A.6-2). Once tagged, the fish moved rapidly downstream and held at Slate Creek

from June 20 to July 2. The fish was next detected August 14 downstream of Everett Island, and subsequently it moved into the Forebay Reach where it remained until September 26. Although not plotted on Figure A.6-2, subsequent telemetry data suggested that this fish was entrained through the Boundary powerplant on October 26 at 1620 hours, and then moved downstream and was detected in the Salmo River at the BC Hydro telemetry station on October 26 at 1642 hours until October 28. However, this fish was also concurrently detected at approximately the same time at the Red Bird Creek station, with concurrent intermittent detections at the Boundary Tailrace Reach and International Border stations. These concurrent detections at multiple stations suggest that the fish was captured or scavenged by an avian predator and moved to a location somewhere downstream in range of both the Red Bird Creek and BC Hydro Salmo River stations.

- Fish 31 was tagged and released in the Tailrace Reach on June 17, moved downstream after release, and was detected once (i.e., a one-event detection – not plotted) at the Red Bird Creek station on July 26 (Figure A.6-3). CART tag releases of triploid rainbow trout into the Tailrace Reach were not in the study plan so this release was inadvertent. Fish 31 was detected in the Salmo River at the BC Hydro monitoring station on October 3 and has continually been detected at this station as of December 8, 2007.

Similar to the spring 2007 release triploids, the high proportion of dead and suspect CART-tagged fish prevented statistical correlations of movement data. Qualitatively, the data suggest that as reservoir temperature increase, the CART-tagged triploids were generally captured near and resided in cold water refugia during high reservoir water temperature (e.g., fish 55 and 40). A consistent pattern of movement in response to changes in other environmental parameters was not evident. Notably, two fish (fish 28 and 31) were detected at the Salmo River Station operated by BC Hydro. Fish 28 was either entrained at Boundary Dam and/or likely captured by an avian predator on October 26 after 135 days at large. Fish 31 was released in the Boundary Tailrace Reach and detected at the Red Bird Creek Station on July 26 after 39 days at large and the Salmo Station on October 3 after 108 days at large.

### **5.3. Triploid Trout Management**

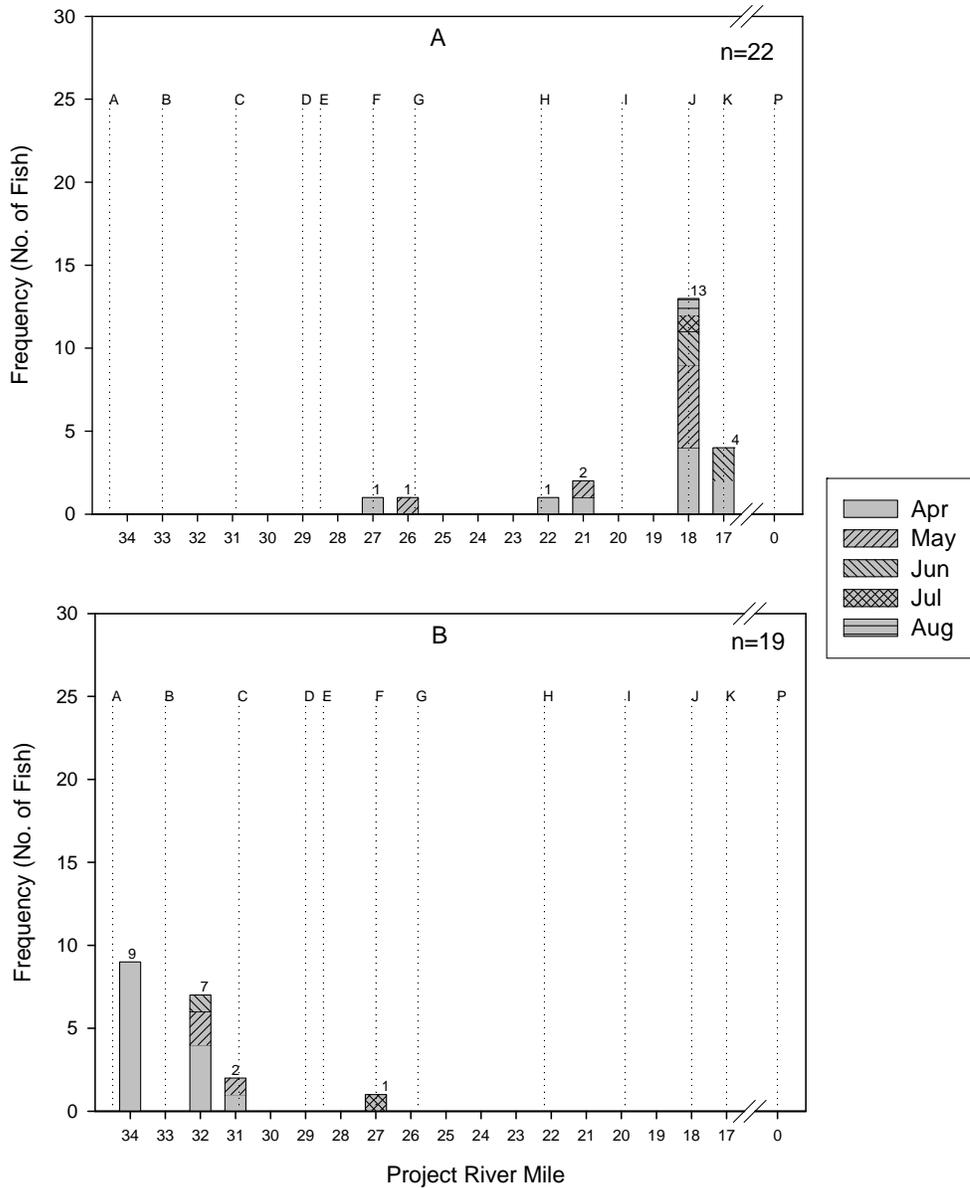
#### **5.3.1. External Tagging**

Information from angler returns of external tags and the capture of tagged fish during fish capture program as part of Study 9 provided both an approximate capture location and a length measurement of the fish at the time of capture. Corresponding Project river mile (PRM) locations were estimated for the capture location of each fish based on angler descriptions and a map location of the capture sample site provided in the Study 9 Interim Report (SCL 2008b, Figure 4.1-1). Measurements of total length were provided by both anglers and the Study 9 fish capture program. Total length measurements provided by anglers were likely subject to more measurement error than the data provided by the fish capture program depending on whether the lobes of the caudal fin were compressed along the midline when the measurements were recorded. Typically, fork length is the standard length measurement for salmonids. Fork length measurements generally tend to be more consistent and are less likely to change in the event the caudal fin lobes of the fish are damaged. Consequently, fork length was recorded for each of the externally tagged triploids at

release. Based on a visual assessment of the fish, the caudal fins of the hatchery fish were not deeply forked and measurements between fork and total length likely were not substantially different. Consequently, a correction of minus 10 millimeters was applied to all total length measurements reported by anglers to account for the difference between total and fork length.

### **5.3.2. Fish Recapture External Tag Recovery: Triploid Movement and Distribution and Tag Loss Estimates**

During fish capture efforts from March 30 to September 23, 2007, under Study 9, 41 (about 4 percent) of the 1,000 triploid trout tagged and released during spring 2007 were recaptured. Of the 41 recaptured fish, one fish was captured twice at the same site immediately downstream of Metaline Falls over two capture sessions 25 days apart. Based on the provided capture locations, the catch distribution indicates that fish released at both the Box Canyon Dam tailrace and in the Boundary Forebay Reach dispersed in both downstream and upstream directions, respectively (Figure 5.3-1). Four fish released in the Forebay Reach were entrained through the Boundary Dam and were captured in the Tailrace Reach. Inspection of the catch data over time indicates that more fish were initially captured at the release locations, and over time, the number of tags recovered at these locations declined. Average downstream movement was significantly greater for fish released at Box Canyon tailrace than upstream movement of fish released at the Forebay Reach (Table 5.3-1).



- |                         |   |                       |   |
|-------------------------|---|-----------------------|---|
| Box Canyon Dam Tailrace | A | Flume Creek           | G |
| USGS Gage Station       | B | Slate Creek           | H |
| Sweet Creek             | C | U/S end of Everett Is | I |
| Pocahontas Creek        | D | Canyon Opening        | J |
| Metaline Launch         | E | Boundary Dam          | K |
| Sullivan Creek          | F | Columbia River        | P |

**Figure 5.3-1.** First capture locations during Study 9 of externally tagged spring 2007 release triploids in relation to release location in the Boundary Forebay Reach (A) at PRM 17.3 and in the Box Canyon Dam tailrace (B) at PRM 34.5.

Note: Boundary Dam site K refers to the Tailrace Reach of Boundary Dam indicating the fish were entrained.

**Table 5.3-1.** Mean dispersal distance, standard deviation, and minimum and maximum values of spring 2007 release triploids released in the Forebay Reach and Box Canyon Dam tailrace based on Study 9 tag recapture data.

Release Location	n	Net Movement (miles) <sup>1</sup>			
		Mean	Std Dev	Min	Max
Forebay Reach	22	1.5	2.6	0	9
Box Canyon Dam Tailrace	19	2.4	1.8	0.5	7.5

**Notes:**

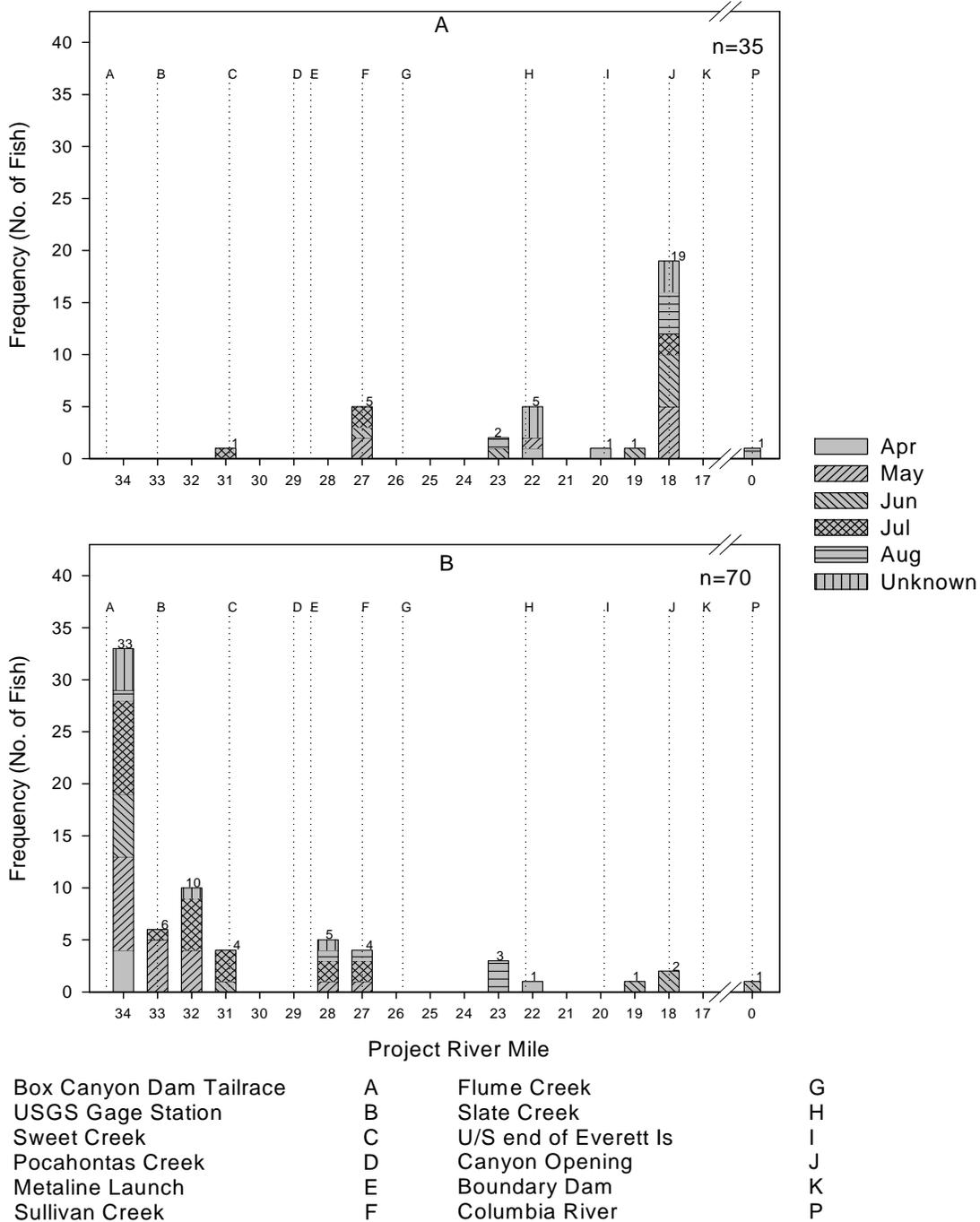
<sup>1</sup> Significance:  $\alpha = 0.05$ ,  $p = 0.8857$ .

Mann-Whitney U test statistic = 322. Chi-square approximation = 8.960 with 1 df.

In addition to the 41 tagged fish recaptured, four other fish identified as triploids with tag wounds at the based of the dorsal fish were also recaptured. Assuming this proportion applied to all tagged fish, tag loss rates are potentially about 8.5 percent. However, information provided by anglers as part of the tag return program indicated that some anglers removed the external tag and then released the fish. Of the 127 recorded tag returns, 25 anglers reported whether they kept or released the fish, and of these, 18 of the 25 fish were released. The effect of this practice by anglers on tag loss rate estimates would depend on what proportion of anglers actually reported their catch. If the large numbers of anglers practiced catch and release and also removed the external tag, this would result in higher tag loss rate estimates than otherwise would be estimated in the absence of angling.

**5.3.3. Angler Tag Returns: Triploid Movement and Distribution Data**

A total of 127 external anchor tags were returned by anglers between March 30 and October 2, 2007, of which 120 were spring 2007 released triploids or approximately 13 percent of the original 1,000 tags deployed. The locations of the spring 2007 release fish captured by anglers were plotted relative to PRM (Figure 5.3-2). Similar to the recaptures from Study 9, the greatest numbers of triploids were captured at the release locations. Capture of triploids by anglers near PRM 34 was relatively constant until August. In contrast, as part of Study 9 triploids were only captured near PRM 34 in April. The number of tagged triploid trout reported captured per month by anglers remained relatively constant until August when the number of reported captures decreased substantially in the vicinity of the Box Canyon Dam tailrace, but increased near Slate Creek, Sullivan Creek, and Pewee Falls in the Forebay Reach. A number of tagged triploid trout were also captured by anglers in late July near Sweet Creek.



**Figure 5.3-2.** Angler tag return catch location data from March 30 to October 2, 2007, indicating the downstream capture location of triploid rainbow trout released in Forebay Reach (A) at PRM 17.3 and the Box Canyon tailrace (B) at PRM 34.5.

Fish released in the Box Canyon Dam tailrace dispersed throughout the reservoir by June and were captured in the Forebay Reach. Fish released in the Forebay Reach dispersed upstream and were captured as far upstream as Sweet Creek in July. Two fish, one from each release location, were also entrained and captured in the Columbia River. One of these fish was captured on August 18 near the Lake Roosevelt-Spokane River confluence, approximately 130 miles from its release location in the Forebay Reach. Although fish released in the Forebay Reach did not disperse as far upstream as fish released in the Box Canyon tailrace dispersed downstream, there was no statistical difference in dispersal distance (Table 5.3-2).

Although approximately equal numbers of tagged triploid trout were released in the Forebay Reach and Box Canyon Dam tailrace, twice as many tags were reported recovered from the group released in the Box Canyon tailrace. This disparity may be partially due to different levels of effort and experience by anglers fishing the different parts of the reservoir. Angler surveys suggest that resident anglers more often fish the Upper Reservoir Reach while visiting anglers more often fish the Forebay Reach.

**Table 5.3-2.** Mean dispersal distance and associated confidence intervals of spring 2007 release triploids released in the Forebay Reach and Box Canyon Dam tailrace based on angler tag return data.

Release Location	n <sup>2</sup>	Net Movement (miles) <sup>1</sup>			
		Mean	Std Dev	Min	Max
Forebay Reach	34	3.1	3.8	0	13.6
Box Canyon Dam tailrace	69	3.4	4.3	0.5	17.0

Notes:

- 1 Significance:  $\alpha=0.05$ ,  $p = 0.115$   
Mann-Whitney U test statistic = 950. Chi-square approximation = 2.490 with 1 df.
- 2 Two fish captured in Columbia River not included.

**5.3.4. Triploid Growth Rates**

Growth rates of the spring 2007 release triploid trout were estimated using the 37 externally tagged fish recaptured during Study 9. The growth rates were calculated from the difference between release and capture fork length measurements divided by days at large. A comparison of growth rates of fish released at both release locations indicated that fish released in the Box Canyon Dam tailrace had a similar growth rate than fish released in the Forebay Reach (Table 5.3-3). Based on the recapture data, linear regression of change in fork-length and days at large was used to estimate triploid growth rate for each release location and for all measurements combined (Figure 5.3-3).

**Table 5.3-3.** Average growth of spring 2007 release triploid rainbow trout in Boundary Reservoir based on Study 9 recaptures.

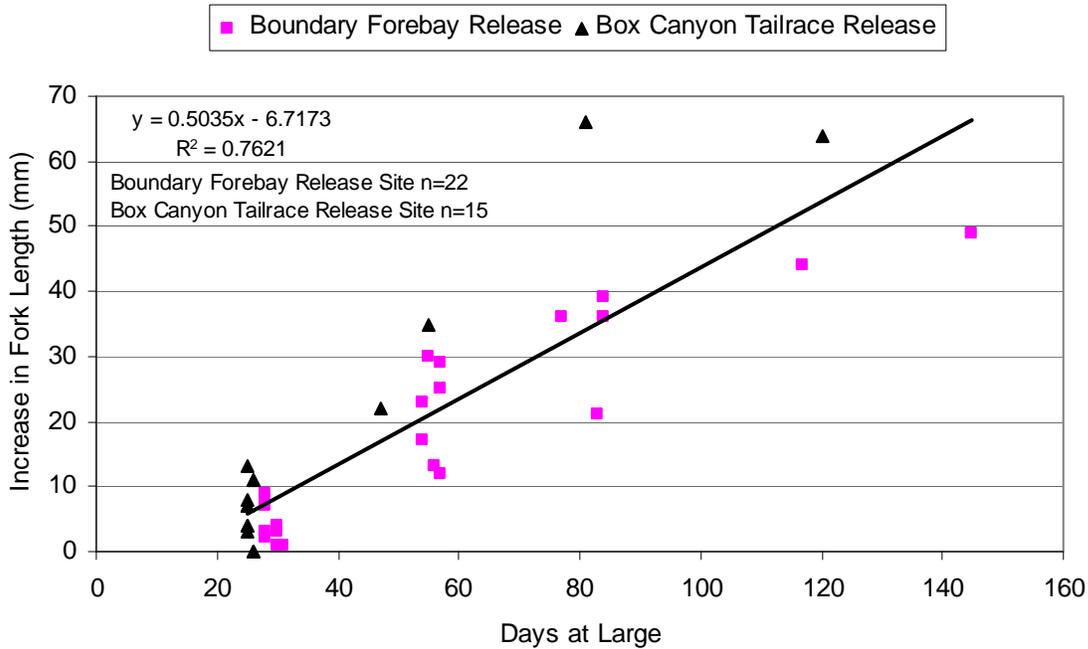
Release Location	n	Increase in Fork Length per Day (mm/day) at Large <sup>1</sup>					
		Mean	Std Dev	95% Lower CI	95% Upper CI	Min	Max
Forebay Reach	22	0.30	0.16	0.22	0.37	0.03	0.55
Box Canyon Tailrace	15	0.34	0.23	0.21	0.47	0	0.81
All Recaptures	37	0.31	0.19	0.25	0.38	0	0.81

Notes:

Table is based on increase in fork length between March 29 and 30 and the date of capture as recorded during Study 9 for fish captured between April 24 and August 21, 2007.

<sup>1</sup> Significance:  $\alpha = 0.05$ ;  $p = 0.7652$ .

CI – confidence interval.



**Figure 5.3-3.** Growth of spring 2007 release triploid trout based on Study 9 recapture data and the difference in fork length between release and recapture between April 24 and August 21, 2007.

The multiple recaptures of a spring 2007 release triploid trout demonstrated an increase in fork length of 18 millimeters over 25 days from April 25 to May 27 and was equivalent to a growth rate of 0.72 millimeter/day. However, the difference in fork length between the release on March 29 and recapture on April 25 was negligible.

Due to the uncertainty about how anglers measured the fish they caught, growth estimates based on angler-provided length data were assumed less accurate. Based on the angler tag return data, a comparison of growth rates of fish released at both release locations indicated that fish released in the Box Canyon Dam tailrace had a higher growth rate than fish released in the Forebay Reach; however, this difference was not statistically significant (Table 5.3-4). Although differences in growth were not statistically significant, the general trend in the data again suggested that fish released in the Box Canyon tailrace may grow faster than fish released in the Forebay Reach. Based on the tag return data, linear regression of change in fork-length and days at large was used to estimate triploid growth rate for each release location and for all measurements combined (Figure 5.3-4).

**Table 5.3-4.** Average growth of the spring 2007 release of triploid rainbow trout in Boundary Reservoir based on angler tag return data.

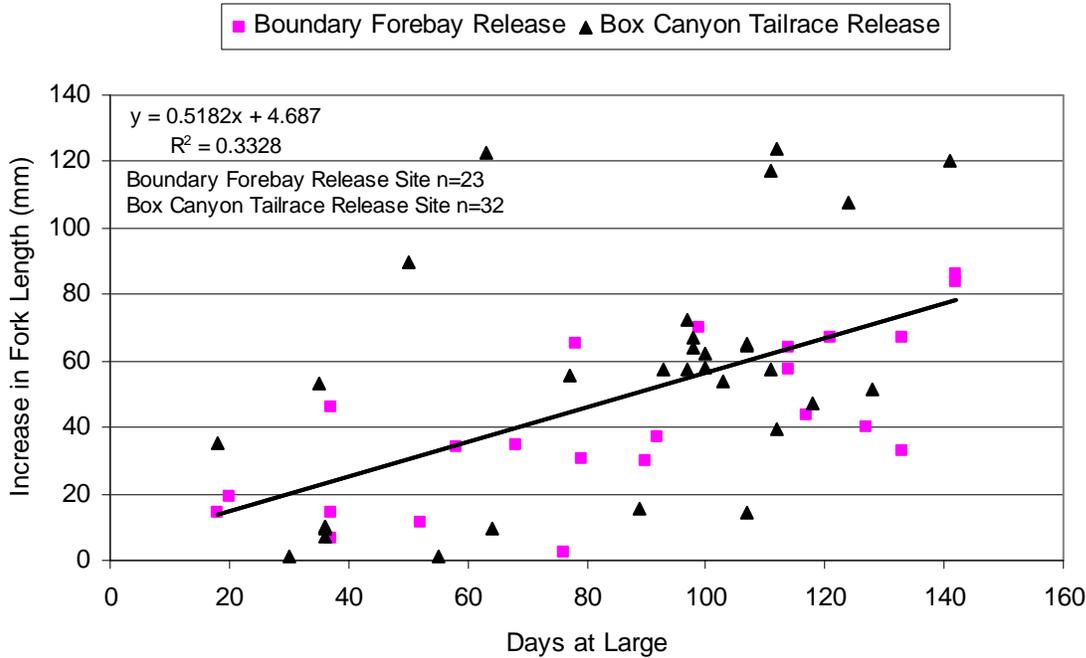
Release Location	n	Increase in Fork Length per Day (mm/day) at Large <sup>1</sup>					
		Mean	Std Dev	95% Lower CI	95% Upper CI	Min	Max
Forebay Reach	23	0.52	0.27	0.40	0.63	0.03	1.24
Box Canyon Tailrace	32	0.67	0.52	0.48	0.85	0.02	1.97
All recaptured	55	0.60	0.44	0.48	0.72	0.02	1.97

Notes:

Growth rates were estimated from increase in fork length between March 29 and 30 and the date of capture for fish capture between by anglers between April 6 and August 18, 2007.

<sup>1</sup> Significance:  $\alpha = 0.05$ ;  $p = 0.1050$ .

CI – confidence interval.



**Figure 5.3-4.** Growth of spring 2007 release triploid trout based on angler tag return data and the difference in fork length between release and recapture between April 6 and August 18, 2007.

**5.3.5. Habitat Use Data Summary for Spring 2007 Released and Carry-over Triploid Trout**

Habitat attributes associated with triploid rainbow trout were recorded during both the biotelemetry component and the fish capture component of Study 9. Much of the habitat use data initially recorded were excluded because these data were associated with fish that were later confirmed to be dead. Establishment and refinement of the habitat data collection protocol was not complete until mid-May and this further reduced the amount of habitat data that could have been collected when most of the tagged fish were still alive. Similarly, delays associated with testing of the acoustic monitoring equipment delayed CART deployment until late May and reduced the amount of habitat data recorded prior to the summer increase in reservoir water temperature and angling pressure. Fish mortality appears to have increased during the warmer summer period and fewer live fish were available to monitor. Further, the amount of detailed habitat data recorded for triploids was intentionally reduced to increase the amount of time to track and monitor native salmonids and smallmouth bass.

The positional accuracy limitations of radio telemetry tracking and the implication on associated fish habitat data were presented in the Study 9 Interim Report (SCL 2008b). The limited amount of habitat data recorded was averaged over each month to identify any large-scale seasonal changes or trends in habitat use by triploid trout.

Overall, the amount of habitat data associated with the spring 2007 release triploids was low and had only limited application to describe triploid habitat use in the Boundary Reservoir (Table 5.3-5). Surface water velocities (measured at a depth of 6 feet) tended to be in excess of 1 foot per second; total river depth associated with fish position was highly variable and likely not representative of fish position in the water column. Surface water temperature at the fish position tended to be equal to the reservoir temperature; reservoir water temperatures were recorded manually within the main channel during mobile tracking. Two of seven fish records were associated with shear zones in June and September, respectively. Substrate use ranged between silt, gravel, and bedrock; habitat cover associations included wood debris and aquatic vegetation.

**Table 5.3-5.** Average monthly habitat use data recorded at locations of radio-tagged spring 2007 release triploid trout identified during mobile telemetry tracking from April to September 2007 in the Boundary Reservoir.

Month	Water Temp. Reservoir (°C) <sup>1</sup>		Water Temp. at Fish (°C)		Dist to Bank (ft.)		Water Depth (ft.)		Surface Vel. (ft./sec.)	
	Mean (SD)	n <sup>2</sup>	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
April	10.6 (0.9)	8	N/A <sup>3</sup>	0	N/A <sup>3</sup>	0	23.7 (24.2)	8	1.3 (0.8)	8
May	13.7 (1.2)	4	13.3 (0.0)	2	70.0 (55.9)	3	18.2 (10.6)	3	1.3 (0.1)	2
June	16.4 (N/A) <sup>3</sup>	1	N/A <sup>3</sup>	0	16.4 (N/A) <sup>3</sup>	1	N/A <sup>3</sup>	0	N/A <sup>3</sup>	0
July	22.3 (2.9)	3	21.2 (3.0)	2	45.9 (41.8)	2	14.8 (19.5)	2	1.9 (N/A) <sup>3</sup>	1
September	15.0 (N/A) <sup>3</sup>	1	N/A <sup>3</sup>	0	91.9 (N/A) <sup>3</sup>	1	34.4 (N/A) <sup>3</sup>	1	2.2 (N/A) <sup>3</sup>	1

Notes:

- 1 Reservoir water temperatures were recorded manually in the main channel during mobile tracking.
  - 2 Data recorded from multiple fish and/or the same fish at multiple locations over one or more tracking sessions.
  - 3 Either one data point or no data.
- ft/s – feet per second.  
SD – standard deviation.

Habitat use data and temperature and depth data recorded from CART-tagged fish were also very limited in quantity (Table 5.3-6). Average surface water velocity associated with CART-tagged fish ranged between 0.6 in July and 2.0 in September. Total river depths associated with fish positions, as measured with the boat depth sounder, were highly variable; CART tag depth data confirmed that fish were higher in the water column. Average water temperature at the fish position tended to be slightly lower than the reservoir temperature in July. In August, substantial differences between fish temperature and reservoir temperatures were not detected because all data were recorded in late August when water temperature were lower (e.g., less than 24°C) and fish use of cold water refugia was less evident or possibly intermittent. One of nine fish records was associated with shear zone. Substrate use ranged between silt gravel, and bedrock. No significant habitat cover was associated with CART-tagged fish. All raw CART data are provided in Appendix 6, Table A.6-3.

**Table 5.3-6.** Average monthly habitat use data recorded at locations of CART-tagged triploid trout identified during mobile tracking from June to September 2007 in the Boundary Reservoir.

Month	Water Temp Reservoir (°C) <sup>1</sup>		Surface Water Temp at fish (°C)		Fish Temp Avg. (°C)		Dist to Bank (ft.)		Water Depth (ft.)		Surface Vel Rep (ft./sec.)		Fish Depth Avg (ft.)	
	Mean (SD)	n <sup>2</sup>	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
Jun	16.0 (0.5)	4	16.4 (0.7)	4	15.5 (1.3)	4	182.1 (112.1)	4	84.2 (81.4)	4	0.9(0.3)	3	5.7 (1.7)	4
Jul	21.3 (2.8)	3	20.5 (N/A) <sup>3</sup>	1	19.6 (1.1)	2	65.6 (N/A) <sup>3</sup>	1	21.3 (N/A) <sup>3</sup>	1	0.6 (N/A) <sup>3</sup>	1	10.3 (6.2)	2
Aug	21.9 (2.3)	3	21.2 (0.0)	2	21.2 (0.0)	2	367.4 (N/A) <sup>3</sup>	1	12.1 (N/A) <sup>3</sup>	1	2.0 (N/A) <sup>3</sup>	1	5.4 (4.5)	2
Sep	15.4 (N/A) <sup>3</sup>	1	15.4 (N/A) <sup>3</sup>	1	N/A <sup>3</sup>	0	N/A <sup>3</sup>	0	N/A <sup>3</sup>	0	(N/A) <sup>3</sup>	0	N/A <sup>3</sup>	0

**Notes:**

- 1 Reservoir water temperatures were recorded manually in the main channel during mobile tracking.
  - 2 Data recorded from multiple fish and/or the same fish at multiple locations over one or more tracking sessions.
  - 3 Either one data point or no data.
- ft/s – feet per second  
 CART – combined acoustic and radio transmitter.  
 SD – standard deviation.

Habitat data recorded during HSC data collection as part of the Study 9 fish electrofishing program provided the majority of habitat use data for triploid trout. Habitat data were recorded in all months except June (Table 5.3-7). With the exception of March, triploids were found near shore in water with average depth of less than 6 feet. Triploids were associated with average water depth of approximately 12 feet in March. In all months but May, water velocities were on average less than 1 foot per second; an average water velocity of 1.6 was recorded in May. Triploid trout were associated with a wide variety of substrate and habitat cover type and demonstrate no clear seasonal preference, with the possible exception of a high affinity with woody cover in March (Tables 5.3-8 and 5.3-9). It should be noted that the habitat data collected during fish sampling was limited to that found in the nearshore shallow water (usually less than 8 feet) region because of sampling limitations of electrofishing in different environments.

**Table 5.3-7.** Triploid trout habitat use data recorded during the Study 9 electrofishing program from March to September 2007 (excluding June) in the Boundary Reservoir and Tailrace Reach.

Sample Period	Depth (ft.)		Velocity (ft./sec.) 0.2 depth		Velocity (ft./sec.) 0.6 depth		Velocity (ft./sec.) 0.8 depth		Water Temp (°C)	
	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	N
Mar	11.6 (3.4)	5	0.3 (0.2)	5	0.1 (0.1)	5	0.2 (0.1)	5	6.0 (0.0)	5
Apr	4.8 (2.7)	40	0.9 (0.7)	21	0.6 (0.6)	19	0.9 (1.0)	21	10.4 (0.4)	40
May	5.6 (3.5)	24	1.6 (0.8)	12	0.3 (0.3)	13	1.4 (0.6)	12	13.8 (0.7)	24
Jul	3.0 (N/A) <sup>1</sup>	1	N/A <sup>1</sup>	0	0.1 (N/A) <sup>1</sup>	1	N/A <sup>1</sup>	0	23.4 (N/A) <sup>1</sup>	1
Aug	4.4(2.8)	11	0.1(0.1)	9	0.3 (0.2)	3	0.1 (0.1)	9	21.1 (1.3)	11
Sep	4.6 (N/A) <sup>1</sup>	1	0.0 (N/A) <sup>1</sup>	1	N/A <sup>1</sup>	0	0.0 (N/A) <sup>1</sup>	1	14.7 (N/A) <sup>1</sup>	1

Notes:

1 Either one data point or no data.

ft/sec – feet per second.

SD – standard deviation.

**Table 5.3-8.** Triploid trout substrate associations recorded during the Study 9 fish capture program from March to September 2007 (excluding June) in the Boundary Reservoir and Tailrace Reach.

