Canton Creek Surveys (2011, 2013, and 2014) with Restoration Opportunities

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by

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2012: Year one
Shelbey Neifert
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Executive Summary

During three summers 2011, 2013 and 2014, a snorkel survey of Canton Creek (North Umpqua basin) was completed by Phoenix school students and staff, as well as Tiffany Caisse, Joe Edmonds, and Jeff MacEnroe of the BLM, and Charley Dewberry of the Pacific Rivers Council. Thomas McGregor, Director of work experience at the Phoenix school coordinated the student participation and Kelly Coates from the Cow Creek Tribe helped with the snorkeling and snorkel training. The survey included all the main- stem Canton Creek to the fourth bridge, Pass Creek, and Mellow Moon Creeks. In addition, several smaller tributaries were surveyed to document steelhead use.

The abundance and distribution of steelhead (the dominant salmonid) in the basin, as well as the evaluation of the habitat and landscape processes provided basic information to identify restoration opportunities within the basin. A number of trends were observed in the trajectory of steelhead within the basin. The population of age-0 steelhead in the basin as a whole declined by one-half in each subsequent survey that was largely due to declines in the lower ten miles of Canton Creek. The trajectory of age-0 steelhead in Pass Creek, Mellow Moon Creek, and Upper Canton Creek peaked in 2013, the second year of the survey. The population of age-1 Steelhead in the basin declined fifty percent between the first two surveys but remained the same between year 2 and year 3. Surprisingly, Age-1 Steelhead in Pass Creek and Upper Canton Creek had almost opposite trajectories, which are basically the left fork and right fork of Canton Creek. They are of similar size and run parallel to each other. The population of age-2 steelhead in the Canton Creek basin was highest in the first survey and lowest in the second survey. The population trajectory was largely driven by age-2 steelhead rearing in lower Canton Creek. Upper Canton Creek also followed the over-all basin trajectory. Like we saw earlier, Pass Creek had the opposite trajectory to the over-all basin trajectory and to upper Canton Creek. The population of cutthroat trout had a similar population trajectory to age-2 Steelhead. That was not surprising. Most cutthroat and most age 2 steelhead were found in lower Canton Creek. With one more year of survey in 2015, we can begin a life-history analysis that will greatly increase our ability to understand the dynamics of steelhead trout within the basin.

Restoration opportunities in Canton Creek entail rebuilding the capital of large wood in the stream channels that can serve as key pieces for building gradient controlling jams in the tributaries and in Pass and upper Canton Creeks. In order to rebuild this capital, timber management must ensure that an adequate amount of timber in the riparian zones be provided to rebuild the stream capital of large wood. Also, included in this riparian area are steep unstable slopes that are the initiation point of landslides and debris flows. In addition, the road network needs to be managed and maintained to minimize its effect on the routing of landslides and debris flows within the basin. The highest priority is to lessen the risk of dam-break floods within the stream system. These events are the most destructive forces currently limiting the recovery of Canton Creek.

Introduction

In 2011, a partnership was formed among the Pacific Rivers Council, Phoenix Charter School in Roseburg, Oregon, the Cow Creek Tribe, and the BLM to collect baseline information prior to designing a restoration project within the Canton Creek Drainage basin. The Canton Creek Drainage was of interest because it is partially within the Oregon and California Railroad Lands (O&C) as well as being strategically located within the North Umpqua basin. This project provides an opportunity to collect background information for designing an effective restoration project within the context of the North Umpqua drainage.

During three summers-2011, 2013 and 2014- a snorkel survey for juvenile salmonids in Canton Creek (North Umpqua basin) was completed by Phoenix school students and staff (Appendix I), Tiffany Caisse, Joe Edmonds and Jeff MacEnroe of the Bureau of Land Management (BLM), and Charley, Dewberry and Kelly Coates (2011) of the Pacific Rivers Council. Dylan and Andrew Dewberry also participated in the snorkel survey. Thomas McGregor, Director of Work Experience at the Phoenix school, coordinated the student participation and Kelly Coates from the Cow Creek Tribe and Jeff MacEnroe (BLM) helped with the snorkel training. The survey included all of the main-stem Canton Creek to the fourth bridge, Pass Creek, and Mellow Moon Creeks. In addition, several smaller tributaries were surveyed to document steelhead use.

Study Area

Canton Creek is a major tributary of Steamboat Creek in the North Umpqua River basin Figure 1). The drainage area is approximately 60 square miles. Canton Creek is a strategically important producer of steelhead trout, coho salmon, chinook salmon and cutthroat trout within the North Umpqua drainage. Most of the western two-thirds of the basin are BLM-private land checkerboard (O&C lands). The remaining one-third of the basin is managed by the U.S. Forest Service (USFS).

