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Lower Stehekin River Cutthroat Trout and Rainbow Trout spawning surveys

2009-2011 summary report

Natural Resource Technical Report NPS/NOCA/NRTR—2012/594

ON THE COVER
Surveyor snorkels a Cutthroat Trout spawning index reach.
Photograph by: Courtesy of North Cascades National Park

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Abstract

Chelan County Public Utilities District, Washington State Department of Fish and Wildlife, United States Forest Service and North Cascades National Park cooperatively manage fish populations within Lake Chelan and its tributaries in accordance with the Lake Chelan Fisheries Plan (Lake Chelan Fishery Plan 2007). The fish management goal under the Lake Chelan Fisheries Plan is to beneficially alter the abundance and composition of fish species in Lake Chelan through continuing efforts to restore and enhance native fisheries.

From 2009 to 2011 National Park Service personnel conducted spawning surveys for Rainbow Trout and Westslope Cutthroat Trout in 12 established index reaches located within side channel habitat of the Stehekin River. The twelve index reaches were selected after assessing 13.7 km of side channel habitat for suitability for trout spawning. Suitable habitats were deemed to have substrate particle size of 2 – 50 mm (Shepard et al. 1984), flow of 30 – 100 cm^3/sec, and an average depth of 30 – 60 cm (Quinn 2005). Three or four surveys were conducted each spring during the months of April, May and June and a total of 19 Rainbow Trout, and 13 Rainbow Trout redds were documented. No Westslope Cutthroat Trout or Westslope Cutthroat Trout redds were seen in any of these spring spawning surveys. In 2011 additional efforts to document Westslope Cutthroat Trout distribution included mainstem pool snorkeling, snorkel surveys in side channel habitat during summer months, and collection of DNA samples from trout fry. Westslope Cutthroat Trout were documented during July and August in mainstem pools and side channel habitat but were not observed spawning.

Introduction

On November 6, 2007, Public Utility District No. 1 of Chelan County (Chelan PUD) filed the Lake Chelan Fishery Plan (LCFP) pursuant to Article 404 of the Federal Energy Regulatory Commission Order on Offer of Settlement and Issuing New License dated November 6, 2006 for the Lake Chelan Hydroelectric Project. The fish management goal under the Lake Chelan Fisheries Plan, adopted by Lake Chelan Fishery Forum (LCFF) representatives from the National Park Service (NPS), United States Forest Service (USFS) and Washington Department of Fish and Wildlife (WDFW), and Chelan PUD, is to beneficially alter the abundance and composition of fish species in Lake Chelan through continuing efforts to restore and enhance native fisheries (Lake Chelan Fishery Plan 2007). Multiple methods are in progress or will be used in the future to accomplish this goal, such as altered fishing regulations, a change in stocking practices, and removal of lake tributary alluvial barriers to spring spawning fish.

Native Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) was historically one of the dominant fish species in Lake Chelan and the Stehekin River exhibiting both fluvial and adfluvial life histories (Brown 1984). A combination of many factors has led to the near disappearance of the Cutthroat Trout within these systems. Historic hatchery egg taking programs, repeated stocking of competing fish species, and Cutthroat Trout hybridization with Rainbow Trout (*Oncorhynchus mykiss)* are important factors leading to the decline of native Cutthroat Trout stocks (Ostberg and Rodriguez 2006).

Native Westslope Cutthroat Trout (WCT) are currently found throughout the Lake Chelan and Stehekin River systems, though their population status is uncertain. Robust populations of fluvial WCT exist in the upper reaches of the Stehekin River above migration barriers (physical and temperature), but below these barriers and throughout the lower Stehekin River introduced Rainbow Trout (RBT) have largely displaced the native WCT.

The LCFP goal for WCT is to re-establish healthy, self-sustaining populations in the lake tributaries and the lake itself and for fish to contribute to the sport fishery (USFS et al. 2009). To reach this goal the following conditions must be met:

1. WCT hatched from eyed egg or fry stocking in lake tributaries must survive to maturity, spawn and contribute to increased natural production.
2. A sufficient number of the catchable size WCT must escape harvest and recruit to the spawning run in order to substantially increase natural production.
3. The catchable size WCT must eventually replace the catchable size Rainbow Trout in the sport fishery.
4. A majority of anglers fishing Lake Chelan must accept the change in species.

Current stocking of WCT occurs in Lake Chelan and its tributary streams (Lake Chelan Fishery Forum 2012 Annual Work Plan 2012). The primary goal of these stocking efforts is to reestablish naturally reproducing populations of adfluvial WCT. These adfluvial fish will spend much of their adult life residing in Lake Chelan, migrating to tributaries to spawn in the spring and early summer.

The objectives relating to re-establishing healthy WCT populations will be monitored through surveys performed by the cooperating agencies. The National Park Service, as represented by the North Cascades National Park Aquatic Resources staff, has been directed under the Lake Chelan Fishery Plan to develop a monitoring and evaluation program for the Stehekin River to assess the efficacy of Cutthroat Trout management actions. As part of this monitoring plan, park staff implemented WCT and RBT spawner surveys in several index reaches during 2009 in order to evaluate spawner distribution and abundance. Spawner surveys were continued in 2010 and 2011 to evaluate trends.

Study Area

The Stehekin River drains an area of 220,000 acres (344 square miles) of mostly public lands within Glacier Peak Wilderness Area, Lake Chelan National Recreation Area, and North Cascades National Park. The Stehekin River headwaters originate from approximately 103 glaciers located along the Pacific Crest of the Cascade Range. The Stehekin is the largest tributary to Lake Chelan, and its major tributaries include Agnes Creek, Bridge Creek, Company Creek, Rainbow Creek and Boulder Creek.

The Stehekin River and Agnes Creek emerge from deep box canyons into the broad lower Stehekin valley. This part of the valley was glaciated by both alpine glaciers and the massive continental glacier from Canada known as the Cordilleran Ice Sheet. During multiple ice ages these glaciers created the valley's characteristic U-shape, straight profile, and flat valley floor.

The gradient of the river at its confluence with Agnes Creek is about 80 ft/mile, decreases to 50 ft/mile above McGregor Meadows, and is 25 ft/mile just above Lake Chelan. However, gradient is somewhat steeper in lower valley reaches with straight, narrow channels where the river encounters large tributary alluvial fans of Boulder, Rainbow and Company creeks (km 2-3, 6-7 and 11-12, respectively). The relatively straight, steep reaches are net transport zones for sediment and large wood, and as a result are areas of relative channel stability. Wood and sediment storage zones between these reaches are characterized by the existence of massive log jams, multiple side channels, and channel instability (Riedel 2008).

The Stehekin River is the largest tributary to Lake Chelan, and offers the majority of spawning habitat available to adfluvial fish species in the Lake Chelan system. While large amounts of appropriate spawning habitat exist within lower mainstem depositional zones of the Stehekin River, high river discharge in the spring months raised safety concerns and precluded us from selecting index reaches within the mainstem Stehekin. Spawning habitats are particularly suitable within the numerous side channels of the lower Stehekin River (below the Agnes Creek confluence) due to moderate velocities and well sorted gravel substrates. The first fish hatchery in Washington State was constructed on the Stehekin River in 1909 for the collection of WCT eggs (WDFW 2002). During its operation the hatchery maintained up to 13 fish traps in the side channels of the Stehekin River for brood stock collection (Campbell 1977).

Methods

Cutthroat Trout and Rainbow Trout index reach spawning surveys

An initial rapid assessment of side channel habitat was completed on April 13-14, 2009. Index sites were selected based on presence of suitable spawning gravels and flows. Suitable substrates varied from 2 - 50 mm in diameter (Shepard et al. 1984). Suitable sites also had a depth of water over the spawning gravel of 30 - 60 cm and a water velocity of 30 - 100 cm/sec during moderate flow conditions (Quinn 2005). Pool tailouts with these conditions were deemed particularly good spawning habitat. Other considerations in the selection of index reaches included the feasibility of conducting snorkel surveys during the May-June period of high flows and the potential stability of candidate index sites for long-term monitoring.

The goal in selecting index sites was to provide a representative sample of approximately 10 to 12 sites with survey lengths of 10 to 20 channel widths. A total of 13.7 km of channels were evaluated (Figure 1), and 19 index sites were initially selected. These sites were pared down

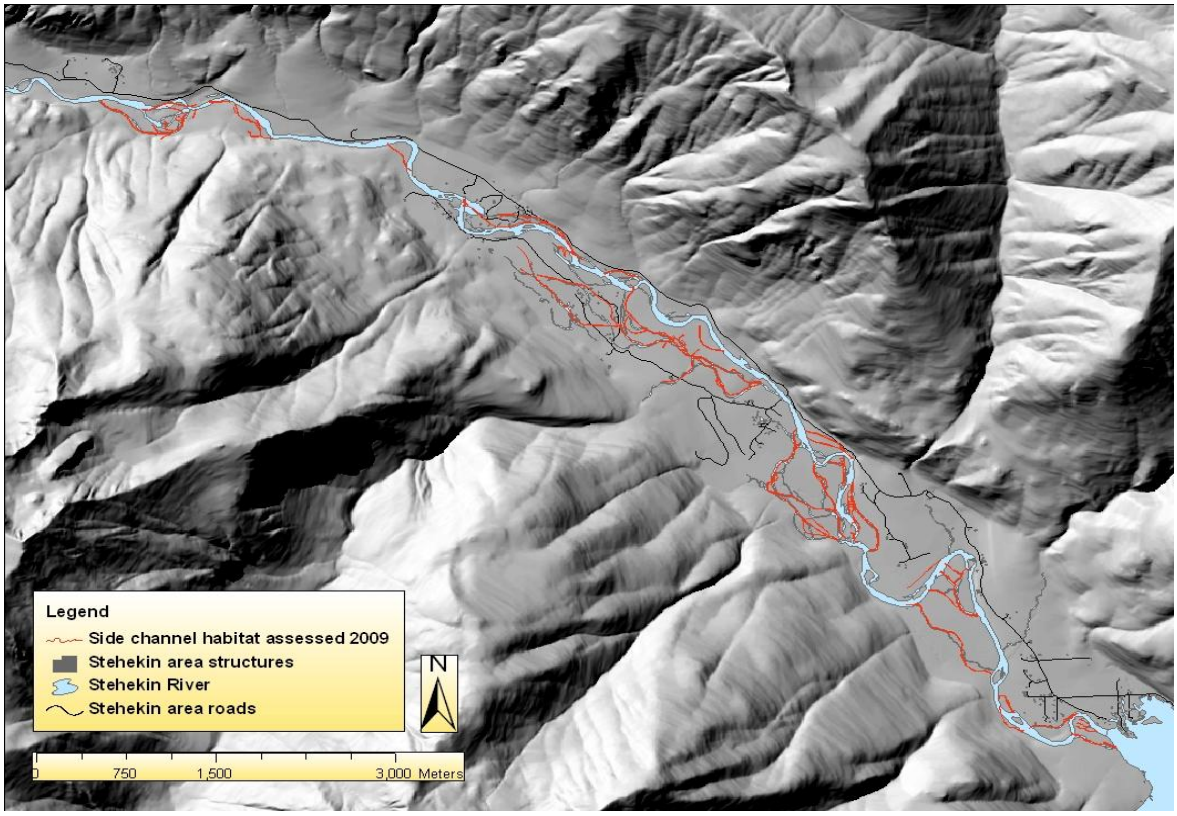

Figure 1. Lower Stehekin River side channels assessed for suitability as index sites for Westslope Cutthroat Trout spawning surveys.