Month	Dominate Substrate Type (percent)									n
	Silt, Clay, Organic	Sand	Small Gravel <sup>1</sup>	Med. Gravel <sup>2</sup>	Large Gravel <sup>3</sup>	Small Cobble <sup>4</sup>	Large Cobble <sup>5</sup>	Boulder <sup>6</sup>	Bedrock	
Mar	0	0	20	20	20	0	0	0	40	5
Apr	8	8	0	28	5	5	13	35	0	40
May	8	8	0	21	13	0	4	29	17	24
Jul	0	0	0	0	100	0	0	0	0	1
Aug	27	18	0	0	9	9	18	9	9	11
Sep	0	0	0	0	0	0	100	0	0	1

Notes:

1 0.25–1.25 cm

2 1.25–3.75 cm

3 3.75–7.5 cm

4 7.5–15 cm

5 15–30 cm

6 >30 cm

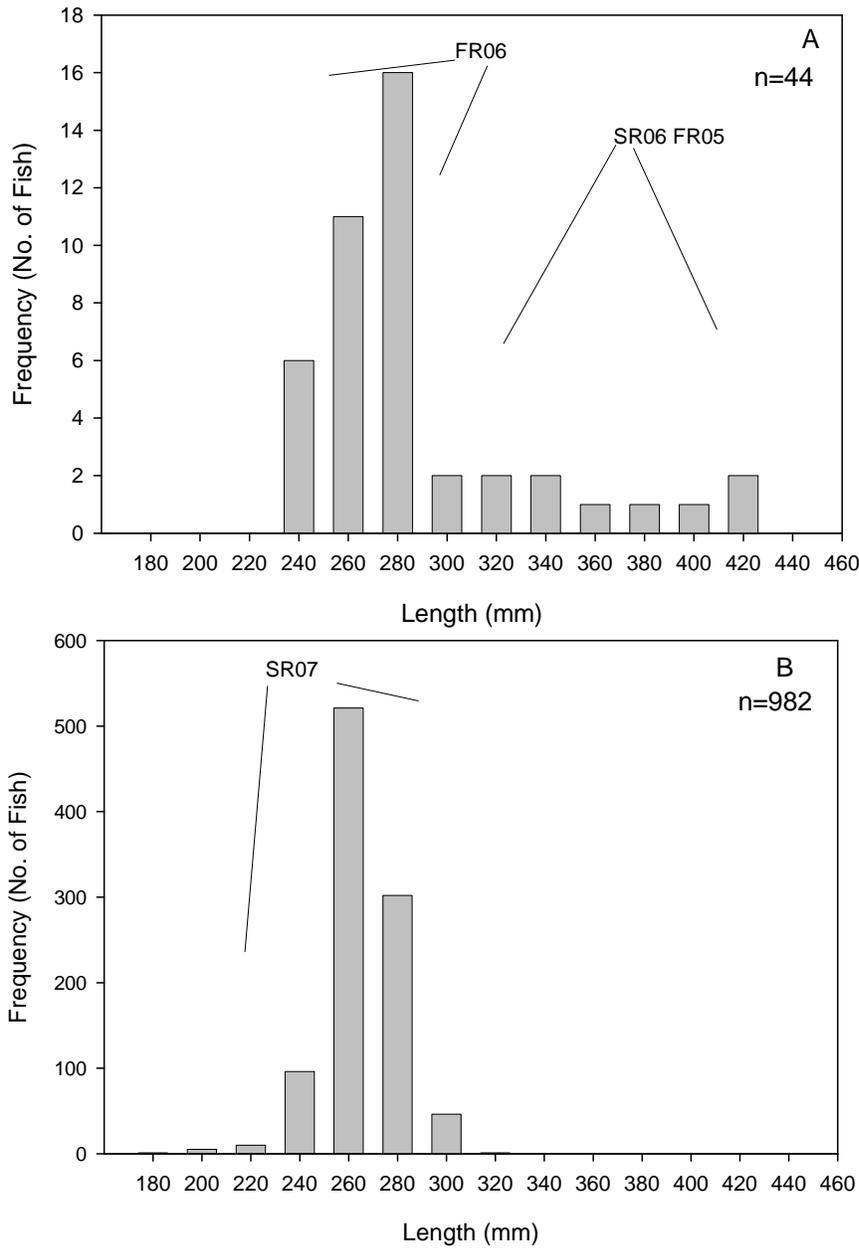
**Table 5.3-9.** Triploid trout habitat cover associations recorded during the Study 9 fish capture program from March to September 2007 (excluding June) in the Boundary Reservoir and Tailrace Reach.

Month	Dominant Habitat (percent)					n
	None	Root Wads	Logs	Aquatic Vegetation	Boulder, Large, Cobble	
Mar	20	20	60	0	0	5
Apr	55	0	18	0	28	40
May	71	0	0	0	29	24
Jul	100	0	0	0	0	1
Aug	27	0	27	9	36	11
Sep	0	0	0	0	100	1

**5.3.6. Triploid Loss**

Planted triploid trout are potentially lost from the reservoir through sport fishing, natural mortality (e.g., disease and predation), and entrainment through either the Boundary Dam powerplant or spillways. To evaluate triploid loss, the length frequency of March 2007 captures of carry-over triploids was compared with fish from the spring 2007 release (Figure 5.3-5). This comparison indicated that two separate groups of triploid trout were already present in the reservoir, prior to the spring 2007 release. Based on past triploid release data (Table 5.3-10), the larger fish were likely the fall 2005/spring 2006 (and older) releases and the smaller group from the fall 2006 release (Figure 5.3-5). Although based on limited data, the length distribution of the fish capture in March 2007 suggested that the fall 2006 release did not grow significantly over the winter. Furthermore, when the length frequency of fall 2006 and spring 2007 releases were compared, they overlapped and could not be separated. This overlapping suggests that each fall triploid release and the following spring triploid release are effectively a single release group when analyzed by length frequency. Fish less than 310 millimeters in fork length were likely released in fall 2006 (see Figure 5.3-5).

The total number of triploids released in spring 2006/fall 2005 was 9,000, compared to 4,300 fish released in fall 2006. Based on the length frequency data in Figure 5.3-5, only a small number of the triploids survive through the summer and carry over to the following spring.



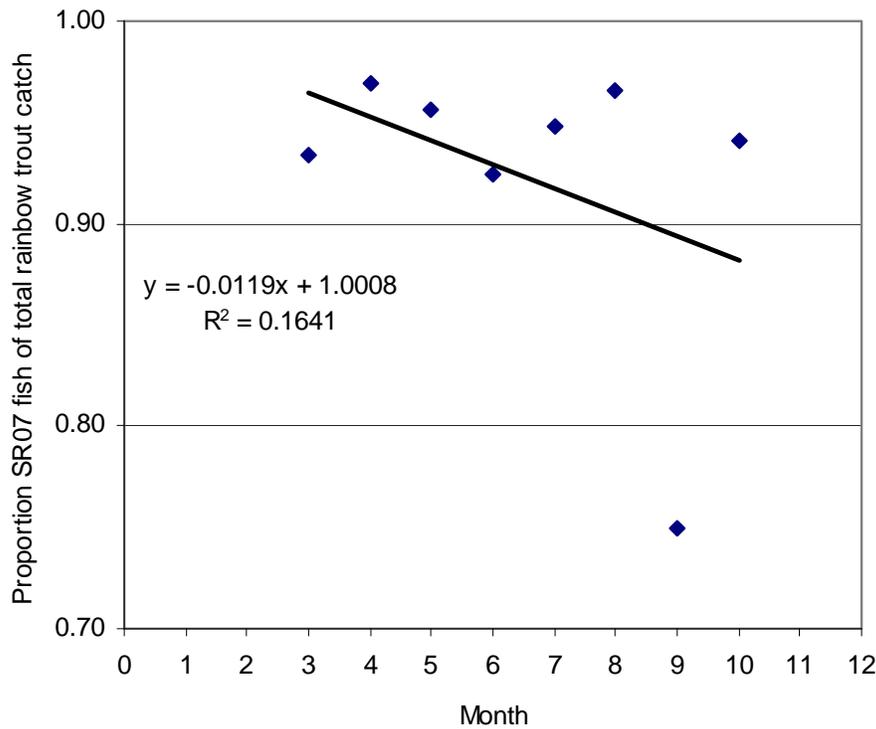
**Figure 5.3-5.** Length frequency distribution of all triploid rainbow trout captured between February 25 and March 13, prior to release of spring 2007 triploid trout on March 29 and 30 (A) compared to the length frequency distribution spring 2007 release (SR07) (B).

Note: Spring release (SR) and fall release (FR) for 2006 and the fall release in 2005 are identified.

**Table 5.3-10.** Historical Boundary Reservoir triploid release information from May 2001 to October 19, 2007.

Date	Size (in.)	Location	# Fish	Notes
May-2001	11-14	Box Canyon	2,100	1/2 tagged
Nov-2001	9-10	Boundary Dam	5,470	1/2 clipped Adipose Fin
Oct-2002	9-10	Jackies-Between Metaline and Box	6,050	
Oct-2002	1-3 lbs	Jackies-Between Metaline and Box	250	
Mar-2003	11-14	Box Canyon	3,300	
Oct-2003	11-14	Jackies-Between Metaline and Box	2,300	
Oct-2003	1-3lbs	Jackies-Between Metaline and Box	670	
Mar-2004	9-10	Boundary Dam	3,400	
28-Oct-04	9-11	Boundary Reservoir	2,000	
28-Oct-04	16-18	Boundary Reservoir	450	
28-Mar-05	9-11	Metaline Boat Launch	4,500	
7-Nov-05	9-11	Boundary Reservoir	4,500	
15-Mar-06	9-11	Metaline Boat Launch	4,500	
9-Nov-06	9-11	Boundary Reservoir	4,300	
29-Mar-07	9-11	Boundary Reservoir	1,580	Unmarked
29-Mar-07	9-11	Boundary Reservoir	500	Tagged
30-Mar-07	9-11	Boundary Reservoir	10	Radio transmitter
30-Mar-07	9-11	Box Canyon Tailrace Launch	10	Radio transmitter
30-Mar-07	9-11	Box Canyon Tailrace Launch	1,600	Unmarked
30-Mar-07	9-11	Box Canyon Tailrace Launch	500	Tagged
18-Oct-07	9-11	Box Canyon Tailrace Launch	1,600	Unmarked
18-Oct-07	9-11	Boundary Reservoir	1,580	Unmarked
18-Oct-07	9-11	Boundary Reservoir	500	Tagged
19-Oct-07	9-11	Box Canyon Tailrace Launch	500	Tagged
19-Oct-07	9-11	Box Canyon Tailrace Launch	10	Radio transmitter
19-Oct-07	9-11	Boundary Reservoir	10	Radio transmitter
<b>Total Number of Triploid Released</b>			<b>52,090</b>	

An estimate was developed of relative survival of newly stocked triploid trout compared to carry-over triploid trout. This information gives an idea of how well newly stocked triploid trout fare in the system compared to their older and larger counterparts. Native rainbow trout populations in the Boundary Reservoir were assumed to be negligible. It was also assumed that first year triploids and carry-over triploid have the same capture probability. Based on an estimated increase in fork length of 0.50 millimeter per day at large derived from Study 9 external tag recapture data, the likely maximum fork length of the upper quartile spring 2007 release fish was estimated in relation to days at large at the time of capture. The fork length of each rainbow trout captured during the Study 9 fish capture program was then compared to this calculated value. If the fish captured had a fork length larger than the calculated spring 2007 release potential maximum, this fish was classified as a carry-over. This classification of triploid trout as carry-over was also confirmed by examination of monthly length-frequency histograms. Linear regression was used to calculate the rate of change in the proportion of spring 2007 of total rainbow catch by month (Figure 5.3-6).



**Figure 5.3-6.** Relative rate of loss of fall 2006/spring 2007 release triploids estimated from the change in rainbow trout (triploid) catch composition from March 29 to October 18, 2007.

Note: The September proportion estimate was based on a total catch of eight fish.

The relative rate of loss of the spring 2007 release triploid (and fall 2006 fish that are indistinguishable from spring fish in length) was not distinguishable (significance:  $p = 0.3194$ ) from the carry-over triploid trout (those spending at least one summer in the reservoir). This suggests that the survival rate of spring 2007 and fall 2006 plants was not distinguishable from the survival rate of carry-over triploid trout from spring 2006 and fall 2005.

Anecdotal information from anglers about triploid loss was provided by T. McGregor (SCL employee, personal communication, 2007). In 2001, approximately 1,000 external tags were deployed out of 2,100 fish released. During a weekend bass derby in May 2003, a \$50 reward was offered for every external tag returned; however, no tags were returned.

An estimate of triploid loss from the reservoir was based on the entrapment of radio- and CART-tagged fish. In total, 4 of the 35 transmitters (11 percent) of deployed tags in the reservoir were entrained (fish 28, 78, 88, and 89), although subsequent data obtained for one of these fish (fish 28) suggested that the tag was moved downstream by an avian predator, either by scavenging the fish from the Forebay Reach or scavenging the fish from the Tailrace Reach after entrapment and subsequently flying downstream. Researchers were unable to determine if these fish were alive and actively swimming at the time of entrapment. Recovery of external tags downstream of Boundary Dam was minimal (i.e., four recaptures in the tailrace, two angler tag

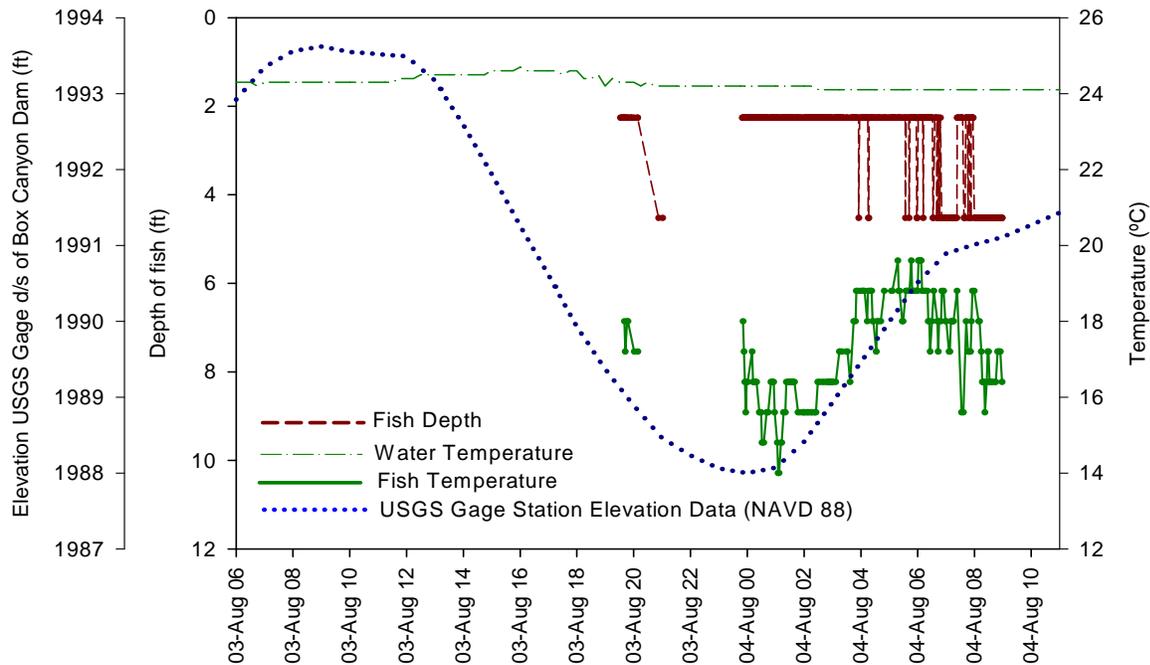
returns); however, moderate numbers ( $n = 39$ ) of carry-over triploids were captured in the Tailrace Reach.

### **Triploid Trout and Native Salmonid Habitat Use Comparison**

Comparison of habitat use between triploid trout and native salmonids was not possible due to low numbers of native salmonids tagged and the high mortality rate of radio- and CART-tagged triploids. Use of cold water refugia by triploids was observed visually and through telemetry tracking of tagged triploids to cold water refugia during periods of high reservoir temperatures. External tags recovered by anglers and from fish recaptured during Study 9 also suggest use of cold water refugia by triploid trout. During intensive tracking of a native salmonid on August 3, 2007, near the mouth of Sweet Creek, CART tag sensor data from a triploid trout (fish 55) in the same vicinity were recorded. Depth and temperature recorded were compared with changes in reservoir temperature and elevation over time. During monitoring, fish 55 remained at shallow depths between 2 and 5 feet at water temperature between 14 and 20°C (Figure 5.3-7). The lowest temperature recorded where the fish was located and shallow depth corresponded to the lowest reservoir elevation (~1,988 feet NAVD 88 [~1,984 feet NGVD 29<sup>1</sup>]) recorded during the monitoring session. This behavior was similar for the native cutthroat trout tracked on the same date at the mouth of Sweet Creek. The cutthroat trout had similar changes in depth and range of temperature use, remaining mostly between 4 and 7 feet deep, and 15 to 22°C (SCL 2008b). Other evidence of cold water refugia use by trout at this time was a visual estimate of what appeared to be 130 triploid trout in the cold water plume of Sweet Creek.

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<sup>1</sup> SCL is in the process of converting all Project information from an older elevation datum (National Geodetic Vertical Datum of 1929 [NGVD 29]) to a more recent elevation datum (North American Vertical Datum of 1988 [NAVD 88]). As such, elevations are provided relative to both data throughout this document. The conversion factor between the old and new data is approximately 4 feet (e.g., the crest of the dam is 2,000 feet NGVD 29 and 2,004 feet NAVD 88).



**Figure 5.3-7.** Depth and temperature CART sensor data recorded during intensive tacking of fish 55 near Sweet Creek on August 3, 2007.

Note: Elevation datum was NAVD 88.

### 5.3.7. Triploid Trout Management Issues and Options

Assessment of triploid management practices and risks was conducted through a literature review and an interview with the WDFW triploid program manager, which is summarized in Appendix 1. The following were the results of this effort:

- There are too few native salmonids using the reservoir to quantitatively assess interactions with triploids.
- Thermal refugia in the reservoir have high densities of triploids and likely have most salmonids using them during the period of thermal maxima. It is not known if the high densities of fish in these areas for a short time of the year result in any density dependent effects on growth or survival.
- Entrainment of triploids has occurred based on radio telemetry, tag returns by anglers, and Study 9 recoveries of triploid trout in the Tailrace Reach area due to evidence that triploid trout were not stocked directly into Seven Mile Reservoir or its tributaries (FISS 2008).
- Stocking of triploid fingerlings in other areas in Washington and in Alaska has provided cost-effective return of catchable-sized fish to anglers in the following year; however, summertime rearing conditions in Boundary Reservoir may be substantially

different than areas where this has been a successful strategy, and fingerling stocking may have ramifications other than cost.

- Survival rates of the catchable-size fish are relatively low, based on length frequency mode analyses but not abnormal for this type of fish stocking.
- Return to fishermen from the releases is likely over 10 percent, based on reward tag returns, but could be much higher if similar to other triploid programs in Washington.
- Based upon angler returns of tags, triploid trout released in the Box Canyon tailrace tend to become more widely distributed in the Boundary Reservoir and have a higher harvest rate than fish released in the Forebay Reach.

## 6 SUMMARY

### 6.1. Recreational Creel and Angler Surveys

The tagged fish reward program was in operation beginning on March 29, when tagged triploid trout were released into Boundary Reservoir, through the end of 2007. Through December 2007, anglers submitted 67 reports accounting for 130 tags. Fully 70 percent of all tags returned for the year were received in May, June, and July, with 30 or 31 tags returned in each month. Most (54 percent of the total) of the reports came from the nearby communities of Metaline, Metaline Falls, and Ione, with 22 tag reports from Ione representing by far the largest single source of returns from any community. Anglers reported the catch location for virtually all of the tags returned. The specific location most commonly identified was Box Canyon Dam (i.e., the tailrace, associated with 20 tags), followed by Boundary Dam (i.e., the Forebay Reach, with 12 tags). Tributary creeks or creek mouths (Slate, Sweet, Lime, Sullivan, and Flume Creeks) accounted for 24 of the reported catch locations, and another 6 locations were identified as “near Slate Creek). The proportion of tagged fish caught that were reported by anglers is unknown.

The visitor survey and the area resident survey conducted as part of the program for Study 21 provide a substantial volume of information related to fishing in the study area. Questions incorporated in these survey instruments addressed both creel survey and angler survey objectives identified for Study 13. The visitor survey provided samples ranging from approximately 150 to 227 respondents (out of a total survey population of approximately 600) who indicated they participated in fishing during their visit to the Boundary Reservoir Area and responded to at least some of the survey questions related to fishing and boating. Although the total population for the area resident survey was similar in size, many of these respondents reported they did not use the Boundary Reservoir Area for recreation and approximately 80 (out of 400 surveys for which responses had been entered through approximately November 15, 2007) responded to the fishing and boating questions. The survey responses provide information about fishing activity and success that can be used (with appropriate qualification) to develop estimates of fishing effort and catch rates. The survey responses also include useful information about the means used for fishing (i.e., from a boat or the shore), access facilities anglers use for launching boats, species preference, and satisfaction with the fishing opportunities. Although “average” was the most common satisfaction rating from each set of respondents, half (50 percent) of the area resident respondents and somewhat more (62 percent) of the visitor respondents provided above-average satisfaction ratings.

The RSP indicates that recreational creel survey work will be conducted to estimate level of angler effort, catch rate, and harvest rate during the 2007 and 2008 recreational fishery seasons. The RSP also states that the angler survey component of Study 13 will be conducted during the 2007 season and may be continued during the 2008 fishing season to increase the number of completed questionnaires, depending on the results of the 2007 survey effort. While the RSP contemplates additional creel survey effort during the 2008 season, it also addresses evaluating the need for additional survey effort based on the results of the 2007 survey activity. The visitor and area resident survey effort in 2007 successfully obtained abundant information applicable to both the recreational creel and angler survey objectives. However, an additional year of data collection would help determine whether the reported 2007 catch and effort conditions were representative. Because the creel portion of the survey was anticipated to occur in 2008, no variance to the RSP will be proposed. Since the angler portion of the survey addressing many factors beyond catch and effort obtained a very high rate of return, it will not be repeated in 2008.

Creel survey work conducted during 2008 would be conducted as a separate field activity, because the broader recreation survey effort conducted for Study 21 will not be repeated in 2008. Specific creel survey methods and instruments for use in 2008 would be refined, based on review of the 2007 results, prior to implementing work in 2008.

## 6.2. Biotelemetry

Assessment of larger fish movement patterns in response to temporal changes in environmental parameters was not possible due to the high mortality rate of radio- and CART-tagged fish. Overall, specific movement in response to changes in environmental parameters was only recorded during intensive tracking for a single CART-tagged carry-over triploid trout (fish 55) that was in the vicinity of Sweet Creek during the monitoring of a westslope cutthroat trout in the same area on August 3, 2007. To a lesser extent, a few radio-tagged spring 2007 release triploids also exhibited movement in response to high reservoir water temperature and apparently moved into areas assumed to be cold water refugia (e.g., fish 77 and 40). Use of cold water refugia by triploid trout was also reliably confirmed through visual confirmation during intensive tracking on August 3, where aggregations of triploids (~130 individuals), including a few with external tags, were observed within the scoured outflow channel of Sweet Creek. Use of tributary deltas by fish during the summer was also known by anglers. During intensive tracking, field staff were informed by anglers fishing near the Sweet Creek delta that a large portion of their catch the previous week were triploid trout and several to many external tags were collected. If this report was accurate, the tags from fish caught in the Sweet Creek delta were not turned in by the anglers for the tag reward because only five tag rewards were claimed for tagged fish that were reported as captured at Sweet Creek.

Telemetry data also were useful in obtaining an estimate of triploid entrainment through the Boundary Dam powerplant based on the proportion of entrained telemetry tags to the total deployed in the reservoir. In total, three radio-tagged fish and one CART-tagged fish were entrained out of 35 deployed tags in the reservoir. Telemetry data recorded in the Forebay Reach and Tailrace Reach were able to determine the exact day and time each fish was entrained. Although it was assumed all four fish were alive, live status was initially assumed for fish 28 based on relocation downstream and confirmation of upstream movement. The health of fish 28

was later considered suspect based on recent telemetry data provided by BC Hydro and later comparison with Red Bird Creek station data that indicated multiple concurrent detections at both stations, suggesting that tag may be located on shore within range of both receivers. Discharge through the powerplant during entrainment of fish 78, 88, and 89 ranged between 31,194 and 43,319 cubic feet per second.

The high mortality rate of tagged triploid trout was likely due to several factors. The following conditions and environmental factors may have contributed to the mortality of radio- and CART-tagged triploid trout:

- Stress during transport from the hatchery combined with stress from tag implantation;
- Inherent poor condition of triploid trout compared to native species;
- Predisposition to capture by anglers;
- Predisposition to predation by avian, terrestrial, and aquatic fish predators; and
- Thermal stress during high reservoir water temperatures.

Possible procedural techniques that may contribute to increased mortality of radio and CART triploid trout were as follows:

- Excessive handling, transport and prolonged hold time in live-wells after tag implantation to release fish near capture location; and
- Capturing fish by electrofishing at water temperatures higher than 18°C.

Possible modifications to the proposed 2008 triploid tagging program are presented in Section 7.

### **6.3. External Tag Recapture and Angler Tag Returns**

The number of external tags recaptured during the Study 9 fish capture program (4 percent recapture rate) was lower than the number of angler tag returns (13 percent return rate). Tag return data suggested that triploids released in both the Forebay Reach and the Box Canyon Reach tended to remain near their release site until summer. Dispersal to other portions of the reservoir by fish released at both locations was confirmed; however, not unexpectedly, fish deployed at Box Canyon appeared to disperse downstream faster than fish deployed in the Forebay Reach dispersed upstream. Statistically, this difference in dispersal rate was not significant. Additional data to be collected in 2008 would allow possible verification of this trend.

Growth rates estimated from recapture and angler return data based on comparison of fork length at release and at capture suggested that fish released at Box Canyon Dam had higher growth rates than fish released in the Forebay Reach. Again, these differences were not statistically significant. Additional data to be collected in 2008 would allow possible verification of this trend.

Preliminary length frequency data from fish captured in the reservoir in March 2007 indicated that the fall 2006 release triploids did not grow substantially over the winter and that these fish cannot be distinguished from spring 2007 release triploids based on length. This growth difference likely applied as well to all previous fall and spring triploid releases. Verification of

this initial finding will be possible based on length data from fall 2007 release triploids obtained as part of the ongoing Study 9 fish capture program.

Loss (e.g., natural mortality, harvest, predation, and emigration) of triploid trout from the reservoir was examined, based on the length frequency data from spring sampling prior to the spring 2007 release. The analysis suggested relatively small percentages of the fall and spring releases survive through to the following autumn, which is consistent with other studies of triploid catchable fish survival (Havens et al. 1995). Verification of this initial finding will be possible based on length data from fall 2007 release triploid obtained as part of the ongoing Study 9 fish capture program in 2008.

Habitat use comparison between triploid trout and native salmonids could not be conducted due to the low numbers of native fish tagged. Additional tagging and data collection in 2008 may provide a better indication of niche overlap between the triploids and native species.

#### **6.4. Triploid Management Options**

Alternative triploid management options will be more fully developed following the 2008 studies. Potential changes could include the timing, stocking location, size at stocking and stocking level (e.g., eliminate fall stockings, eliminate or reduce Boundary Forebay stocking levels, increase overall stocking levels, etc.). Changes in the current strategy could potentially be evaluated for changes in survival, growth, and harvest rates.

Given the low number of fish currently being stocked, the stocking rates would likely need to be increased substantially before any changes in growth or survival would likely be observed. One exception would be if impacts occur because of competition for space in cold water refugia during a limited time of the year. Such competition would be very difficult to model or predict and would likely require empirical data from alternative stocking densities before convincing evidence of density dependent effects could be obtained.

Benefits or risks of changes in the existing program will most likely be evaluated through changing practices and using adaptive management approaches to evaluate results and making adjustments to the stocking program.

### **7 VARIANCES FROM FERC-APPROVED STUDY PLAN AND PROPOSED MODIFICATIONS**

#### **7.1. Variances**

There were no significant variances in the executed study plan from the RSP (SCL 2007). Small sample sizes because of lack of available native fish precluded comparisons of triploids with native species, particularly salmonids. Small adjustments were made to the telemetry program to accommodate logistical issues as described in the methodology.

The one proposed variance to the study plan relating to the recreational fishery study is presented below:

1. Survival of triploid trout radio-tagged during fall 2007 will be evaluated over the winter. If survival is poor, additional radio-tagging of triploid trout planned for the spring of 2008 will be reconsidered and discussed with relicensing participants. If the radio-tagging of spring 2008 triploid releases is eliminated, these tags could potentially be re-allocated to additional tagging of carry-over triploid trout.

## 7.2. Proposed Modifications

The following recommendations are intended to refine sampling efforts for 2008. These recommendations are not considered variances for the FERC-approved study plan.

The recommended modification to the recreational and angler survey follows.

1. Do not conduct the angler survey portion of the creel and angler survey in 2007. A very high rate of return of the angler survey forms occurred during 2007 from both on-site visitors and residents. This information supplied good confidence that the desires and use information of anglers and other recreational users were well quantified. Therefore, another year of detailed angler survey questions would not substantially change overall assessment of use and desires for the Boundary Project area concerning angling-related activities.

Several of the recommendations suggested in the Study 9 Interim Report (SCL 2008b) will also likely benefit the biotelemetry aspects of the triploid biotelemetry monitoring program.

Recommendations for the 2008 triploid biotelemetry and external tagging work are as follows:

1. Implant CART tags in triploid trout at water temperature no greater than 15 to 16°C. Review tagging and handling procedures to identify factors that may increase mortality.
2. Conduct a dedicated fish capture session using local anglers for carry-over triploid trout and tag them during optimal environmental conditions. Fish captured should be operated on immediately and released within 1 hour after recovery. Tagged fish should not be held in live wells for sustained periods while the boat is moving.
3. Deploy more external tags (750 in each of the Forebay and Box Canyon tailrace groups) in the spring 2008 release.
4. Record both fork length and total length of spring 2008 release and all triploids captured under Study 9.

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## **Appendix 1. Triploid Management Issues and Options Information**



## **Triploid Management Issues and Options Information**

Stocking of triploid trout has risks and benefits. The following discussion addresses the major management concerns of triploid trout being introduced into surface waters.

### **Disease**

Introduction and transfers of fish involve risks as well as benefits. Codes of practice with a logical framework for thorough evaluation of proposed introductions and transfers have been developed; a widely known example was developed by ICES (International Council for the Exploration of the Sea) and EIFAC (European Inland Fisheries Advisory Commission) as detailed in Turner (1988). Given crowded hatchery conditions and their history as source of disease transmission, and the possibility for reduced fitness (including reduced immunity) where natural selection is not in force, codes of practices should apply for the introduction and transfer of hatchery fish to natural waters.

WDFW has a document The Salmonid Disease Control Policy of Fisheries Co-Managers of Washington State that is ostensibly used to guide fish health decisions including hatchery practices and transfers of fish, eggs, water, carcasses, etc. It is for WDFW as well as tribal and private entities. Fish stocking at the Boundary Project should be subject to these standards. However, John Kerwin, WDFW's Hatcheries Division Manager, said WDFW no longer conducts fish health inspections at private suppliers' facilities, and that fish health is the responsibility of the individual suppliers (Kerwin, WDFW ,personal communication, December 4, 2007).

Whirling disease in salmonids is caused by the protozoan *Myxosoma cerebralis*, and it is propagated through an intermediate host, a tubifex worm. The intermediate host can be transmitted to other water bodies via bird or other animal feces. Mr. Kerwin stated that whirling disease has never been observed in a private farm or public hatchery in Washington State. He said a wild fish health survey conducted in 2001 and 2002 found evidence of whirling disease in streams in northeast Washington, possibly including tributaries to the Pend Oreille River, and more generally in headwater streams in the Colville National Forest. Mr. Kerwin said he had no idea of the origin of the disease in those waters (Kerwin, personal communication, [date?]).

Mr. Kerwin mentioned that whirling disease was found in 2004 in a private hatchery in suburban Portland, Oregon. The facility reared rainbow trout in earthen ponds, and was partially closed by Oregon Department of Fish and Wildlife after the whirling disease was discovered. Four sites in Washington State that received fish from the private Oregon hatchery were sampled, and Mr. Kerwin said he did not recollect finding any evidence of the disease in those sites. He said most of the sites were farm ponds, providing a "dead end" effect for disease transmission, and that likelihood of disease transmission was further reduced because most fish did not survive through the summer. Mr. Kerwin acknowledged that the disease could be transmitted to other areas via bird or other animal feces (Kerwin, WDFW, personal communication, December 4, 2007).

Mr. Kerwin said whirling disease was also observed in the early 1990s in the Grande Ronde River (southeastern Washington), a tributary to the Snake River, and may have originated further

upstream in the Snake River valley, possibly in a state or federal hatchery or in one of the private trout farms in Idaho. He also mentioned whirling disease had been found in one Chinook that returned to the Priest River hatchery, and speculated that fish may have originated in Idaho. Mr. Kerwin said an unidentified *Myxobolus* organism (same genus as the causative agent of whirling disease) was found in the Entiat River system, but its species was not *cerebralis*, the same as whirling disease, and that infected fish exhibited a pathology, but not similar to whirling disease (Kerwin, WDFW, personal communication, December 4, 2007). It is very possible that disease outbreaks are not more prevalent because of the very specific nature of the intermediate host for the pathogen (Marnell 1986).

