

Trap and Haul Emergency Procedures and Feasibility Plan at Lower Granite Dam

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INTRODUCTION

Precipitous declines of Snake River (SR) Sockeye Salmon *Oncorhynchus nerka* led to their Federal listing as endangered in 1991 (56 FR 58619). The same year, the Idaho Department of Fish and Game (IDFG) and National Oceanographic and Atmospheric Administration (NOAA) Fisheries initiated a captive broodstock program to gene bank and prevent species extinction. The captive broodstock program has been instrumental at increasing the number of adult spawners in the hatchery and Sawtooth basin lakes as well as the number of juveniles (e.g., smolts) released into the natural environment that contribute to restoring an anadromous life history. However, the number of adults needed for the hatchery program and population genetic diversity is currently maintained in the captive broodstock as the number of anadromous adults is not currently large or diverse enough to replace the captive broodstock and meet production goals (O'Reilly and Kozfkay 2014).

The overall goal of the SR sockeye salmon program is to restore a healthy, self-sustaining population that has a complete natural anadromous life history (80 FR 32365, NMFS 2015). Allowing anadromous adults to migrate to the Stanley Basin on their own is critical to the objective of replacing full-term captive fish and improving population fitness. While the trends in SR Sockeye Salmon returns have improved over the last decade (Ford 2015), abnormally high mortality has been observed in the Columbia River and tributaries when low snowpack combined with high ambient temperatures resulted in unfavorably warm water conditions (Graves et al. 2016). In 2015, in-river mortality of SR sockeye salmon between Bonneville and Lower Granite Dam (LGR) was estimated to be > 95% (Graves et al. 2016, Figure 1).

Regional recovery forums as well as NOAA's 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp) have stressed the need to investigate ground transport of SR Sockeye Salmon from LGR to Idaho. Emergency trap and haul of adult Sockeye Salmon from LGR was included in RPA 42 of the 2008 BiOp and has been maintained in all subsequent BiOps (NMFS 2009, NMFS 2010). This RPA was developed to address the concern of low adult Sockeye Salmon conversions between LGR and the Sawtooth Valley basin as a result of warm water temperatures during their migration through the Snake and lower Salmon rivers. As described in RPA 42, IDFG, NOAA, and the United States Army Corp of Engineers (USACOE) successfully tested adult Sockeye Salmon trapping at LGR and transport to the Eagle Fish Hatchery (EFH) near Boise, ID in 2010 when water temperatures were near average. During the summer of 2013, low summer flows and warm water temperatures resulted in a large temperature differential between the tailrace and fish ladder at LGR which, presented significant passage

difficulties for adult salmonids (e.g., Sockeye Salmon, Chinook Salmon, and steelhead) attempting to pass LGR. An adult Sockeye Salmon passage emergency was declared and trap and haul was attempted. However, no adult Sockeye Salmon were collected because of high water temperatures in the adult fish ladder which prohibited adults from ascending the fish ladder to the trap. The USACOE determined that the ladder auxiliary pumps could be operated to provide cooler water to the ladder and improve adult passage; however, it was not possible to run the trap and pumps concurrently. Following the 2013 passage emergency, the Region through the System Configuration Team, prioritized the USACOE to use Columbia River Fish Mitigation Funds to update with Regional review and input the previously developed plans for addressing warm water in the LGR fish ladder, and implement as soon as reasonably possible.

Conditions from Bonneville Dam to LGR prompted emergency trap and transport in 2015. In mid-June, we observed alarmingly warm water temperatures in the lower Columbia River and weather forecasts predicting continued hot weather. These unusually warm conditions prompted IDFG and NOAA to start discussions on the possibility of emergency trap and haul. We were confident that adult Sockeye Salmon could be successfully trapped at LGR because of the ladder temperature improvement structures that had been put in place by the USACOE after the unsuccessful attempt in 2013. Following the 4th of July weekend, it became very clear that a passage emergency action was necessary with water temperatures in the lower Columbia River above 70°F and climbing, continued hot temperature forecasts, reports of adult sockeye holding and dying in cool water refuges, and PIT tag data indicating increasing fallback and migration delays in the lower Columbia River. Permitting and logistics were developed with a start date of Monday July 13th for emergency adult Sockeye Salmon trap and haul from LGR. Adult sockeye were successfully trapped and transported from LGR the first day of operating under this emergency procedure (Graves et al. 2016, Figure 1)