following visits under different flow and visibility conditions. Ultimately 12 channel segments totaling 1781 meters were selected as long term index sites (Table 1 and Appendix A.). In 2009 three spawning surveys were conducted at each of the index sites; on May 5, May 27 and June 2. In 2010 four surveys were conducted; on April 19, May 17, June 7 and June 28. In 2011 three surveys were conducted in the spring; on April 26, May 24 and June 28. Post-spawning surveys

were conducted on July 20 and August 30 to provide additional seasonal distribution information on adfluvial trout. Complete data from these surveys are presented in Appendix C.

Table 1. Stehekin River Westslope Cutthroat Trout spawning index reach dimensions.

Index Reach ID	Reach Length (m)	Reach Wetted Width (m)
i1	115	11
i2	44	3
i3	43	2
i4	217	12
i5	245	15
i6	292	15
i7	189	9
i8	134	6
i9	176	9
i10	125	8
i11	116	4
i12	85	5

Spawning surveys were conducted by teams of two, one acting as the observer counting and identifying fish and the other recording data. Fish were tallied into length groups of less than 150 mm, 150 – 299 mm, 300 – 449 mm and ≥450 mm. We considered any fish in the spawning reaches during the period of April 1 – June 30 with a length of over 300 mm as an adfluvial spawner. The assumption that WCT greater than 300 mm are adfluvial is based on research conducted in the Saint Joe River, a tributary to Lake Coeur d'Alene, Idaho (Averett and MacPhee 1971). In this river system all WCT greater than 300 mm showed lake growth on their scales. Cutthroat Trout were distinguished from Rainbow Trout by a lack of or very few spots on the lower side and head of the fish. Cutthroat Trout also exhibited an orange-red ventral surface while Rainbow Trout exhibited a conspicuous pink stripe along the lateral line.

Fish observations and redd data were recorded on separate datasheets (Appendix B). Water temperature, precipitation, viewing condition and cloud cover data were taken at the beginning of each day. Underwater visibility was determined at the beginning of each survey day by measuring the maximum horizontal distance that a Secchi disk could be viewed under water. Discharge data for the mainstem of the Stehekin River were taken from the USGS website: http://waterdata.usgs.gov/wa/nwis/uv?station=12451000 (accessed 28 November 2011) at noon each day of survey. Survey environmental conditions are found in Appendix C.

Surveys were conducted from both the stream bank and by snorkeling, depending on water depth and underwater visibility conditions. Surveyors began at the downstream end of each index reach and proceeded upstream searching for fish and new redds. Care was taken not to step in existing fish redds. New redds were flagged when first observed so as not to recount them on subsequent visits. Flagging was secured adjacent to fish redds on terrestrial vegetation. Redds were identified as either Rainbow Trout or Cutthroat Trout depending on if there were fish observed on the redd. If no fish were present on or adjacent to the redd it was determined to be of unknown origin.

Mainstem Stehekin River discharge varied from 836 to 5530 ft^3/sec during spring snorkel surveys. Mainstem flows above 4000 ft^3/sec indicated increasingly difficult survey conditions within side channel index reaches due to increased channel velocities and decreased underwater visibility. Surveys were typically cancelled or postponed when discharge was at or above 4500 ft^3/sec.

Mainstem Stehekin River pool snorkel surveys

After spring snorkel surveys in 2009 and 2010 failed to provide evidence of WCT spawning, it was decided to increase our survey efforts in 2011 to include snorkeling mainstem pools. Eight large channel-spanning pools were identified in the lower 7 km of the mainstem Stehekin River (Figure 2). Snorkel surveys of these eight pools were completed once in the early spring, and six of the eight pools were surveyed twice in the late summer during periods of low river discharge and good underwater visibility. The two pools not surveyed in the latter surveys were determined to be poor candidate sites for long-term monitoring due to flow and habitat conditions.

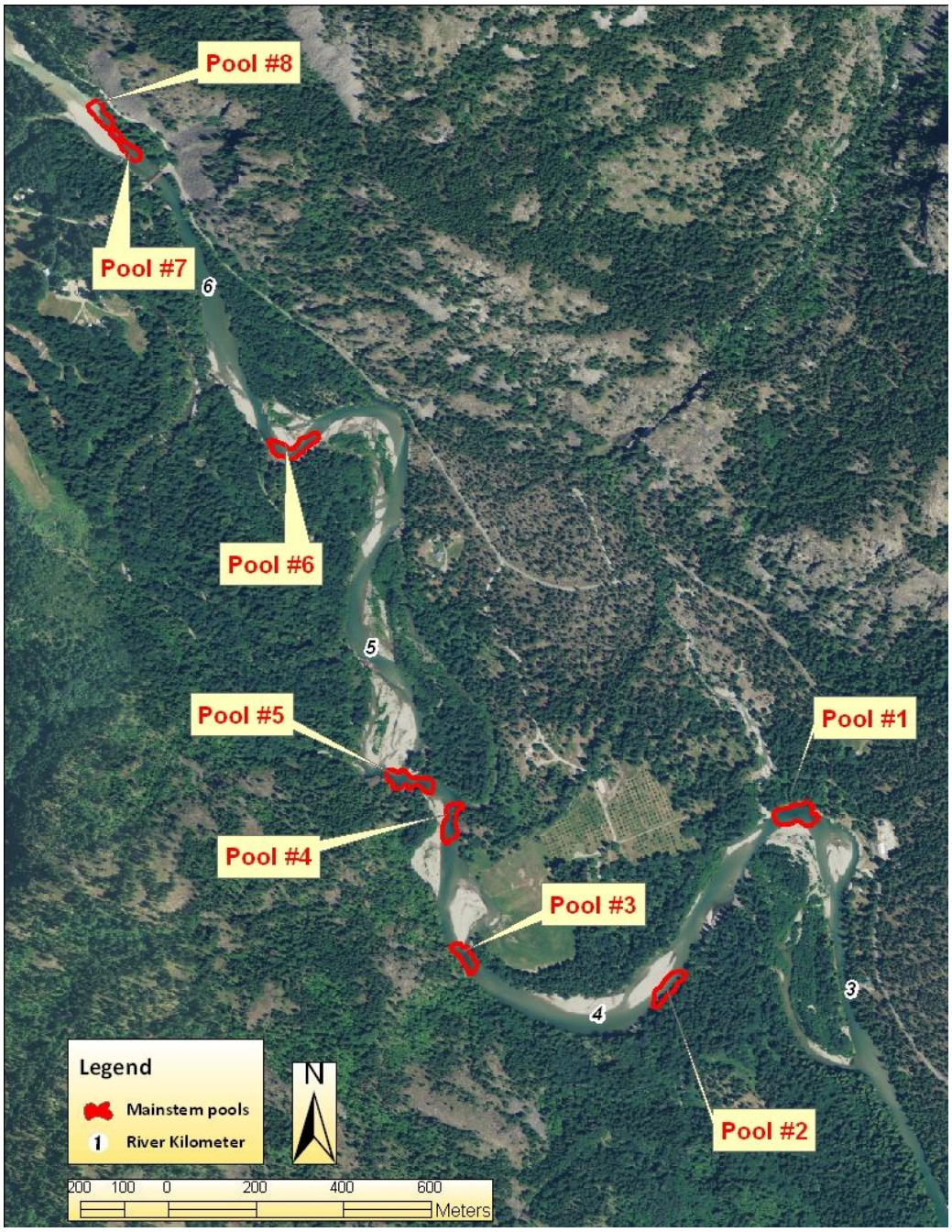

Figure 2. Channel spanning mainstem pools in the lower 7 km of the Stehekin River.

Snorkel surveys were conducted by teams of two, with one surveyor counting fish and one surveyor on the channel bank timing the snorkel pass and recording data. Fish were tallied into length groups of less than 150 mm, 150 – 299 mm, 300 – 449 mm ≥ 450 mm. Snorkelers worked in an upstream direction through each pool whenever possible to enumerate fish, though on occasion currents proved too swift and snorkelers were forced to float downstream through the subject pool. Each pool was snorkeled three times and observation time was recorded for each pass.

Results

Spring Spawning Surveys

Westslope Cutthroat Trout (WCT) spawners and redds were not observed in any of the index reach surveys conducted from 2009 through 2011. Rainbow Trout (RBT) spawner observations and redd counts are shown in Tables 2 and 3. Detailed fish survey data by index reach and date are shown in Appendix D.

2009

Eight RBT greater than 300 mm were observed in the index reaches (Table 2). In total, nine RBT redds and four unknown redds were seen within the index reaches (Table 3). The substrate size within redds ranged from 5 - 70 mm in diameter, though mostly substrate was from 10 - 40 mm in size.