Given the presence of bass (*Micropterus* spp.) at the Boundary Reservoir, it is also worth noting here that larvae from the bass tapeworm (*Proteocephalus ambloplites*), a cestode, have been found in wild salmonids that were in waters shared with introduced black bass (Becker and Brunson 1968). The principal intermediate host for this cestode is *Cyclops bicuspidatis*, a prey item for salmonids (Antipa 1974).

## Genetic Effects

Genetic impacts on native salmonid populations are the primary reason triploid trout are more frequently used for planting in support of local sport fisheries. Genetic effects of stocking can have at least three forms: interspecific and intraspecific introgression, and indirect effects on a native population's genetic integrity through disease, ecological imbalance, and changed community structure. Good conservation practices generally seek to maintain the widest range of a species' adaptations. With geographically isolated sub-populations, these adaptations can be very local in nature and likely reflect an evolved response to the selective pressures of that area's environmental conditions. Cutthroat trout in particular have many subspecies with much genetic, morphological, and ecological variation (Allendorf and Leary 1988).

Interspecific introgression – hybridization between species – can produce offspring with reduced fitness. Leary, Allendorf and Knudsen (1985) found that hybrids between rainbow trout and three different subspecies of cutthroat trout had decreased developmental stability. Allendorf and Leary (1986) produced experimental hybrids between rainbow trout and westslope cutthroat trout to test for differences in growth rate; hybrids had slower growth rates than parental taxa under hatchery conditions. Martin et al (1985) found evidence of introgression from rainbow trout in 7 of 39 cutthroat trout populations in Utah, and introgressed populations of Paiute and coastal cutthroat trout with rainbow trout were described by Busack and Gall (1981) and Campton and Utter (1985). Evidence of hybridization and introgression between introduced rainbow trout and Yellowstone cutthroat trout was also detected by Allendorf and Leary (1986).

Where species introduced are the same as native species, but from a different stock, intraspecific introgression can occur, altering the native species' genome and adaptations to local conditions, including subtle behavioral and physiological traits (Coates 1998; Hindar et al 1991). For example, much of the genetic variation within the westslope cutthroat trout subspecies occurs in relatively few local populations; preserving genetic variation requires preserving as many local populations as possible (Allendorf and Leary 1988).

Allendorf and Leary (1988) identify the greatest danger to the conservation of cutthroat trout as introgressive hybridization among subspecies and with rainbow trout.

Because the fish stocked at the Boundary Project are triploid, the risk of genetic introgression is minimized. However, some research has shown that triploid males, though they have few or no gametes, may still have spawning behavior, migrating to spawning grounds and competing with other males for females. Stocking only female triploids in put-and-take fisheries is one possible solution as this strategy has been implemented in fisheries in Alaska where there is the potential for interaction with native stocks (Havens et al. 1995).

## **Ecological Impacts and Changes to Community Structure**

Apart from possible impacts associated with genetic introgression and introduction of disease detailed above, hatchery-reared fish can have impacts to ecology and community structure. Significant predation by introduced brown trout on resident fish has been observed on other salmonids (Taylor et al. 1984) as well as non-game fish (Moyle and Marciochi 1975; Garman and Nielsen 1982). Sholes and Hallock (1979) reported that stocked yearling Chinook (*O. tshawytscha*) consumed up to 15 times as many stocked Chinook fry in the Feather River, California.

Bachman (1984), Petrosky (1984), and Petrosky and Bjorn (1985) studied the effects of hatchery trout on wild populations, and found that energy-conserving behaviors determined the results of competition between hatchery and wild fish. Bachman (1984) found that wild fish tended to prevail as they were better able to conserve energy for extended periods. Petrosky (1984) observed competition between hatchery and wild trout, but more often for positioning to feed than for individual acts of feeding. This positioning established size-dominated hierarchies, and suggested that the inefficient foraging behavior learned by hatchery trout – scrambling periodically, rather than feeding methodically to conserve energy – put them at a competitive disadvantage.

Relatively little research has been done comparing growth and survival of wild fish after hatchery fish introductions, or results were compromised by lack of control or other experimental design flaws. Petrosky (1984) reported no significant impacts on growth or survival of wild trout in Idaho streams from introduced hatchery rainbow trout, even at very high stocking densities. Reisenbichler and McIntyre (1977) mated Deschutes River (OR) steelhead to test for growth and survival. Crosses were hatchery with hatchery, hatchery with wild, and wild with wild. The pure wild fish had the highest survival in the natural stream environment, and the hatchery/wild cross tended to have higher growth rates in the same environment. The pure hatchery fish had the highest growth and survival rate but only when reared in the hatchery ponds. Vincent (1975, 1985) conducted very long-term monitoring of wild rainbow and brown trout populations in the Madison River (Montana) and concluded that both numbers and biomass of wild trout increased substantially after stocking was discontinued, though the study results were somewhat compromised by environmental changes (increased in-stream flows) close to the time when stocking ceased.

Competition could result in displacement of the less well-adapted species, or in extreme cases, complete replacement. Looking specifically at effects of hatchery-reared fish on wild fish, some research has demonstrated encroachment of brown trout populations on wild brook trout, and rainbow trout on native brook trout populations (Marnell 1986).

### **Triploid Stocking Rates**

Optimum stocking densities of both triploid and diploid rainbow trout as fingerlings have been explored experimentally by the State of Alaska (Havens and Sonnichsen 1992). The study was limited to natural lakes without an outlet capable of passing fish. Stocking densities of fry at 50, 100, 200, 400, 800 and 1,000 fish per surface acre of the lake resulted in annual survivals of 37 percent, 35 percent, 30 percent, 11 percent, 10 percent, and 15 percent, respectively. Growth rates based on size at recapture indicated a similar trend. Based on this study and economic analysis, policies were adopted that limit stocking of rainbow trout to 100 fish per surface acre in lightly fished lakes and 200 fish per surface acre in heavily fished lakes. Catchable sized fish (> 200 cm) are typically stocked in Alaska at densities of 50-300 fish per acre and are generally not stocked in lakes where competition with natural stocks is a potential. If there is any potential for interbreeding, only triploid females are stocked. Comparative studies suggest growth rates and survival are less for triploids when compared with diploids but the numbers are still sufficient to justify the stocking program. Catchable programs were confined to systems that were having very high use with harvests occurring rapidly with high public access (Havens et al. 1995).

Densities of stocking of triploid catchable size rainbow in the spring and fall in Boundary Reservoir are far below standards practices used in other jurisdictions (9,000/1,636 surface acres = ~5.5/acre). The only likely time that densities may be a factor is when fish aggregate in cold water refugia during the summer months. This may limit growth during this period of time because of intra-specific competition but is likely to have little impact on overall survival. The high degree of aggregation likely contributes to fishermen's success rate. Because of the very low density of salmonids in the reservoir, competition for space during these warm periods would likely be the only time of the year where the triploids may significantly compete for resources with native salmonids. The low numbers of native salmonids encountered preclude quantitative assessment of any of the effects other than as indicated from very limited telemetry data, they likely occupy the same habitat during the warmest part of the year.

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## **Appendix 2. Project-Area Visitor Questionnaire**





**Seattle City Light**

# **SURVEY**

of Recreation Visitors to the  
**Boundary Reservoir Area**

Northern Pend Oreille County, Washington

Site Name \_\_\_\_\_

Date \_\_\_\_\_

# *Introduction to Boundary Visitor Survey*

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Dear Visitor,

Seattle City Light (SCL) operates Boundary Dam and Reservoir and provides several recreation sites in the area. SCL is conducting a survey to learn about your opinions and experiences concerning recreation in the Boundary Reservoir Area and nearby areas in northern Pend Oreille County.

By completing this survey you will help SCL and other resource managers maintain and improve the recreation opportunities available at Boundary Reservoir. Your participation in the survey is completely voluntary and your answers will be kept in strict confidence. We estimate that it may take up to 15 minutes to complete.

To show our gratitude, all visitors completing a questionnaire will be entered into a prize drawing to occur at the end of the study. A pool of 10 people who complete the survey will be selected at random to receive cash prizes ranging from \$20 to \$150. There is a space at the end of the questionnaire for you to provide contact information so that we may notify you if you are selected for a cash prize. Your name and contact information will not be provided to a third party and will be destroyed after the drawing.

We encourage you to take time now to complete the questionnaire and hand it back to one of our crew members. If you complete your survey after we have left, please place it in one of the labeled drop boxes provided at the Vista House, the Boundary Dam Visitors' Gallery, the campground or the boat ramp at the Forebay Recreation Area, the boat ramp at Metaline Waterfront Park, the campground below Box Canyon Dam (Campbell Park), or at Sweet Creek Falls Rest Area. If you cannot complete the questionnaire during your visit, please place it in the stamped, self-addressed envelope provided and send it to us by mail within the next week.

Most of the questions ask you about your current visit to the Boundary Reservoir Area as opposed to visits that you have made in the past.

If you have any questions regarding this survey, please contact me at

**509-446-3083** or **lonnie.johnson@seattle.gov**

or Michele Lynn, SCL's Recreation Resources Coordinator, at

**206-386-4578** or **michele.lynn@seattle.gov**.

Thank you for your cooperation with this important recreation study!

Sincerely,

Lonnie Johnson

Boundary Powerhouse Supervisor

# Information on Your Visit

1. Is this your **first** visit to the Boundary Reservoir Area? (Please see map for extent of area. Circle one.)

1 No → Skip to Question 3

2 Yes

2. Do you think that you would visit the Boundary Reservoir Area again? (Circle one.)

1 No

2 Yes

3 I'm not sure

3. How many people, including yourself, are in your group for this visit? (Your group is all the people you arrived with and/or planned to meet here.)

# \_\_\_\_ People    # \_\_\_\_ Males    # \_\_\_\_ Females

4. On this visit to the Boundary Reservoir Area, are you staying overnight? (Circle one.)

1 No, just passing through on the way to somewhere else → Skip to Question 6

2 No, just here today for a total of \_\_\_\_ hours (Write number of hours.) → Skip to Question 6

3 Yes, staying overnight for a total of \_\_\_\_ nights (Write number of nights.)

5. Where are you staying overnight? (Circle all that apply if you are staying more than one night.)

1 Campground at Boundary Dam (Forebay Area) in a tent \_\_\_\_ or in an RV/camper \_\_\_\_ (Check one)

2 Campground at Box Canyon Dam (Campbell Park) in a tent \_\_\_\_ or in an RV/camper \_\_\_\_ (Check one)

3 U.S. Forest Service campground (Please name.) \_\_\_\_\_

4 Privately-operated campground (Please name.) \_\_\_\_\_

5 Hotel, motel, resort or bed & breakfast (Please name the town.) \_\_\_\_\_

6 Private home of family or friends

7 Other (Please describe.) \_\_\_\_\_

6. What is the ZIP code or postal code at your primary residence? (where you live on a permanent basis)

ZIP/Postal Code \_\_\_\_\_



# Recreation Activities

7. Please indicate which of the following activities you plan to do or have done during this visit to the Boundary Reservoir Area. (Circle all that apply.)

- |   |   |
|---|---|
| 1 Fishing   | 14 Photography  |
| 2 Swimming  | 15 Nature study (bird/wildlife watching, flowers/rocks)                       |
| 3 Picnicking  | 16 Collecting edible fruits, berries, mushrooms                               |
| 4 Motor boating for pleasure                                | 17 Car/tent/RV camping (developed facilities, services, people present)       |
| 5 Water skiing  | 18 Car/tent/RV camping on back roads (secluded, no services, fewer amenities) |
| 6 Canoeing/kayaking   | 19 Boat-in camping along river shoreline                                      |
| 7 Personal watercraft (jet ski)                             | 20 Socializing  |
| 8 Viewing scenery/sight seeing                              | 21 Spending time alone  |
| 9 Viewing/visiting the dam(s)                               | 22 Off-roading (dirt bike, ATV, 4X4)  |
| 10 Traveling State Route 31 North Pend Oreille Scenic Byway | 23 Hunting  |
| 11 Day hiking/nature trails                                 | 24 Attend a special event/festival  |
| 12 Walking/jogging  | 25 Other (Please specify.) _____  |
| 13 Bicycling  |   |

8. Which one of the activities that you circled in the list above was your primary recreation activity for this visit to the Boundary Reservoir Area? (Your primary recreation activity is the one that you spent the most time doing. Please write the number from the list on the previous page.)

I spent most of my time doing activity # \_\_\_\_\_ during this visit.

9. Overall, how would you rate the quality of your recreation experience for this visit to the Boundary Reservoir Area? (Circle one number on the scale.)

1	2	3	4	5	6	7	8	9
Very Poor			Average			Excellent		



## IMPORTANT - PLEASE READ

The Fishing Section is only for visitors who are fishing on this visit to the Boundary Reservoir Area. If you did not circle fishing in Question 7 and your party does not plan to fish on this visit, please skip to Question 16 (on page 7).

**10. How much time did/will you and others in your party spend fishing on this visit to the Boundary Reservoir Area?** *(Please write the number.)*

Number of people fishing \_\_\_\_\_

Number of days fished \_\_\_\_\_

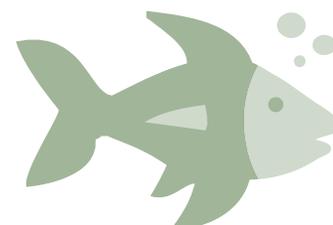
Average/typical number of hours fished per day \_\_\_\_\_

**11. How did you go fishing during this visit to the Boundary Reservoir Area?** *(Circle all that apply.)*

- 1 Boat/watercraft *(Please specify type.)* \_\_\_\_\_
- 2 Shore/bank
- 3 Both
- 4 Other means *(Please specify.)* \_\_\_\_\_

**12. In what area(s) did/will you fish during this visit to the Boundary Reservoir Area?** *(See map to identify areas. Circle all that apply.)*

- 1 Forebay area of Boundary Reservoir (Boundary Dam to north end of canyon)
- 2 Canyon area of Boundary Reservoir
- 3 Boundary Reservoir between Metaline and Metaline Falls
- 4 Boundary Reservoir between Metaline and Box Canyon
- 5 Mouth of creek(s) entering Boundary Reservoir *(Please specify.)* \_\_\_\_\_
- 6 Creek(s) entering Boundary Reservoir (above creek mouth) *(Please specify.)* \_\_\_\_\_
- 7 Other creek/stream in the area *(Please name.)* \_\_\_\_\_
- 8 Box Canyon Reservoir
- 9 Sullivan Lake
- 10 Mill Pond
- 11 Other lake/pond *(Please name.)* \_\_\_\_\_



# Fishing

13. While fishing in the Boundary Reservoir Area, what species of fish do you want to catch? (Circle all that apply.)

- 1 Triploid rainbow trout
- 2 Other trout
- 3 Smallmouth bass
- 4 Largemouth bass
- 5 Other species (Please identify.) \_\_\_\_\_

14. Please tell us about the fish you and your party caught during this visit to the Boundary Reservoir Area. (Please write your responses in the blanks.)

Type of Fish	Number Caught	Size Range (inches)
Triploid rainbow trout	_____	_____
Other trout	_____	_____
Smallmouth bass	_____	_____
Largemouth bass	_____	_____
Other: _____	_____	_____
Other: _____	_____	_____

15. Overall, how would you rate your satisfaction with the fishing opportunities at Boundary Reservoir? (Circle one number on the scale.)

1	2	3	4	5	6	7	8	9
Very Poor			Average			Excellent		



# Boat Launches and Reservoir Use

16. Did you operate or ride in a boat or other watercraft on Boundary Reservoir during this visit? (Circle one.)

- 1 No → Skip to Question 19
- 2 Yes

17. Which boat launch did you use during this visit to the Boundary Reservoir Area? (See map. Circle all that apply.)

- 1 Launch at Boundary Dam (Forebay Area)
- 2 Metaline Waterfront Park launch
- 3 Launch below Box Canyon Dam (Campbell Park)
- 4 Private boat launch (Please specify.) \_\_\_\_\_
- 5 Launched directly from shore with no boat launch (Specify.) \_\_\_\_\_ → Skip to Question 19
- 6 I'm not sure

18. Did the boat launch or launches that you circled in Question 17 adequately meet your needs for this visit to the Boundary Reservoir Area? (Circle one.)

- 1 Yes
- 2 No (Describe below any boat launch problems you encountered.)

19. Whether you used a boat or not, did the water conditions of the reservoir/river cause any problems for you during this visit to the Boundary Reservoir Area? (For example, rising or falling water levels, fast currents, or rapids. Circle one.)

- 1 I did not use or access the reservoir/river or its shoreline on this visit
- 2 No problems
- 3 Minor problems
- 4 Major problems, but this would not keep me from returning in the future
- 5 Major problems that would keep me from returning in the future
- 6 I'm not sure

(Please describe any problems with water conditions you encountered.)

# Recreation Facilities and Service

20. Different people look for different recreation facilities and opportunities. Some of the items listed below may be found at the Boundary Reservoir Area and others may not be available. Thinking about your recreation needs, please rate how **important** it is to you to have each of these items available when you recreate. Then, rate your **satisfaction** with each item at the Boundary Reservoir Area. (Circle one number for **IMPORTANCE** on the left and one number for **SATISFACTION** on the right. If something is not at all important to you or does not apply, you may circle NA.)

	IMPORTANCE					SATISFACTION					Does Not Apply
	Not at all Important			Extremely Important		Not at all Satisfied			Extremely Satisfied		
Tent campsites	1	2	3	4	5	1	2	3	4	5	NA
RV campsites	1	2	3	4	5	1	2	3	4	5	NA
RV hookups/utilities	1	2	3	4	5	1	2	3	4	5	NA
Campsite fees	1	2	3	4	5	1	2	3	4	5	NA
Parking area	1	2	3	4	5	1	2	3	4	5	NA
Road access to recreation areas	1	2	3	4	5	1	2	3	4	5	NA
Access for the disabled	1	2	3	4	5	1	2	3	4	5	NA
Drinking water	1	2	3	4	5	1	2	3	4	5	NA
Flush toilets	1	2	3	4	5	1	2	3	4	5	NA
Vault/portable toilets	1	2	3	4	5	1	2	3	4	5	NA
Trash containers/collection	1	2	3	4	5	1	2	3	4	5	NA
Picnic sites	1	2	3	4	5	1	2	3	4	5	NA
Swimming/beach access	1	2	3	4	5	1	2	3	4	5	NA
Historic sites/information	1	2	3	4	5	1	2	3	4	5	NA
Scenic views/viewpoints	1	2	3	4	5	1	2	3	4	5	NA
Wildlife viewing/nature trails	1	2	3	4	5	1	2	3	4	5	NA
Interpretive/education programs	1	2	3	4	5	1	2	3	4	5	NA
Hiking trails	1	2	3	4	5	1	2	3	4	5	NA
Boat ramps	1	2	3	4	5	1	2	3	4	5	NA
Boat docks	1	2	3	4	5	1	2	3	4	5	NA
Boating safety information	1	2	3	4	5	1	2	3	4	5	NA
Navigation hazard marking	1	2	3	4	5	1	2	3	4	5	NA
River/shore access for fishing	1	2	3	4	5	1	2	3	4	5	NA
Fishing opportunities	1	2	3	4	5	1	2	3	4	5	NA
Hunting opportunities	1	2	3	4	5	1	2	3	4	5	NA
Boat-in campsites	1	2	3	4	5	1	2	3	4	5	NA
Canoe/kayak access facilities	1	2	3	4	5	1	2	3	4	5	NA
Other: _____	1	2	3	4	5	1	2	3	4	5	NA
Other: _____	1	2	3	4	5	1	2	3	4	5	NA

**21. Based on your experiences during this visit, are there any improvements to the existing recreation opportunities at the Boundary Reservoir Area that you think are needed?** *(These could be recreation ACTIVITIES that you would like to do here that are not currently available, or specific recreation FACILITIES that are not currently available or that do not adequately meet your needs. These should be activities or facilities THAT YOU WOULD USE YOURSELF if they were present. Circle one.)*

- 1 No, I am satisfied with the recreation activities/facilities currently available here
- 2 I'm not sure
- 3 Yes, I would like other recreation activities/facilities at this destination *(Please list.)*



# Your Primary Destination

---

**22. For this visit, what specific sites in the Boundary Reservoir Area do you intend to visit or have you already visited?** (See map. Circle all that apply.)

- |  |  |
|--|--|
| 1 Vista House                                    | 7 Metaline Waterfront Park                                       |
| 2 Boundary Dam Visitors' Gallery                 | 8 Campground below Box Canyon Dam (Campbell Park)                |
| 3 Picnic area below Boundary Dam (Tailrace Area) | 9 Sweet Creek Falls Rest Area/Trail                              |
| 4 Campground at Boundary Dam (Forebay Area)      | 10 Small boat-in campsite or day use site on the reservoir/river |
| 5 On the water in a boat/other watercraft        | 11 Other (Specify) _____   |
| 6 Crescent Lake                                  | _____  |

**23. Which one of the places that you circled in the list above was your primary destination for this visit to the Boundary Reservoir Area?** (Your primary destination is the site where you spent the most time during this visit. Please write the number from the above list.)

I spent most of my time at site # \_\_\_\_\_ during this visit.

**24. Please indicate whether or how much you felt crowded on this visit to your primary destination listed in Question 23.** (Circle one number on the scale.)

- |                    |   |   |                    |   |   |                   |   |   |
|--------------------|---|---|--------------------|---|---|-------------------|---|---|
| 1                  | 2 | 3 | 4                  | 5 | 6 | 7                 | 8 | 9 |
| Not at all Crowded |   |   | Moderately Crowded |   |   | Extremely Crowded |   |   |

**25. During this visit to the destination you listed in Question 23, did you experience any problems or conflicts with other visitors or their behaviors that detracted from your enjoyment of being there?** (Circle one.)

- 1 No
- 2 Yes (Please describe what occurred.)

# Your Primary Destination

---

**26. Based on your experiences during this visit at the destination you listed in Question 23, do you intend to adjust your recreation plans to avoid the presence or behaviors of other visitors at this site in the future?** *(Circle one.)*

- 1 No → Skip to Question 28
- 2 Yes

**27. How do you intend to adjust your recreation plans?** *(Circle all that apply.)*

- 1 Move my activity to a different site in the Boundary Reservoir Area
- 2 Go to a different site in the region outside the Boundary Reservoir Area
- 3 Visit this same site earlier or later in the year to avoid busier times of year
- 4 Visit this same site on weekdays instead of weekends or holidays
- 5 Visit this same site at a different time of day to avoid busier times of day
- 6 Other *(Please specify.)* \_\_\_\_\_

**28. For this visit, did you find the facilities at your primary destination that you listed in Question 23 to be adequately maintained?** *(Circle one.)*

- 1 Yes
- 2 No *(Describe any maintenance needs you thought were not currently met.)*

# Past Visits

---

**29. How many times have you visited the Boundary Reservoir Area within the past 12 months?** *(Write the number. Do not include this visit.)*

# \_\_\_\_\_ Visits in the past 12 months      If this is your first visit → Skip to Question 32

**30. About how many years have you been visiting the Boundary Reservoir Area?** *(Write the number.)*

# \_\_\_\_\_ Years

**31. In what seasons of the year do you visit the Boundary Reservoir Area?** *(Circle all that apply.)*

Spring      Summer      Fall      Winter

**32. What do you particularly like about visiting the Boundary Reservoir Area or what is it that attracted you to come here?** *(Circle all that apply.)*

- |   |   |
|---|---|
| 1 The scenery/I like the views                          | 7 It's quiet/peaceful                                     |
| 2 It's close to home/easy to get to                     | 8 It's a good place to explore/I wanted to see a new area |
| 3 It's a good place for fishing                         | 9 Other reason <i>(Please specify.)</i> _____             |
| 4 It's a good place to go boating/recreate on the water | _____   |
| 5 I like the small/low-key camping areas                | _____   |
| 6 I like the cost/it's affordable                       |   |

**33. Which other lakes or rivers in the region do you frequently visit for recreation?** *(Please name up to three.)*

Lake/river \_\_\_\_\_ State/Province \_\_\_\_\_  
Lake/river \_\_\_\_\_ State/Province \_\_\_\_\_  
Lake/river \_\_\_\_\_ State/Province \_\_\_\_\_

**34. Which other places or features in the region do you intend to visit or have you already visited during this visit to the Boundary Reservoir Area?** *(Circle all that apply.)*

- |  |  |
|--|--|
| 1 North Pend Oreille Scenic Byway (State Route 31) | 10 Little Pend Oreille Lakes                   |
| 2 Selkirk International Loop                       | 11 Sullivan Lake/Mill Pond area                |
| 3 British Columbia, Canada                         | 12 Salmo-Priest Wilderness                     |
| 4 Northern Idaho                                   | 13 Box Canyon Reservoir                        |
| 5 Spokane, Washington                              | 14 Columbia River/Lake Roosevelt               |
| 6 Colville, Washington                             | 15 Gardner Caves/Crawford State Park           |
| 7 Newport, Washington                              | 16 Other places <i>(Please specify.)</i> _____ |
| 8 Little Pend Oreille National Wildlife Refuge     | _____  |
| 9 Colville National Forest                         | _____  |

**35. Overall, please rate the visual quality of the scenery at the Boundary Reservoir Area.** (Circle one number on the scale.)

1	2	3	4	5	6	7	8	9
Very poor			Average			Excellent		

**36. During this visit to the Boundary Reservoir Area, have you seen any facilities or structures associated with the Boundary Hydroelectric Project?** (E.g., the dam itself, maintenance buildings, utility lines and towers near the dam, SCL recreation facilities, etc. Circle one.)

- 1 No → Skip to Question 39
- 2 I'm not sure
- 3 Yes

**37. Where were you when you saw these facilities?** (See map. Circle all that apply.)

- 1 Vista House
- 2 Picnic area below Boundary Dam (Tailrace Area)
- 3 Campground at Boundary Dam (Forebay Area)
- 4 On the water/river (Boundary Reservoir surface)
- 5 Roads near reservoir
- 6 Other (Please specify.) \_\_\_\_\_

**38. How did seeing these facilities affect your enjoyment of the scenery at the Boundary Reservoir Area on this visit?** (Circle one.)

- 1 These facilities greatly enhanced my overall enjoyment of the scenery here.
- 2 These facilities slightly enhanced my overall enjoyment of the scenery here.
- 3 These facilities had no effect on my overall enjoyment of the scenery here.
- 4 These facilities slightly detracted from my overall enjoyment of the scenery here.
- 5 These facilities greatly detracted from my overall enjoyment of the scenery here.

(Please explain your response.)



# Trip Expenses

**39. Please estimate the total amount of money that you spent or will spend in Pend Oreille County for this visit to Boundary Reservoir Area for the following types of purchases.** *(Please write the approximate amounts in U.S. dollars that you paid for yourself, for others in your group, and any portion of your shared expenses.)*

Someone else paid my expenses *(Circle one.)*

1 No 2 Yes → Skip to Question 40  
↓

	Amount Spent
Hotels, motels, bed & breakfast, other lodging	\$ _____
Camping/RV hookup fees	\$ _____
Eating/drinking establishments	\$ _____
Grocery/food and beverage purchases	\$ _____
Gasoline, oil, other auto supplies and services	\$ _____
Rentals of boats or recreation vehicles (including fuel/oil)	\$ _____
Hunting/fishing supplies (bait/tackle, ammunition)	\$ _____
Shopping/souvenirs	\$ _____
Recreational services (e.g., excursions, guided tours)	\$ _____
Other expenses <i>(Please specify.)</i> _____	\$ _____

# About You and Your Party

**40. Are you?** *(Circle one.)*

Male      Female

**41. What is your age?** *(Check one.)*

\_\_\_\_ under 16    \_\_\_\_ 16-19    \_\_\_\_ 20-29    \_\_\_\_ 30-39    \_\_\_\_ 40-49    \_\_\_\_ 50-59    \_\_\_\_ 60-69    \_\_\_\_ 70 and up

**42. What are the ages of the other people in your group?** *(Please write the number of people for each.)*

# \_\_\_\_ under 16    \_\_\_\_ 16-19    \_\_\_\_ 20-29    \_\_\_\_ 30-39    \_\_\_\_ 40-49    \_\_\_\_ 50-59    \_\_\_\_ 60-69    \_\_\_\_ 70 and up

---

**Seattle City Light would like to thank you for your time. You have helped us to learn more about the people who visit and recreate at the Boundary Reservoir Area. We welcome any additional input or comments from you about how we can improve the management of the Boundary Reservoir Area. (Please feel free to write any additional comments below.)**

**Thank you for participating in this important study!**

.....

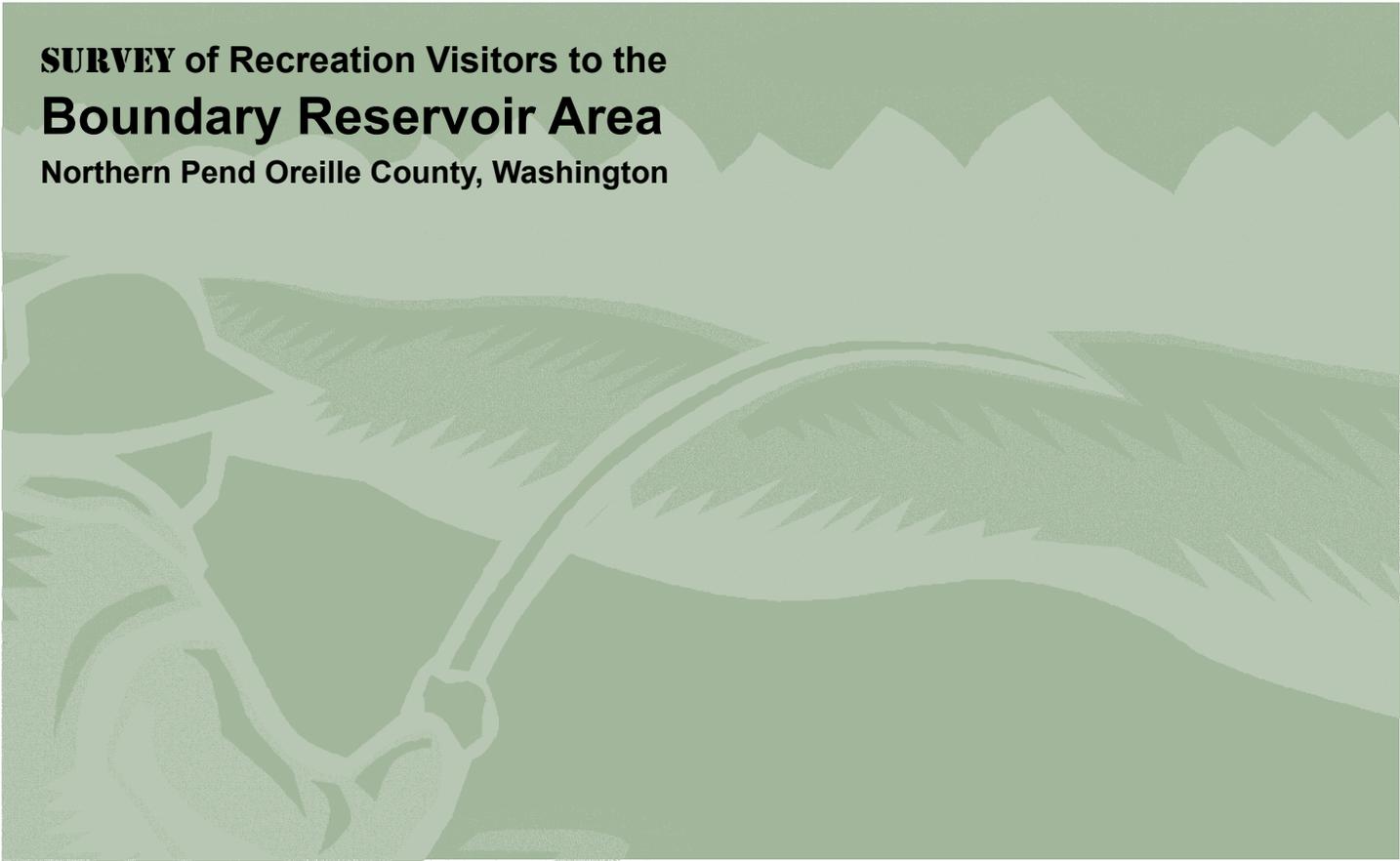
**Please remember to provide your contact information so that we may enter your name in a drawing for a cash prize. (Fully completed questionnaires will be considered for a cash prize. We will detach your contact information from your answers and will not share it with a third party.)**

Name \_\_\_\_\_

Address \_\_\_\_\_

Telephone # \_\_\_\_\_

**SURVEY of Recreation Visitors to the  
Boundary Reservoir Area  
Northern Pend Oreille County, Washington**



**P.O. Box 604  
Ione, WA 99139**

## **Appendix 3. Tagged Fish Reward Program Documentation**



# ATTENTION ANGLERS



## REWARD for Reporting Catch of 2007 Yellow Floy-Tagged Fish

Seattle City Light is studying the movements of hatchery - raised, triploid rainbow trout that are stocked each year in Boundary Reservoir in an effort to improve the fishery. Will you please help? We are asking you to do the following things:



- Please **RELEASE** any fish you catch that have a **RED, DOUBLE-STRAND STREAMER TAG**. These tags indicate fish that have radio transmitters to track their movement; and
- Please **REPORT** any fish you catch with a **SINGLE-STRAND YELLOW TAG** (Floy tag; see photo) and **RETURN THE TAG** to us. For reporting, please provide the number on the tag, your contact information (name, address, phone number), the harvest date, specific harvest location, and approximate length of the fish.