The basin is entirely within the Western Cascades. The geology is dominated by sedimentary and volcanic rock from Eocene through Lower Miocene age (Marlimillerphoto.com). The dominant forest community is western Hemlock- Douglas fir.

Methods

The snorkel surveys were conducted during August and September each year using the Hankin-Reeves method (Hankin and Reeves 1988). A dive crew, consisting of two or more people, work their way upstream through their designated stream reach. The stream channel was divided into three habitat types: riffles, pools, and glides. For each habitat unit the length and width was estimated. The frequency of the surveyed units was: 1:10 riffles; 1:8 glides; and 1:5 pools. All salmonids were counted in each surveyed stream habitat. In the habitat units that were snorkeled, the length and width of the habitat unit were measured.

The Phoenix students participated in a day of training prior to conducting the surveys. The topics emphasized during the training were safety, identifying the three habitat types in Canton Creek, how to identify the species and age of the salmonids found in the basin, and how to approach counting the fish in a habitat unit. During training, the students spent a total of four hours in the stream conducting actual counts in habitat units. All students could identify coho, steelhead and cutthroat trout. Two students participated in the Canton Creek snorkel surveys during all three years.

The Phoenix School students divided into three teams. One team snorkeled Mellow Moon Creek, a west-side tributary of Pass Creek. The second team snorkeled Pass Creek, the major left fork of Canton Creek, while the third team snorkeled upper Canton Creek. Charley

Dewberry worked with the Pass Creek crews to verify their counts. In addition, he snorkeled a reach of Mellow Moon Creek, upper Canton Creek, and Pass Creek to verify the student counts.

Charley, Andrew, and Dylan Dewberry snorkeled the main-stem of Canton Creek and finished Pass and upper Canton Creeks. The main-stem of Canton Creek consists of the lower ten miles of Canton Creek up to the confluence of Pass and Upper Canton creeks.

For these surveys, age-0 and 1 trout include both steelhead and cutthroat trout. While some individuals are easy to identify into their respective species, others are very difficult. We elected to combine both species into these age categories. Age-2 steelhead were differentiated from age-2 cutthroat trout. While a few adult salmonids were observed in the surveys, they are not included in this discussion.

Results and Discussion

Surveyed Reaches

During the three years, the following reaches of Canton Creek were snorkeled at least once: Mellow Moon Creek, Pass Creek including the left and right forks, Upper Canton Creek to the falls, part of No Man Creek, part of Francis Creek, part of Chilcote Creek, and part of an unnamed tributary in upper Canton Creek (see Figure_). During 2011, a survey completed the main-stem but only parts of Mellow Moon Creek, Pass Creek and Upper Canton Creek (see Figure _A). The survey in 2013 completed the main-stem, Pass Creek, and Upper Canton as well as a number of minor tributaries (Figure _B). The 2014 survey completed the mainstem, Pass Creek, and Upper Canton Creeks (Figure _C).

In all three years the main-stem of Canton Creek was snorkeled by Charley and Andrew Dewberry. In all three years, the Phoenix school divers finished Mellow Moon Creek and at least 75% of both Pass and Upper Canton Creeks. In 2013, Charley Dewberry completed Pass Creek and Upper Canton Creek as well as additional minor tributaries. In 2014, the Phoenix school students finished about 75% of Pass Creek and 100% of Upper Canton Creek. Charley Dewberry finished Pass Creek in addition to verifying the counts of the Phoenix school divers.

Salmonid Population Estimates

The results of the three years of snorkel surveys are summarized in Tables 1-….. Coho salmon, steelhead trout, and cutthroat trout were observed and their populations estimated in the basin. In addition, a few adult steelhead and Chinook salmon were observed in the main-stem.

Age-0 Steelhead

Steelhead trout were the most abundant salmonid within the basin. All three ages of steelhead were observed. As expected, age-0 fish dominated the survey with a population estimate of over 40,000 for the main-stem of Canton Creek and Pass, Upper Canton Creek, and Mellow Moon Creek in 2011 (Table 1- Figure 1). In 2013, a total of 31,00 age-0 steelhead were observed. The 2014 count was approximately one-half of the 2013 count (16,000). The 2011 survey was also underestimated, because only about three-quarters of Pass Creek and Upper Canton Creeks were completed in the snorkel survey. No explanation is immediately available at this time to explain the declines. There are a number of possibilities including: declining number of spawning adults, timing of flood events allowing adult steelhead to migrate upstream to spawning areas, and flood waters scouring out redds or reducing survival of the fry due to high amounts of sedimentation. With additional surveys we will gain greater understanding of the factors controlling the steelhead population in Canton Creek.