Table 2. Survey dates and numbers of Rainbow Trout observed in index reaches.

	Number of Rainbow Trout observed				
Survey Date	**<150 mm**	**150-299 mm**	**300-449 mm**	**≥450 mm**	**Total**
5/5/2009	0	0	0	2	2
5/26/2009	0	0	3	2	5
6/23/2009	4	3	1	0	8
2009 Totals	**4**	**3**	**4**	**4**	**15**
4/19/2010	0	3	0	0	3
5/17/2010	0	0	0	0	0
6/7/2010	1	0	2	0	3
6/28/2010	4	2	2	0	8
2010 Totals	**5**	**5**	**4**	**0**	**14**
4/26/2011	0	0	0	1	1
5/24/2011	0	1	1	4	6
6/27/2011	0	0	1	0	1
2011 Totals	**0**	**1**	**2**	**5**	**8**

2010

Four RBT greater than 300 mm were observed in the index reaches (Table 2). In total, nine unknown redds were seen within the index reaches (Table 3). The substrate size within redds ranged from 15 - 70 mm in diameter, though mostly substrate was from 20 - 60 mm in size.

2011

Seven RBT greater than 300 mm were observed in the index reaches (Table 2). In total, four RBT redds and fourteen unknown redds were seen within the index reaches in 2011 (Table 3). The substrate size within redds ranged from sand to 110 mm in diameter, though mostly substrate was 15 - 80 mm in size.

A summary of biweekly total redd counts and RBT observed for all surveys conducted 2009 through 2011 is shown in Figure 3. Peak spawner activity occurred during the May 16-31 period.

Table 3. Observation dates and numbers of redds in index reaches.

Survey Date	# New Redds WCT	# New Redds RBT	# New Redds UNKNOWN
5/5/2009	0	5	0
5/26/2009	0	4	0
6/23/2009	0	0	4
2009 Totals	**0**	**9**	**4**
4/19/2010	0	0	0
5/17/2010	0	0	0
6/7/2010	0	0	9
6/28/2010	0	0	0
2010 Totals	**0**	**0**	**9**
4/26/2011	0	0	10
5/24/2011	0	4	4
6/27/2010	0	0	0
2011 Totals	**0**	**4**	**14**

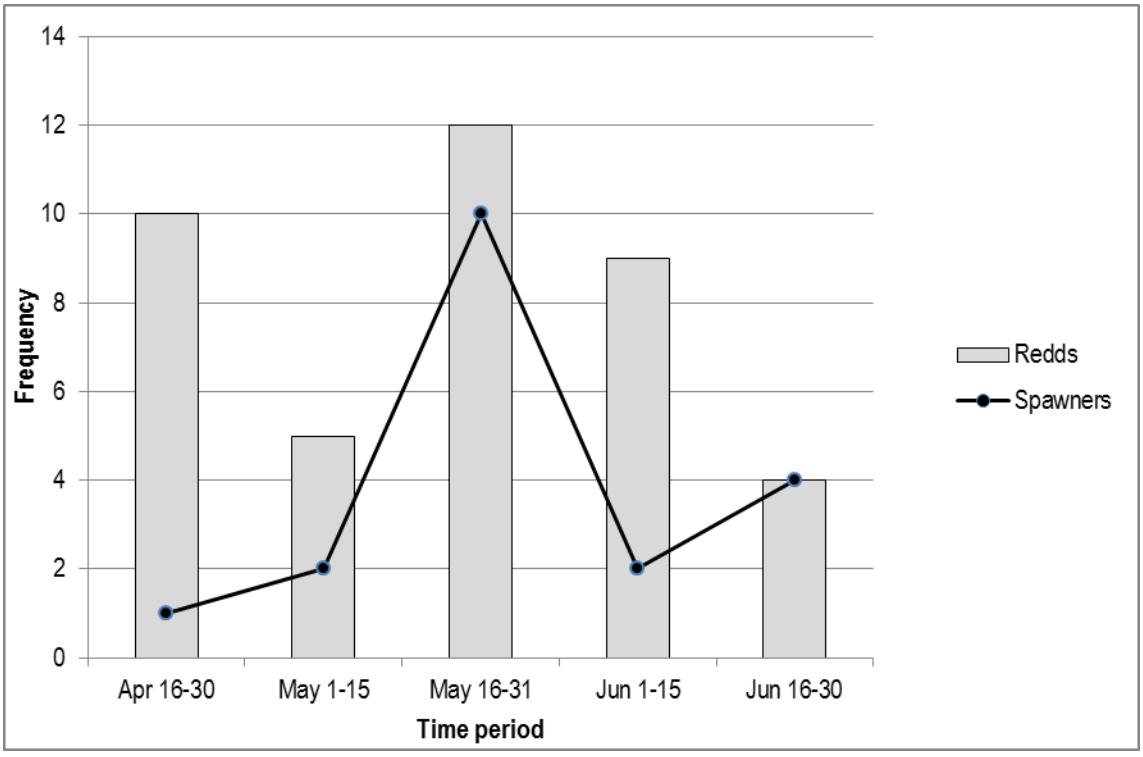

Figure 3. Summary of the frequency and timing of redds and spawning Rainbow Trout in index reaches, 2009 – 2011.

2011 Summer Fish Observations

In 2011 we conducted two snorkel surveys outside of the projected spring spawning window. Results are shown in Appendix D. On 7/20/2011 we observed two RBT in the 300 – 449 mm size class. We also observed one Eastern Brook Trout (*Salvelinus fontinalis*) in the 300 – 449 mm size class. Eastern Brook Trout (EBT) were distinguished from Bull Trout (*Salvelinus*

confluentus) by the presence of a dark band across the nostril and black markings on the dorsal fin. No redds of any species were observed on the 7/20/2011 survey.

On 8/30/2011 another survey was conducted within the index reaches and eight WCT in the 300 – 449 mm size class were observed. These large WCT did not appear to be spawning and fish collected via hook and line were not "ripe" as they did not eject milt or eggs when gently squeezed. These fish were holding in shallow water among numerous spawning Kokanee, and were likely feeding on kokanee eggs. During this survey we viewed 4 RBT trout in the 300 – 449 mm size class within the index reaches. No redds of any species other than Kokanee were observed during this August survey.

Additional Fish Observations

Other fish species observed during these spawning surveys include unidentified sculpin species, Eastern Brook Trout, and Kokanee fry. A few unidentified fish, holding at the bottom of deeper pools, were believed to be either sucker or whitefish species (Appendix E). Kokanee fry were observed throughout the spring spawning surveys from May 17 through July 20. Sculpin were frequently observed during surveys and were noted throughout the season, from May 5 to August 30. Eastern Brook Trout were observed during summer 2011 surveys, on July 20 and August 30. Eastern Brook Trout abundance increased markedly during the August 30 surveys to 24 individuals less than 150 mm and 11 individuals 150 -299 mm in a single index reach. The largest EBT observed was approximately 300 mm in length.

Mainstem Stehekin River pool snorkel surveys

Within the lower seven km of the Stehekin River, eight large channel-spanning pools were initially identified and snorkeled on April 27, 2011 (Table 4, Figure 2). After assessing the suitability of these eight pools to long-term monitoring under the given conditions, these eight pools were reduced to six which were surveyed on August 2 and August 30, 2011. Four of these six pools will be selected for continued annual surveys based on documented WCT presence and safety of conducting snorkel surveys within the pool. Pools best suited for long term monitoring are as follows: Pool 1 (Rainbow Creek Hole), Pool 3 (Orchard Hole), Pool 6 (Below Harlequin Logjam) and Pool 7 (Harlequin Lower). Complete snorkel count, flow and visibility data are presented in Appendix F.

Table 4. Pool names, numbers and locations (head of pool) within the lower 7 km of the Stehekin River main channel.

Pool #	Pool Name	Length (m)	Width (m)	UTM_E	UTM_N	River km
1	Rainbow Creek Hole	90	48	670767	5356173	3.4
2	House Hole	85	26	670522	5355822	3.9
3	Orchard Hole	51	34	670034	5355937	4.3
4	Buckner Rock Hole	58	35	670042	5356174	4.5
5	Blackberry/Buckner Hole	109	21	669883	5356270	4.6
6	Below Harlequin/Logjam Hole	23	22	669619	5357094	5.6
7	Harlequin Lower	36	31	669251	5357726	6.3
8	Harlequin Upper	34	29	669194	5357781	6.4

WCT were observed in survey pools on seven occasions during the three mainstem pool snorkel surveys (Table 5). WCT were observed in pool numbers 1, 6, 7 and 8. All WCT observed were holding within pools and exhibiting feeding behavior.

Table 5. Mean fish counts from 3-pass snorkel surveys conducted on select Stehekin River mainstem pools.

		Cutthroat Trout				Rainbow Trout				Other[1]			
Survey Date	Pool #	<150 mm	150-299 mm	300-449 mm	≥450 mm	<150 mm	150-299 mm	300-449 mm	≥450 mm	<150 mm	150-299 mm	300-449 mm	≥450 mm
4/27/2011	1	0	0	0	0	0	0	0.33	0	0	0	0	0
4/27/2011	2	0	0	0	0	0	0	1.33	0	0	0	0	0
4/27/2011	3	0	0	0	0	0	0	1.33	0	0	0	1	0
4/27/2011	4	0	0	0	0	0	0	2.33	0	0	0	0	0
4/27/2011	5	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	6	0	0	1	0	0	0	0	1	0	0	0	0
4/27/2011	7	0	0	2	0	0	0	2	1	0	0	0	0
4/27/2011	8	0	0	1	0	0	0	3	1	0	0	0	0
8/2/2011	1	0	0.67	1	0	0	1	0	0	0	0.67	0	0
8/2/2011	2	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]
8/2/2011	3	0	0	0	0	0	0	0.33	0	0	2	0	0
8/2/2011	4	0	0	0	0	0	0	0	0	0	0	0	0
8/2/2011	5	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]
8/2/2011	6	0	0	0	0	0	0.67	0	0	0	0	0	0
8/2/2011	7	0	0.33	0	0	2	3	1	0	0.67	0	0.33	0
8/2/2011	8	0	0.33	0	0	1.50	2.67	0	0	0	0	0	0
8/30/2011	1	0	0	0	0	0	1	2	0	0	0	0	0
8/30/2011	2	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]
8/30/2011	3	0	0	0	0	0	0	0	0	0	0.33	0	0
8/30/2011	4	0	0	0	0	0.33	0	0.33	0	0	0.33	0	0
8/30/2011	5	0	0	0	0	0	0	0.33	0	0	0	0	0
8/30/2011	6	0	0	0	0	0.33	0.33	0.67	0	0	0	0	0
8/30/2011	7	0	0	1	0	2.67	3.67	0	0	0	0	0	0
8/30/2011	8	0	0	0	0	5.67	1.33	0	0	0	0.67	0	0

[1] Other refers to other fish species observed as noted in the comments field of the datasheet, such as sculpin, Brook Trout, Chinook, etc.