- Put yellow Floy tags in envelopes provided at key Boundary Reservoir locations, and then place in drop boxes at these locations, or mail to us at the address below.

You can contact us via the toll-free hotline number:

**1-866-712-0067**

Harvest reports **AND TAGS** can be mailed to this address:

Tetra Tech EC, Inc.  
19803 North Creek Parkway  
Bothell, WA 98011

Attn: SCL Boundary Reservoir  
Tagged Fish Reward Program

We will send a \$10 reward to each angler who reports a yellow-tagged catch and confirms the report by returning the tag. In addition, all anglers with a confirmed catch report will be entered into the next reward drawing after their catch, with a chance to win a cash prize of up to \$100. Drawings will be held on June 1, September 1, and December 1. Winners will be notified by mail following each drawing. Please understand that we need your contact information and the tag to confirm the catch and send your reward.

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**Table A.3-1.** Return log for tagged fish reward program tag returns.

Entry #	Mail Date	Sender Address	Tag #	Catch Date	Kept or Released	Hours Fished	Fish Length (Inches)	Catch Location
1	4/9/2007	PO Box 307, Metaline WA 99152	70662	4/6/07	R		11	1/4 mi. north of Slate Creek
2	4/17/2007	PO Box 307, Metaline WA 99152	70297	4/16/07	R		11	1/4 mi. north of Slate Creek
<b>April Tot</b>		<b>2 reports</b>	<b>2 tags</b>					
3	5/2/2007	P.O. Box 551, Ione, WA 99139	70574	4/29/07	K	2	11	Box Canyon Dam boat launch
4	5/3/07?	24409 Entwistle Road East, Buckley, WA 98321	70519	4/16/07	R	2	10	Box Canyon Dam
			70504	4/17/07	R	1	11	Box Canyon Dam
5	5/3/2007	P.O. Box 771, Ione, WA 99139	70407	4/18/07			11	Everett Creek Island
			70154				11	1/4 mi. north of Slate Creek
			70319				11	1/4 mi. north of Slate Creek
			70451				11	1/4 mi. north of Slate Creek
6	5/3/2007	23031 LeClerc Rd. N, Ione, WA 99139	70583	5/4/07	R	4	9	Box Canyon Dam
			70871	5/4/07	R	1	9	Metaline
7	5/10/2007	P.O. Box 88, Usk, WA 99180	70105	5/7/07				Boundary Reservoir
			70415	5/7/07				Boundary Reservoir
8	5/15/2007	3361-B Thompson Road, Valley, WA 99181	70349	5/9/07	K	2	10	Boundary Dam
9	5/22/2007	2318 E Boone Ave, Spokane, WA 99202	70043	5/20/07	K	1	11	Boundary Dam
10	5/24/2007	P.O. Box 121, Ione, WA 99139	70986	5/24/07			10	Box Canyon Dam
11	5/24/2007	P.O. Box 760, Ione, WA 99139	70892	5/4/07			13	North of Box Canyon Dam
			70609	5/19/07			14	North of Box Canyon Dam
<b>May Tot</b>		<b>9 reports</b>	<b>16 tags</b>					
<b>Bass Derby</b>								
12	NA	P.O. Box 1166, Newport, WA 99156	70088	Derby wkd			11	Near powerhouse below Falls
13	NA	P.O. Box 203, Ione, WA 99139	70638	Derby wkd			11	Near Box Canyon Resort
14	NA	P.O. Box 652, Ione, WA 99139	70929	Derby wkd			11	In front of Box Canyon Resort
15	NA	P.O. Box 396, Metaline Falls, WA 99153	70344	Derby wkd			11	Just north of Slate Creek
16	NA	2326 Highway 25 North, Evans, WA 99126	70390	Derby wkd				
17	NA	2643 Onion Creek Rd #28, Northport, WA 99157	74007	Derby wkd			SM bass	1 mile north of Tech Cominco mine
18	NA	P.O. Box 256, Cusick, WA 99119	70338	Derby wkd			12	Near powerhouse below Falls
19	NA	P.O. Box 64, Cusick, WA 99119	70756	Derby wkd				Near powerhouse below Falls
20	NA	P.O. Box 792, Newport, WA 99156	70961	Derby wkd				Near eagles' nest
			70976	Derby wkd				Near Box Canyon Resort
21	NA	P.O. Box 185, Metaline, WA 99152	70942	Derby wkd			11	Near old eagles' nest
22	NA	P.O. Box 121, Ione, WA 99139	70739	Derby wkd				Near back eddy downstream of high school

Table A.3-1, continued...

Entry #	Mail Date	Sender Address	Tag #	Catch Date	Kept or Released	Hours Fished	Fish Length (Inches)	Catch Location
23	NA	P.O. Box 146, Ione, WA 99139	70676	Derby wkd				Near Box Canyon Resort
			70664	Derby wkd				Near Box Canyon Resort
<b>Derby Tot</b>		<b>12 reports</b>	<b>14 tags</b>					
<b>Drop Box 6/14/2007</b>								
24	NA	P.O. Box 204, Metaline, WA 99152	70130	4/1-15/07				Boundary Dam
			70616	4/1-15/07				Boundary Reservoir
			70702	4/1-15/07				Boundary Reservoir
			70759	4/1-15/07				Boundary Reservoir
			70913	4/1-15/07				Boundary Reservoir
			70947	4/1-15/07				Boundary Reservoir
			70996	4/1-15/07				Boundary Reservoir
<b>DB Tot</b>		<b>1 report</b>	<b>7 tags</b>					
25	6/4/2007	P.O. Box 681, Ione, WA 99139	70027	5/26/07			11	Dock at Forebay Rec Area
26	6/7/2007	PO Box 533, Metaline Falls, WA 99153	70421	6/5/07			12	Above old mining powerhouse below Falls
27	6/12/2007	905 Celia Crescent, Trail, B.C. V1R 1B7	74564	5/30/07			11	2 miles above Seven Mile Dam
28	6/13/2007	P.O. Box 178, Ione, WA 99139	70944	5/10/07				Box Canyon boat ramp
			70639	5/10/07				Box Canyon boat ramp
			70577	5/10/07				Box Canyon boat ramp
			70678	5/17/07				Box Canyon boat ramp
			70999	5/17/07				Box Canyon boat ramp
			70660	6/1/07				Stream gage below Box Canyon
			70979	6/1/07				Stream gage below Box Canyon
			70792	6/10/07				Stream gage below Box Canyon
			70933	6/10/07				Stream gage below Box Canyon
			70703	6/10/07				Stream gage below Box Canyon
			70627	6/10/07				Stream gage below Box Canyon
29	6/14/2007	205 8th Ave., Ione, WA 99139	70260	6/13/07			11	North side of boat dock
30	6/18/2007	261 Gregory Drive, Cheney, WA 99004-1102	70216	6/14/2007	K		8.5	Boundary Dam
31	6/18/2007	P.O. Box 324, Blanchard, ID 83804	70037	6/15/2007	K	1	13	Boundary Dam
			70893	6/15/07	K	1	12	Boundary Dam
32	6/22/07?	220 Lone Willow Lane, Ellensburg, WA 98926	70207	6/16/07			12	Near Pewee Falls
33	6/25/2007	P.O. Box 132, Cusick, WA 99119	70989	6/1/07	K	3	16	Boundary Dam
34	6/26/2007	211 Fir Drive, Cusick, WA 99119	70246	6/23/07			9	Mouth of Slate Creek
35	6/27/07?	P.O. Box 307, Metaline, WA 99152	70938	6/27/07	R		11	Sweet Creek area

Table A.3-1, continued...

Entry #	Mail Date	Sender Address	Tag #	Catch Date	Kept or Released	Hours Fished	Fish Length (Inches)	Catch Location
			74003	6/27/07	R		SMB-11	Sweet Creek area
<b>June Tot</b>		<b>11 reports</b>	<b>23 tags</b>					
<b>Running Total</b>		<b>35 reports</b>	<b>62 tags</b>					
36	7/9/2007	PO Box 607, Ione WA 99139	70386	6/29/07			11.5	Lime Creek
37	7/9/2007	181 Highline Road, Metaline Falls, WA 99153	74585	7/7/07			SMB-10	Below Boundary Dam
38	7/13/2007	PO Box 307, Metaline WA 99152	74006	7/10/07			SMB-10	Below Box Canyon
39	7/16/2007	PO Box 185, Metaline WA 99152	70614	7/1/07			13	In front of Box Canyon Motel
40	7/18/2007	PO Box 771, Ione, WA 99139	70958	5/5/07			11	North of Metaline near High School
41	7/19/2007	P.O. Box 681, Ione, WA 99139	70593	7/15/07			11	Mouth of Sweet Creek
			70709	7/15/07			11	Mouth of Sweet Creek
			70813	7/15/07			13	Mouth of Sweet Creek
42	7/21/2007	P.O. Box 652, Ione, WA 99139	70965	7/19/07			13	Eagles Nest Viewpoint
			70882	7/19/07			15	Eagles Nest Viewpoint
			70551	7/20/07			13	Eagles Nest Viewpoint
			70557	7/20/07			14	Eagles Nest Viewpoint
43	7/24/2007	PO Box 221, Ione, WA 99139	70628	7/20/07				below Eagles' Nest Look Out
44	7/24/2007	PO Box 221, Ione, WA 99139	70636					below Eagles' Nest Look Out
			74097					below Eagles' Nest Look Out
45	7/25/2007	PO Box 145, Ione, WA 99139	70982	7/5/07	R		13	Just below Box Canyon Dam
			70599	7/5/07	R		13	Just below Box Canyon Dam
			70611	7/6/07	R		13	Just below Box Canyon Dam
			70780	7/6/07	R		13	Just below Box Canyon Dam
			70728	7/8/07	R		13	Just below Box Canyon Dam
			70579	7/8/07	R		13	Just below Box Canyon Dam
46	7/25/2007	235 W. Cleveland Ave., Spokane, WA 99205	70307	7/6/07	R		13	Boundary Dam, 100 yds from silver barrels
47	7/26/2007	23613 57th Ave SE, Woodinville, WA 98072	70924	7/10/07				
			70966	7/10/07				
48	8/1/2007	PO Box 354, Metaline Falls, WA 99153	70781					Metaline Falls Park
		413 Pend Oreille Blvd.						
49	8/1/2007	2318 E. Boone Ave., Spokane, WA 99202-3712	70311				14	Boundary Reservoir Dam

Table A.3-1, continued...

Entry #	Mail Date	Sender Address	Tag #	Catch Date	Kept or Released	Hours Fished	Fish Length (Inches)	Catch Location
			70418				17	Boundary Reservoir Dam
50	8/3/2007	PO Box 14, Metaline, WA 99152	70564	7/11/07			12	Sullivan Creek mouth
			70041	7/21/07			12.5	Sullivan Creek mouth
			70213	7/21/07			13	Sullivan Creek mouth
			70086	7/24/07			12	Pewee Falls
<b>July Tot</b>		<b>15 reports</b>	<b>31 tags</b>					
<b>Running Total</b>		<b>50 reports</b>	<b>93 tags</b>					
51	8/6/2007	5307 Prufer Rd., Deer Park, WA 99006	70927	8/5/07			12.5	1/4 mile below Box Canyon Dam
52	8/10/2007	PO Box 673, Deer Park, WA 99006-0673	70095				13	East shore at Boundary Dam
53	8/13/2007	716 W. King Ave., Chewelah, WA 99109	70303					
54	8/14/2007	PO Box 369, Metaline Falls, WA 99153	70552	7/26/07			13	Mouth of Sullivan Creek
			70559	8/1/07			14	Mouth of Sullivan Creek
55	8/17/2007	23031 LeClerc Road N., Ione, WA 99139	70600	7/3/07	R	2		Metaline
			70837	7/3/07	R	2		Metaline
56	8/22/2007	PO Box 185, Metaline, WA 99152	70620	8/12/07			10.5	Metaline Park
57	8/22/2007	PO Box 915, Ione, WA 99139	70324	8/3/07			12	East bank, betw. log boom & survey mon.
			70225	8/9/07			12	Pewee Falls
			70139	8/9/07			12	Pewee Falls
			70788	8/9/07			10	Slate Creek
			70894	8/9/07			12	Slate Creek
58	8/13/2007	PO Box 383, Usk, WA 99180	70263	8/3/07				Pewee Falls
			70730					
59	8/30/2007	266 East 2nd Avenue, Colville, WA 99114	70538					
			70831					
<b>Aug Tot</b>		<b>9 reports</b>	<b>17 tags</b>					
<b>Running Total</b>		<b>59 reports</b>	<b>110 tags</b>					
60	9/10/2007	PO Box 346, Chattaroy, WA 99003	70440	8/18/07			15	Slate Creek
			70617	8/18/07			15	Slate Creek
61	8/18/2007	PO Box 85, Wilbur, WA 99185	70374	8/18/07			14	L. Roosevelt confluence w/ Spokane R.

Table A.3-1, continued...

Entry #	Mail Date	Sender Address	Tag #	Catch Date	Kept or Released	Hours Fished	Fish Length (Inches)	Catch Location
62	9/20/2007	476 Sandhagen Road, Port Angeles, WA 98363	70683					Near stream gage below Box Canyon
			70791					Near stream gage below Box Canyon
63	9/21/2007	23031 LeClerc Road, Ione, WA 99139	70904		R	4.5	13	Box Canyon Dam
			70908		R		13	Box Canyon Dam
64	9/25/2007	PO Box 1233, Newport, WA 99156	70066	7/28/07			13	Mouth of Sweet Creek
65	9/10/2007	PO Box 346, Chattaroy, WA 99003	70545	6/2/07			11	Lime Creek
<b>Sep Tot</b>		<b>6 reports</b>	<b>9 tags</b>					
<b>Running Total</b>		<b>65 reports</b>	<b>119 tags</b>					
66	10/9/2007	PO Box 21, Davenport, WA 99122						
			70951	7/13/07			20	Mouth of Lime Creek
			70392	7/21/07			19	Flume Creek
			70458	8/18/07			19	Lime Creek
			70188	8/4/07			19	Flume Creek
			70322	8/4/07			20	Flume Creek
			70543	8/18/07			20	Lime Creek
<b>Oct Tot</b>		<b>1 report</b>	<b>6 tags</b>					
<b>Running Total</b>		<b>66 reports</b>	<b>125 tags</b>					
<b>Nov Tot</b>		<b>0 reports</b>	<b>0 tags</b>					
<b>Running Total</b>		<b>66 reports</b>	<b>125 tags</b>					
67	12/8/2007	658 Clagstone Road, Spirit Lake, ID 83869	70206	8/13/2007			13	Boundary Dam/Pewee Falls/Launch
			70211	8/13/2007			13	Boundary Dam/Pewee Falls/Launch
			70284	8/13/2007			13	Boundary Dam/Pewee Falls/Launch

Table A.3-1, continued...

Entry #	Mail Date	Sender Address	Tag #	Catch Date	Kept or Released	Hours Fished	Fish Length (Inches)	Catch Location
			70414	8/14/2007			13	Boundary Dam/Pewee Falls/Launch
			70441	8/14/2007			13	Boundary Dam/Pewee Falls/Launch
<b>Dec Tot</b>		<b>1 report</b>	<b>5 tags</b>					
<b>Running Total</b>		<b>67 reports</b>	<b>130 tags</b>					

Notes:

Entries cover tags returned through December 14, 2007.

Highlighted tag numbers are from smallmouth bass; rest are triploid trout

## **Appendix 4. Fish Status, Implantation Information, and CART Tag Physical Data Record**



**Table A.4-1.** Deployed radio and CART tags in spring 2007 release and carry-over triploid rainbow trout and the status of the tag, whether the fish is alive, dead, or suspected to be dead.

Release Information						Station Detections		Mobile Tracking		Condition Status and Fate of Fish	
						Time and Location of last Detection		Time and Location of Last Detection			
Triploid Rainbow Trout Type	Tag Type	Radio Tag Code	Acoustic Tag Code	Release Site Reach	Release Date	Date and time	PRM	Date and time	PRM	Status	Evidence Code <sup>2</sup>
Carryover	CH-TP11-18	11	800	forebay	22-Sep-07	26-Sep-07 23:27	17	25-Sep-07 17:11	17.8	Alive	0
Carryover	CH-TP11-18	28	2500	upper reservoir	13-Jun-07	26-Sep-07 22:33	17	25-Sep-07 17:11	17.8	Alive	0
Carryover	CH-TP11-18	31	2800	tailrace	17-Jun-07	17-Jun-07 23:02	16	n/a <sup>1</sup>	n/a <sup>1</sup>	Alive	0
Carryover	CH-TP11-18	34	3100	canyon	22-Jun-07	24-Sep-07 18:00	22.1	28-Aug-07 14:45	22	Dead	1
Carryover	CH-TP11-18	35	3200	forebay	22-Jun-07	23-Jun-07 07:44	17.9	31-Jul-07 16:55	18	Suspect	4
Carryover	CH-TP11-18	36	3300	canyon	22-Jun-07	24-Jun-07 04:41	22.1	4-Jul-07 17:05	18.3	Dead	4
Carryover	CH-TP11-18	37	3400	forebay	20-Jun-07	9-Sep-07 08:06	17.9	25-Sep-07 17:11	17.9	Dead	4
Carryover	CH-TP11-18	38	3500	forebay	20-Jun-07	21-Jun-07 02:21	17.9	31-Jul-07 16:55	18	Dead	4
Carryover	CH-TP11-18	39	3600	upper reservoir	21-Sep-07	24-Sep-07 19:10	30.9	n/a <sup>1</sup>	n/a <sup>1</sup>	Alive	0
Carryover	CH-TP11-18	40	3700	forebay	25-May-07	25-Sep-07 22:17	29.6	26-Sep-07 15:57	28.9	Suspect	4
Carryover	CH-TP11-18	49	4600	upper reservoir	28-Jul-07	29-Jul-07 04:37	30.9	26-Sep-07 14:30	30.9	Suspect	4
Carryover	CH-TP11-18	55	5200	upper reservoir	13-Jun-07	12-Aug-07 04:31	30.9	1-Aug-07 15:00	31.1	Suspect	4
Carryover	CH-TP11-18	61	5800	upper reservoir	28-Jul-07	24-Sep-07 17:30	22.1	28-Aug-07 14:45	22	Dead	2
Carryover	CH-TP11-18	62	5900	upper reservoir	28-Jul-07	30-Jul-07 19:17	26.9	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	5
Carryover	CH-TP11-18	70	6700	upper reservoir	27-Jul-07	30-Jul-07 00:18	26.9	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	6
Spring 2007	NTC-6-2	76		upper reservoir	30-Mar-07	2-May-07 14:00	29.6	26-Apr-07 15:40	31.3	Suspect	5
Spring 2008	NTC-6-2	77		upper reservoir	30-Mar-07	8-Sep-07 01:20	34.1	25-Sep-07 14:25	25.8	Suspect <sup>3</sup>	4
Spring 2009	NTC-6-2	78		upper reservoir	30-Mar-07	7-Sep-07 21:33	34.1	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	6
Spring 2010	NTC-6-2	79		upper reservoir	30-Mar-07	11-Sep-07 13:48	34.1	29-Aug-07 10:55	34.3	Dead	2
Spring 2011	NTC-6-2	80		upper reservoir	30-Mar-07	11-Sep-07 12:47	34.1	29-Aug-07 11:33	33.1	Dead	2
Spring 2012	NTC-6-2	81		upper reservoir	30-Mar-07	26-Sep-07 09:52	34.1	29-Aug-07 10:55	34.3	Dead	4
Spring 2013	NTC-6-2	82		upper reservoir	30-Mar-07	16-Jul-07 02:52	30.9	5-Jul-07 12:13	34.1	Suspect	5
Spring 2014	NTC-6-2	83		upper reservoir	30-Mar-07	1-May-07 22:11	26.6	25-Sep-07 14:07	26.3	Suspect	6
Spring 2015	NTC-6-2	84		upper reservoir	30-Mar-07	16-May-07 10:07	26.6	8-May-07 13:33	26.7	Suspect	6

Table A.4-1, continued...

Release Information						Station Detections		Mobile Tracking		Condition Status and Fate of Fish	
						Time and Location of last Detection		Time and Location of Last Detection			
Triploid Rainbow Trout Type	Tag Type	Radio Tag Code	Acoustic Tag Code	Release Site Reach	Release Date	Date and time	PRM	Date and time	PRM	Status	Evidence Code <sup>2</sup>
Spring 2016	NTC-6-2	85		upper reservoir	30-Mar-07	31-Mar-07 01:00	34.1	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	5
Spring 2017	NTC-6-2	87		forebay	30-Mar-07	25-Sep-07 10:36	18	28-Aug-07 15:50	18	Dead	3
Spring 2018	NTC-6-2	88		forebay	30-Mar-07	18-Apr-07 13:36	16	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	5
Spring 2019	NTC-6-2	89		forebay	30-Mar-07	5-Apr-07 05:38	16	30-Aug-07 10:51	16.7	Dead	4
Spring 2020	NTC-6-2	90		forebay	30-Mar-07	11-Jul-07 12:16	18	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	5
Spring 2021	NTC-6-2	91		forebay	30-Mar-07	8-May-07 11:11	17	8-May-07 17:45	17	Suspect	5
Spring 2022	NTC-6-2	92		forebay	30-Mar-07	1-Apr-07 08:26	17	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	5
Spring 2023	NTC-6-2	93		forebay	30-Mar-07	1-Apr-07 01:42	17.9	18-Jul-07 15:17	28.6	Suspect	5
Spring 2024	NTC-6-2	94		forebay	30-Mar-07	30-Mar-07 20:57	16	n/a <sup>1</sup>	n/a <sup>1</sup>	Suspect	5
Spring 2025	NTC-6-2	95		forebay	30-Mar-07	24-Sep-07 17:59	22.1	28-Aug-07 14:00	22.5	Dead	3
Spring 2026	NTC-6-2	96		forebay	30-Mar-07	27-Sep-07 08:38	17	28-Aug-07 15:50	18	Dead	3

Notes:

Tag status and location were determined based on mobile telemetry tracking and data recorded at shore-based telemetry station during the 2007 biotelemetry monitoring, April to September 2007.

- 1 No detections or unreliable detection by fixed stations and mobile tracking.
- 2 Evidence code      Evidence description
  - 0                      alive, movement recorded
  - 1                      tag recovered from river, above high water mark
  - 2                      tag recovered from river, below high water mark
  - 3                      tag not recovered, stationary, above high water mark
  - 4                      tag not recovered, stationary, below high water mark
  - 5                      location unknown, no or very few valid detections
  - 6                      continual downstream movement
  - 7                      tag returned by angler
- 3 False tag code

**Table A.4-2.** Tag implantation, surgery, and release information of spring 2007 release triploid rainbow trout and carry-over triploids rainbow trout captured and radio tagged as part of the 2007 biotelemetry monitoring.

Sample Number	Capture Site Reach	Capture Site	PRM Capture	Water Temp (°C)	Triploid Rainbow Trout Type	Fork Length (mm)	Total Length (mm)	Weight (g)	Date of Surgery	Surgeon Initials	Radio tag tested Y/N	Tag Type	Radio Tag Frequency (MHz)	Radio Tag Code	Acoustic Tag Code	Streamer Tag No.	Tag Color	Fish Rel with tags (Y/N)	Release Date	Release Time	Release Location	Release Site Reach	Comments/ External Condition	PRM Release
91127	forebay	F1E	17.7	17.8	Carry-over	452	460	937	21-Sep-07	RM	y	CH-TP11-18	151.4	11	800			y	22-Sep-07	8:00	F2E	forebay		17.7
91132	forebay	F1E	17.3	12	Carry-over	364	367	469	16-Oct-07	TL	y	CH-TP11-18	151.4	12	900	97	red	y	17-Oct-07	9:30	F1E	forebay		17.3
91103	upper reservoir	below Box Canyon Dam	34.3	8.1	Carry-over	316	322	406	13-Jun-07	RM	y	CH-TP11-18	151.4	28	2500	58	red	y	13-Jun-07	23:46	below Box Canyon	upper reservoir	T309-524	34.3
91102	tailrace	Tailrace	16.5	14.1	Carry-over	376	381	541	17-Jun-07	RM	y	CH-TP11-18	151.4	31	2800	66	red	y	17-Jun-07	4:50	Tailrace	tailrace	released with cart tag T309-527	16.5
91131	forebay	F1E	17.3	12	Carry-over	450	455	803	16-Oct-07	TL	y	CH-TP11-18	151.4	32	2900	98	red	y	17-Oct-07	9:30	F1E	forebay	maxillary deformity, old hook wound	17.3
91122	canyon	C3E	25.2	20.6	Carry-over	386	403	598	30-Aug-07	EC	y	CH-TP11-18	151.4	33	3000	120	red	y	30-Aug-07	13:30	C3E, lower cell	canyon	Fish captured near the outfall of small tributary where water temperature was recorded at 19.5 C; fish held for approximately 6 hours at the outflow of the stream prior to surgery; fish released healthy as soon as it recovered from surgery	25.2
91112	tailrace	Tailrace	16.5	15.5	Carry-over	417	440	797	22-Jun-07	RM	y	CH-TP11-18	151.4	34	3100	80	red	y	22-Jun-07	18:00	Slate Cr delta	canyon	transferred above Boundary Dam	22.2
91111	tailrace	Tailrace	16.5	15.5	Carry-over	377	390	570	22-Jun-07	RM	y	CH-TP11-18	151.4	35	3200	76	red	y	22-Jun-07	17:45	Peewee Cr	forebay	transferred above Boundary Dam	17.9
91110	tailrace	Tailrace	16.5	15.5	Carry-over	359	372	458	22-Jun-07	RM	y	CH-TP11-18	151.4	36	3300	73	red	y	22-Jun-07	18:00	Slate Cr delta	canyon	transferred above Boundary Dam	22.2
91106	forebay	Peewee Cr delta	17.9	15.7	Carry-over	338	346	475	20-Jun-07	RM	y	CH-TP11-18	151.4	37	3400	67	red	y	20-Jun-07	18:55	Peewee Cr	forebay	346mm total length	17.9
91107	forebay	Peewee Cr delta	17.9	15.7	Carry-over	350	361	538	20-Jun-07	RM	y	CH-TP11-18	151.4	38	3500	68	red	y	20-Jun-07	18:55	Peewee Cr	forebay	361mm total length	17.9
91126	upper reservoir	UR5E	30.9	16.7	Carry-over	415	420	590	20-Sep-07	RM	y	CH-TP11-18	151.4	39	3600	150	red	y	21-Sep-07	15:50	UR5E	upper reservoir		30.9
91101	forebay	F2E	17.3	14	Carry-over	427	450	450	25-May-07	TL	y	CH-TP11-18	151.4	40	3700	50	red	y	25-May-07	3:00	Forebay, near boat launch	forebay	triploid carryover	17.3



Table A.4-2, continued...

Sample Number	Capture Site Reach	Capture Site	PRM Capture	Water Temp (°C)	Triploid Rainbow Trout Type	Fork Length (mm)	Total Length (mm)	Weight (g)	Date of Surgery	Surgeon Initials	Radio tag tested Y/N	Tag Type	Radio Tag Frequency (MHz)	Radio Tag Code	Acoustic Tag Code	Streamer Tag No.	Tag Color	Fish Rel with tags (Y/N)	Release Date	Release Time	Release Location	Release Site Reach	Comments/ External Condition	PRM Release
91134	upper reservoir	UR1E	33.6	11	Carry-over	352	367	456	19-Oct-07	TL	y	CH-TP11-18	151.4	44	4100	140	red	y	20-Oct-07	8:00	gaging station below Box Canyon Dam	upper reservoir	released healthy	34
91136	upper reservoir	UR1E	33.6	11	Carry-over	351	374	459	19-Oct-07	TL	y	CH-TP11-18	151.4	48	4500	139	red	y	20-Oct-07	8:00	gaging station below Box Canyon Dam	upper reservoir	released healthy	34
91117	upper reservoir	UR5	30.9	22.7	Carry-over	349	364	468	28-Jul-07	RM	y	CH-TP11-18	151.4	49	4600			y	28-Jul-07	8:20	UR5	upper reservoir	Captured at the Sweet Creek delta; fish held holding sock in 16.5 C water at Sweet Creek prior to surgery for approximately 3 hours; fish released in tributary mouth where cool water was mixing with reservoir approximately 30 minutes after surgery; temperature of reservoir at time of release was 22.7; fish released healthy	30.9
91135	upper reservoir	UR1E	33.6	11	Carry-over	360	375	444	19-Oct-07	TL	y	CH-TP11-18	151.4	53	5000	138	red	y	20-Oct-07	8:00	gaging station below Box Canyon Dam	upper reservoir	released healthy	34
91104	upper reservoir	Sweet Cr delta	30.9	8.1	Carry-over	392	415	668	13-Jun-07	RM	y	CH-TP11-18	151.4	55	5200	62	red	y	13-Jun-07	23:50	Sweet Cr	upper reservoir	T309-552	30.9
91118	upper reservoir	UR5	30.9	22.7	Carry-over	397	415	663	28-Jul-07	RM	y	CH-TP11-18	151.4	61	5800			y	28-Jul-07	8:20	UR5	upper reservoir	Captured at the Sweet Creek delta; fish held holding sock in 16.5 C water at Sweet Creek prior to surgery for approximately 3 hours; fish released in tributary mouth where cool water was mixing with reservoir approximately 30 minutes after surgery; temperature of reservoir at time of release was 22.7; fish released healthy	30.9



Table A.4-2, continued...

Sample Number	Capture Site Reach	Capture Site	PRM Capture	Water Temp (°C)	Triploid Rainbow Trout Type	Fork Length (mm)	Total Length (mm)	Weight (g)	Date of Surgery	Surgeon Initials	Radio tag tested Y/N	Tag Type	Radio Tag Frequency (MHz)	Radio Tag Code	Acoustic Tag Code	Streamer Tag No.	Tag Color	Fish Rel with tags (Y/N)	Release Date	Release Time	Release Location	Release Site Reach	Comments/ External Condition	PRM Release
91120	upper reservoir	UR9	27	25	Carry-over	450	455	1009	28-Jul-07	RM	y	CH-TP11-18	151.4	62	5900			y	28-Jul-07	8:20	UR9	upper reservoir	Captured near Sullivan Creek; fish held in 18 C water in Sullivan Creek prior to surgery for approximately 2 hours and post surgery for approximately 2 hours; fish released in tributary mouth where cool water was mixing with reservoir; temperature of reservoir at time of release was 25; fish released healthy	27
91116	upper reservoir	UR1	33.6	24	Carry-over	342	358	500	27-Jul-07	RM	y	CH-TP11-18	151.4	70	6700			y	27-Jul-07	14:20	UR1	upper reservoir	Captured in UR1E transect late evening; transported and held in Sweet Creek at 16.5 C water prior to surgery for approximately 2 hours and post surgery for approximately 7 hours; fish transported back to UR1E for release where water temperature was 24 C at time of release; fish released healthy	33.6
91113	tailrace	Tailrace	16.5	15.5	Carry-over	371	391	569	22-Jun-07	RM	y	CH-TP11-18	151.4	72	6900	83	red	n					sacrificed, tag removed	
91119	upper reservoir	UR9		15.5	Carry-over	455	472	1113	28-Jul-07	RM	y	CH-TP11-18	151.4	72	6900			n					Captured near Sullivan Creek; fish held in 18 C water in Sullivan Creek prior to surgery for approximately 2 hours and post surgery for approximately 2 hours; died in holding sock	
1					Spring 2007		265	166	29-Mar-07	BC	y	NTC-6-2	151.4	76		2	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir	42°F	34.2
2					Spring 2008		274	198	29-Mar-07	BC	y	NTC-6-2	151.4	77		3	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
3					Spring 2009		268	164	29-Mar-07	EC	y	NTC-6-2	151.4	78		4	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
4					Spring 2010		289	182	29-Mar-07	EC	y	NTC-6-2	151.4	79		6	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
5					Spring 2011		265	164	29-Mar-07	RN	y	NTC-6-2	151.4	80		7	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
6					Spring 2012		270	170	29-Mar-07	RM	y	NTC-6-2	151.4	81		8	red	Y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
7					Spring 2013		272	184	29-Mar-07	TL	y	NTC-6-2	151.4	82		9	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
8					Spring 2014		239	144	29-Mar-07	TL	y	NTC-6-2	151.4	83		10	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2



Table A.4-2, continued...