Adult trap and haul from lower Snake River dams is an action to only be taken during an adult passage emergency. Based upon prior experiences with transport, three major themes have emerged for the future implementation of this action. First, a lot more attention is being directed into monitoring water temperature and adult sockeye passage conditions in the FCRPS hydrosystem. Secondly, if atypical conditions indicate a passage emergency may develop, NOAA and IDFG would plan to start trapping and transporting adults from LGR earlier and for a longer duration (i.e., more hours in a day or more days of the week) than was done in 2015. Lastly, IDFG will not propose to add or move emergency adult sockeye trap and haul from/to Ice Harbor Dam (ICE) but supports a pilot study to test the feasibility so that this measure can be further investigated (Appendix A).

This plan provides the framework to evaluate passage conditions and conduct adult Sockeye Salmon

trap and haul activities from LGR. Specific goals of this plan are to 1) identify indicators that will be monitored, 2) develop trapping, holding, and transport protocols, and 3) develop a person of contact (POC) list to facilitate coordination and distribution of program updates among cooperators and 4) develop a list of resources and personnel required to successfully implement this activity. This plan will be a critical component of future anadromous Sockeye Salmon broodstock collections in years when a passage emergency has been declared. The ultimate implementation of this plan will rely on good communication and coordination between regional cooperators

INDICATORS and METRICS

Based upon prior year's information (e.g., 2013 and 2015) and the modeling efforts of Crozier et al. (2014), the following metrics are recommended to monitor as important indicators of fish passage delays or blockages: 1) in-river temperatures and forecasted weather conditions 2) conversion rates through the FCRPS 3) average passage timing through the FCRPS and 4) SR adult Sockeye Salmon run strength and run timing. Increased temperatures lead to direct mortality but can also lead to decreased swim speeds of adults and increased temperature exposure and stress on migrating adults. Warm water temperatures in the adult ladders and forebays at mainstem dams can also cause migration delays or barriers, as observed in 2013, and lead to lower conversion rates and higher fallback rates. This information will be monitored at least on a weekly basis, more frequently during warm water periods, and will be important to determine the status and potential stressors on the population.

Migration Corridor River Temperatures

Below is a list of useful links for water temperature and stream flow data, which are recommended for monitoring conditions in the hydrosystem. Figure 2 displays an example of the type of data that can be summarized annually and between years.

http://fpc.org/river/Q_dailyforebaywatertempgraph.php

Forebay and tailrace temperatures are available at this link.

<http://fpc.org/river/watertemp.php>

Migration corridor river temperatures can be monitored real-time at four project dams (Bonneville, McNary, Ice Harbor, and Lower Granite) and compared to the prior year and 10 year averages.

<http://www.nwd-wc.usace.army.mil/tmt/>

The above web site provides a water temperature data tab in the lower left corner that has several useful links. The ‘Forebay Temperature Strings’ are used to track the pool of cold water available in Dworshak Reservoir (DWR), and the temperature profiles in the forebays at all the lower Snake River dams including McNary Dam. Two new strings (S1 & S2) at LGR were added in 2016 to help track temperature effects of the new ladder exit shower. The ‘Basin Temperatures’ are used to track water temperatures in the Snake River at Anatone, the forebay and tailrace at each lower Snake River dam, and the Clearwater River (including the North Fork and mainstem before and after the DWR cold water is released). The ‘LGR Fish Ladder’ is a new site added in 2016 to track temperature in the LGR fish ladder, adult trap, and forebay at the ladder exit.

<http://waterdata.usgs.gov/id/nwis/current?type=flow>

This USGS site has stream flow and water temperature data, including the Salmon River at White Bird.