[2] Indicates survey was not completed due to high velocities.

Discussion

The index reaches selected for monitoring within the lower Stehekin River appear to have ample suitable spawning habitat as evidenced by the spawning RBT observed. The body length of adfluvial WCT returning to the Stehekin River is comparable to the body length of the spawning adfluvial RBT and thus their spawning substrate preferences should be similar.

It is probable that the absence of spawning WCT in our index reaches from 2009 to 2011 is due to the low number of WCT residing in the Lake Chelan system and the limited number of surveys conducted during the spring season. Spawning dates were estimated from observations of emergent fry for Company Creek and Blackberry Creek, tributaries to the Stehekin River, by Duke Engineering and Services Inc. (2001, pg. 12). Based on emergence timing they concluded that WCT spawned between May 22 and August 1. However, the August 1 estimated spawning date may not be reliable because it was based on unverified species information from observations of fry in the water. Excluding these observations, the latest back-calculated spawning date for WCT in Blackberry and Company Creeks would have occurred around June 24 (Duke Engineering and Services, Inc. 2001; Table 3-7, pg 11).

Other WCT spawning and emergence information in the Lake Chelan basin coincides with historic spawning timing. The WCT currently stocked into Lake Chelan originate from the WDFW hatchery at Twin Lakes near Wenatchee, Washington. The timing of WCT spawning within these lakes ranges from April 5 to the end of June (Cory Morrison, WDFW, per. comm.). Johnson and Archibald (2009) estimated spawning timing on two Lake Chelan tributaries (Grade and Safety Harbor Creeks) as occurring between mid-May and late June based on observations of emergent fry on July 30, 2009. NPS staff found that WCT in Triplet Lakes (Fourmile Creek drainage of Lake Chelan, at 1981 m elevation) had almost completed spawning by July 1, 2009. Water temperature at the time of this survey was 13.5^{o} C. In addition, during 2008 WCT emergent fry were observed in the outlet area of Upper Triplet Lake between August 11 and 16.

In regard to spawning timing information, direct observations of WCT behavior and the lack of expressed milt or eggs when handled, we believe the WCT observed in July and August were not spawning WCT. Rather it is suspected that WCT spawn between April 1 and June 30 and either remain in the Stehekin River main channel or migrate to and from Lake Chelan to feed on Kokanee eggs and aquatic macroinvertebrates during the summer months.

Recommendations

- Considering that a number of adfluvial WCT were seen in late summer side channel and mainstem snorkeling surveys, conduct additional snorkeling surveys on current index sites later in the summer. While this would not necessarily document WCT spawning populations, it would establish an index of WCT abundance in the Stehekin system.

- Annual spring surveys for WCT spawners have not documented any WCT spawning. We propose to discontinue these annual spring spawning surveys for a period of three years. Step trend procedures will be used to examine data. Step trend analysis can be useful in interpreting short term changes occurring over longer records of time and for documenting changes occurring to a response variable following a known event (e.g., fry stocking) that occurred at a specific time.

- Discontinue spawning surveys at index reach 1 (i1). Channel characteristics at this site have changed since the initiation of this survey; the channel has enlarged so that flow velocities are routinely too high for surveyors to safely snorkel.

- Conduct exploratory snorkel surveys during the spring spawning period within the mainstem of the Stehekin River. We would target areas with appropriate spawning gravels and flow conditions in an attempt to locate spawning WCT.

- Determine species composition of RBT and WCT fry, collected from selected index reaches in 2011, using genetic markers (contracted with USGS-WFRC, Seattle). Continue this effort by sampling fry from other index reaches during 2012.

- Release hatchery raised WCT fry into Blackberry Creek and Company Creek side channels to encourage adult returns to the Stehekin system.

- Collect tissue samples, length and weight data from adfluvial WCT collected via hook and line for genetic analysis.

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Appendix A. Lower Stehekin River Cutthroat Trout spawning survey index reaches.

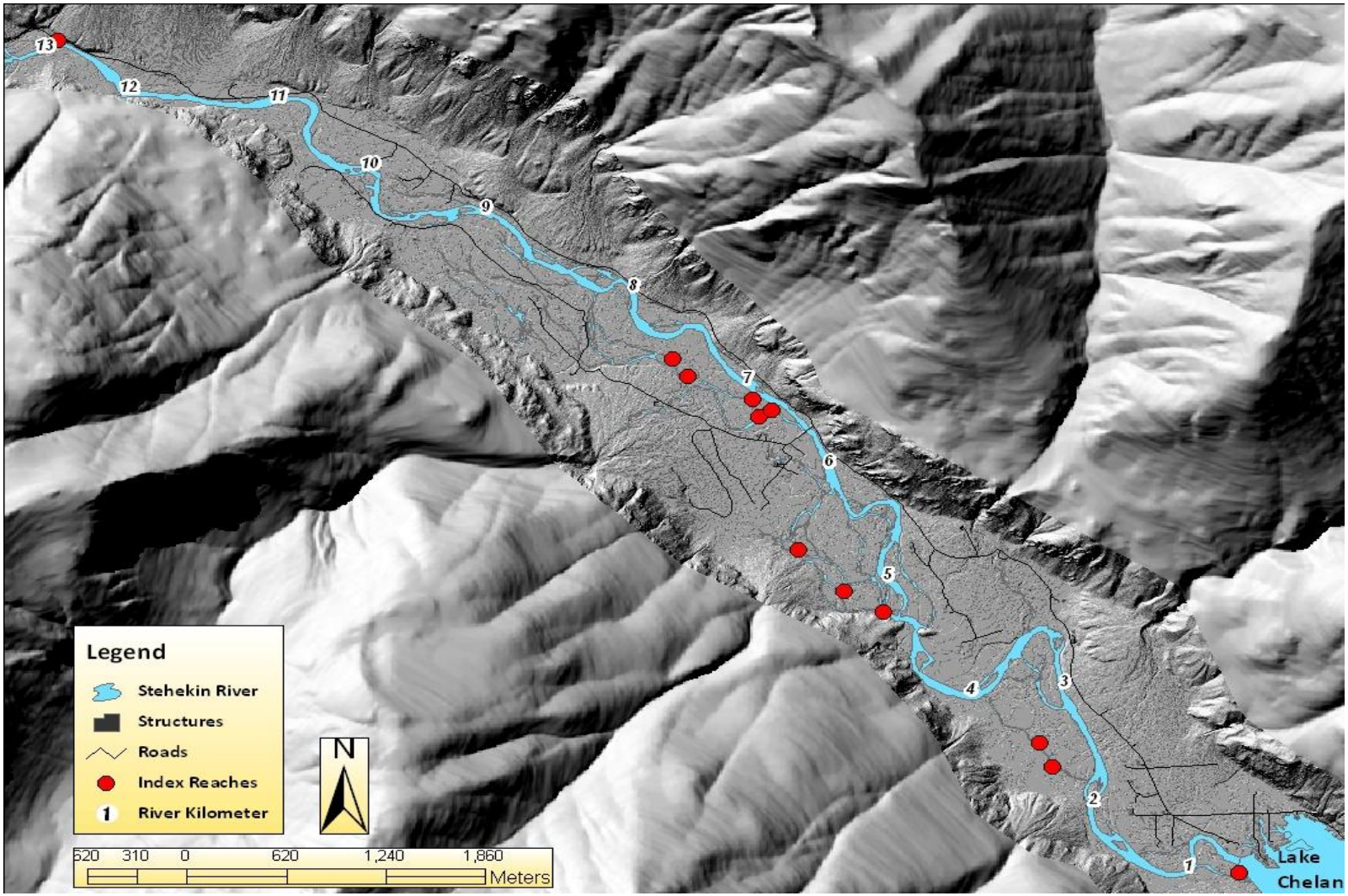

Figure A.1. Spawning survey reaches overview map.

Appendix A. Lower Stehekin River Cutthroat Trout spawning survey index reaches (continued).