Sample Number	Capture Site Reach	Capture Site	PRM Capture	Water Temp (°C)	Triploid Rainbow Trout Type	Fork Length (mm)	Total Length (mm)	Weight (g)	Date of Surgery	Surgeon Initials	Radio tag tested Y/N	Tag Type	Radio Tag Frequency (MHz)	Radio Tag Code	Acoustic Tag Code	Streamer Tag No.	Tag Color	Fish Rel with tags (Y/N)	Release Date	Release Time	Release Location	Release Site Reach	Comments/ External Condition	PRM Release
9					Spring 2015		265	174	29-Mar-07	DF	y	NTC-6-2	151.4	84		11	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
10					Spring 2016		232	122	29-Mar-07	BC	y	NTC-6-2	151.4	85		12	red	y	30-Mar-07	9:28	Box Canyon TR	upper reservoir		34.2
11					Spring 2017		265	158	29-Mar-07	DF	y	NTC-6-2	151.4	87		14	red	y	30-Mar-07	12:23	Boundary FB	forebay	7.1°C	17.3
12					Spring 2018		288	210	29-Mar-07	BC	y	NTC-6-2	151.4	88		15	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
13					Spring 2019		282	206	29-Mar-07	EC	y	NTC-6-2	151.4	89		16	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
14					Spring 2020		265	164	29-Mar-07	RM	y	NTC-6-2	151.4	90		19	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
15					Spring 2021		268	190	29-Mar-07	EC	y	NTC-6-2	151.4	91		18	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
16					Spring 2022		268	172	29-Mar-07	EC	y	NTC-6-2	151.4	92		20	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
17					Spring 2023		256	150	29-Mar-07	RM	y	NTC-6-2	151.4	93		21	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
18					Spring 2024		267	174	29-Mar-07	TL	y	NTC-6-2	151.4	94		22	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
19					Spring 2025		263	182	29-Mar-07	RM	y	NTC-6-2	151.4	95		23	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3
20					Spring 2026		282	224	29-Mar-07	TL	y	NTC-6-2	151.4	96		25	red	y	30-Mar-07	12:23	Boundary FB	forebay		17.3



**Table A.4-3.** CART tag data for carry-over triploid rainbow trout during biotelemetry mobile tracking 26 April to 27 September 2007

Index	Triploid Rainbow Trout Type	Tag Type	Radio Code	Date, Time	PRM	Water Temp Reservoir <sup>1</sup> (°C)	Water Temp at fish <sup>2</sup> (°C)	Tag Temp 1 (°C)	Tag Temp 2 (°C)	Tag Temp 3 (°C)	Tag Depth 1 (ft)	Tag Depth 2 (ft)	Tag Depth 3 (ft)	Tag Depth 4 (ft)	Tag Depth 5 (ft)	Tag Depth 6 (ft)
98	Carryover	CART	40	6/19/07 17:36	17.8	15.6	15.6	14.8	14.8	14.8	4.5	4.5	4.5	4.5	4.5	4.5
59	Carryover	CART	40	6/6/07 17:30	17.9	16.4	17.2	17.2	17.2		2.2	2.2	2.2	4.5	9.0	
246	Carryover	CART	40	8/29/07 15:14	28.6	20.5	21.2	21.2	21.2	21.2	2.2	2.2	2.2	2.2	2.2	2.2
113	Carryover	CART	28	7/4/07 16:35	21.5	19		18.8			4.5	6.8	4.5	6.8	6.8	
96	Carryover	CART	28	6/19/07 16:40	22	15.6	16	14	14	14.8	6.8	6.8	6.8	11.3	6.8	6.8
235	Carryover	CART	28	8/28/07 16:22	17.6	20.6	21.2	21.2	21.2	21.2	9.0	9.0	9.0	9.0	6.8	9.0
130	Carryover	CART	55	7/5/07 15:05	30.1	20.5	20.5	20.4	20.4	20.4	9.0	13.5	9.0	11.3	18.1	27.1
158	Carryover	CART	55	7/18/07 15:17	31	24.5										
102	Carryover	CART	55	6/20/07 12:13	31	16.5	16.8	15.6	15.6	15.6	6.8	6.8	6.8	6.8	6.8	6.8
205	Carryover	CART	34	8/14/07 15:11	22	22.2										
111	Carryover	CART	34	7/4/07 15:30	22	19										
271	Carryover	CART	49	9/26/07 14:30	30.9	15.4	15.4									
190	Carryover	CART	49	8/1/07 12:49	30.6	24.5										
206	Carryover	CART	61	8/14/07 15:11	22	22.2										
174	Carryover	CART	61	7/31/07 15:28	21.9	24.4						4.5	4.5	2.2		

Notes:

- 1 Mainstem reservoir temperature in flowing region nearest fish site
- 2 Reservoir temperature at fish location

**Table A.4-4.** Status and days at large alive of radio- and CART-tagged triploid rainbow trout in the Project area from March 29 to September 26, 2007.

Fish Radio Frequency Code	Release Date	Fish Status			No. Days at Large Alive (Days)	Percentage Time Alive Over Monitor Period (%)	Evidence Code <sup>1</sup>	Status
		Alive	Dead	Suspect				
		Last Detection	Date of Tag Recovery	Date After Which Fish Health Was Suspect				
11	22-Sep-07	26-Sep-07			4	2.2	0	Alive
28	13-Jun-07	26-Sep-07			105	58.0	0	Alive
31	17-Jun-07	26-Jul-07			39	21.5	0	Alive
34	22-Jun-07		25-Sep-07	22-Jun-07	0	0.0	1	Dead
35	22-Jun-07			31-Jul-07	39	21.5	4	Suspect
36	22-Jun-07		04-Jul-07	04-Jul-07	12	6.6	4	Dead
37	20-Jun-07		17-Jul-07	21-Jun-07	1	0.6	4	Dead
38	20-Jun-07			31-Jul-07	41	22.7	4	Dead
39	21-Sep-07	24-Sep-07			3	1.7	0	Alive
40	25-May-07			22-Aug-07	89	49.2	4	Suspect
49	28-Jul-07			01-Aug-07	4	2.2	4	Suspect
55	13-Jun-07			12-Aug-07	60	33.1	4	Suspect
61	28-Jul-07		25-Sep-07	02-Aug-07	5	2.8	2	Dead
62	28-Jul-07			30-Jul-07	2	1.1	5	Suspect
70	27-Jul-07			31-Jul-07	4	2.2	6	Suspect
76	30-Mar-07			02-May-07	33	18.2	5	Suspect
77	30-Mar-07			17-Jul-07	109	60.2	4	Suspect
78	30-Mar-07			15-May-07	46	25.4	6	Suspect
79	30-Mar-07		11-Sep-07	13-Apr-07	14	7.7	2	Dead
80	30-Mar-07		11-Sep-07	13-Apr-07	14	7.7	2	Dead
81	30-Mar-07			13-Apr-07	14	7.7	4	Dead
82	30-Mar-07			17-Jul-07	109	60.2	5	Suspect
83	30-Mar-07			17-Jul-07	109	60.2	6	Suspect
84	30-Mar-07			16-May-07	47	26.0	6	Suspect
85	30-Mar-07			31-Mar-07	1	0.6	5	Suspect
87	30-Mar-07			30-Mar-07	0	0.0	3	Dead

Table A.4.-4, continued...

Fish Radio Frequency Code	Release Date	Fish Status			No. Days at Large Alive (Days)	Percentage Time Alive Over Monitor Period (%)	Evidence Code <sup>1</sup>	Status
		Alive	Dead	Suspect				
		Last Detection	Date of Tag Recovery	Date After Which Fish Health Was Suspect				
88	30-Mar-07			18-Apr-07	19	10.5	5	Suspect
89	30-Mar-07			05-Apr-07	6	3.3	4	Dead
90	30-Mar-07			13-Jul-07	105	58.0	5	Suspect
91	30-Mar-07			08-May-07	39	21.5	5	Suspect
92	30-Mar-07			01-Apr-07	2	1.1	5	Suspect
93	30-Mar-07			01-Apr-07	2	1.1	5	Suspect
94	30-Mar-07			30-Mar-07	0	0.0	5	Suspect
95	30-Mar-07			06-Apr-07	7	3.9	3	Dead
96	30-Mar-07			12-May-07	43	23.8	3	Dead

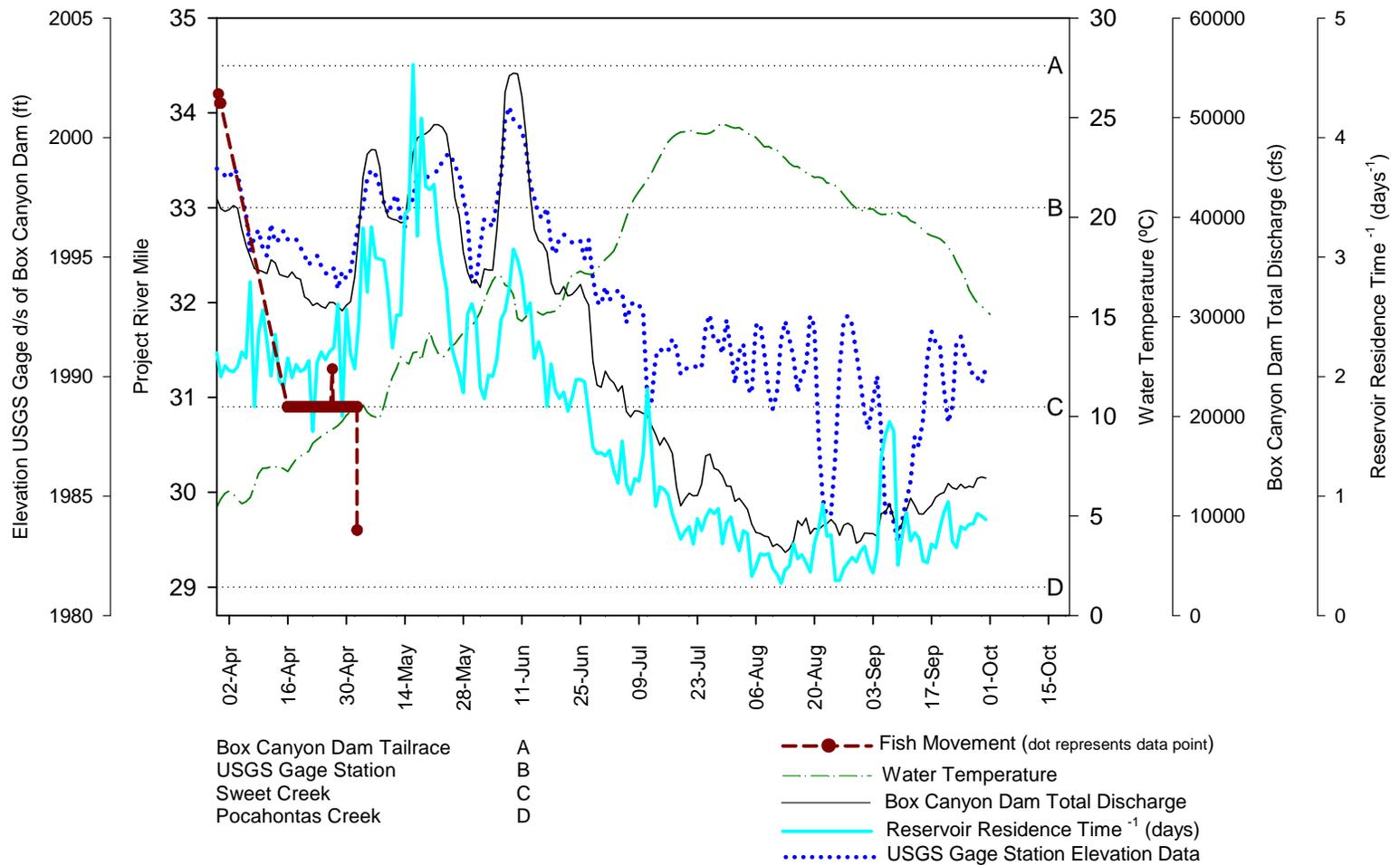
Note:

- |   |               |   |
|---|---------------|---|
| 1 | Evidence code | Evidence description  |
|   | 0             | alive, movement recorded<br>tag recovered from river, above high water mark |
|   | 1             | mark<br>tag recovered from river, below high water mark                     |
|   | 2             | mark<br>tag not recovered, stationary, above high water mark                |
|   | 3             | water mark<br>tag not recovered, stationary, below high water mark          |
|   | 4             | water mark<br>location unknown, no or very few valid detections             |
|   | 5             | detections  |
|   | 6             | continual downstream movement   |
|   | 7             | tag returned by angler  |

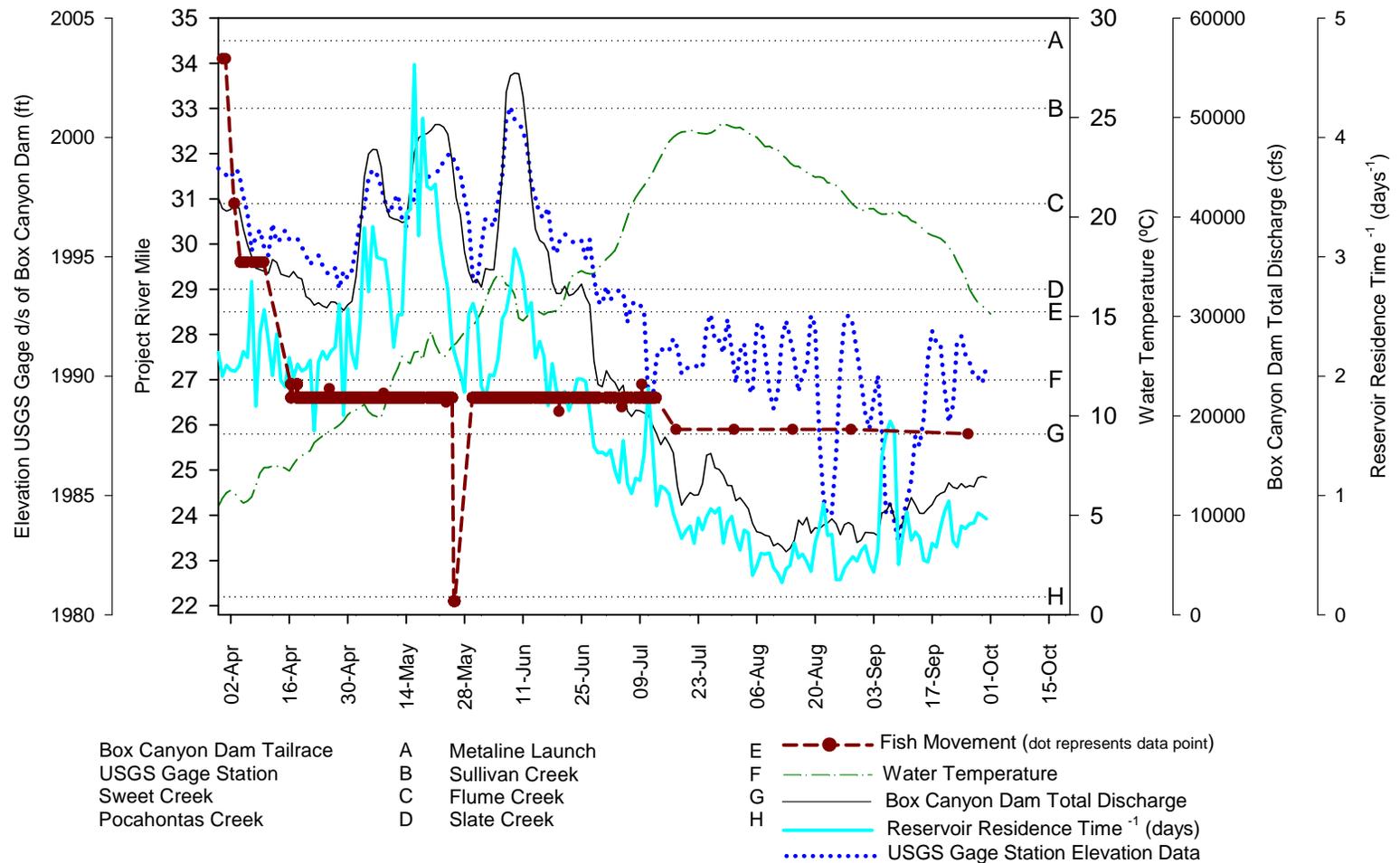
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## **Appendix 5. Spring 2007 Release Radio Tag Tracking**

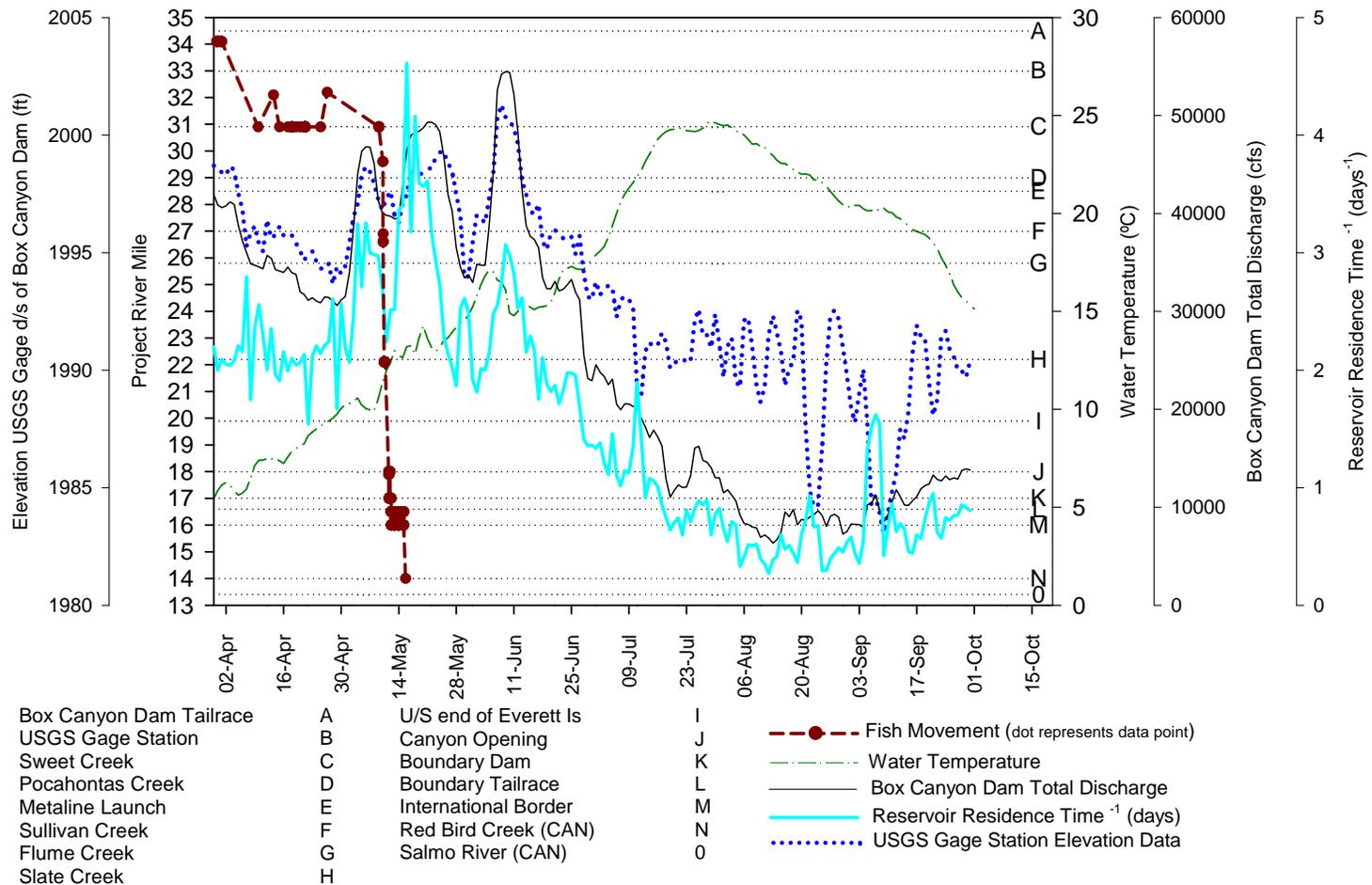




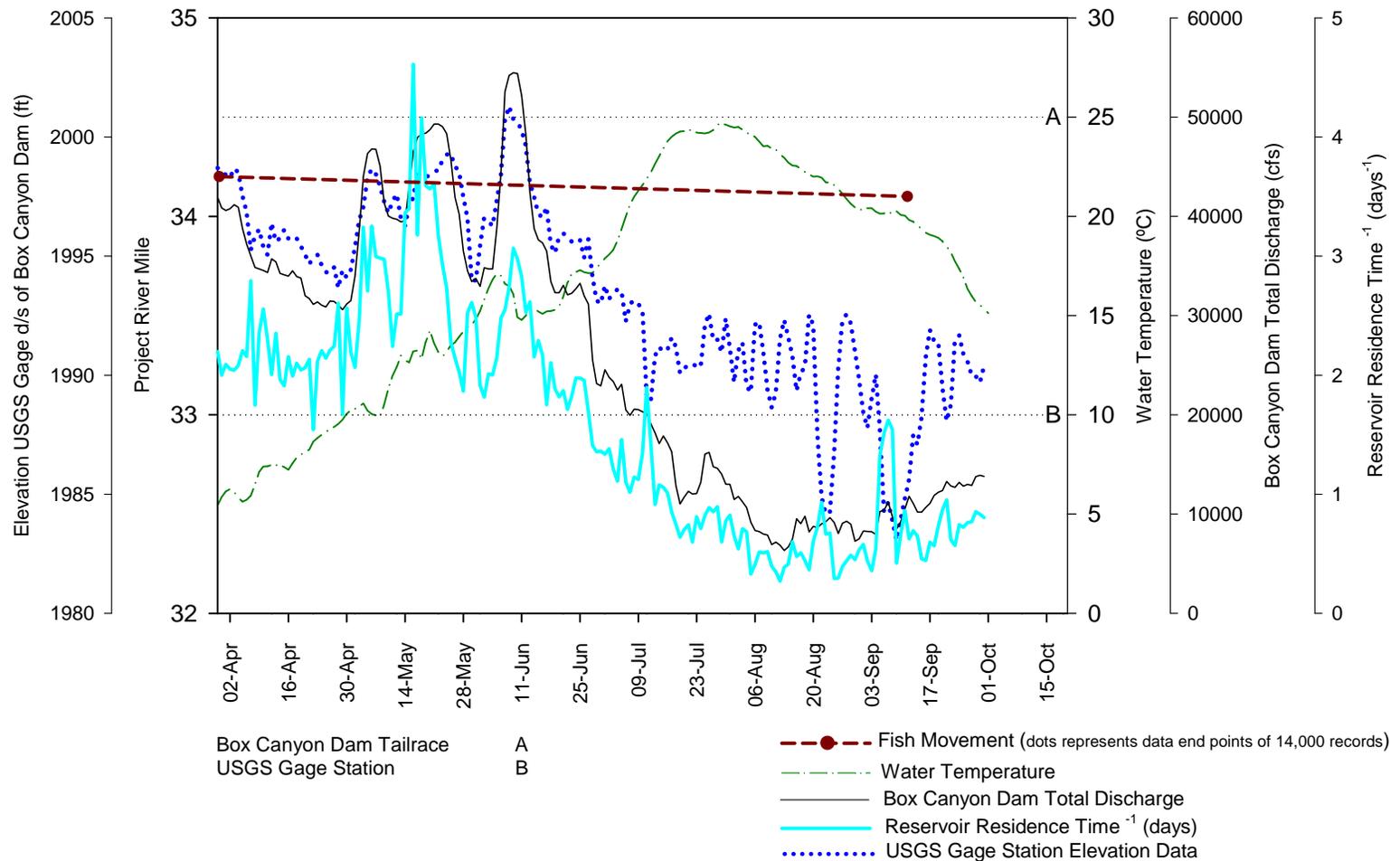
**Figure A.5-1.** Movement data of a radio-tagged (fish 76) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



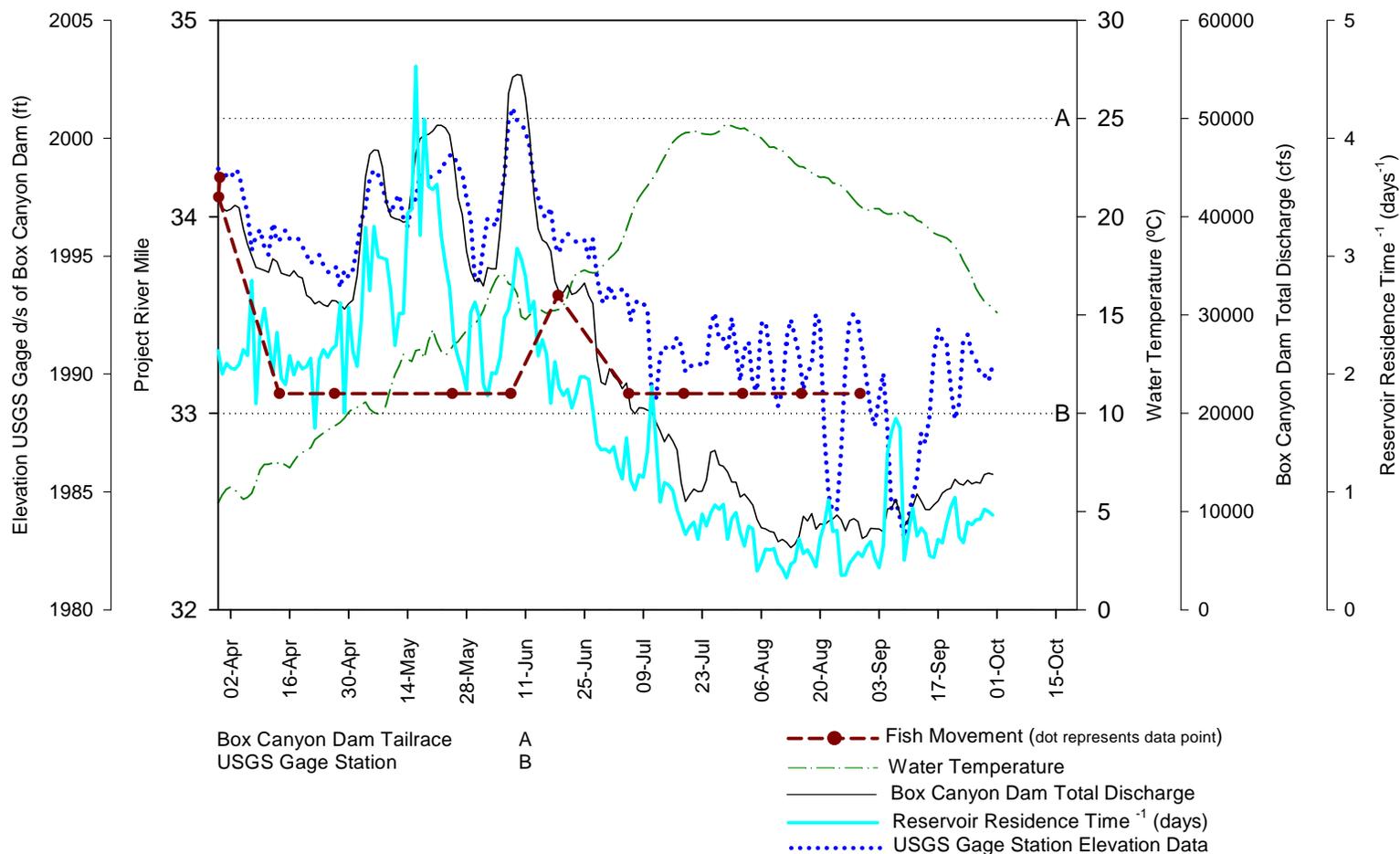
**Figure A.5-2.** Movement data of a radio-tagged (fish 77) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir and Canyon reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



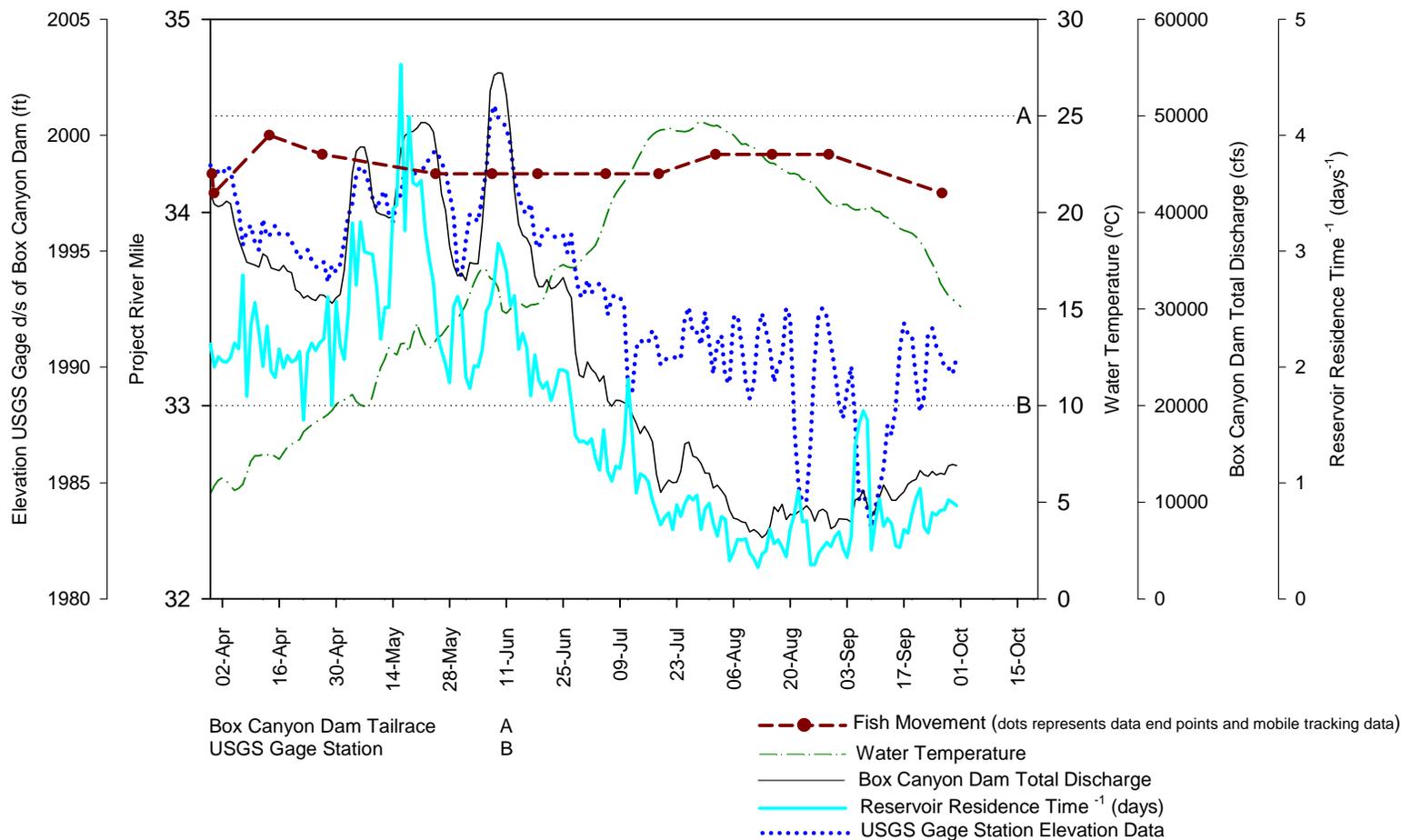
**Figure A.5-3.** Movement data of a radio-tagged (fish 78) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir, Canyon, Forebay, and Tailrace reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