The number of age-0 steelhead was examined by reach. In the main-stem (the lower approximately 10 miles) of Canton Creek the number of age-0 steelhead declined by about one-half with each successive survey (Table 1). The 2013 estimate was one-half of the 2011 survey and the 2014 survey was one-half of the 2013 survey. The main-stem counts were made by the same snorkel divers in each year, so snorkel diver variability could not account for the differences in the numbers from year to year.

In Pass Creek the population estimates of age -0 steelhead were 3138, 9523, and 2841 respectively for the three survey years. There is a different trend in the population estimates from those of the main-stem of Canton Creek. The estimate for 2013 is approximately three times the estimate of the other two surveys.

In Upper Canton Creek the population estimates of age-0 steelhead were 3888, 5948, and 3247 respectively for the three survey years. This is a similar pattern to that of Pass Creek and different from the main-stem.

In Mellow Moon Creek, a tributary of Pass Creek, the population estimates for age-0 steelhead were 135, 233, and 165. Again this is a similar pattern to that of Pass and Upper Canton Creeks and different from the main-stem of Canton Creek.

When the total number of age-0 steelhead in the basin was high, the main stem of Canton Creek accounted for about three-quarters of the age-0 steelhead in the basin. When the number of age-0 Steelhead was low in the basin (2014), only about 45% of the age-0 steelhead were in the main-stem of Canton Creek. This suggests that the preferred habitat for age-0 steelhead is in Pass, upper Canton, and the tributaries, not the main stem of Canton Creek.

To summarize, the total number of age-0 steelhead in the Canton Creek drainage declined throughout the three years of surveys. The trajectory of age-0 steelhead in the main-stem of Canton Creek mirrored that of the stream system as a whole. This was not surprising as the main stem of Canton is by far the largest reach. However, Pass, Upper Canton, and Mellow Moon Creeks did not reflect this pattern. In these three reaches, the population estimates of age-0 steelhead peaked during 2013.

Age-1 Steelhead

The population estimates of age-1 steelhead in the three surveys were 5082, 2567, and 2523 respectively (Table 2). In the second two surveys the estimated populations of Age 1 steelhead were about one-half of the first year's survey. The first year's survey underestimated the number of fish because only about three-quarters of Pass Creek and Upper Canton Creeks were completed.

The population estimates were also calculated by reach. In the main-stem of Canton Creek the population estimates of age-1 steelhead were 3615, 892, and 1512 respectively. In 2011, a high population year, the main stem accounted for about 70% of the total age-1 steelhead in the basin; while 2014, in a low population year, the main stem accounted for only 60% of the age-1 steelhead in the basin. In 2013, also, a low population year, the main stem only accounted for 35% of the total age-1 steelhead in the basin. These dynamics suggest that the distribution of age-1 steelhead in the basin is probably caused by a number of factors, total basin population numbers being only one of them.

The population estimates for the age-1 steelhead in Pass Creek were 211, 937, and 173 respectively (Table 2). This is a different pattern than that of the whole basin in which 2011 was about twice the estimate of the other two surveys. In Pass Creek, the 2013 survey was about four times the other two surveys.

The population estimate of age-1 steelhead in Upper Canton Creek were 1059, 644, and 444 respectively. It is curious that the trajectory of age-1 steelhead is significantly different in Upper Canton Creek and Pass Creeks. These two reaches are of similar location and size within the stream network. In essence, Pass Creek is the left fork of Canton Creek, while Upper Canton is the right fork. This suggests that the factors controlling the number of fish rearing in particular reaches are many and complex.

The population estimates of age-1 steelhead in Mellow Moon Creek were 53, 197, and 12 respectively for the three sample years. It is interesting that the trajectory of the age-1 steelhead is the same in Mellow Moon as it is in Pass Creek. Mellow Moon is a tributary of Pass Creek.

In summary, the abundance of age-1 steelhead in the basin declined by about 50% from 2011 to the latter two surveys. The number of age-1 steelhead in the Canton Creek basin was about 11% of the number of age-0 steelhead in the system. In Canton and Upper Canton Creeks the highest number of age-1 steelhead were observed during the 2011 survey. In the rest of the reaches the highest number of age-1 steelhead were observed in the 2013 surveys.