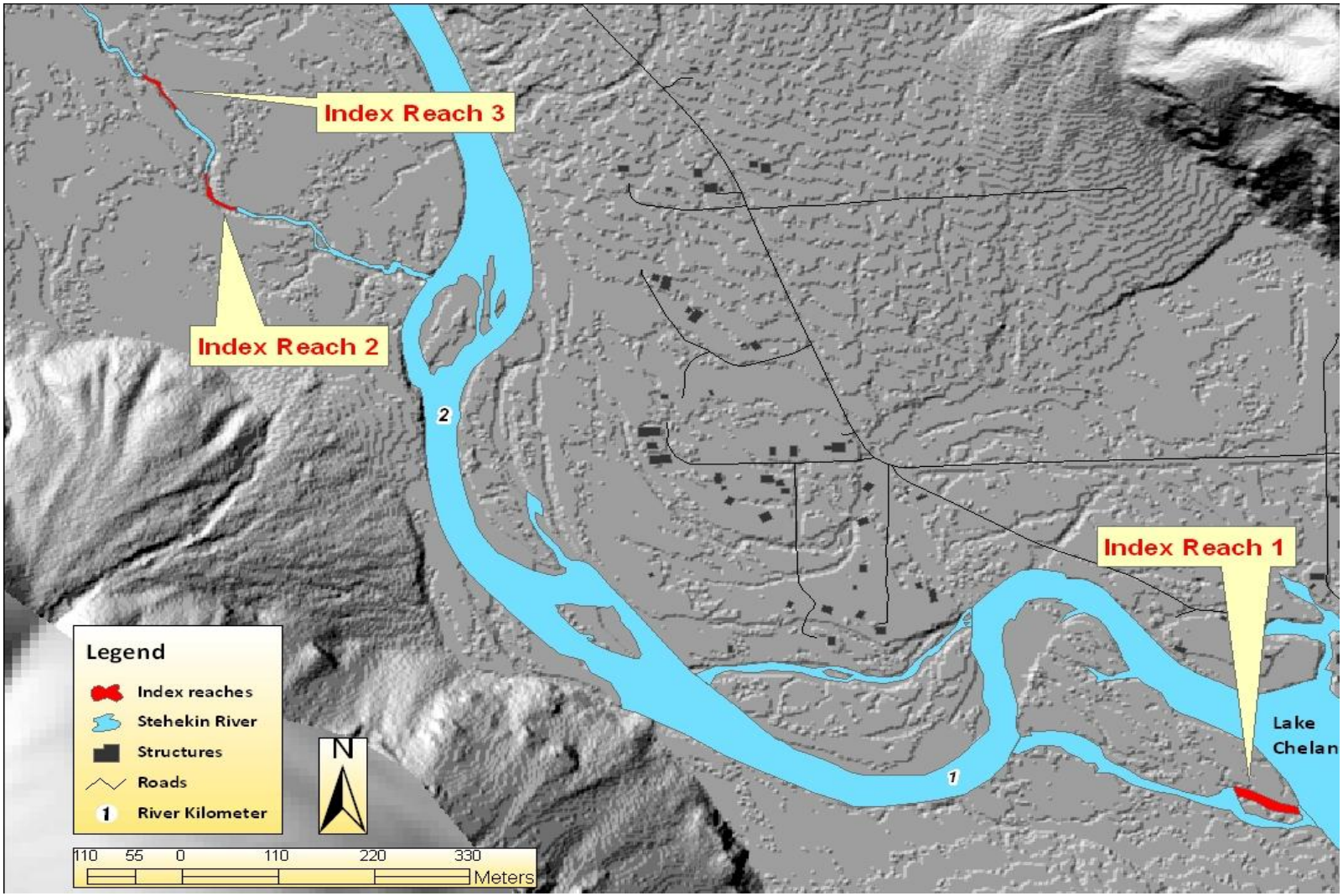

Figure A.2. Spawning survey reaches 1 - 3.

Appendix A. Lower Stehekin River Cutthroat Trout spawning survey index reaches (continued).

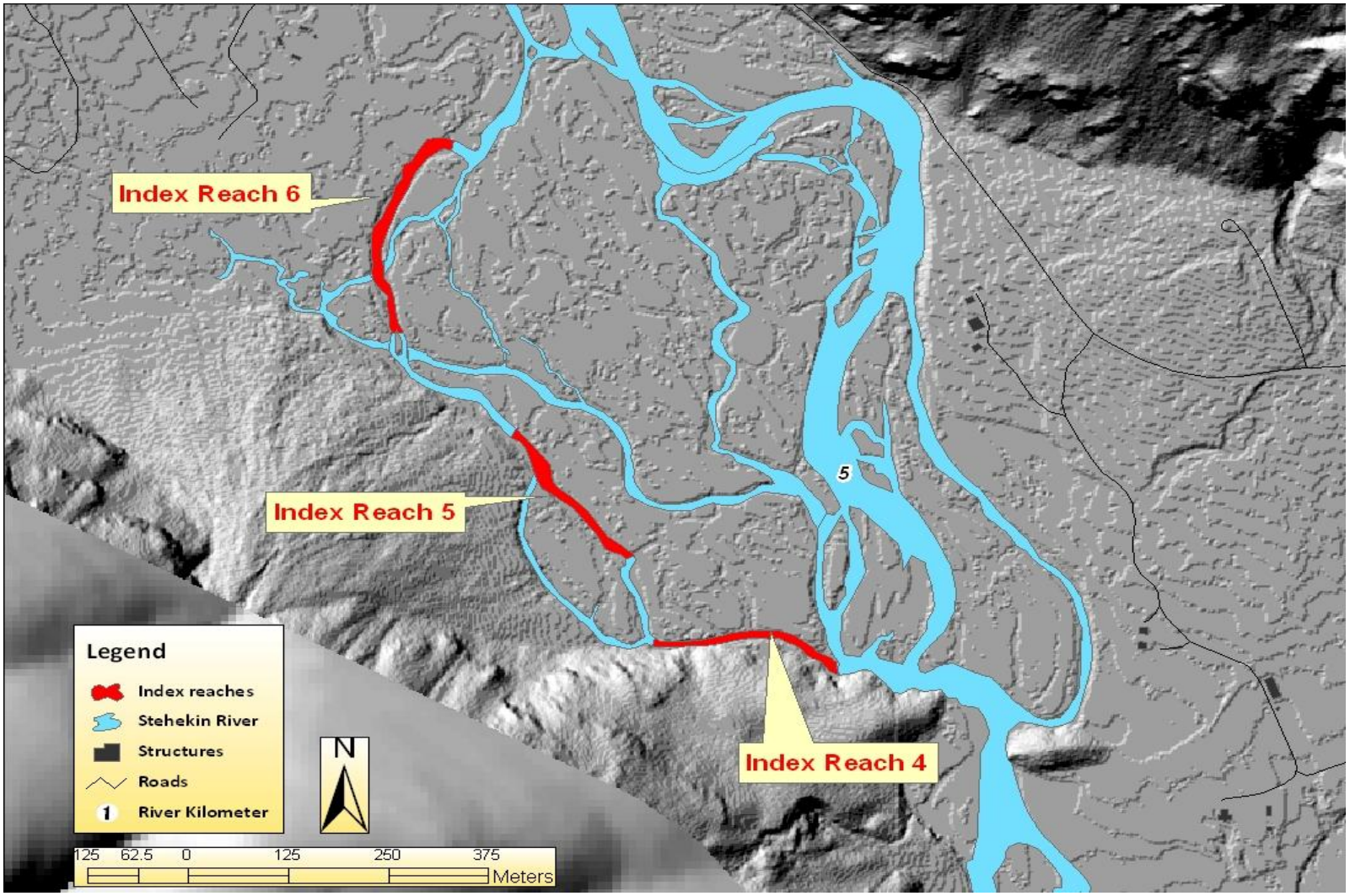

Figure A.3. Spawning survey reaches 4 - 6.

Appendix A. Lower Stehekin River Cutthroat Trout spawning survey index reaches (continued).

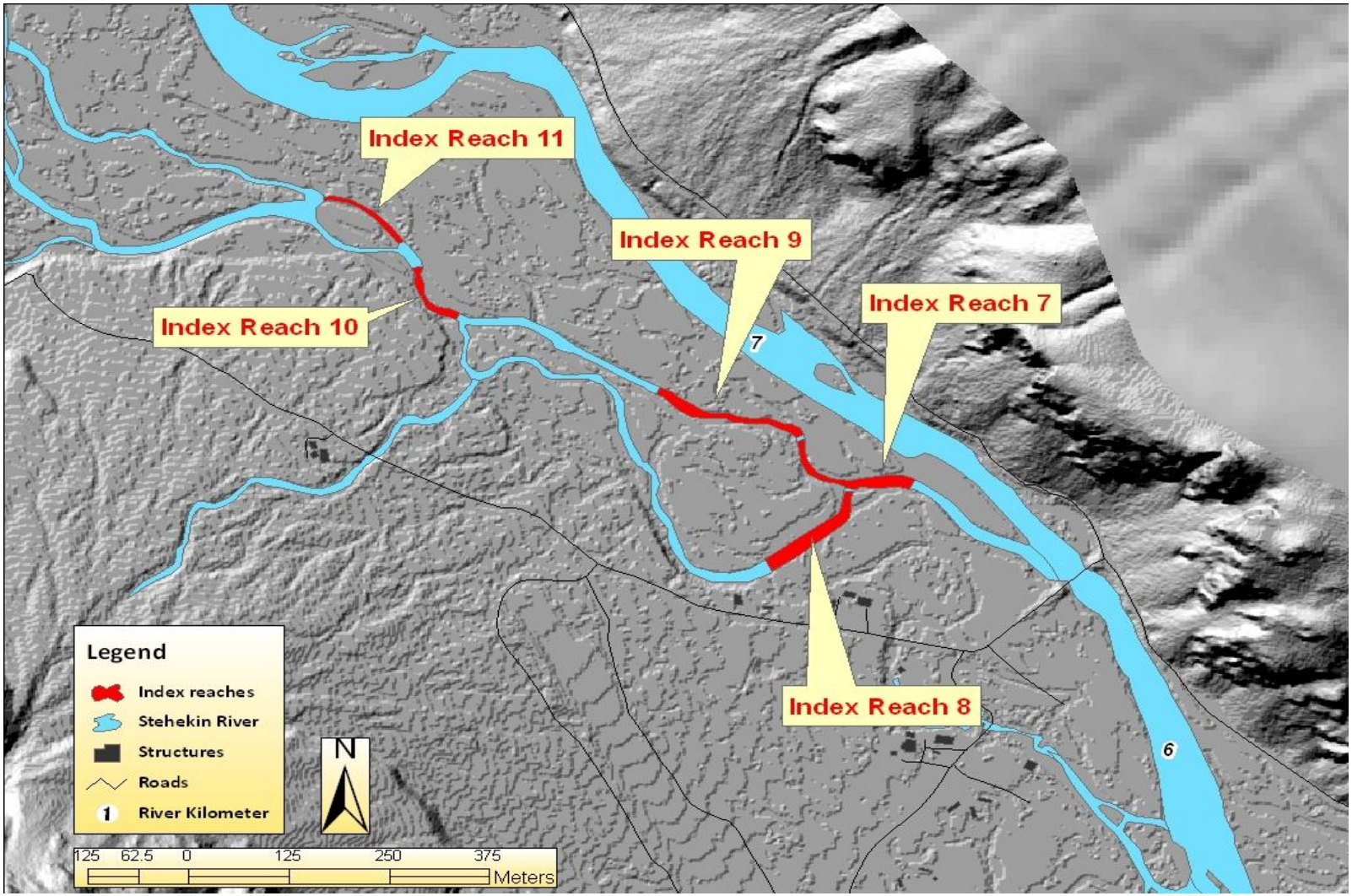

Figure A.4. Spawning survey reaches 7 - 11.