PIT Tag Monitoring

Adult SR Sockeye Salmon that were previously PIT-tagged as juvenile are important for evaluating conversion rates, run timing and fallback through the FCRPS hydrosystem. Starting for BY14, 50,000 PIT tags were inserted into the Springfield Hatchery smolt releases and this level of tagging will be continued in future smolt releases. An additional, 2,000 – 5,000 naturally emigrating smolts from Redfish, Alturas, and Pettit lakes will be PIT-tagged. PIT-tag data will be loaded into PITAGIS and queries will be built annually to track returning adults through the FCRPS. In-season conversion rates and passage times will be compared with historical averages (Crozier et al. 2015, Johnson et al. 2016) and migration year 2015 to provide perspective (Table 1, Figure 1). Window counts of sockeye at Lower Snake River hydro projects will also be monitored to evaluate conversion and run timing to help supplement PIT tag data. Since these estimates are calculated real-time and in-season, dam arrival dates will also provide perspective on the proportion of the run included in the estimates (Table 2).

These indicators can determine whether there is a passage emergency similar to 2013 or 2015 in downstream reaches of the FCRPS. However, given the long travel between LGR and the basin (~30 days travel time), it may be difficult to monitor survival between LGR and the basin to determine if there is a passage emergency. By the time that survival is estimated from LGR to the basin, the majority of fish may have passed LGR and the opportunity to collect them would be missed (Figure 3). Current and predicted

temperature data may be a better predictor of the need for transport (Crozier et al. 2014). Additional research and modeling is needed to develop other real-time indicators.

LOWER GRANITE ADULT TRAPPING FACILITY PROTOCOLS

Permits

Permitting to sample SR Sockeye Salmon at LGR is currently covered under an ESA Section 10 permit (No. 1454). However, this does not cover the collection of SR adults during emergency trapping or the incidental take of non-targeted ESA-listed salmonids during trapping. IDFG will collaborate with NOAA Fisheries to obtain the necessary permitting under the FCRPS 2008 Opinion Take Determination Process within a 24-48 hour period of the declared emergency. IDFG would be responsible for obtaining applicable fish transport permits from neighboring states (e.g., Washington Transport Permit, Idaho Transport Permit and Idaho Department of Agriculture Permit). BPA will also be informed of the intended action so the scope of work (SOW) can be updated to include the activity.

Access

Approval from the USACOE must be granted for employees prior to accessing the adult trap at LGR. This requires completing and returning an Access Request Form for approval (Appendix B). Staff must also complete an annual Hazardous Energy Control Program (HECP) Awareness training available at: <http://hecp.vividlms.com/>.

Sampling Rates and Duration

The trap is typically in operation between early March and late November and targets multiple fish species including spring/summer Chinook Salmon, fall Chinook Salmon, steelhead, Sockeye Salmon, and Coho Salmon. An adult fish trap located in the LGR fish ladder is capable of catching a set or fixed portion of the run (trapping rate) in addition to uniquely tagged individuals. Trapping at LGR supports multiple fish management and research needs including: broodstock collection, tag application and retrieval for upstream population abundance estimates, genetic stock identification and parentage based tagging efforts to partition the aggregate group at LGR into different reporting units. The summer sampling rate (when SR Sockeye Salmon are encountered) is set by regional cooperators and takes into account the forecasted run sizes at LGR, target sample sizes for collection of biological data, and daily physical limitations of the trap.

The actual sampling rate used to collect sockeye would depend on whether the passage emergency coincides with routine trapping operations (temperatures at the trap are $\leq 70^{\circ}\text{F}$) or outside of normal trapping operations. If a passage emergency is declared during routine trapping operations then the pre-defined daily trapping rate would be used to collect Snake River Sockeye Salmon. If a passage emergency is declared when water temperatures at the trap are $> 70^{\circ}\text{F}$, as was the case in 2015, then sampling rates would be set to maximize the collection of SR Sockeye Salmon within the existing personnel and facility constraints. Sampling would occur sooner than it did in 2015 and for longer durations (more days or more hours). However, it is not anticipated that the sockeye trap at LGR would be operated past 3 pm on a given day. Identifying and targeting Sockeye Salmon passing the fish count window can also be used to minimize trapping time and decrease the handling of non-targeted salmonids (see Graves et al. 2016). Separation by code procedures typically will not be used during emergency trapping due to the length of time that fish may be in the trap prior to removal.