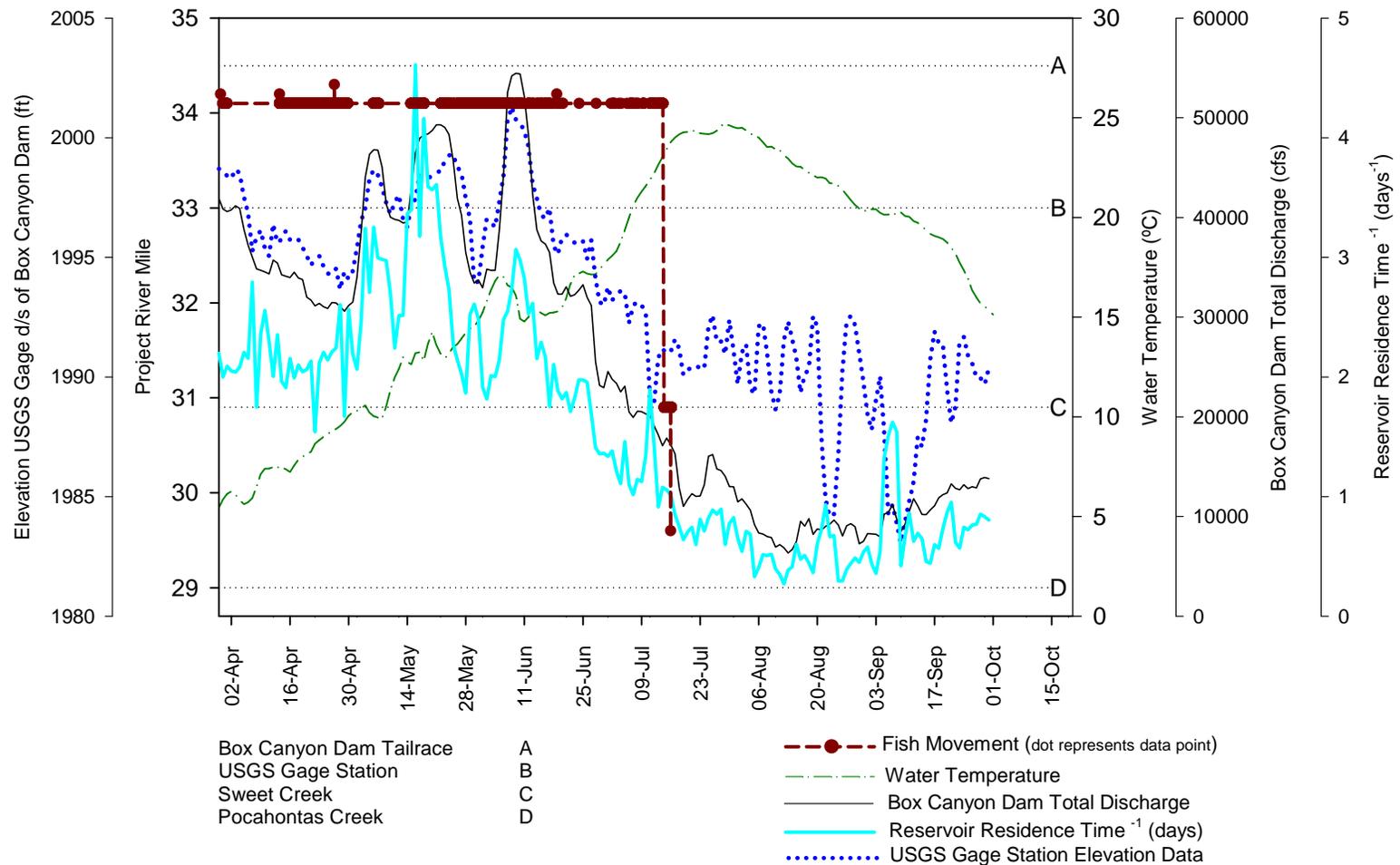
**Figure A.5-4.** Movement data of a radio-tagged (fish 79) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



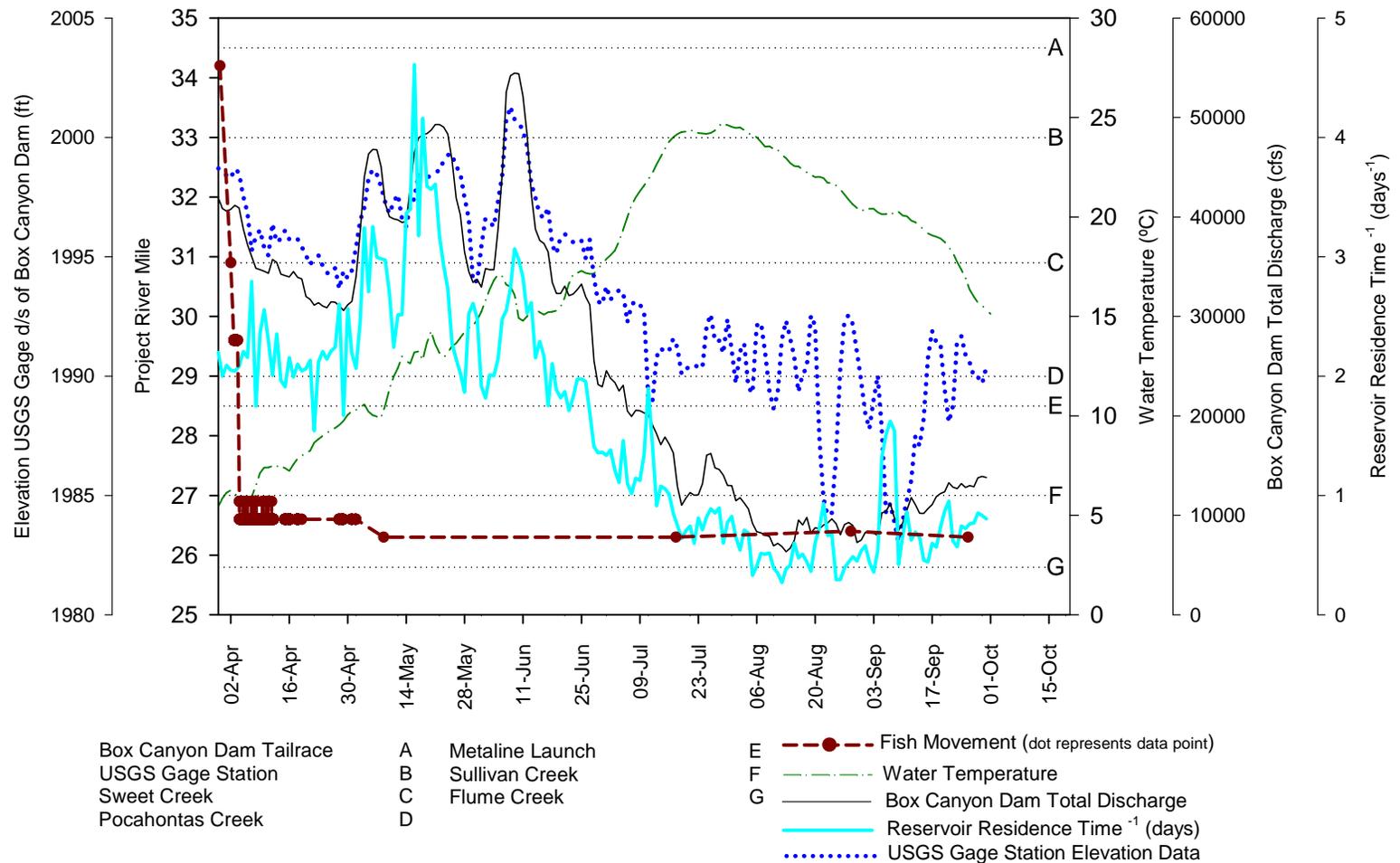
**Figure A.5-5.** Movement data of a radio-tagged (fish 80) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



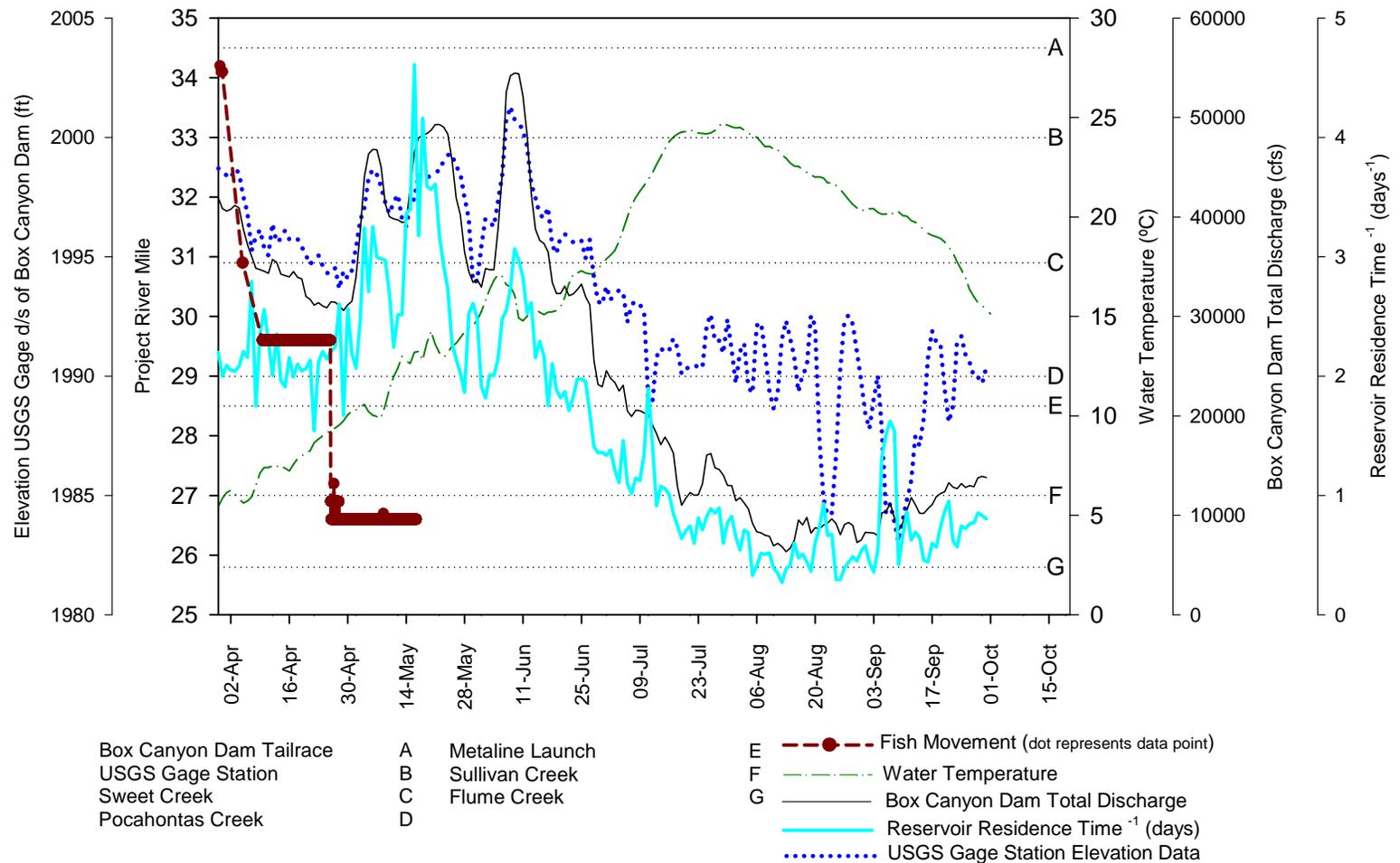
**Figure A.5-6.** Movement data of a radio-tagged (fish 81) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



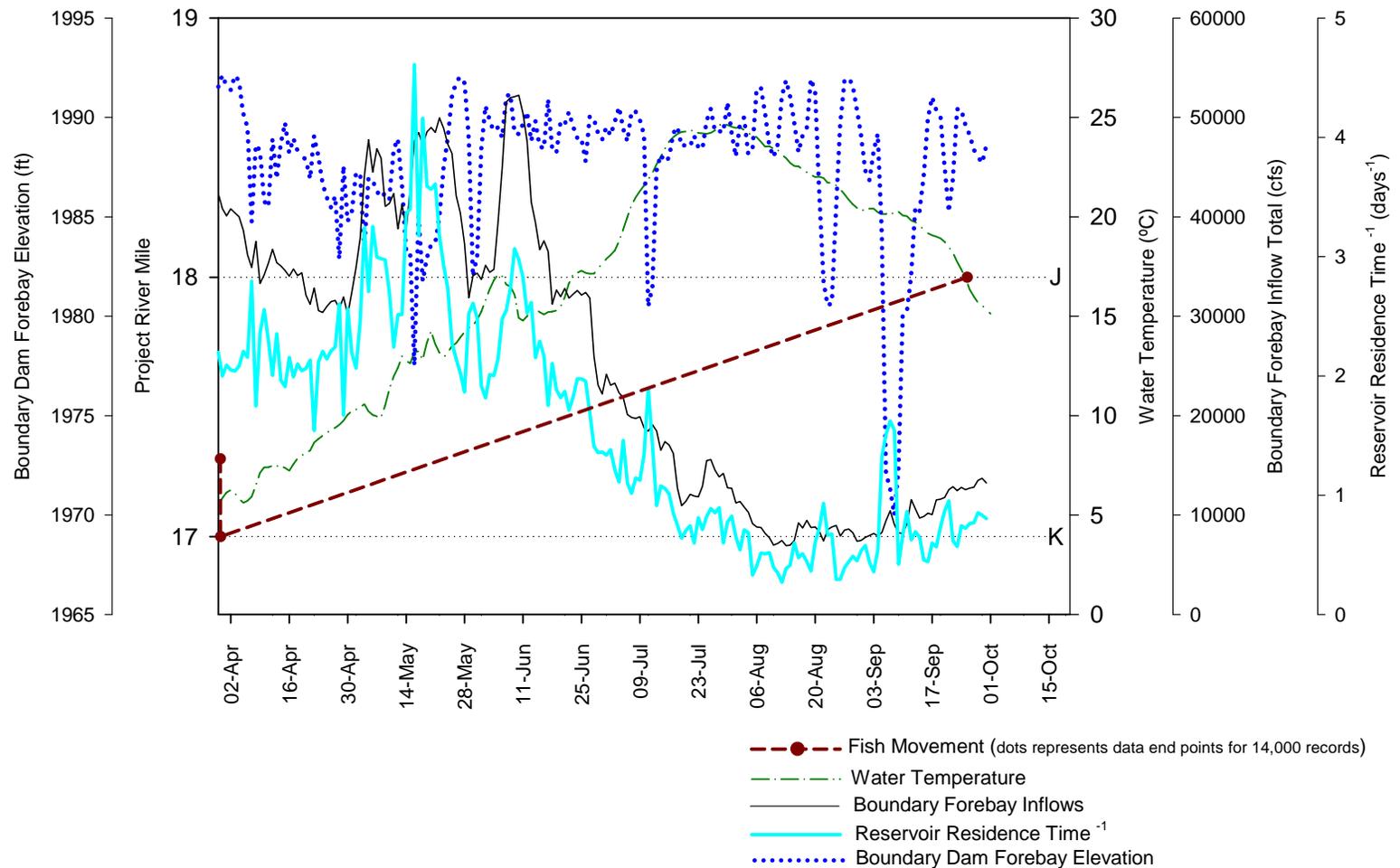
**Figure A.5-7.** Movement data of a radio-tagged (fish 82) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



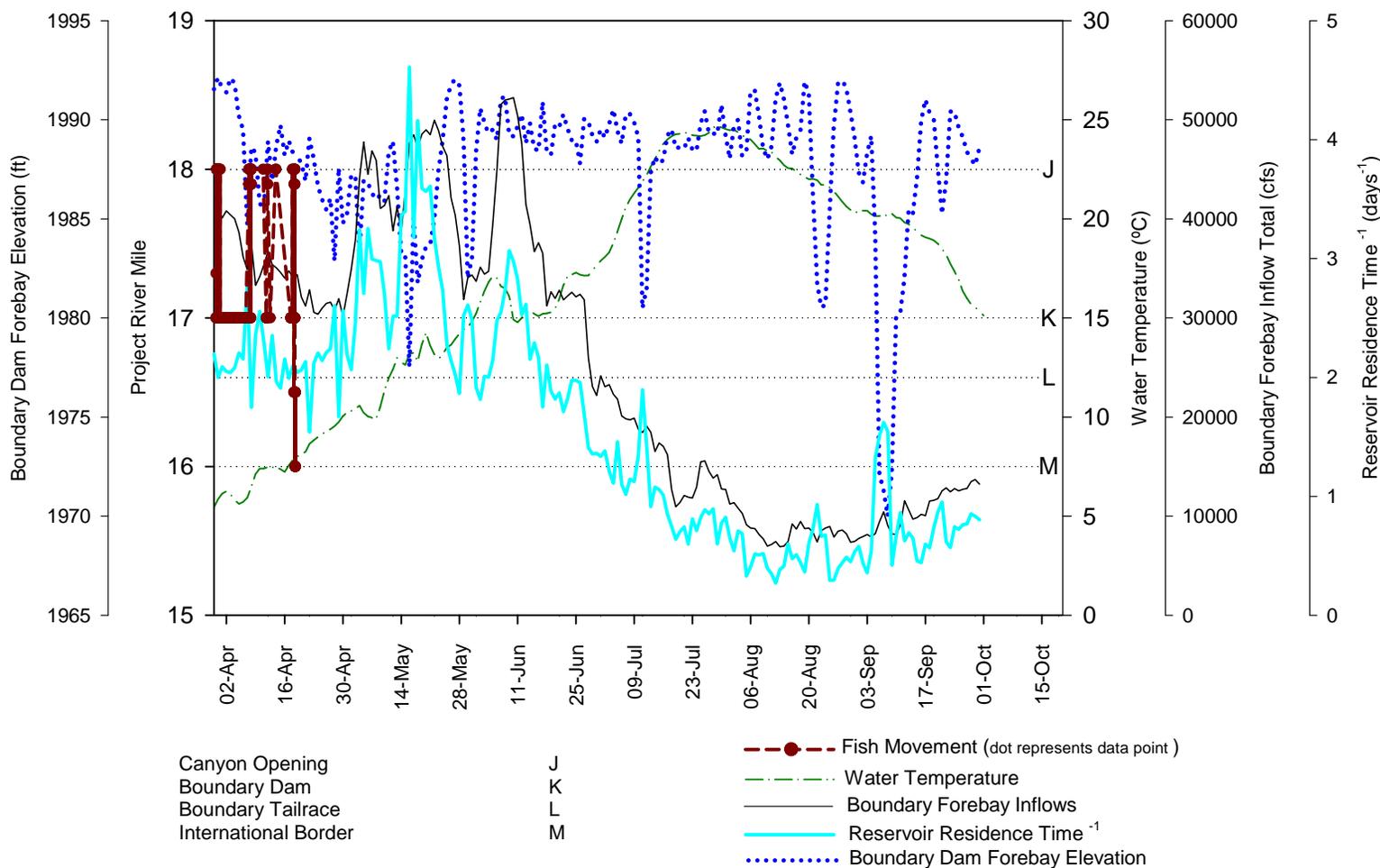
**Figure A.5-8.** Movement data of a radio-tagged (fish 83) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir and Canyon reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



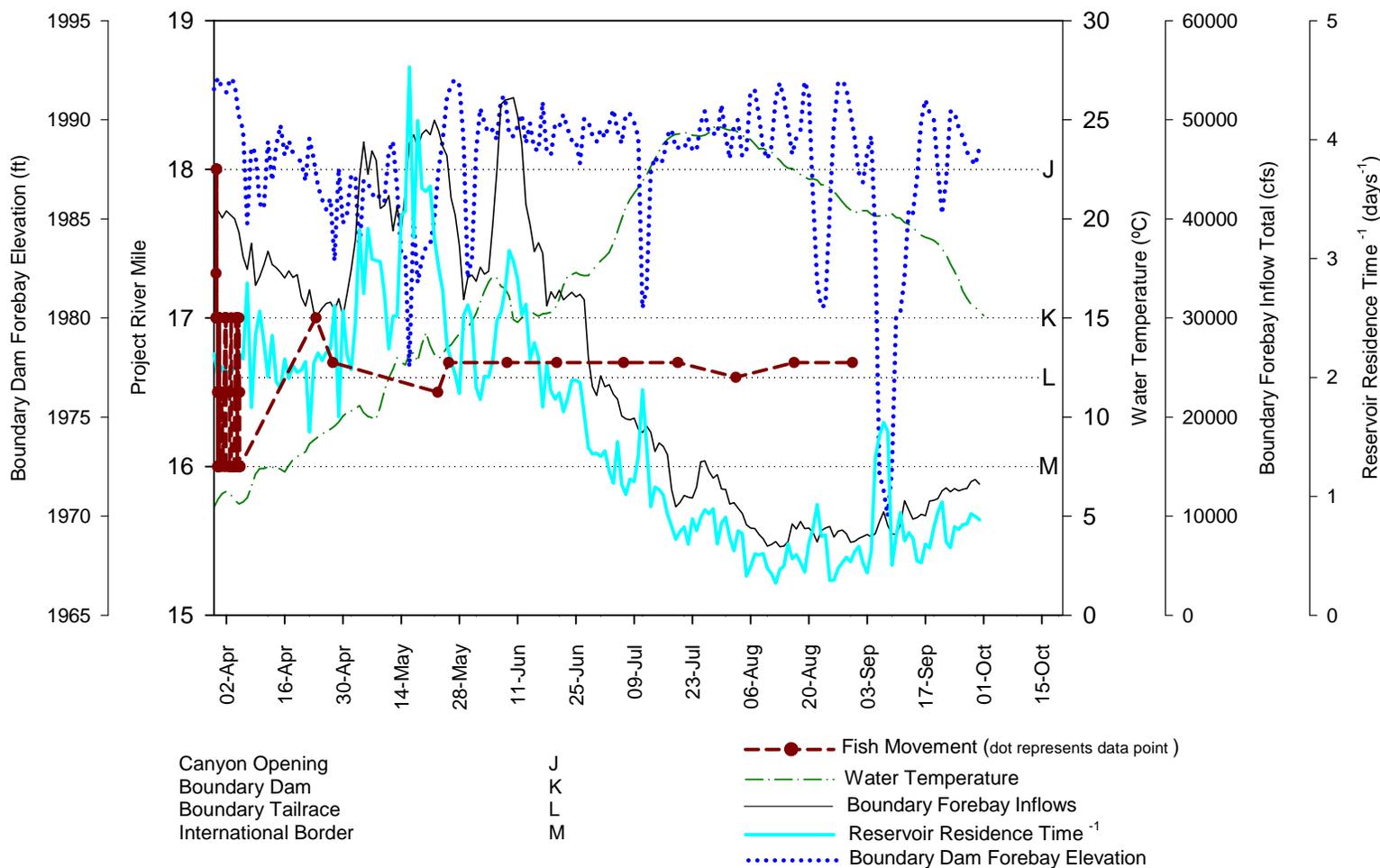
**Figure A.5-9.** Movement data of a radio-tagged (fish 84) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Upper Reservoir and Canyon reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



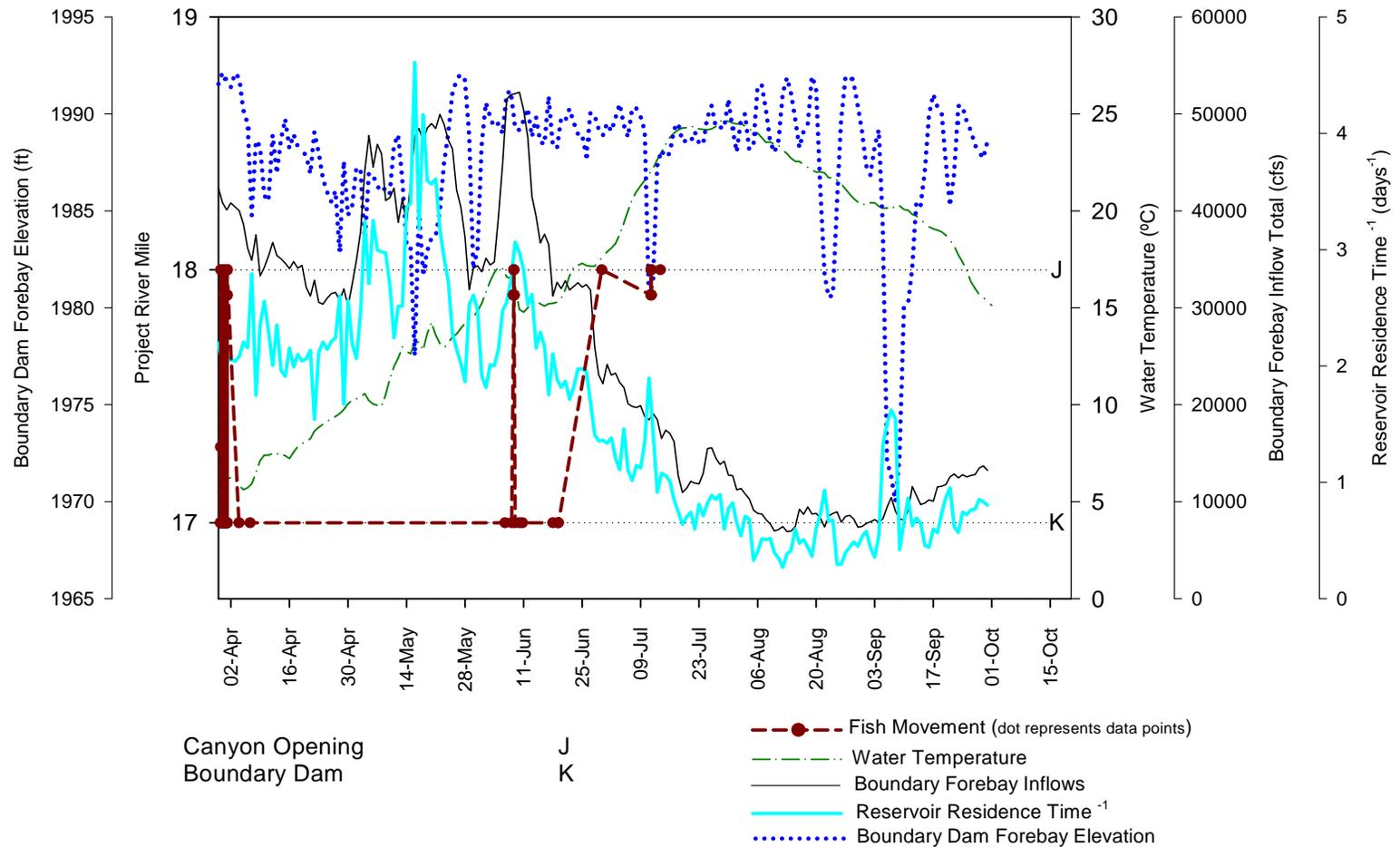
**Figure A.5-10.** Movement data of a radio-tagged (fish 87) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



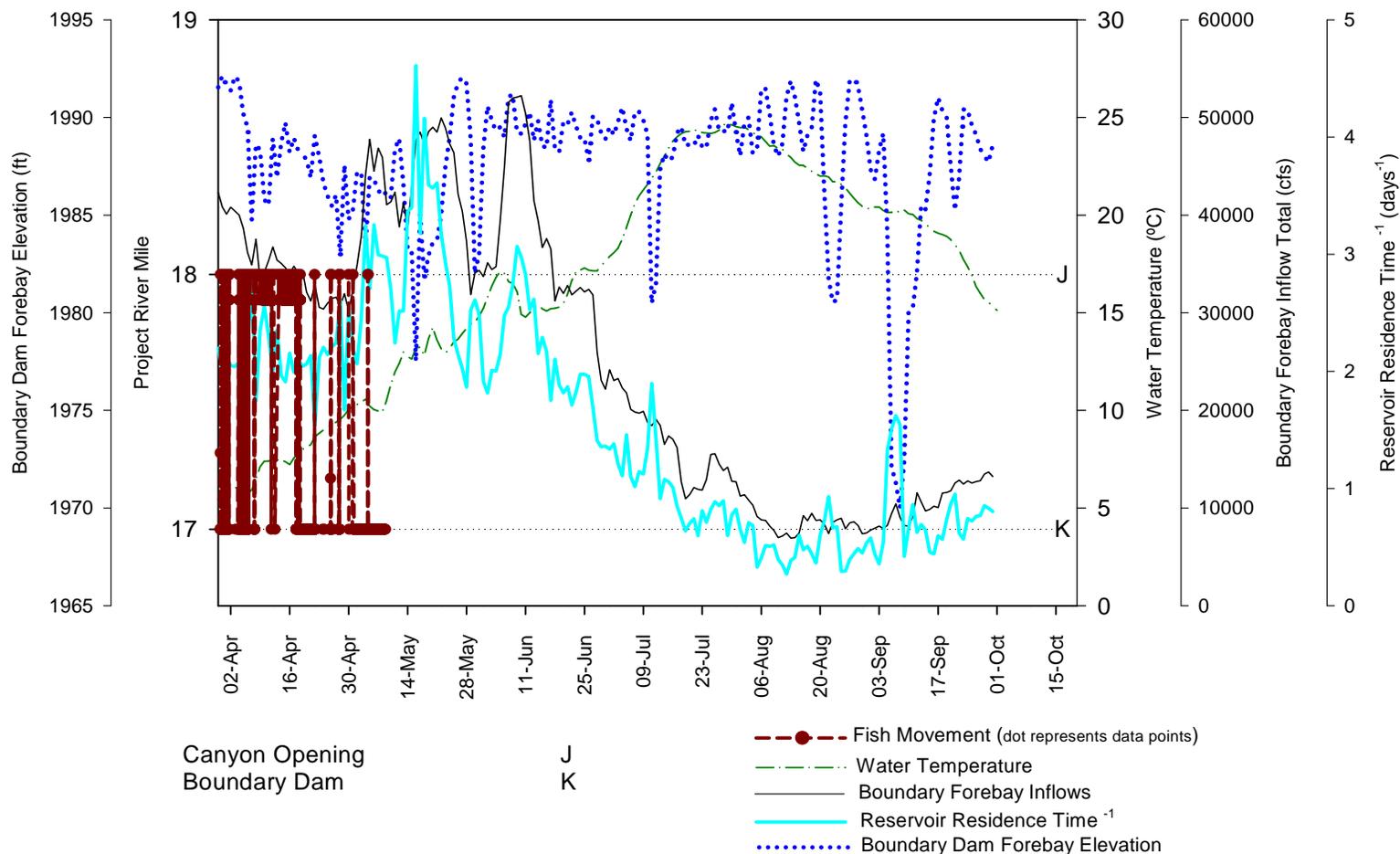
**Figure A.5-11.** Movement data of a radio-tagged (fish 88) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay and Tailrace reaches in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



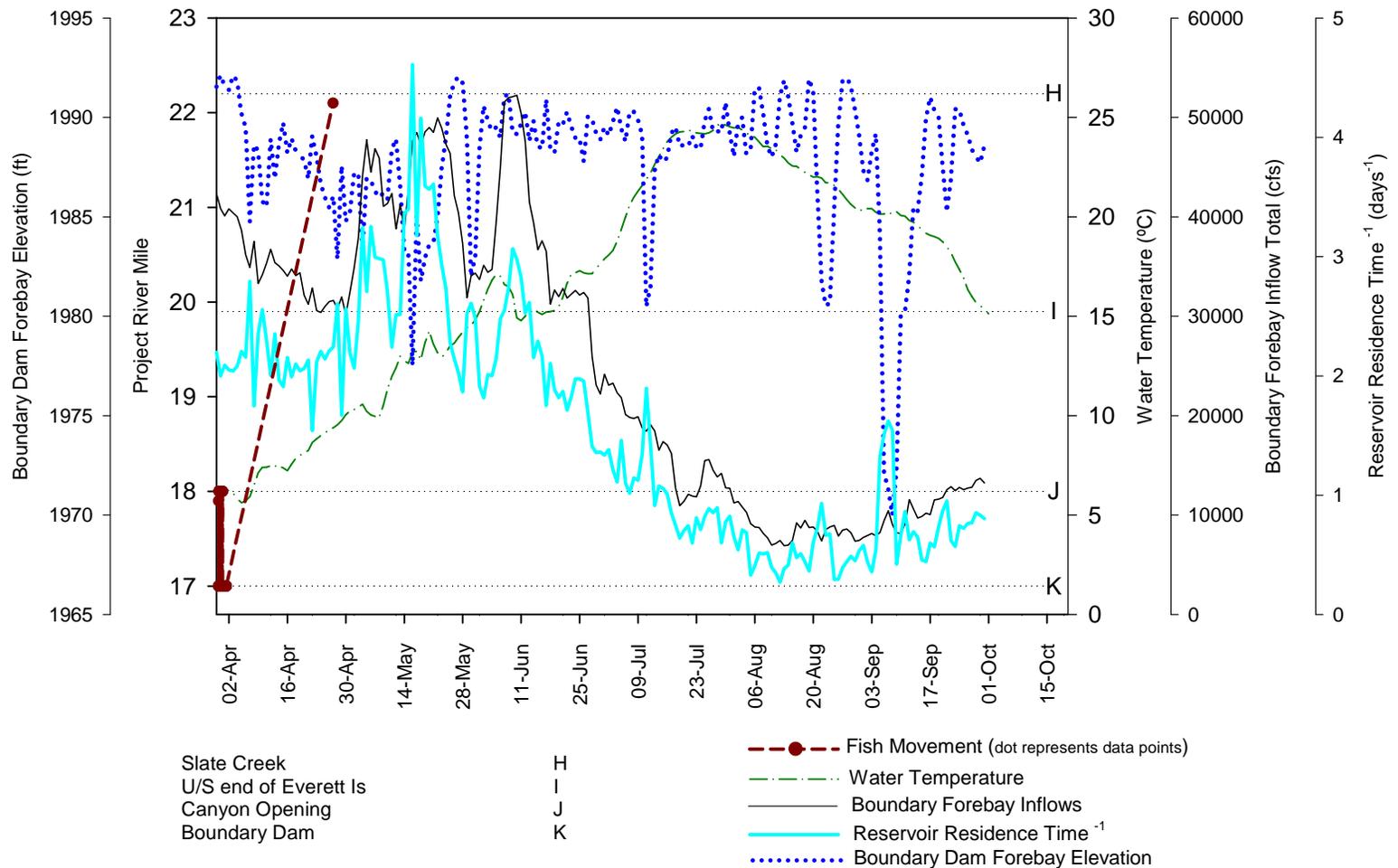
**Figure A.5-12.** Movement data of a radio-tagged (fish 89) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay and Tailrace reaches in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