Appendix A. Lower Stehekin River Cutthroat Trout spawning survey index reaches (continued).

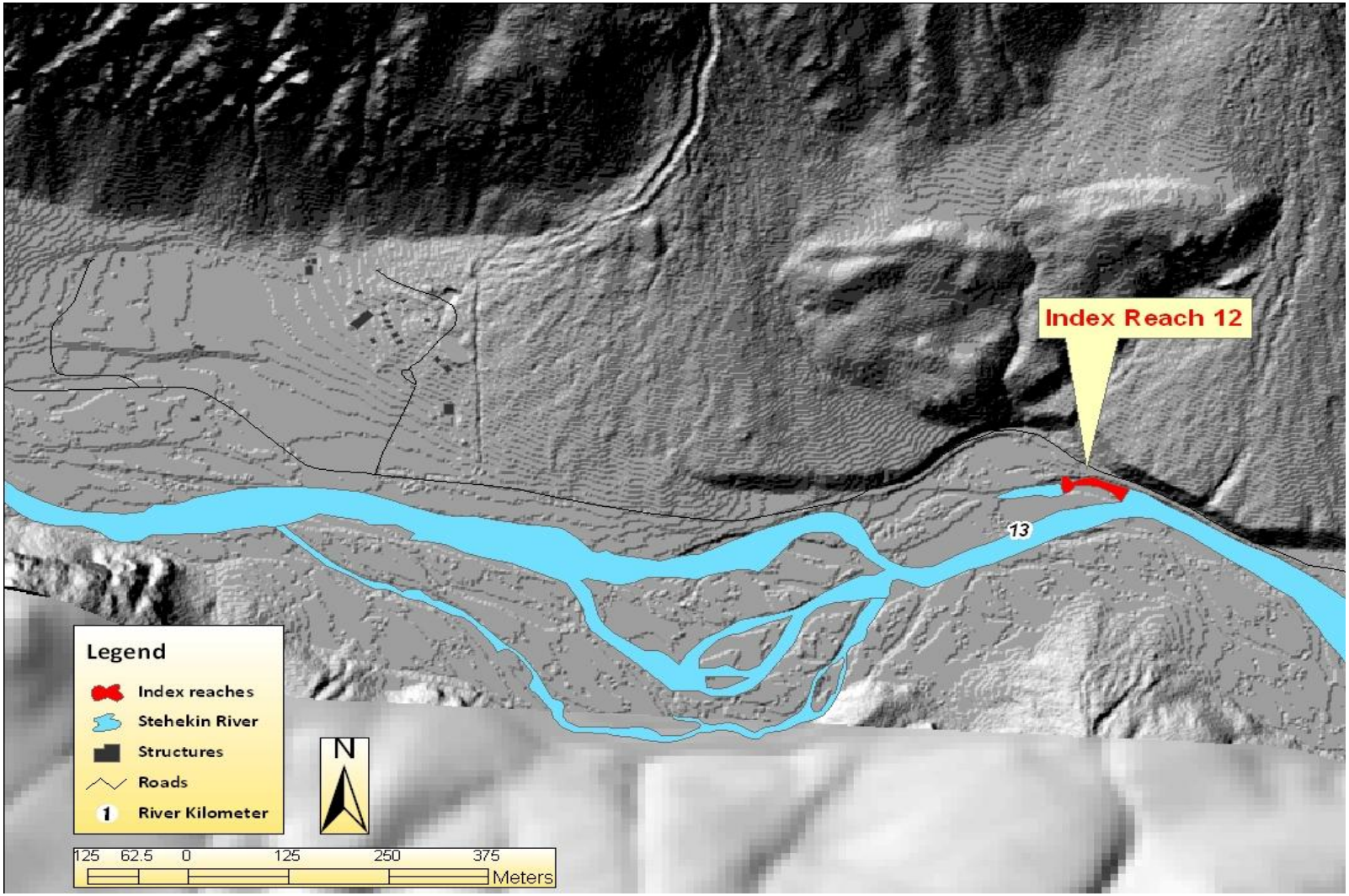

Figure A.5. Spawning survey reach 12.

Appendix B. Fish observation and redd parameter datasheets.

Stehekin Cutthroat Trout Spawning Survey Datasheet

Survey Date	Observer	Recorder	%Cloud Cover	Precip.	Water Cond.	Water Temp °C	Time of Temp. (24hr)	USGS Discharge cu. ft/sec	Visibility (m)

Cloud Cover- Estimate % cloud cover in 10% increments

Precipitation- none (n), light rain (lr), heavy rain (hr), snow (s)

Water Condition- low flow, clear (lc), low medium clear (lmc), low muddy (lm)
medium flow, clear (mc), medium/medium clear (mmc), medium/ muddy mm)
high clear (hc), high medium clear (hmc), high muddy (hm), flooding (fld)

Discharge- Discharge is taken from the USGS website: http://waterdata.usgs.gov/nwis/uv?12451000 for each survey date.

Comments- Include zeros present, other fish and wildlife observations, photo #, disturbance to channel, ect…

									# of Fish observed											
				Bottom of Reach		# of New Redds			Cutthroat (mm)†				Rainbow				Other (specify in comments)			
Site #	Index Site ID	Length (m)	Width (m)	UTM_E	UTM_N	WCT	RBT	Unkwn	<150mm	150-299	300-449	≥450	<150mm	150-299	300-449	≥450	<150mm	150-299	300-449	≥450
i1	Ste-dev-i2	115	11	672055	5354398															
i2	Ste-orc-i2	44	3	670890	5355168															
i3	Ste-orc-i1	43	2	670805	5355338															
i4	Ste-s14a-i1	217	12	669828	5356291															
i5	Ste-s14a-i2	245	15	669587	5356441															
i6	Ste-s14a-i3	292	15	669300	5356744															
i7	Ste-cc-i1	189	9	669147	5357764															
i8	Ste-cc-i3	134	6	669134	5357759															
i9	Ste-cc-i2	176	9	669015	5357843															
i10	Ste-cc-i5	125	8	668608	5358009															
i11	Ste-cc-i7	116	4	668512	5358132															
i12	Ste-up-i1	85	5	664675	5360456															

Additional Comments:

†Note fish with clipped adipose fins

Appendix B. Fish observation and redd parameter datasheets (continued).

Stehekin Cutthroat Trout Spawning Survey/ Redd parameters datasheet

Survey Date	Observer	Recorder

Redd Number	Index Reach ID	Number and species of Fish on Redd	Redd Diameter	Gravel Size w/in Redd (10 random measurements)	Redd Depth	Water Temp	Habitat Description
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Comments

Appendix C. 2009- 2011 spawning survey environmental data.

Event Number	Index Reach ID	Survey Date	Observer[1]	Recorder[1]	% Cloud Cover	Precip.[2]	Water Condition[3]	Water Temp. ˚C	Time of Temp (24hr)	Discharge (cuft/sec)	Underwater Visibility (m)
1	i1	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
2	i2	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
3	i3	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
4	i4	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
5	i5	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
6	i6	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
7	i7	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
8	i8	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
9	i9	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
10	i10	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
11	i11	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
12	i12	5/5/2009	HA, CW	HA, CW	100	lr	mc	6	1510	2000	8
13	i1	5/27/2009	HA	CW	0	n	hm	9	840	4180	2.7
14	i2	5/27/2009	HA	CW	0	n	hm	9	840	4180	2.7
15	i3	5/27/2009	HA	CW	0	n	hm	9	840	4180	2.7
16	i4	5/27/2009	HA	CW	0	n	hm	9	840	4180	2.7
17	i5	5/27/2009	HA	CW	0	n	hm	9	840	4180	2.7
18	i6	5/27/2009	HA	CW	0	n	hm	9	840	4180	2.7
19	i7	5/26/2009	CW	HA	100	lr	hmc	7	900	4430	2.7
20	i8	5/26/2009	CW	HA	100	lr	hmc	7	900	4430	2.7
21	i9	5/26/2009	CW	HA	100	lr	hmc	7	900	4430	2.7
22	i10	5/26/2009	CW	HA	100	lr	hmc	7	900	4430	2.7
23	i11	5/26/2009	CW	HA	100	lr	hmc	7	900	4430	2.7
24	i12	5/26/2009	CW	HA	100	lr	hmc	7	900	4430	2.7
25	i1	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
26	i2	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
27	i3	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
28	i4	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
29	i5	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
30	i6	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
31	i7	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
32	i8	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
33	i9	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
34	i10	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
35	i11	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9
36	i12	6/23/2009	HA	SZ	0	n	lc	7	1230	2200	9

Event Number	Index Reach ID	Survey Date	Observer[1]	Recorder[1]	% Cloud Cover	Precip.[2]	Water Condition[3]	Water Temp. ˚C	Time of Temp (24hr)	Discharge (cuft/sec)	Underwater Visibility (m)
37	i1	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
38	i2	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
39	i3	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
40	i4	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
41	i5	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
42	i6	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
43	i7	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
44	i8	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
45	i9	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
46	i10	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
47	i11	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
48	i12	4/19/2010	HA	HA	10	n	lc	5	1015	1650	8
49	i1	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
50	i2	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
51	i3	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
52	i4	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
53	i5	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
54	i6	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
55	i7	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
56	i8	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
57	i9	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
58	i10	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
59	i11	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
60	i12	5/17/2010	HA	BP	100	n	hm	5	1010	5530	0.5
61	i1	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
62	i2	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
63	i3	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
64	i4	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
65	i5	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
66	i6	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
67	i7	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
68	i8	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
69	i9	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
70	i10	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
71	i11	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
72	i12	6/7/2010	HA	HA	70	n	mmc	7	730	4040	5
73	i1	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
74	i2	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
75	i3	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1