Adult Handling at the Trap

Trap and haul operation at LGR is not expected to significantly increase the current workload of the sampling crew at the Lower Granite Adult Fish Trap (LGAFT). IDFG staff will assist LGAFT staff with adult handling. Trapped fish will be handled similar to all other species until they are identified as *Oncorhynchus nerka*, at which time they would be placed into a wet carrying sleeve and transferred to a fish transport vehicle (on-site). Receiving water in transport vehicles and holding tanks would be tempered appropriately to avoid thermal shock. In 2015, holding was available in the kelt tanks at the juvenile bypass facility for a 24-hour period and this proved to be a successful measure to reduce the number of trips to LGR. No data collection would be required at the trap site since these adults would receive a full biological and health work-up at the EFH. Data collected after arrival at EFH would include: presence of marks or tags, fork length (mm), weight (g), injuries, and gender. A genetic sample would be collected from each fish and analyzed real-time during holding to determine origin and if any upper Columbia River fish have been incidentally collected. Adults would be retained at the EFH pending genetic fingerprinting. Final disposition of SR sockeye would be to either EFH (artificial spawning) or Redfish Lake (volitional spawning). Data collected at EFH would be sent to personnel representing multiple tribes and agencies and be included in the 1454 annual permit report.

Transport handling

IDFG personnel will be responsible for transporting and assisting trap personnel with handling the trapped adults. Transport trucks will be provided by the EFH. IDFG personnel will be responsible for

monitoring the collected fish during transport to the EFH (following transport protocols). Transport data collected will include: travel time, transport temperature, and dissolved oxygen measurements.

Resources Required for Implementation

The two main components required to implement the trap and haul program from LGR are 1) personnel and 2) transport vehicles. Trained staff would need to be available to assist on-site at the LGR trap and to transport adult Sockeye Salmon from LGR to the EFH. Depending on water temperatures and the trapping protocols in place, two people would be required to assist at the LGAFT and transport collected adults to either the EFH or exchange transport vehicles in Grangeville. In 2015, transport occurred outside of normal trapping operations so personnel from Lewiston were available to assist at LGAFT and transport the fish to Grangeville on the days when fish were trapped. If trapping occurred within normal trapping activities, the Lewiston personnel would be needed at LGAFT. Two staff from the Eagle Hatchery would either drive to Lower Granite Dam or meet the other transport vehicle in Grangeville, exchanging transport vehicles and returning to Eagle Hatchery with the trapped Sockeye. Daily per diem and lodging would be necessary under this framework. Two transport vehicles would be required insuring one vehicle is always available and on-site at LGAFT during trapping. Depending on the extent and duration of sampling and other programmatic needs and obligations, transport vehicles and staff may be available from the Sockeye Program during late June to mid-July, and possibly later. If trapping were to continue into late July or August, staff and transport vehicles would be limited due to trapping activities taking place in the Sawtooth Basin. Under both scenarios, additional staffing is likely required to trap and transport adults. Funding needs to be developed in advance to provide for adequate staffing and resources; however, developing a budget is difficult given the uncertainty of this activity on an annual basis. Further discussions regarding sources of funding are needed to maximize the efficiency and safety of personnel and the targeted fish with the above plans.

LITERATURE CITED

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Tables and Figures

Table 1. Conversion rates (% Survival) and passage times (d) for Snake River Sockeye Salmon from Bonneville to the Sawtooth Basin traps. Years are in parentheses.

	BON-TDA	TDA-MCN	MCN-IHD	IHD-LOMO	LOMO-LGO	LGO-LGR	LGR-BASIN
Avg. Survival (08-14)*	84%	78%	98%	99%	97%	na	55%
Avg. Survival (15)	63%	24%	61%	81%	66%	82%	26%
Avg. Survival (16)	87%	84%	98%	98%	98%	98%	60%
Average Travel Times (08-14)	1.7-1.8	3.4-3.7	1.4-1.9	1.2 (2014)	1.3 (2014)	1.7 (2014)	35.3-42.7
Average Travel Time (15)	2.3	5.0	2.8	3.0	2.4	13.1	48
Average Travel Times (16)	1.5	3.5	2.1	1.6	1.5	2.1	37

*2008-2014 data obtained from Crozier et al. (2015).

Table 2. Dam arrival dates (median and 25-75% range) for Snake River Sockeye Salmon (2008-2016).