Age-2 Steelhead

The population estimates for age-2 steelhead were 944, 331, and 624 respectively (Table 3). The number of age-2 steelhead in Canton Creek during the three survey years was 19% of the number of age-1 steelhead in the system.

The population estimates of age-2 steelhead were also calculated by stream reach. In the main-stem of Canton Creek the population estimates were 673, 113, and 432 respectively (Table 3). The trajectory of the age-2 steelhead in the main stem tracked closely with the trajectory of the basin as a whole because the main stem is the largest and usually dominant section for age-2 steelhead.

The population estimates for age-2 steelhead in Upper Canton Creek were 173, 36, and 102 respectively. The trajectory was the same as for the basin as a whole.

The population estimates for age-2 steelhead in Pass Creek were 29, 124, and 28. The trajectory of the age-2 steelhead is the exact opposite as the basin as a whole.

The population estimate for age-2 steelhead in Mellow Moon was 69, 58, and 6. These numbers are so low as to make comparisons of limited value. However, the number of age-2 steelhead in Mellow Moon did not track with either Canton Creek as a whole or Pass Creek of which Mellow Moon is a tributary.

In summary, the trajectory of age-2 steelhead in the three surveys was highest in 2011, lowest in 2013, and medium in 2014. The survey estimates in all reaches except Pass Creek and Mellow Moon followed that pattern. In Pass Creek, the trajectory was exactly opposite all other reaches. In Mellow Moon the estimated populations were low and did not show a reliable trajectory.

Cutthroat Trout

The majority of the cutthroat trout observed in the Canton Creek basin were in the main-stem reach. The population estimates in other reaches were too low to observe any real trends. In 2011, Pass Creek did have a large number of Cutthroat trout. The trajectory of Cutthroat trout in the Canton Creek watershed was similar to the age-2 steelhead in the basin. They were highest in the 2011 survey and lowest in the 2013 survey and moderate in the 2014 survey (Table 4).

Coho and Chinook salmon

In each survey year, less than a thousand coho salmon juveniles were observed in the lower reaches of Canton Creek. The trajectory of their population estimates was similar to age-2 steelhead, i.e. highest in 2011, lowest in 2013, and moderate in 2014 (Table 5). Almost all of the coho were observed in side channels connected to pools and away from the major swimming areas. All coho were observed below the falls just below the first bridge crossing over Canton Creek.

Chinook salmon were observed in very low numbers in lower Canton Creek in each of the surveys. Their numbers were so low that reliable population estimates could not be made. No more than 10 juveniles were observed in any one year. All observed chinook were below the first series of falls.

Overview of the salmonids in the basin

The lower ten miles of the main-stem of Canton Creek are the most important reaches for adult cutthroat trout and juvenile coho and chinook salmon. No juvenile coho or chinook salmon juveniles were observed above the third falls just below the first bridge (See figure). Steelhead trout of all ages are distributed throughout the Canton Creek basin.

Restoration Opportunities

The idealized view of landscape process dynamics is as follows: The cycle begins with a forest fire. The fire reduces the root strength in the soil for about 10 years until the new vegetation growth becomes established. Large storms increase the likelihood of landslides and debris flows (landslides that move down stream channels) in this ten-year window. The result is a large pulse of rocks, sediment and large wood into the stream systems. This pulse of rocks and large wood is the capital that will build the stream habitats for over the next century. Mature Douglas fir logs take over a century to decompose and western red cedar takes over four-hundred years to decompose if they are kept wet. After the fire, the vegetation begins to grow on the hillsides. It takes at least 75 years for the trees to grow big enough to provide the capital (key pieces) for building the stream habitat. So after the fire, the stream rapidly gains the majority of the capital that will build the habitat for over a century. The capital peaks a decade or so after the fire, then it generally declines until the next major fire, unless there is a major storm event of approximately 100-year or greater recurrence interval. These very large storms can bring in substantial material to reset capital for building stream habitat. Meanwhile, the vegetation begins to regrow on the uplands. It starts slow and after 75 years the trees are large enough to begin to provide large inputs into the stream. The large wood inputs to the stream increase until the next major fire. At that point they spike and begin a new cycle. So the wood capital in the stream is out of sync with the age of the trees on the uplands.

Additionally, in the riparian zones that are less likely to burn, large trees are undercut by the stream or through wind-throw fall into the stream. These large trees can become key pieces that collect and hold large wood, creating a jam.