Event Number	Index Reach ID	Survey Date	Observer[1]	Recorder[1]	% Cloud Cover	Precip.[2]	Water Condition[3]	Water Temp. ˚C	Time of Temp (24hr)	Discharge (cuft/sec)	Underwater Visibility (m)
76	i4	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
77	i5	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
78	i6	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
79	i7	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
80	i8	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
81	i9	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
82	i10	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
83	i11	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
84	i12	6/28/2010	JB, HA	ME	10	n	mmc	8	1430	4490	3.1
85	i1	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
86	i2	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
87	i3	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
88	i4	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
89	i5	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
90	i6	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
91	i7	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
92	i8	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
93	i9	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
94	i10	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
95	i11	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
96	i12	4/26/2011	HA, JS	HA	100	n	lc	6	1400	836	12.9
97	i1	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
98	i2	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
99	i3	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
100	i4	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
101	i5	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
102	i6	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
103	i7	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
104	i8	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
105	i9	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
106	i10	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
107	i11	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
108	i12	5/24/2011	HA	ME	30	n	mc	6	1500	4290	5
109	i1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
110	i2	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2
111	i3	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2
112	i4	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2
113	i5	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2
114	i6	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2

Event Number	Index Reach ID	Survey Date	Observer[1]	Recorder[1]	% Cloud Cover	Precip.[2]	Water Condition[3]	Water Temp. ˚C	Time of Temp (24hr)	Discharge (cuft/sec)	Underwater Visibility (m)
115	i7	6/27/2011	HA	ME	90	n	mc	5	900	4020	4.7
116	i8	6/27/2011	HA	ME	90	n	mc	5	900	4020	4.7
117	i9	6/27/2011	HA	ME	90	n	mc	5	900	4020	4.7
118	i10	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2
119	i11	6/28/2011	HA	ME	40	n	hc	5	900	4740	3.2
120	i12	6/27/2011	HA	ME	90	n	mc	5	900	4020	4.7
121	i1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
122	i2	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
123	i3	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
124	i4	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
125	i5	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
126	i6	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
127	i7	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
128	i8	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
129	i9	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
130	i10	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
131	i11	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
132	i12	7/20/2011	HA	KM	75	n	mmc	6.5	910	3850	3.7
133	i1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
134	i2	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
135	i3	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
136	i4	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
137	i5	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
138	i6	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
139	i7	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
140	i8	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
141	i9	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
142	i10	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
143	i11	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7
144	i12	8/30/2011	HA	CD	20	n	lc	11	907	1210	8.7

[1] Personnel: HA= Hugh Anthony, CW= Carmen Welch, JS= Jake Sarrantonio, CD= Chris Delorto, SZ= Stan Zyskowski, KM= Kelly Martin

[2] Precipitation: N= None, LR= light rain, HR= heavy rain, S= snow

[3] Water Condition: LC= low flow/clear, LMC= low/medium clear, LM= low/muddy, MC= medium/clear, MMC= medium/ medium clear, MM= medium muddy, HC= high clear, HMC= high medium clear, HM= high muddy, FLD= flooding

Appendix D. 2009- 2011 RBT and WCT index reach survey data.

Index Reach ID	Survey Date	# Fish Observed_WCT				# Fish Observed_RBT				# Fish Observed_UNKWN[1]			
		<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm
i1	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i2	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i3	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i4	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i5	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i6	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i7	5/5/2009	0	0	0	0	0	0	0	0	1	0	0	0
i8	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i9	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i10	5/5/2009	0	0	0	0	0	0	0	2	0	0	0	0
i11	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i12	5/5/2009	0	0	0	0	0	0	0	0	0	0	0	0
i1	5/27/2009	0	0	0	0	0	0	0	0	0	0	0	0
i2	5/27/2009	0	0	0	0	0	0	0	0	0	0	0	0
i3	5/27/2009	0	0	0	0	0	0	0	0	0	0	0	0
i4	5/27/2009	0	0	0	0	0	0	0	0	0	1	0	0
i5	5/27/2009	0	0	0	0	0	0	0	0	0	0	0	0
i6	5/27/2009	0	0	0	0	0	0	0	0	0	0	0	0
i7	5/26/2009	0	0	0	0	0	0	0	0	0	0	0	0
i8	5/26/2009	0	0	0	0	0	0	3	2	1	0	0	0
i9	5/26/2009	0	0	0	0	0	0	0	0	0	0	0	0
i10	5/26/2009	0	0	0	0	0	0	0	0	0	0	0	0
i11	5/26/2009	0	0	0	0	0	0	0	0	0	0	0	0
i12	5/26/2009	0	0	0	0	0	0	0	0	0	0	0	0
i1	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i2	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i3	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i4	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i5	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i6	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i7	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i8	6/23/2009	0	0	0	0	3	1	1	0	2	0	0	0
i9	6/23/2009	0	0	0	0	1	2	0	0	0	0	0	0
i10	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i11	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0

Index Reach ID	Survey Date	# Fish Observed_WCT				# Fish Observed_RBT				# Fish Observed_UNKWN[1]			
		<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm
i12	6/23/2009	0	0	0	0	0	0	0	0	0	0	0	0
i1	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i2	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i3	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i4	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i5	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i6	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i7	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i8	4/19/2010	0	0	0	0	0	3	0	0	0	0	0	0
i9	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i10	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i11	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i12	4/19/2010	0	0	0	0	0	0	0	0	0	0	0	0
i1	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i2	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i3	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i4	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i5	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i6	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i7	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i8	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i9	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i10	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i11	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i12	5/17/2010	0	0	0	0	0	0	0	0	0	0	0	0
i1	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i2	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i3	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i4	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i5	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i6	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i7	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i8	6/7/2010	0	0	0	0	0	0	2	0	0	0	0	0
i9	6/7/2010	0	0	0	0	1	0	0	0	0	0	0	0
i10	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i11	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i12	6/7/2010	0	0	0	0	0	0	0	0	0	0	0	0
i1	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0

Index Reach ID	Survey Date	# Fish Observed_WCT				# Fish Observed_RBT				# Fish Observed_UNKWN[1]			
		<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm
i2	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0
i3	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0
i4	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0
i5	6/28/2010	0	0	0	0	2	0	1	0	0	0	0	0
i6	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0
i7	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0
i8	6/28/2010	0	0	0	0	0	0	1	0	0	0	0	0
i9	6/28/2010	0	0	0	0	2	2	0	0	20	0	0	0
i10	6/28/2010	0	0	0	0	0	0	0	0	4	0	0	0
i11	6/28/2010	0	0	0	0	0	0	0	0	1	0	0	0
i12	6/28/2010	0	0	0	0	0	0	0	0	0	0	0	0
i1	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i2	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i3	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i4	4/26/2011	0	0	0	0	0	0	0	1	0	0	0	0
i5	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i6	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i7	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i8	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i9	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i10	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i11	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i12	4/26/2011	0	0	0	0	0	0	0	0	0	0	0	0
i1	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i2	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i3	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i4	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i5	5/24/2011	0	0	0	0	0	0	0	1	0	0	0	0
i6	5/24/2011	0	0	0	0	0	0	1	1	0	0	0	0
i7	5/24/2011	0	0	0	0	0	0	0	2	0	0	0	0
i8	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i9	5/24/2011	0	0	0	0	0	1	0	0	0	0	0	0
i10	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i11	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i12	5/24/2011	0	0	0	0	0	0	0	0	0	0	0	0
i1	6/28/2011	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
i2	6/28/2011	0	0	0	0	0	0	0	0	0	0	0	0
i3	6/28/2011	0	0	0	0	0	0	0	0	0	0	0	0

Index Reach ID	Survey Date	# Fish Observed_WCT				# Fish Observed_RBT				# Fish Observed_UNKWN[1]			
		<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm	<150mm	150-299mm	300-449mm	≥450mm
i4	6/28/2011	0	0	0	0	0	0	0	0	1	0	0	0
i5	6/28/2011	0	0	0	0	0	0	0	0	0	0	0	0
i6	6/28/2011	0	0	0	0	0	0	0	0	0	0	0	0
i7	6/27/2011	0	0	0	0	0	0	1	0	0	0	0	0
i8	6/27/2011	0	0	0	0	0	0	0	0	0	0	0	0
i9	6/27/2011	0	0	0	0	0	0	0	0	0	0	0	0
i10	6/28/2011	0	0	0	0	0	0	0	0	0	0	0	0
i11	6/28/2011	0	0	0	0	0	0	0	0	0	0	0	0
i12	6/27/2011	0	0	0	0	0	0	0	0	0	0	0	0
i1	7/20/2011	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
i2	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i3	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i4	7/20/2011	0	0	0	0	0	0	0	0	2	0	0	0
i5	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i6	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i7	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i8	7/20/2011	0	0	0	0	0	0	1	0	0	0	0	0
i9	7/20/2011	0	0	0	0	0	0	1	0	0	0	0	0
i10	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i11	7/20/2011	0	0	0	0	0	1	0	0	0	0	0	0
i12	7/20/2011	0	0	0	0	0	0	0	0	0	0	0	0
i1	8/30/2011	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
i2	8/30/2011	0	0	0	0	4	1	0	0	0	0	0	0
i3	8/30/2011	0	0	0	0	2	0	0	0	0	0	0	0
i4	8/30/2011	0	0	1	0	11	0	0	0	0	0	2	0
i5	8/30/2011	0	0	2	0	28	0	0	0	0	0	0	0
i6	8/30/2011	0	0	1	0	34	3	0	0	0	0	0	0
i7	8/30/2011	0	0	0	0	19	3	0	0	0	0	0	0
i8	8/30/2011	0	0	0	0	17	1	0	0	0	0	0	0
i9	8/30/2011	0	0	3	0	6	7	0	0	0	0	2	0
i10	8/30/2011	0	0	0	0	20	6	0	0	0	0	0	0
i11	8/30/2011	0	0	1	0	12	1	0	0	0	0	0	0
i12	8/30/2011	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1] UNKWN refers to an unidentified fish.