Year	Bonneville	The Dalles	McNary	Ice Harbor	Lower Granite
2008	30 Jun (28 Jun-2 Jul)	--	5 Jul (3-9 Jul)	7 Jul (4-12 Jul)	11 Jul (9-16 Jul)
2009	29 Jun (22 Jun-1 Jul)	--	5 Jul (29 Jun-8 Jul)	7 Jul (2-10 Jul)	13 Jul (11-14 Jul)
2010	29 Jun (25 Jun-9 Jul)	--	4 Jul (1-12 Jul)	7 Jul (3-12 Jul)	10 Jul (7-16 Jul)
2011	5 Jul (1-9 Jul)	--	12 Jul (8-16 Jul)	14 Jul (10-17 Jul)	18 Jul (15-23 Jul)
2012	5 Jul (29 Jun-10 Jul)	--	10 Jul (4-16 Jul)	13 Jul (6-18 Jul)	16 Jul (9-24 Jul)
2013	1 Jul (27 Jun- 6 Jul)	2 Jul (29 Jun-7 Jul)	6 Jul (3-11 Jul)	8 Jul (5-12 Jul)	13 Jul (7-27 Jul)
2014	3 Jul (28 Jun-8 Jul)	5 Jul (30 Jun-9 Jul)	9 Jul (4-12 Jul)	10 Jul (5-14 Jul)	16 Jul (10-19 Jul)
2015	2 Jul (26 Jun-9Jul)	2 Jul (27 Jun- 7Jul)	1 Jul (26Jun-7Jul)	30 Jun (25 Jun-5 Jul)	8 Jul (1-17 Jul)
2016	26 Jun (23 Jun-29 Jun)	28 Jun (25 Jun- 1 Jul)	2 Jul (25 Jun-5 Jul)	4 Jul (30 Jun-8 Jul)	8 Jul (4-13 Jul)

*2008-2014 data obtained from Crozier et al. (2015).

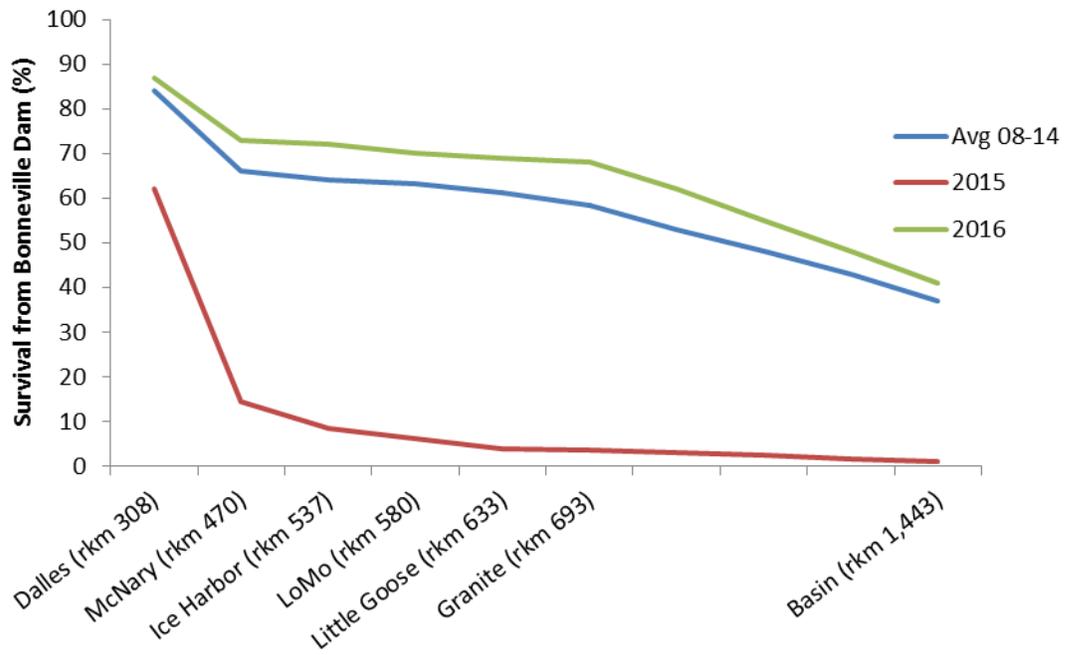


Figure 1. Survival rates from Bonneville to the Sawtooth Valley basin traps based on fish tagged with PIT tags.