When a pulse of rock and large wood enters a stream channel, it usually forms a jam where it sets up. This jam creates a temporary dam, storing sediment above it and creating a deep pool below it. Tributary streams and the headwaters of Canton Creek historically would have had a number of these temporary dams and would store sediment. The jams would also control the long profile of the stream. When the stream capital is high, the grade of the stream would be controlled by the temporary dams. Most of the stream energy would be dissipated as it drops over the jams. In the main-stem of Canton Creek, only a few temporary dams would be significant enough to remain in place for any period of time. The stream power in the main-stem of Canton Creek is sufficient to move all but the largest trees and jams.

Management activities such as road building and timber harvest change the amount and size of the material that enters the stream. Timber harvest, like fire, reduces the root strength of the soil and increases the likelihood of initiating landslides. However, there will be little large wood remaining after timber harvest. When the debris flows stop, they create temporary dams, but many of them do not have enough large wood to maintain the dam through the initial storm. When these dams fail, they create what is called a dam-break flood. The resulting wall of water and debris scours the stream channel for miles before dissipating. These events are among the most destructive phenomena that happen in streams.

In the Canton Creek watershed, timber harvest and road building has had a significant effect on the amount and timing of the inputs of capital to build the stream system. Timber harvest has decreased the amount of large wood capital in the stream system to build the habitat. Also, timber harvest has greatly increased the likelihood of creating a dam-break flood. The road system has also increased the likelihood of catastrophic slope failure if a section of road fails during a storm. The road network can also disrupt the routing of sediment into stream channels.

In the headwater reaches of Canton Creek, there is a variable amount of large wood capital in the streams and portions of the hill-slopes have been harvested. For instance, in the West Fork of Pass Creek, there are several jams that control the gradient in the upper reaches. The frequency of these jams is within the natural variability. In the lower reaches of the west fork, there are a few large key pieces that could serve as the foundational pieces for jams but there are no jams in the lower portion of the reach where jams are controlling the stream gradient. In addition to the hill-slope and road recommendations, large wood could be placed on the key pieces to simulate jams until the vegetation inputs into the stream are large enough to serve as these key pieces.

In these headwater streams, the key management recommendation is to ensure that in areas that are likely to initiate landslides and debris flows large trees are established and protected to provide the capital to build the stream habitats when they slide. On federal lands, these areas include the riparian zones of ephemeral and intermittent streams. The second major management action is to ensure that the road network does not generate large magnitude slides or reroute the natural movement of debris flows in the basin, either by upgrading the road network or decommissioning roads that are not immediately necessary to meet the management objectives.

Lastly, fire management should be addressed. Specific goals should be established for fire management within the basin.

In the mid-reaches, this includes Pass Creek and upper Canton Creek (above Pass Creek confluence), the existing capital of large wood in the stream system is very low. There is only one jam that is controlling the gradient in the mid-reaches. It is in upper Canton Creek (see photos). Many riparian zones in these mid-reaches have large trees that are beginning to fall into the stream. Over time, they will increase the large wood capital in these reaches. Protection of trees that can reach the stream channels during wind-thrown events is critical, given the lower volume of large wood in the stream reaches. A limited number of large trees could be tipped into the reaches to stimulate jam creation.

In both Pass Creek and upper Canton Creek, there are a number of unconstrained reaches where the stream is or has been braided over time. These areas provide excellent opportunities for adding large wood to the system. These areas are also the most important areas for protecting trees within the riparian zone.

The lower main-stem of Canton creek has no large wood gradient control and has limited amounts of large wood within the channels. This reach has high power and all but the largest conifers are immediately broken up and exported downstream. There are very limited opportunities for large wood placement. Also, the lower 4 miles experiences a high volume of recreational use during the summer months. This recreational area coincides with the distribution of coho within the basin. There are limited opportunities to place large wood in side channel and backwater areas to provide critical habitat for coho in lower Canton Creek. The major recommendation is to protect the riparian zone trees and allow them to blow down naturally.

Recommendations for future work

1) Continue the snorkel surveys for at least 2 more years. This will allow a life-history analysis of the steelhead populations. This is a powerful analytical tool for understanding the dynamics of steelhead in the basin. Incorporate the adult counts into the life-history analysis as well. This information will greatly increase the ability to design effective restoration actions within the basin.

2) Complete an analysis of the salmonids in the basin based on densities within habitat units. This information greatly enhances the life-history understanding of the population dynamics within the basin. (First year of analysis will be completed with BLM and Watershed Council funding).

3) Incorporate the fire and flood history of the basin into the understanding of the salmonid population dynamics.

Literature Cited:

Hankin, D.G. and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquaric Sciences 45:834-844.

Table 1. Population estimate of Steelhead Age 0 in Canton Creek (2011,2013, and 2014).