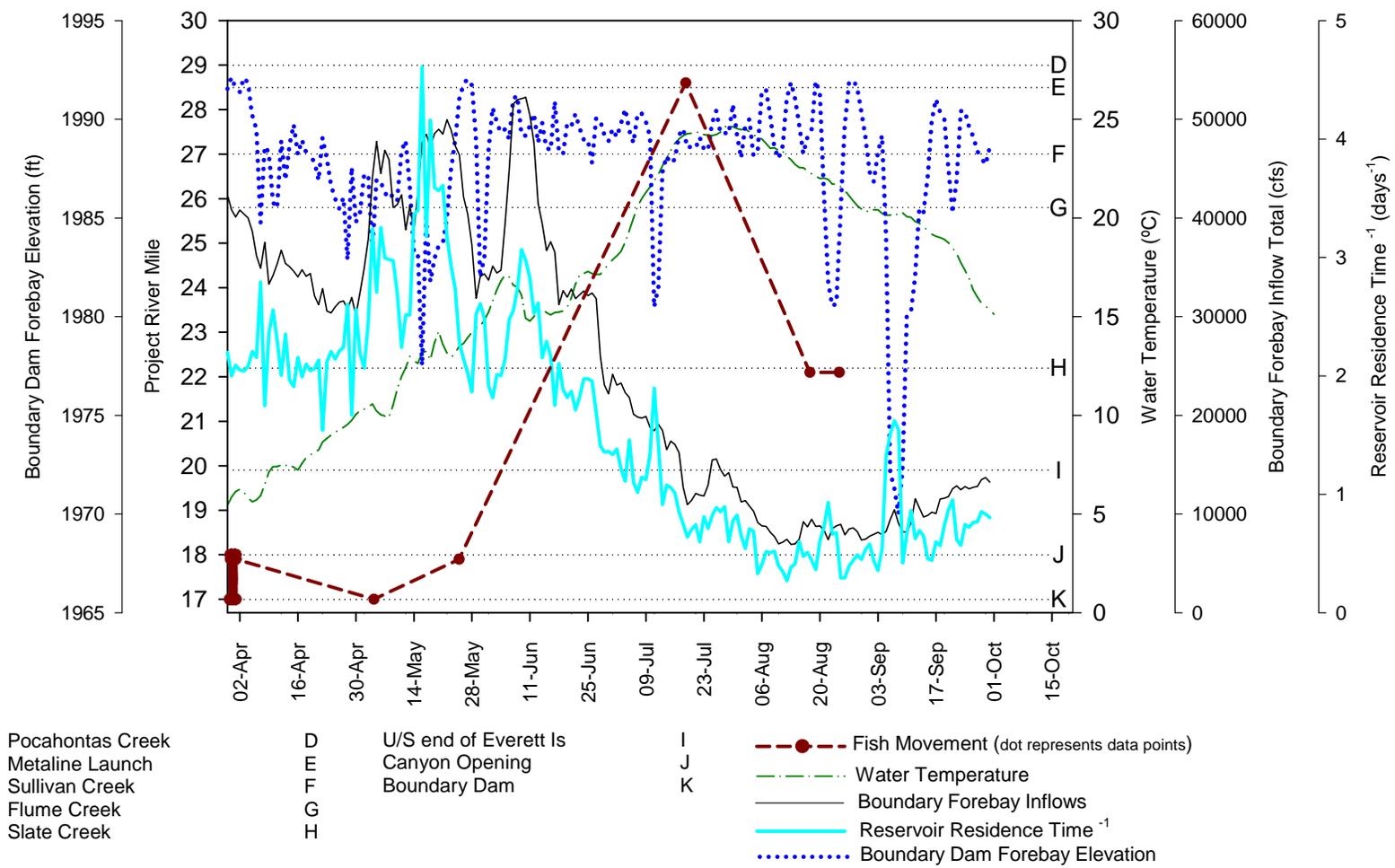
**Figure A.5-13.** Movement data of a radio-tagged (fish 90) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



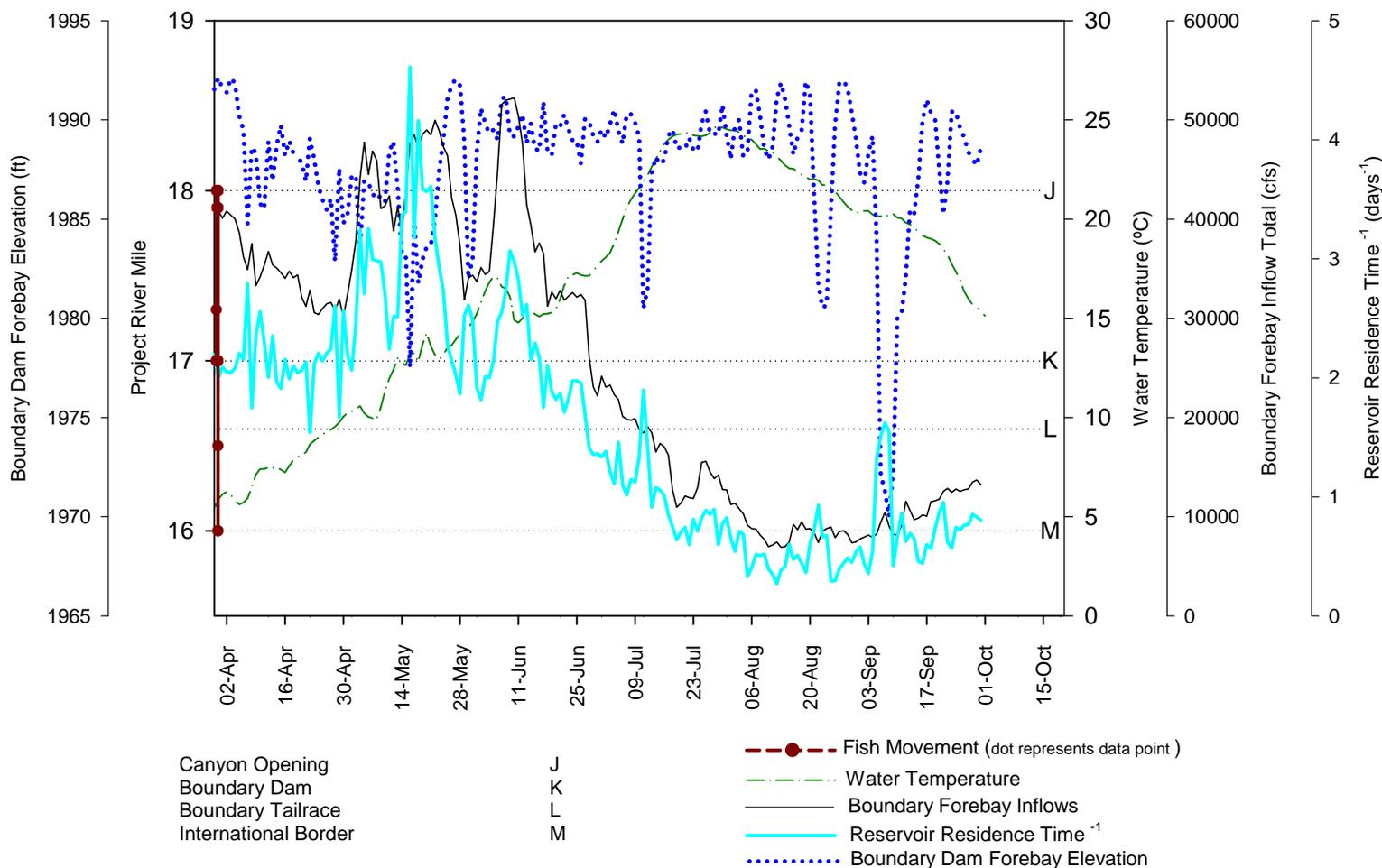
**Figure A.5-14.** Movement data of a radio-tagged (fish 91) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



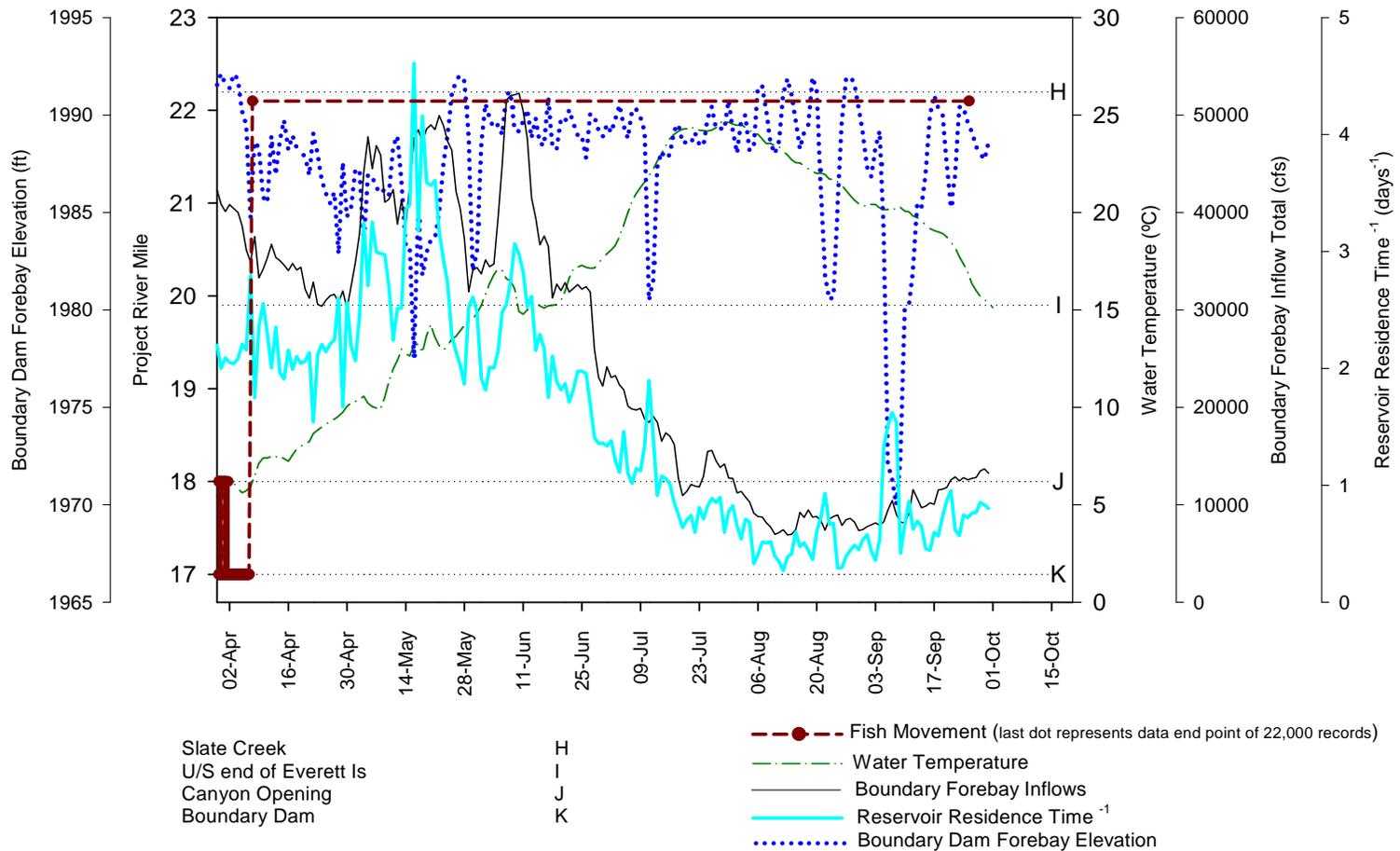
**Figure A.5-15.** Movement data of a radio-tagged (fish 92) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



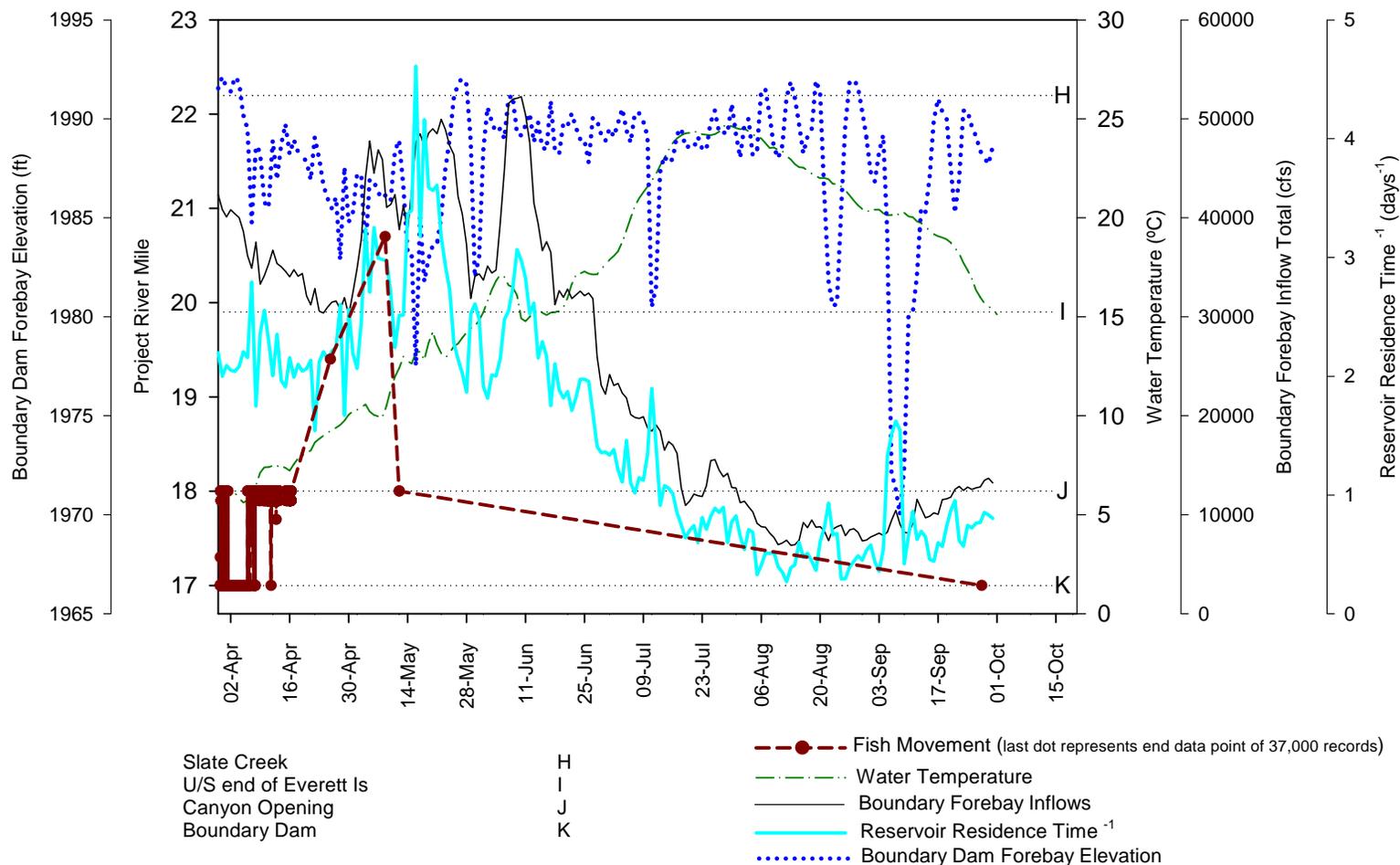
**Figure A.5-16.** Movement data of a radio-tagged (fish 93) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007. Data after April 1 were mainly one event records and were considered suspect.



**Figure A.5-17.** Movement data of a radio-tagged (fish 94) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay and Tailrace reaches in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



**Figure A.5-18.** Movement data of a radio-tagged (fish 95) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007. Fish was likely killed on April 6, after which fish 95 was detected continuously by the Slate Creek receiver.

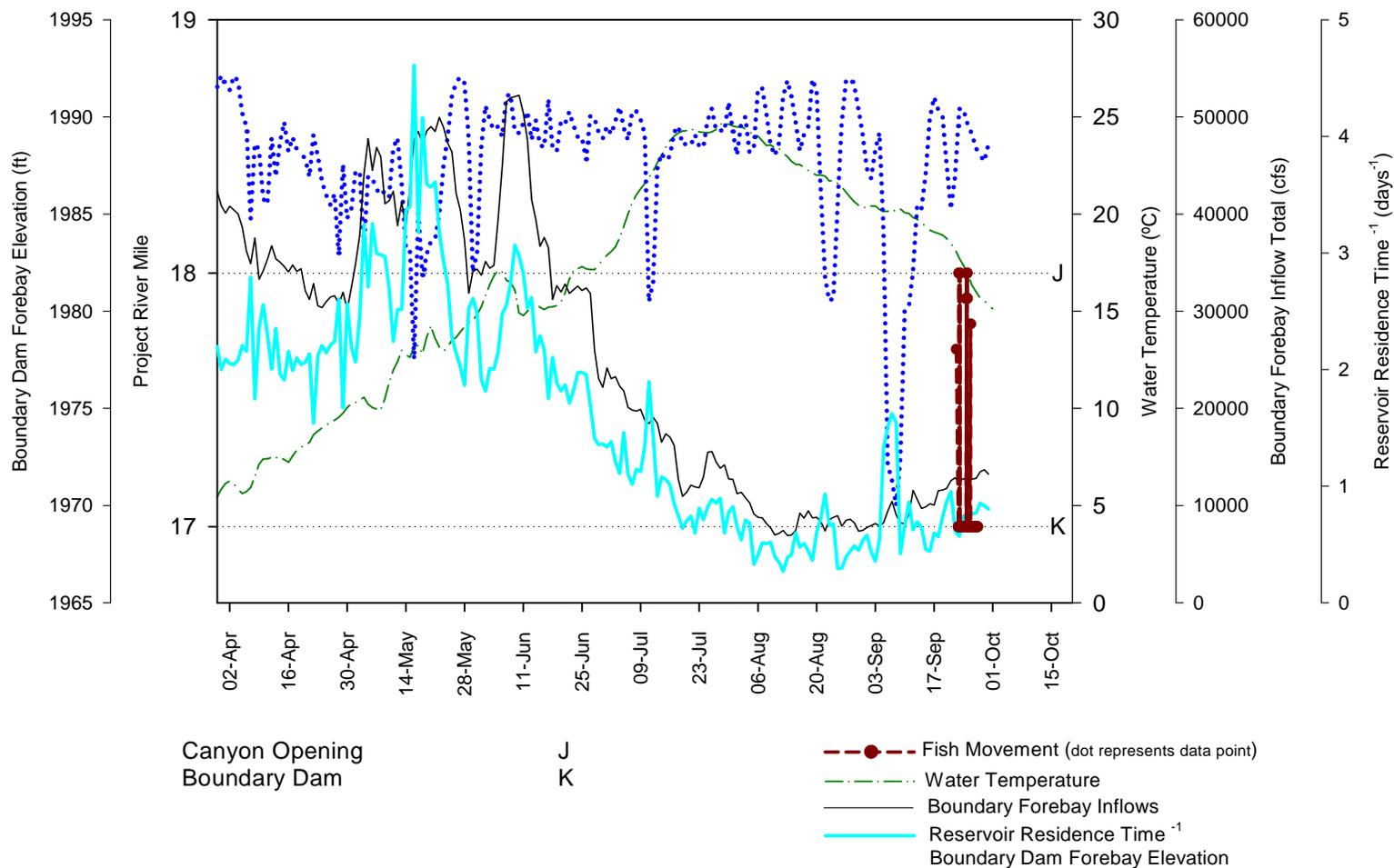


**Figure A.5-19.** Movement data of a radio-tagged (fish 96) 2007 spring release triploid rainbow trout (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007. Fish was likely killed on May 12, after which fish 96 was detected continuously by receivers in the Forebay Reach.

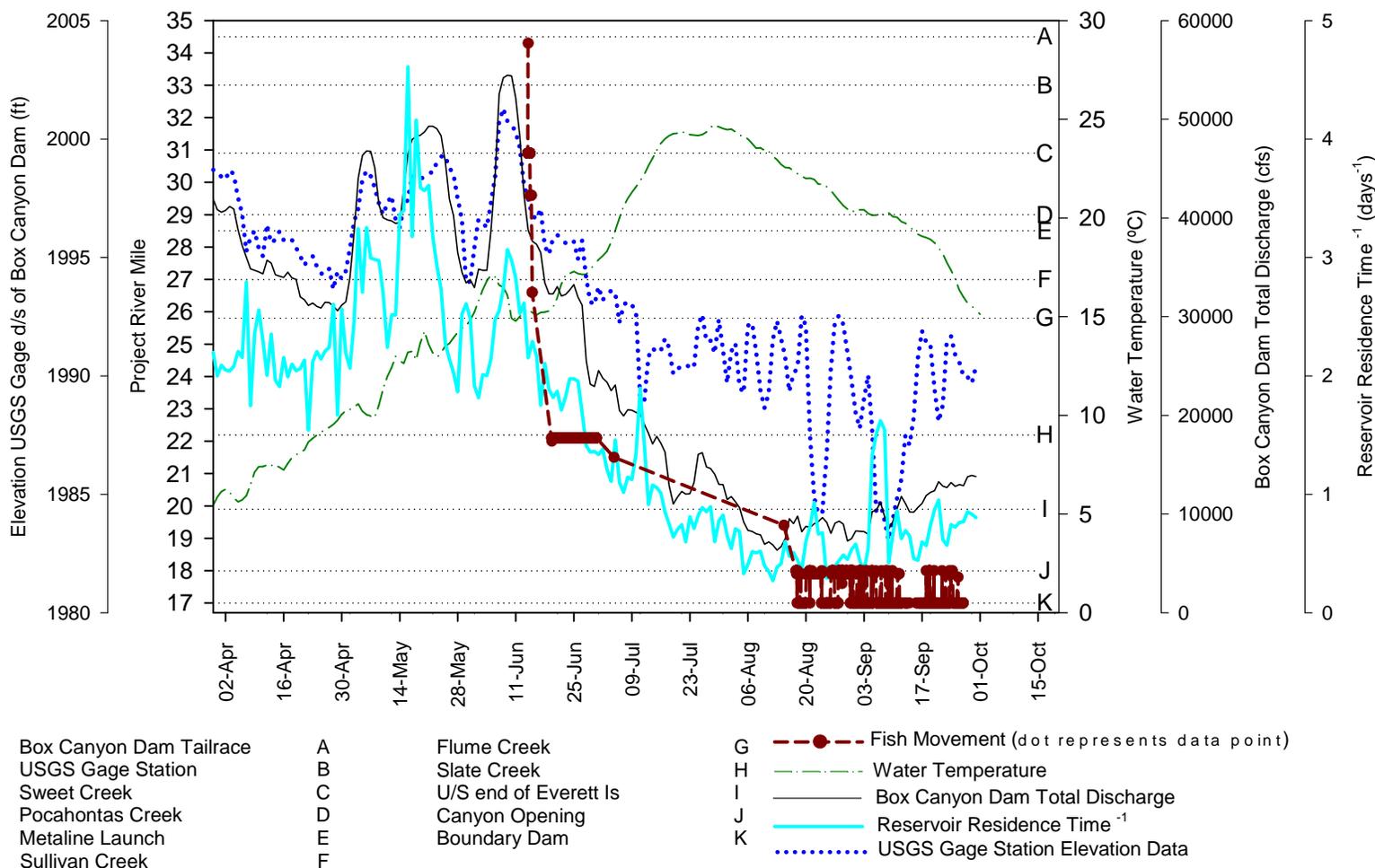
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## **Appendix 6. CART Tag 2007 Tracking**

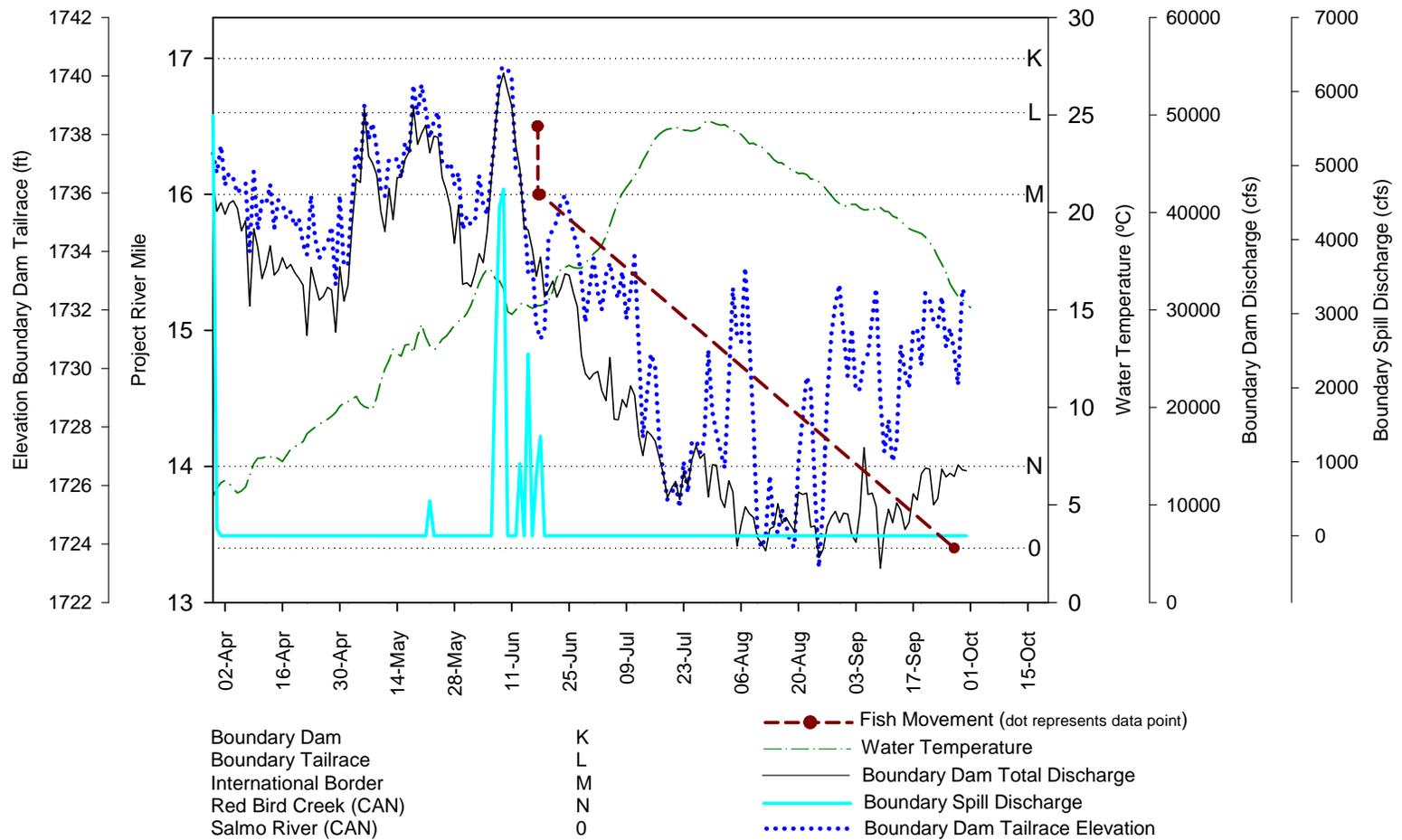




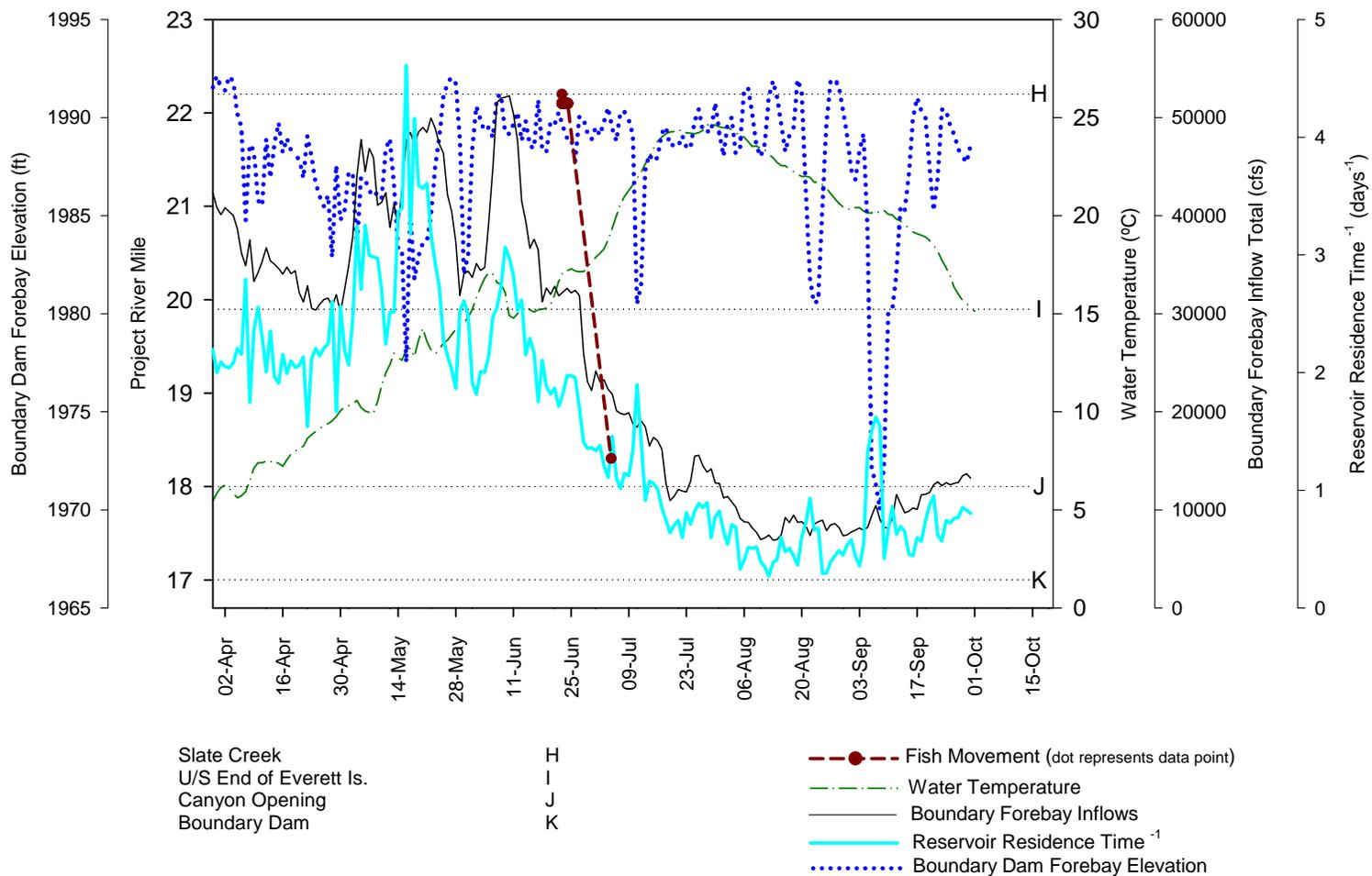
**Figure A.6-1.** Movement data of a radio-tagged (fish 11) rainbow trout tripliod carry-over (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



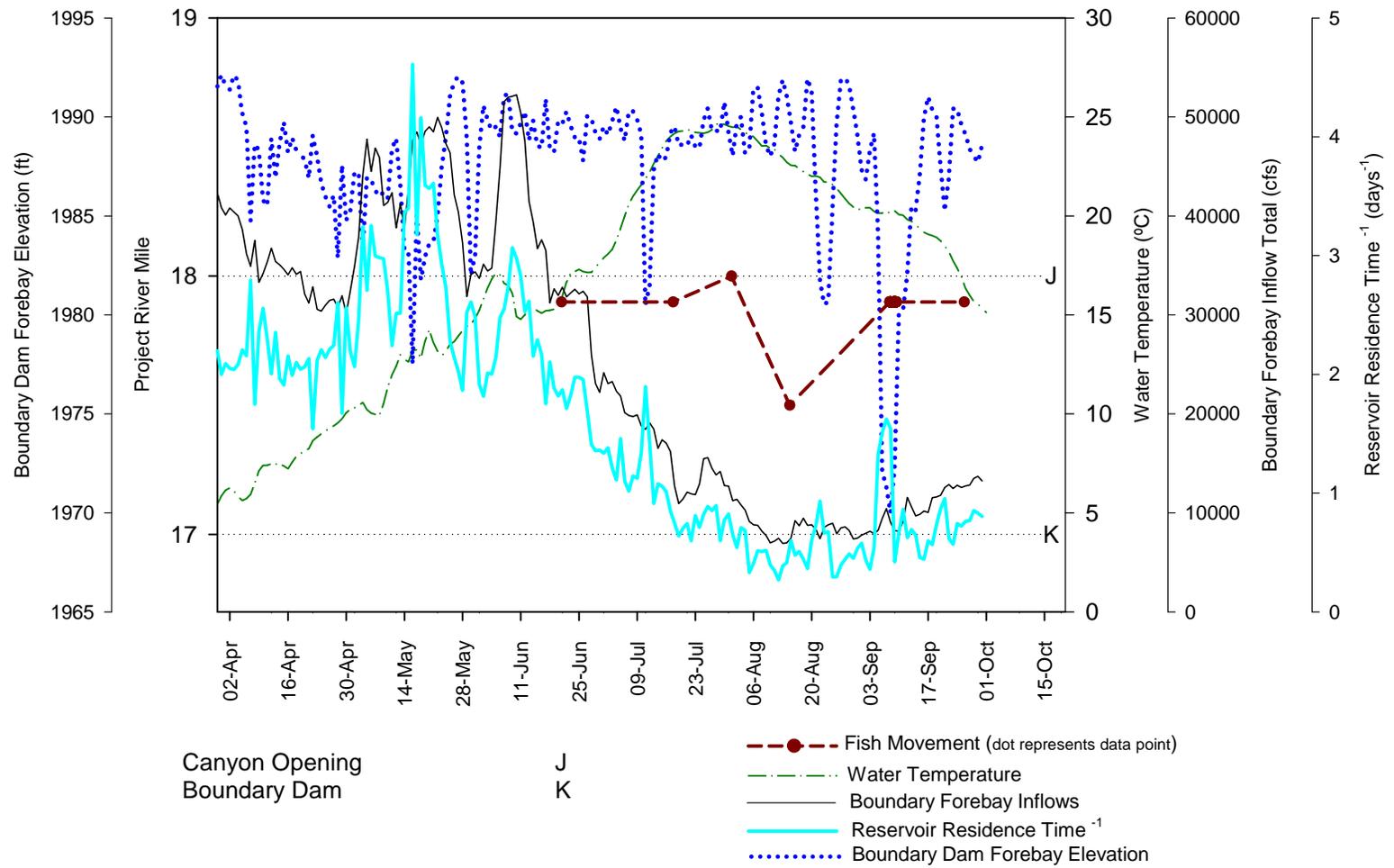
**Figure A.6-2.** Movement data of a radio-tagged (fish 28) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir, Canyon, and Forebay reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