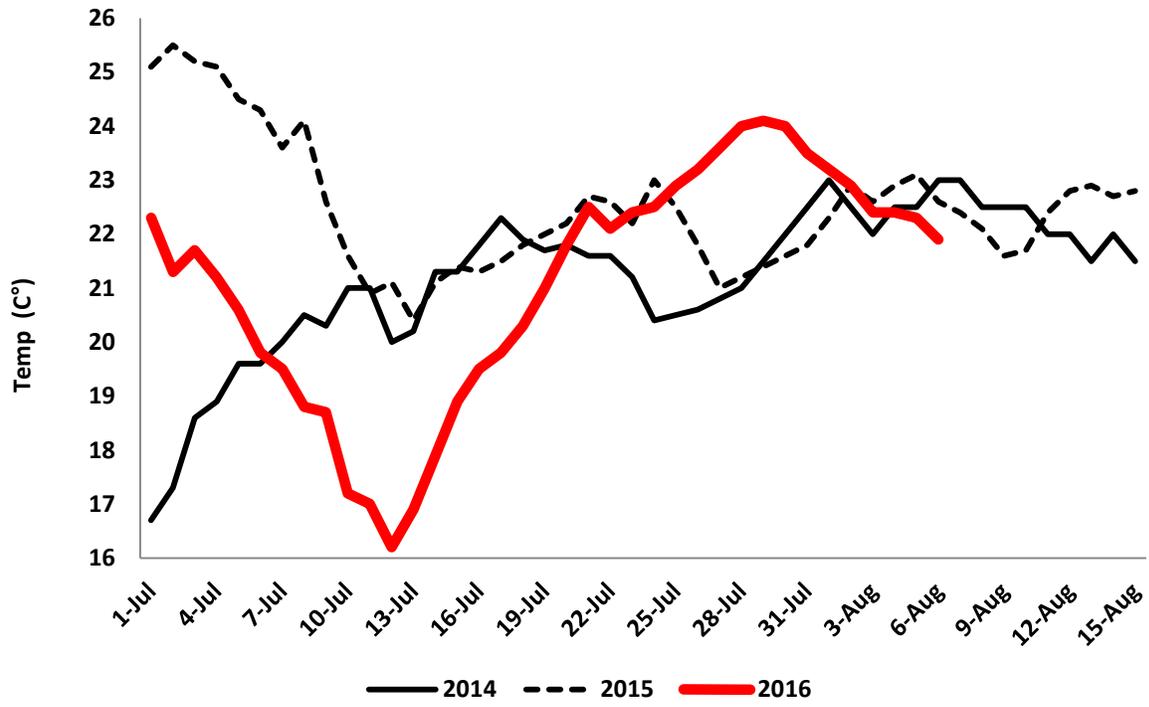


Figure 2. Salmon River water temperatures (20:00 PDT) at Whitebird gauge station.