Reach	2011	2013	2014
Mainstem	32,968	15,430	7,433
Upper Cant	3,888	5,948	3,247
Pass Creek	3,138	9,523	5,089
RF Pass Creek		200	131
LF Pass Creek		165	216
Mellow Mo	135	233	165
Total	40,129	31,499	16,281

Table2. Population estimate of Steelhead Age 1 in Canton Creek (2011,2013, and 2014).

Reach	2011	2013	2014
Mainstem	3,615	892	1,512
Upper Cant	1,059	644	444
Pass Creek	211	937	518
RF Pass Creek		6	0
LF Pass Creek		35	37
Mellow Mo	197	53	12
Total	5,082	2,567	2,523

Table3. Population estimate of Steelhead Age 2 in Canton Creek (2011,2013, and 2014).

Reach	2011	2013	2014
Mainstem	673	113	432
Upper Cant	173	36	102
Pass Creek	29	124	84
RF Pass Creek		0	0
LF Pass Creek		0	0
Mellow Mo	69	58	6
Total	944	331	624

Table4. Population estimate of Cutthroat in Canton Creek (2011,2013, and 2014).

Reach	2011	2013	2014
Mainstem	167	42	165
Upper Cant	31	35	6
Pass Creek	107	13	15
RF Pass Creek		0	0
LF Pass Creek		0	0
Mellow Moon		0	6
Total	305	90	192

Table5. Population estimate of Coho Salmon in Canton Creek (2011,2013, and 2014).

Reach	2011	2013	2014
Mainstem	710	376	416
Upper Cant	0	0	0
Pass Creek	0	0	0
RF Pass Creek		0	0
LF Pass Creek		0	0
Mellow Moon		0	0
Total	710	376	416