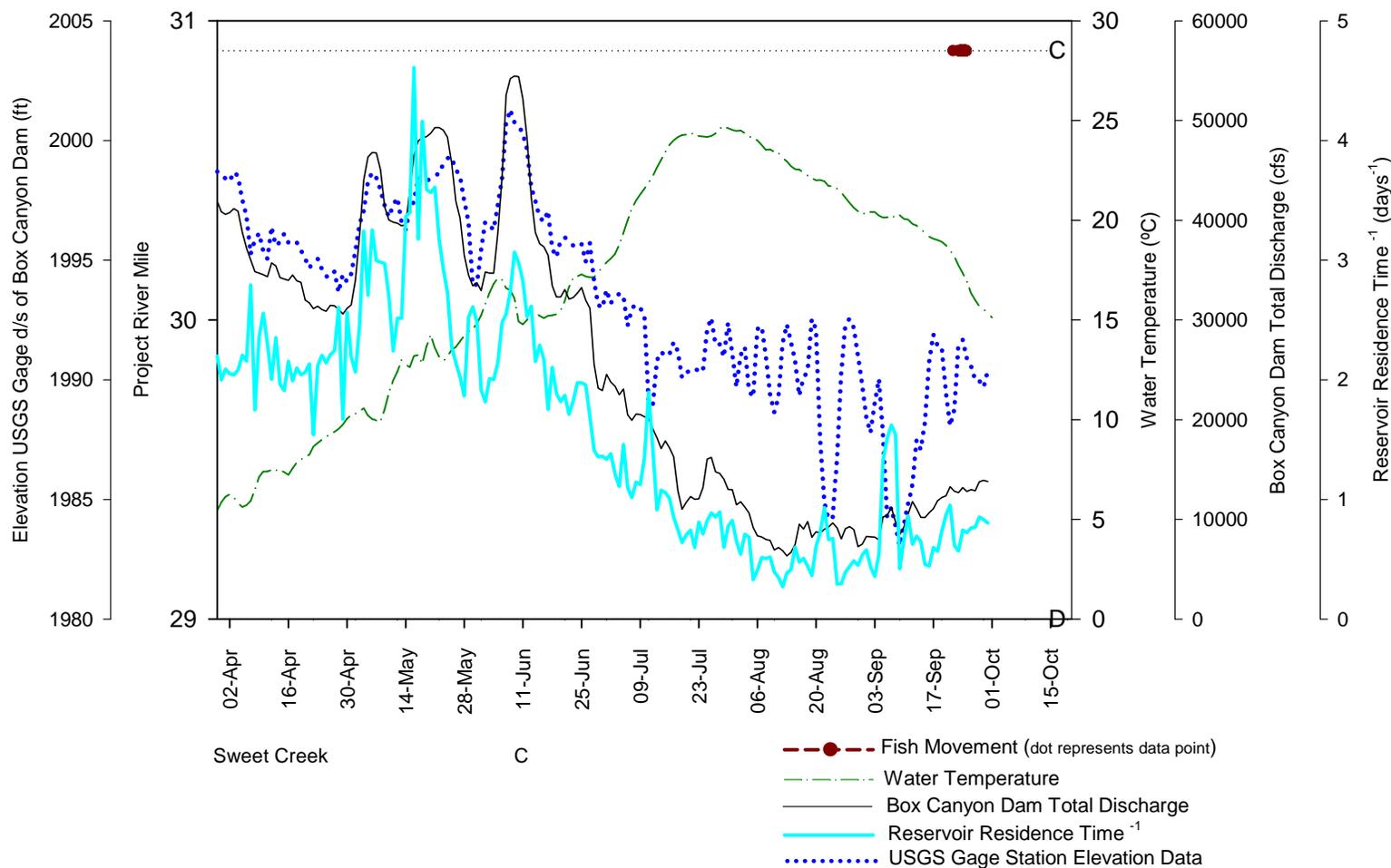
**Figure A.6-3.** Movement data of a radio-tagged (fish 31) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Boundary Tailrace Reach in relation to daily average water temperature, daily average total Boundary discharge, Boundary spill discharge, and daily average water level elevation (NAVD 88) as measured at Boundary tailrace, March 30 to September 30, 2007.



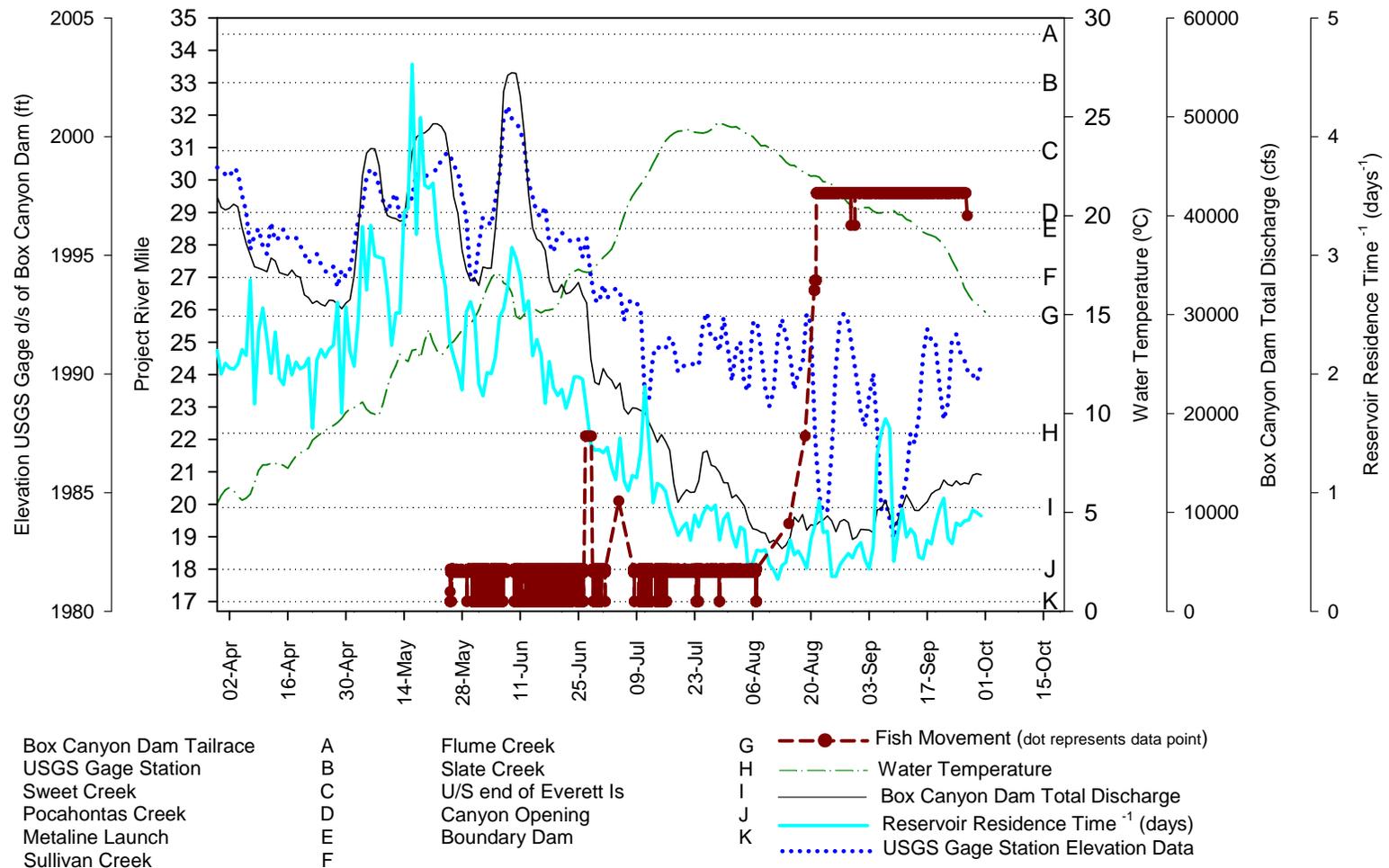
**Figure A.6-4.** Movement data of a radio-tagged (fish 36) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Canyon and Forebay reaches in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



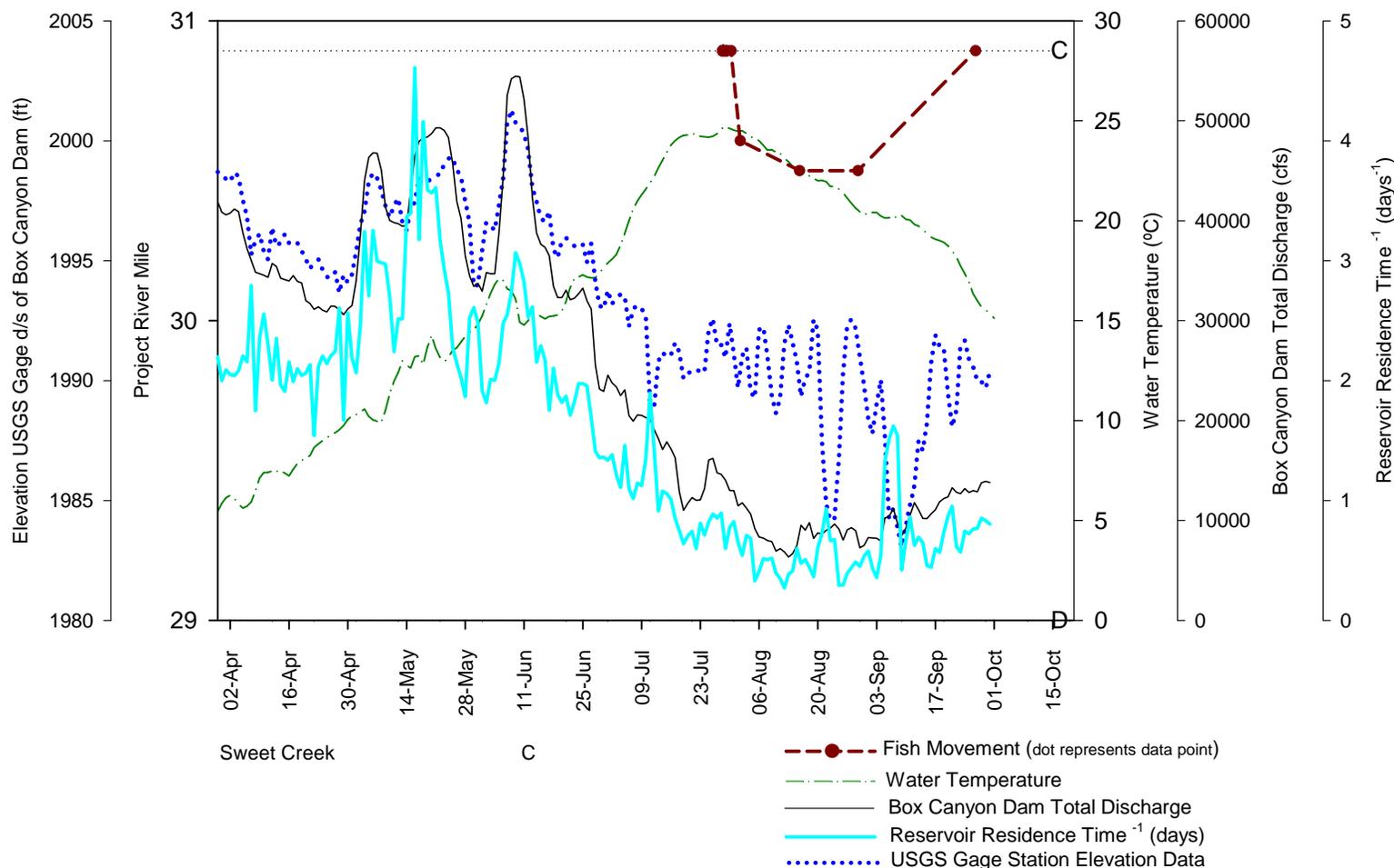
**Figure A.6-5.** Movement data of a radio-tagged (fish 37) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Forebay Reach in relation to daily average water temperature, daily average total Boundary Forebay Reach inflows, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at Boundary forebay, March 30 to September 30, 2007.



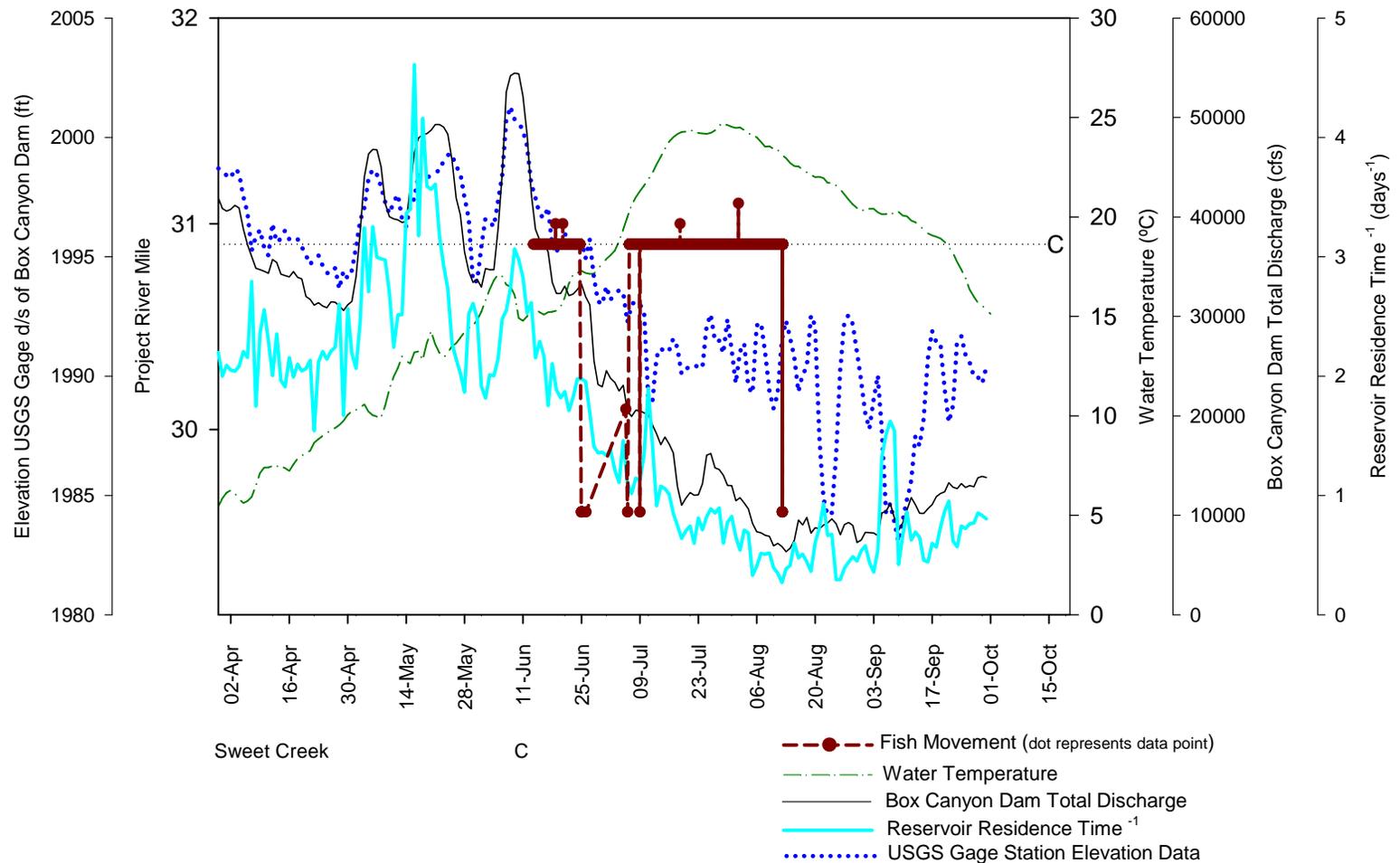
**Figure A.6-6.** Movement data of a radio-tagged (fish 39) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



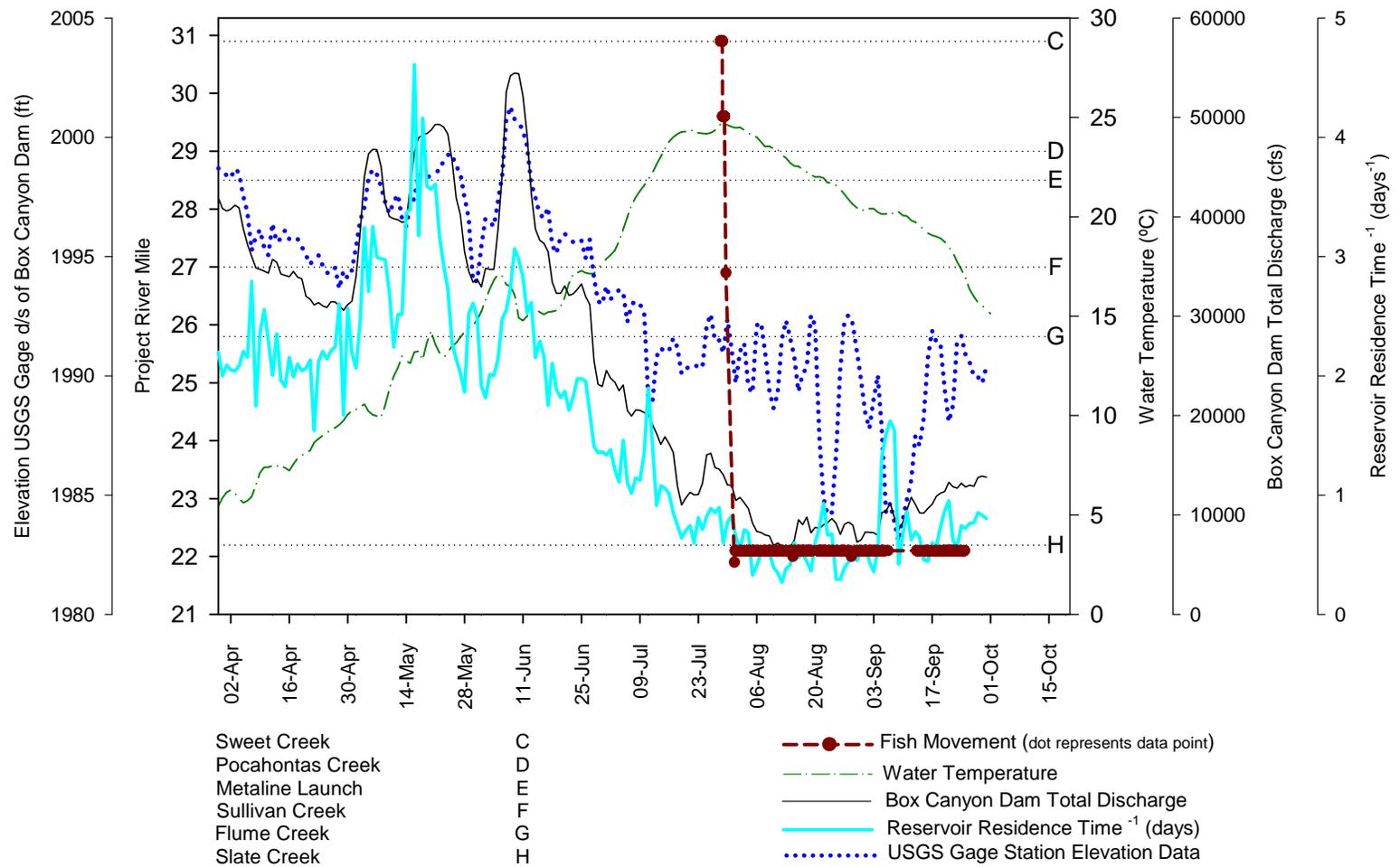
**Figure A.6-7.** Movement data of a radio-tagged (fish 40) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir, Canyon, and Forebay reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



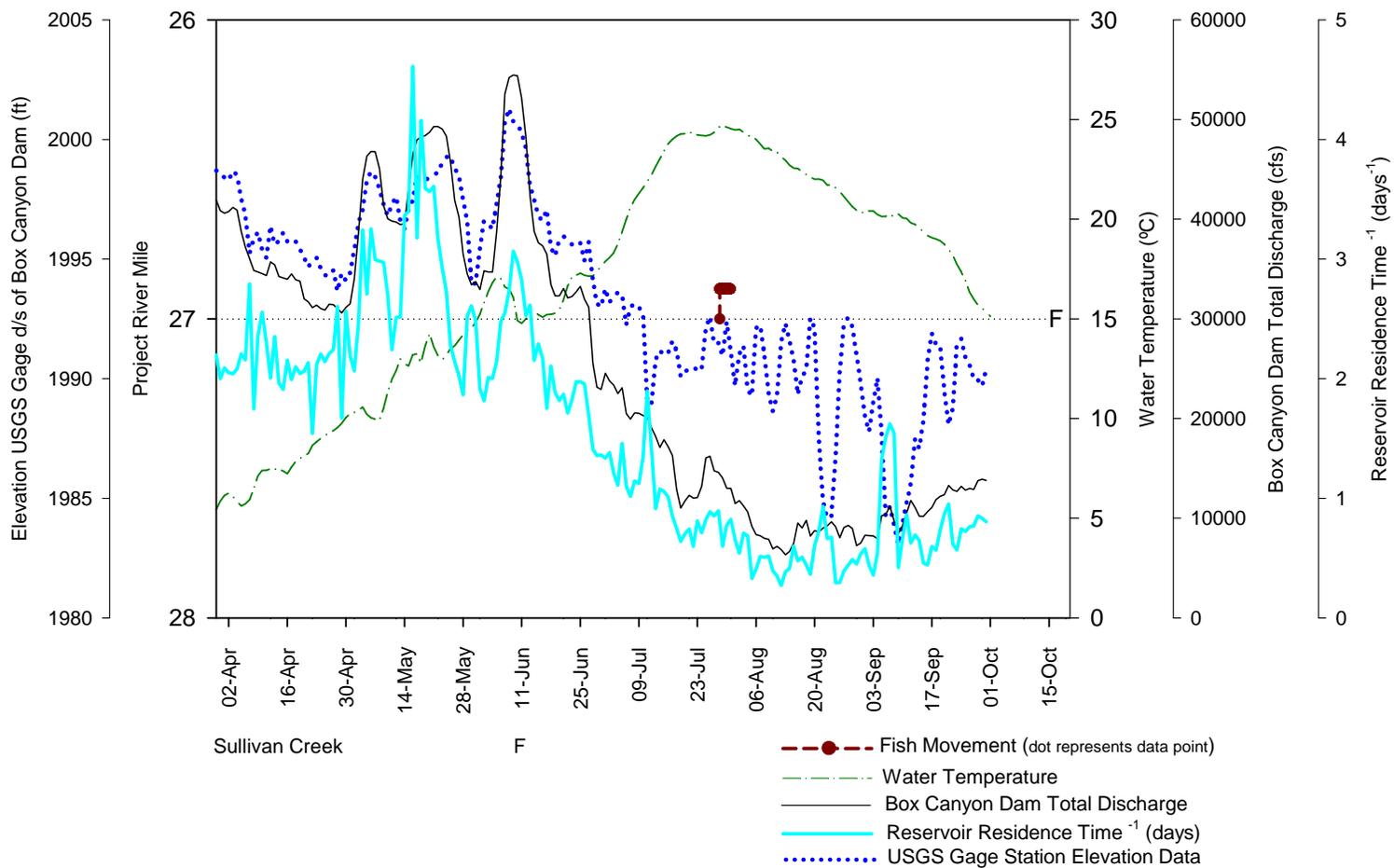
**Figure A.6-8.** Movement data of a radio-tagged (fish 49) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



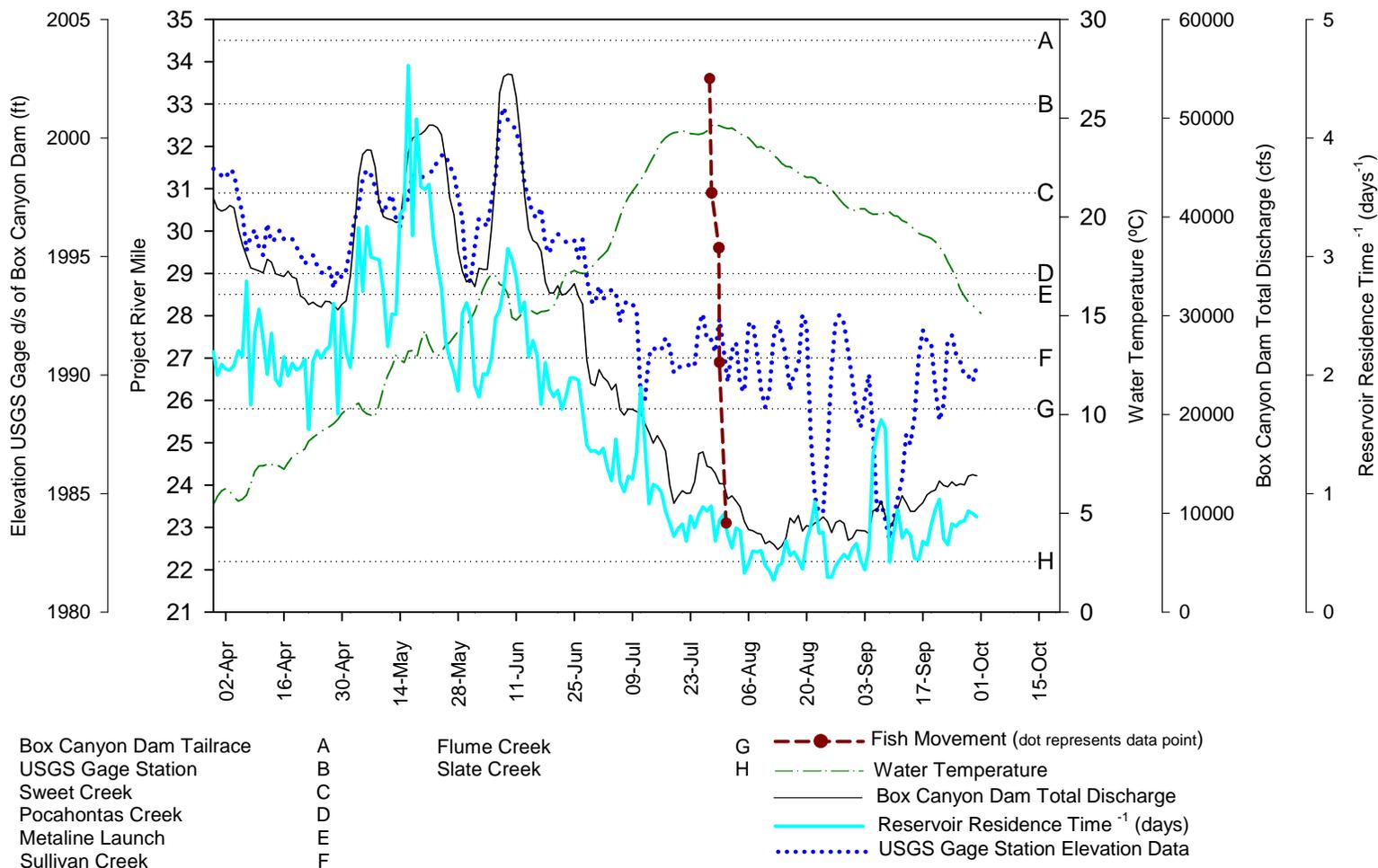
**Figure A.6-9.** Movement data of a radio-tagged (fish 55) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



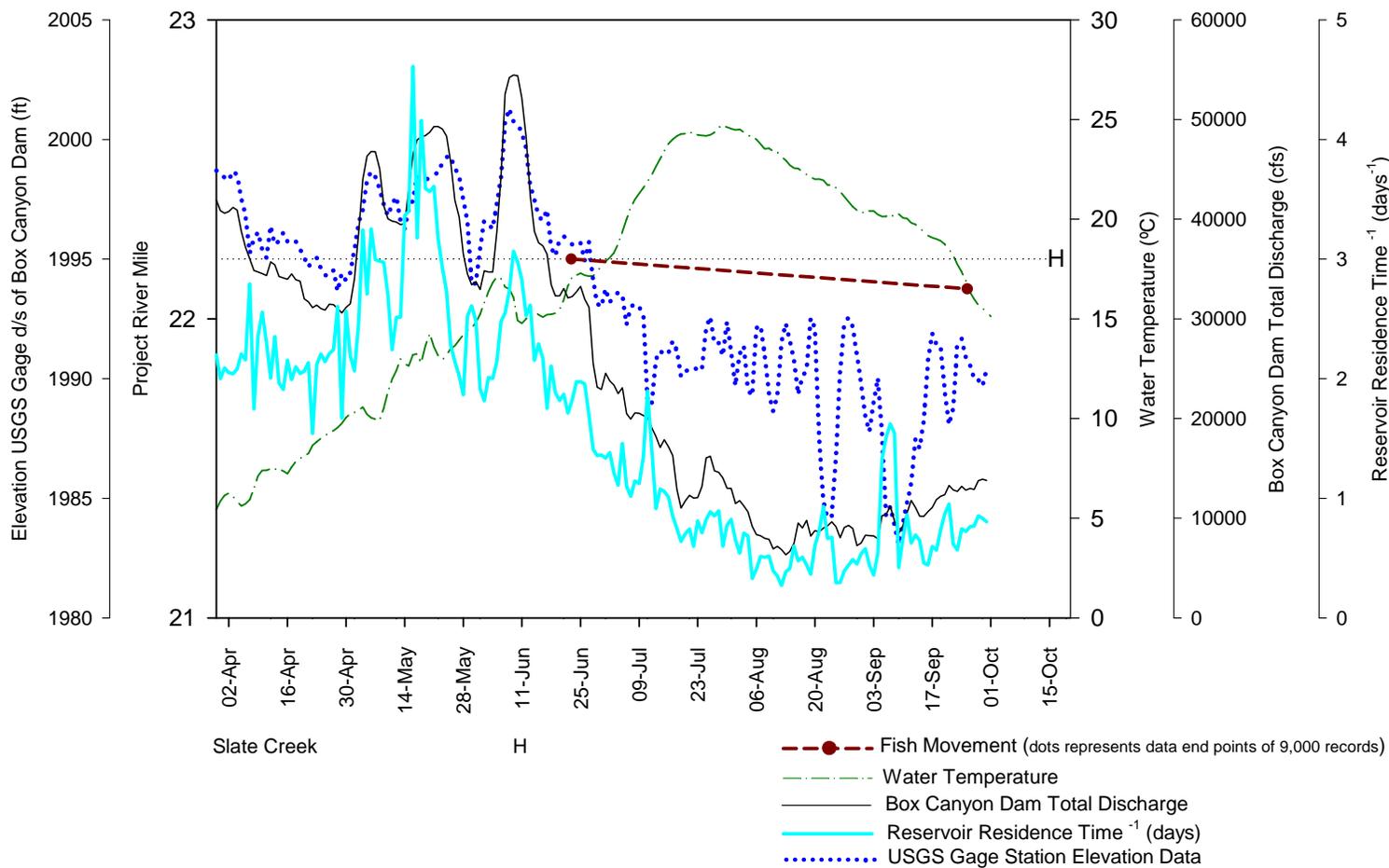
**Figure A.6-10.** Movement data of a radio-tagged (fish 61) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir and Canyon reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



**Figure A.6-11.** Movement data of a radio-tagged (fish 62) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



**Figure A.6-12.** Movement data of a radio-tagged (fish 70) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Upper Reservoir and Canyon reaches in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.



**Figure A.6-13.** Movement data of a radio-tagged (fish 34) rainbow trout triploid carry-over (*Oncorhynchus mykiss*) in the Canyon Reach in relation to daily average water temperature, daily average total discharge from Box Canyon Dam, inverse reservoir residence time (reservoir velocity), and daily average water level elevation (NAVD 88) as measured at the USGS Auxiliary Gage station 1.2 miles downstream of Box Canyon Dam, March 30 to September 30, 2007.

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