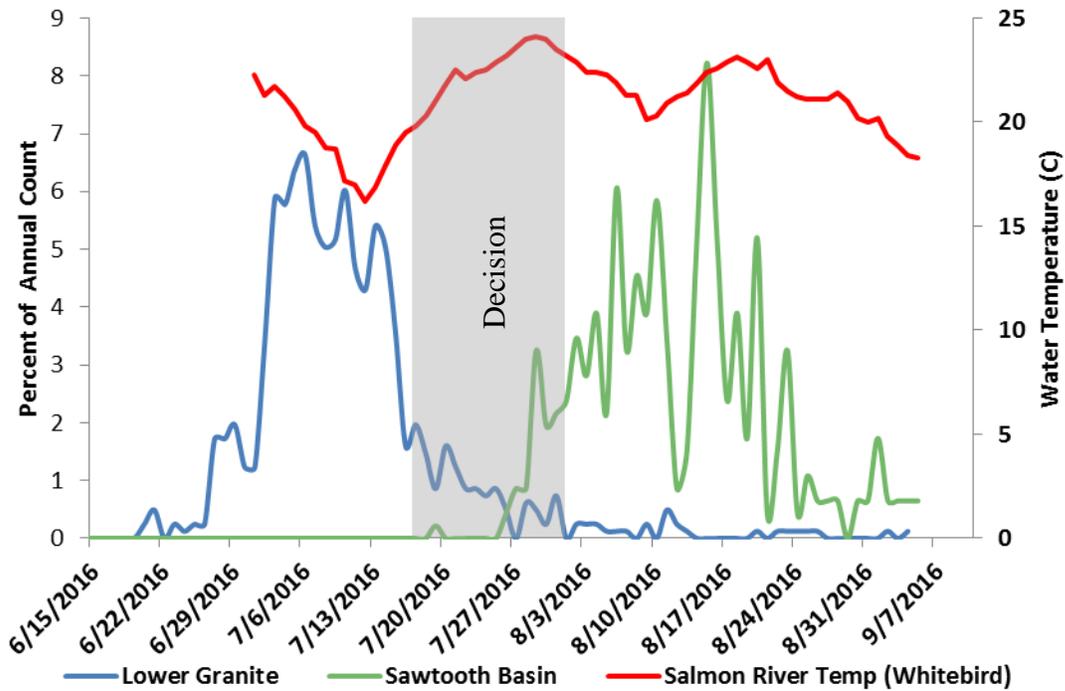


Figure 3. Run timing at LGR and Sawtooth Basin showing arrival times in the Sawtooth Basin are after the majority of the run has passed LGR. In this example, Salmon River water temperatures begin rapidly rising as fish counts at Lower Granite Dam decline

Appendix A: Position on Ice Harbor Dam

IDFG will not implement emergency adult Sockeye Salmon trap and haul from Ice Harbor Dam (ICE) due to logistical constraints and a high likelihood of trapping Sockeye Salmon destined for the mid and upper Columbia River. The fish facilities at ICE are staffed with a small USACE smolt condition monitoring crew and adding a trap and haul operation would require new staffing or significant reallocation of existing personnel. In contrast, staff at LGR consists of a large contingent of fisheries personnel from multiple agencies (NOAA, USACE, IDFG and NPT) who routinely operate the adult trap and handle ESA listed adults and are available to assist during emergency adult trap and haul operations. The added complexity of coordinating trap and haul from two locations would also increase the probability of an error resulting in additional fish mortalities. Water temperature at ICE is another key consideration. Temperatures in the tailrace, fish ladder, and adult trap are warmer than at LGR, which increases the risk of handling mortalities. The trapping infrastructure at ICE is an additional constraint. The adult trap at ICE is more cumbersome, especially for non-target species, and the higher water temperatures would increase the risk of non-target species mortalities. Finally, in 2015, approximately 1/3rd of the adult Sockeye Salmon trapped at LGR were strays from the mid and upper Columbia River. Trapping at ICE would likely result in an even higher proportion of Columbia River strays being trapped and transported.

Appendix B: LGR Access Request Form



Lower Granite Dam- Access Request Form

To be completed by person requesting access:

Last name (surname): _____ Last 4 of SSN: _____
 First Name: _____ Middle Initial: _____
 U.S. Citizen Yes No
 Company Name: _____ Company Phone #: _____
 Company Fax #: _____ Email Address: _____
 USACE POC: _____
 Start Date: _____ End Date: _____
 Signature: _____ Date: _____

USACE POC use only

Access Badge: Yes No ID Card only: Yes No
 Existing badge: Yes No If YES, badge # _____

Weekly Access (circle)								Hours required access	_____ am/pm	to	_____ am/pm
	M	T	W	T	F	S	S				

Requested Areas for Access: _____
 Key Required: Yes No
 NWW District Security Office Approval for non-U.S. Citizens Yes No N/A
 Name of Approving QAR Official (please print): _____
 QAR Approving Signature: _____ Date: _____
 USACE Approving Official: _____ Date: _____

This section to be filled out by LGR Security

Card Number: _____ Photo ID: Yes No
 Date Issued: _____ Date Expired: _____
 Date Returned: _____ Signature: _____
 Returned to: _____

Other comments: (e.g. key #, pager #) _____

Last Update Date: 8 May 2014

Appendix C: Person of Contact (POC) List for Trap and Haul Activities at LGR.

Idaho Fish and Game	Title	Work	Email
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