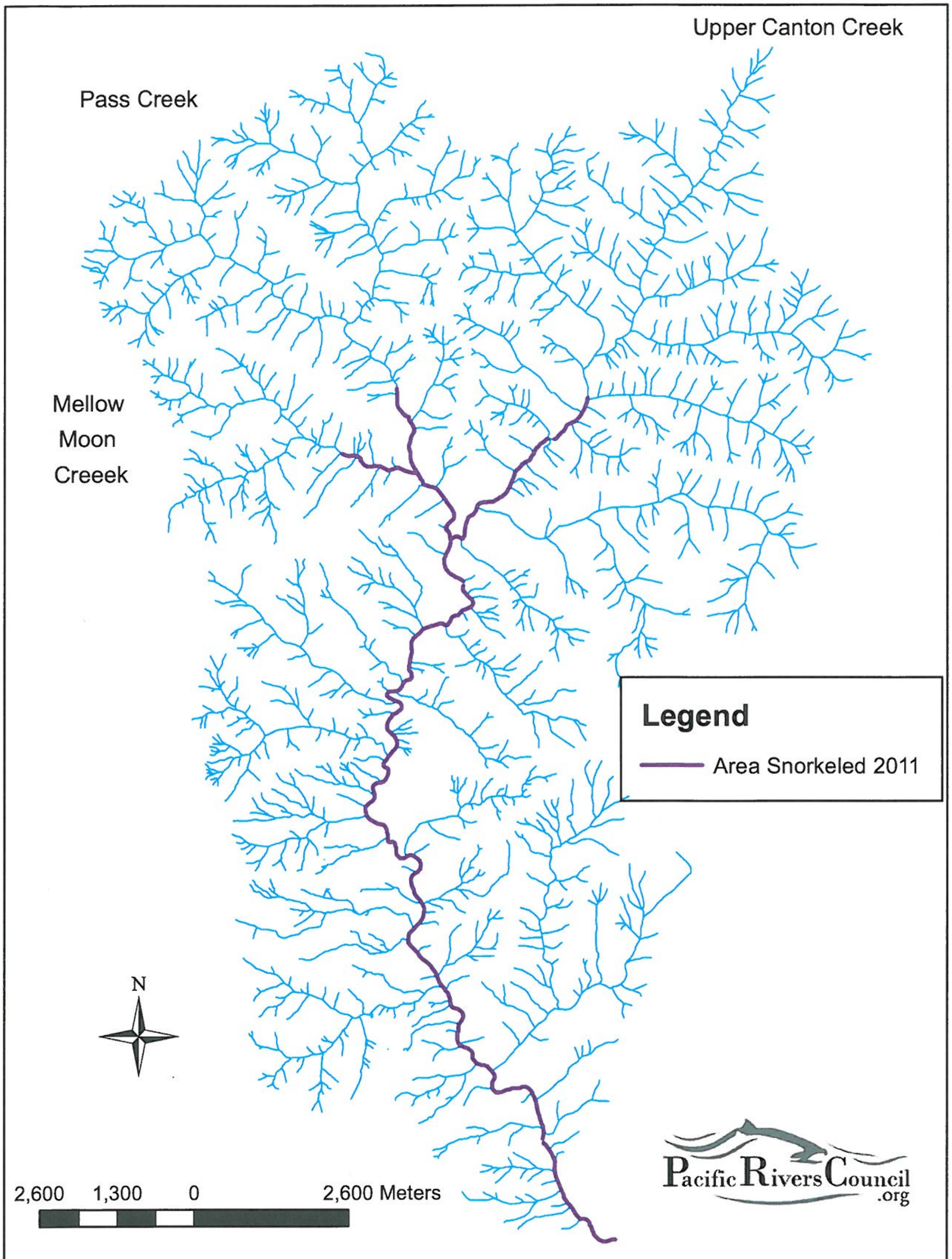

Figure 1A. Area of Canton Creek snorkeled 2011

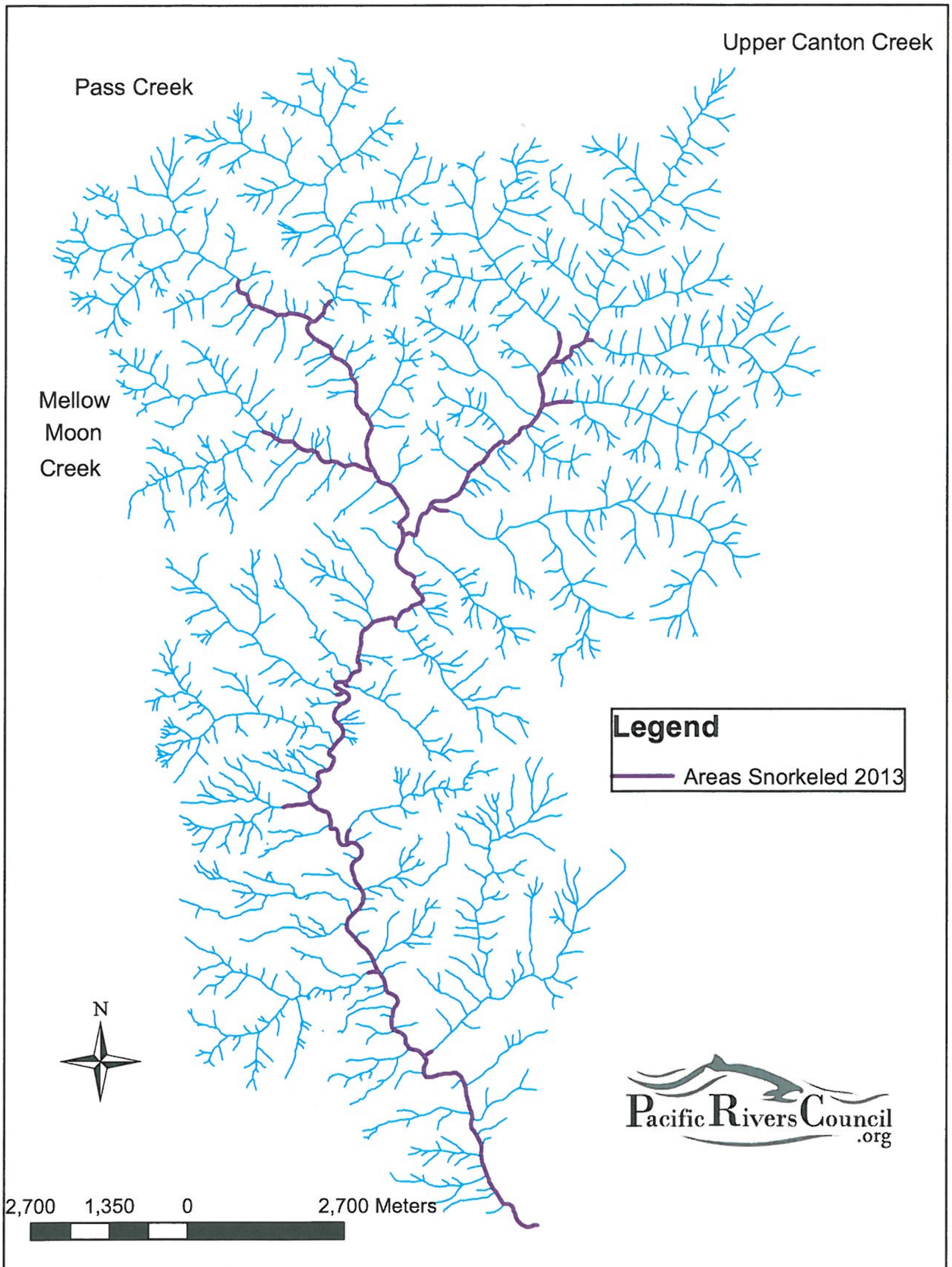

Figure 1B. Snorkel Survey of Canton Creek 2013.