Appendix E. Stehekin River side channel index sites additional fish observations.

Index Reach ID	Survey Date	# Fish Observed_UNKWN <150mm	150 - 299mm	300 - 449mm	# Fish Observed_OTHER <150mm	150 - 299mm	300 - 449mm	Comments
i7	5/5/2009	1	0	0	1	0	0	1 sculpin, 1 unknwn zero
i8	5/26/2009	1	0	0	0	0	0	1 unidentified trout <150mm.
i4	5/27/2009	0	1	0	0	0	0	1 unidentified trout approx. 200mm.
i4	6/23/2009	0	0	0	1	0	0	1 sculpin <150mm
i8	6/23/2009	2	0	0	0	0	0	2 unknwn fry
i4	5/17/2010	0	0	0	25	0	0	25 zeros seen in backwater habitat, likely kokanee.
i4	6/7/2010	0	0	0	50	0	0	50 zeros seen in backwater habitat, likely kokanee.
i9	6/7/2010	0	0	0	0	0	0	30 zeros seen in backwater habitat, likely kokanee.
i10	6/28/2010	4	0	0	0	0	0	4 unidentified zeros.
i5	6/28/2010	0	0	0	12	0	0	Two sculpin <150mm seen. Approx 10 zeros.
i9	6/28/2010	20	0	0	0	1	0	approx. 20 zeros. "other" fish was EBT, about 225mm in length.
i4	4/26/2011	0	0	0	0	0	0	Many zero's present, likely Kokanee
i10	7/20/2011	0	0	0	11	0	0	likely kokanee fry
i11	7/20/2011	0	0	0	6	0	0	other is: 1 sculpin ,150mm, 5 kokanee fry
i4	7/20/2011	2	0	0	0	0	0	likely kokanee fry
i6	7/20/2011	0	0	0	2	0	1	other is EBT, 1 @ 300mm
i7	7/20/2011	0	0	0	5	0	0	likely kokanee fry
i10	8/30/2011	0	0	0	9	1	0	"Other" is EBT
i11	8/30/2011	0	0	0	4	0	0	"Other" is EBT.
i4	8/30/2011	0	0	2	3	2	0	"Other" is EBT, 2 unknw @380mm likely whitefish or sucker sp.
i5	8/30/2011	0	0	0	3	0	0	"Other" is EBT
i6	8/30/2011	0	0	0	24	11	0	"Other" is EBT, 2 sculpin <150mm
i7	8/30/2011	0	0	0	2	0	0	"Other" is EBT, 4 sculpin <150mm
i8	8/30/2011	0	0	0	9	1	0	"Other" is EBT, 1 sculpin <150mm
i9	8/30/2011	0	0	2	4	0	0	"Other" is EBT, unknown likely whitefish or sucker sp.

Appendix F. Mainstem Stehekin River pool snorkel survey fish observations.

Survey Date	Discharge ft3/sec	Underwater Vis. (m)	Pool #	Cutthroat ≤150mm	Cutthroat >150-299	Cutthroat 300-449	Cutthroat ≥450	Rainbow ≤150mm	Rainbow >150-299	Rainbow 300-449	Rainbow ≥450	Other[1] ≤150mm	Other[1] >150-299	Other[1] 300-449	Other[1] ≥450
4/27/2011	836	12.9	1	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	836	12.9	1	0	0	0	0	0	0	0	0	0	0	0	0
4/27/2011	836	12.9	1	0	0	0	0	0	0	0	0	0	0	0	0
4/27/2011	836	12.9	2	0	0	0	0	0	0	0	0	0	0	0	0
4/27/2011	836	12.9	2	0	0	0	0	0	0	2	0	0	0	0	0
4/27/2011	836	12.9	2	0	0	0	0	0	0	2	0	0	0	0	0
4/27/2011	836	12.9	3	0	0	0	0	0	0	2	0	0	0	1	0
4/27/2011	836	12.9	3	0	0	0	0	0	0	1	0	0	0	1	0
4/27/2011	836	12.9	3	0	0	0	0	0	0	1	0	0	0	1	0
4/27/2011	836	12.9	4	0	0	0	0	0	0	5	0	0	0	0	0
4/27/2011	836	12.9	4	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	836	12.9	4	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	836	12.9	5	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	836	12.9	5	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	836	12.9	5	0	0	0	0	0	0	1	0	0	0	0	0
4/27/2011	836	12.9	6	0	0	1	0	0	0	0	1	0	0	0	0
4/27/2011	836	12.9	6	0	0	1	0	0	0	0	1	0	0	0	0
4/27/2011	836	12.9	6	0	0	1	0	0	0	0	1	0	0	0	0
4/27/2011	836	12.9	7	0	0	2	0	0	0	2	1	0	0	0	0
4/27/2011	836	12.9	7	0	0	2	0	0	0	2	1	0	0	0	0
4/27/2011	836	12.9	7	0	0	2	0	0	0	2	1	0	0	0	0
4/27/2011	836	12.9	8	0	0	1	0	0	0	3	1	0	0	0	0
4/27/2011	836	12.9	8	0	0	1	0	0	0	3	1	0	0	0	0
4/27/2011	836	12.9	8	0	0	1	0	0	0	3	1	0	0	0	0
4/27/2011	836	12.9	9	0	0	0	0	0	0	0	0	0	0	0	0
4/27/2011	836	12.9	9	0	0	0	0	0	0	0	0	0	0	0	0
4/27/2011	836	12.9	9	0	0	0	0	0	0	0	0	0	0	0	0
8/2/2011	2540	6.7	1	0	1	1	0	0	1	0	0	0	1	0	0
8/2/2011	2540	6.7	1	0	0	1	0	0	1	0	0	0	1	0	0
8/2/2011	2540	6.7	1	0	1	1	0	0	1	0	0	0	0	0	0
8/2/2011	2540	6.7	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	3	0	0	0	0	0	0	1	0	0	1	0	0
8/2/2011	2540	6.7	3	0	0	0	0	0	0	0	0	0	3	0	0

Survey Date	Discharge ft3/sec	Underwater Vis. (m)	Pool #	Cutthroat ≤150mm	Cutthroat >150-299	Cutthroat 300-449	Cutthroat ≥450	Rainbow ≤150mm	Rainbow >150-299	Rainbow 300-449	Rainbow ≥450	Other[1] ≤150mm	Other[1] >150-299	Other[1] 300-449	Other[1] ≥450
8/2/2011	2540	6.7	3	0	0	0	0	0	0	0	0	0	2	0	0
8/2/2011	2540	6.7	4	0	0	0	0	0	0	0	0	0	0	0	0
8/2/2011	2540	6.7	4	0	0	0	0	0	0	0	0	0	0	0	0
8/2/2011	2540	6.7	4	0	0	0	0	0	0	0	0	0	0	0	0
8/2/2011	2540	6.7	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	6	0	0	0	0	0	1	0	0	0	0	0	0
8/2/2011	2540	6.7	6	0	0	0	0	0	1	0	0	0	0	0	0
8/2/2011	2540	6.7	6	0	0	0	0	0	0	0	0	0	0	0	0
8/2/2011	2540	6.7	7	0	0	0	0	0	4	0	0	0	0	1	0
8/2/2011	2540	6.7	7	0	1	0	0	4	1	1	0	0	0	0	0
8/2/2011	2540	6.7	7	0	0	0	0	2	4	2	0	2	0	0	0
8/2/2011	2540	6.7	8	0	0	0	0	1	2	0	0	0	0	0	0
8/2/2011	2540	6.7	8	0	1	0	0	2	2	0	0	0	0	0	0
8/2/2011	2540	6.7	8	0	0	0	0		4	0	0	0	0	0	0
8/2/2011	2540	6.7	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/2/2011	2540	6.7	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/30/2011	1210	5	1	0	0	0	0	0	1	2	0	0	0	0	0
8/30/2011	1210	5	1	0	0	0	0	0	0	2	0	0	0	0	0
8/30/2011	1210	5	1	0	0	0	0	0	2	2	0	0	0	0	0
8/30/2011	1210	5	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/30/2011	1210	5	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/30/2011	1210	5	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/30/2011	1210	5	3	0	0	0	0	0	0	0	0	0	1	0	0
8/30/2011	1210	5	3	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2011	1210	5	3	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2011	1210	5	4	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2011	1210	5	4	0	0	0	0	0	0	1	0	0	1	0	0
8/30/2011	1210	5	4	0	0	0	0	1	0	0	0	0	0	0	0
8/30/2011	1210	5	5	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2011	1210	5	5	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2011	1210	5	5	0	0	0	0	0	0	1	0	0	0	0	0
8/30/2011	1210	5	6	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2011	1210	5	6	0	0	0	0	0	0	1	0	0	0	0	0
8/30/2011	1210	5	6	0	0	0	0	1	1	1	0	0	0	0	0
8/30/2011	1210	5	7	0	0	0	0	0	1	0	0	0	0	0	0

Survey Date	Discharge ft3/sec	Underwater Vis. (m)	Pool #	Cutthroat ≤150mm	Cutthroat >150-299	Cutthroat 300-449	Cutthroat ≥450	Rainbow ≤150mm	Rainbow >150-299	Rainbow 300-449	Rainbow ≥450	Other[1] ≤150mm	Other[1] >150-299	Other[1] 300-449	Other[1] ≥450
8/30/2011	1210	5	7	0	0	1	0	0	4	0	0	0	0	0	0
8/30/2011	1210	5	7	0	0	2	0	8	6	0	0	0	0	0	0
8/30/2011	1210	5	8	0	0	0	0	6	2	0	0	0	0	0	0
8/30/2011	1210	5	8	0	0	0	0	6	1	0	0	0	1	0	0
8/30/2011	1210	5	8	0	0	0	0	5	1	0	0	0	1	0	0
8/30/2011	1210	5	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/30/2011	1210	5	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8/30/2011	1210	5	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1] Other refers to other fish species observed as noted in the comments field of the datasheet, such as sculpin, Brook Trout, Chinook ect.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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