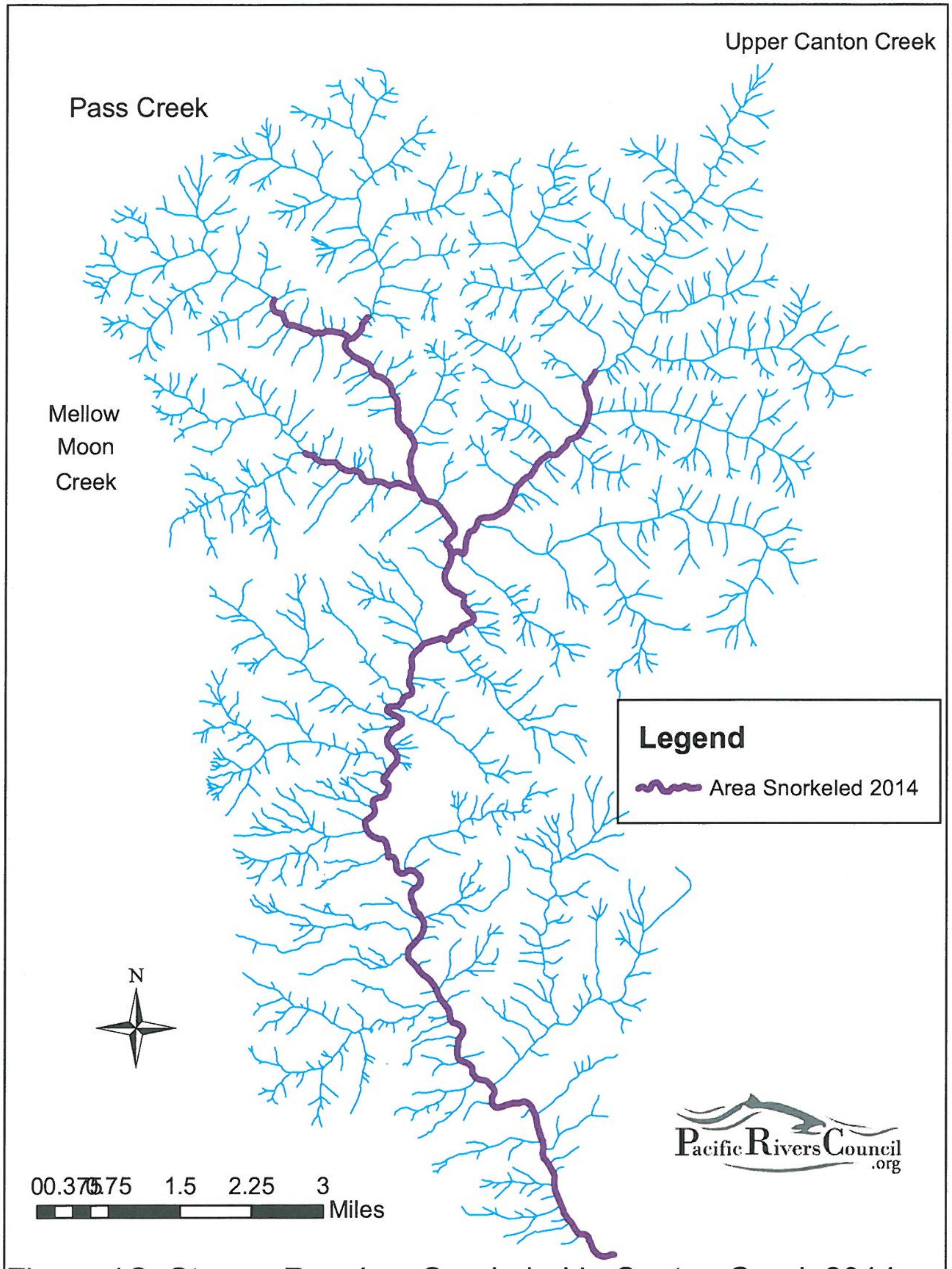

Figure 1C. Stream Reaches Snorkeled in Canton Creek 2014