

COEUR ALASKA KENSINGTON PROJECT



USFS Annual Report 2009

**TSF Ecological Monitoring:
Upper Slate Dolly Varden**

January 2010

1.0 Introduction

This report describes monitoring conducted during 2009 in accordance with the Ecological Monitoring Plan for the TSF (Tailings Storage Facility). Minnow trapping surveys were conducted in Mid-Lake Slate Creek in August 2009 to investigate the recolonization of the creek following restoration work in 2008. The diversion pipe at Mid-Lake Slate Creek was rebuilt in September 2009 and the creek diverted around the TSF, formerly known as Lower Slate Lake and now referred to as the Tailings Treatment Facility or TTF. Following diversion of water, Dolly Varden in the remaining section of Mid-Lake Slate Creek were captured and released downstream of the TTF. Dolly Varden spawner surveys were also conducted in October and November in Upper Slate Lake.

2.0 Mid-Lake Slate Creek

The Ecological Monitoring Plan for the TSF states that “*Dolly Varden in Mid-Lake Slate Creek will be captured and released below the TSF dam from the beginning of construction of the TSF until confirmation that suitable conditions for Dolly Varden are present in the TSF.*” Mid-Lake Slate Creek (MLSC) originally ran from Upper Slate Lake (USL) to Lower Slate Lake (LSL). The creek began at elevation 200m at Lower Slate Lake (LSL) and rose to 226m at Upper Slate Lake. The original creek was dominated by riffle and cascade habitat with few pools. The creek was 468m long prior to road construction in 2006, with a natural barrier to upstream fish migration at approximately 215m from LSL.

During the summer of 2006, preparation of the TSF involved diversion of MLSC around Lower Slate Lake to East Fork Slate Creek (Figure 1). The diversion was removed and the creek restored to allow downstream fish passage during September and October of 2008. In August 2009, the U.S. Army Corps of Engineers 404 permit was reinstated allowing use of Lower Slate Lake as a Tailings Treatment Facility and construction work continued once more. The diversion structure was rebuilt in September 2009 and the creek once again diverted around the lake to reduce the lake water level prior to dam construction.

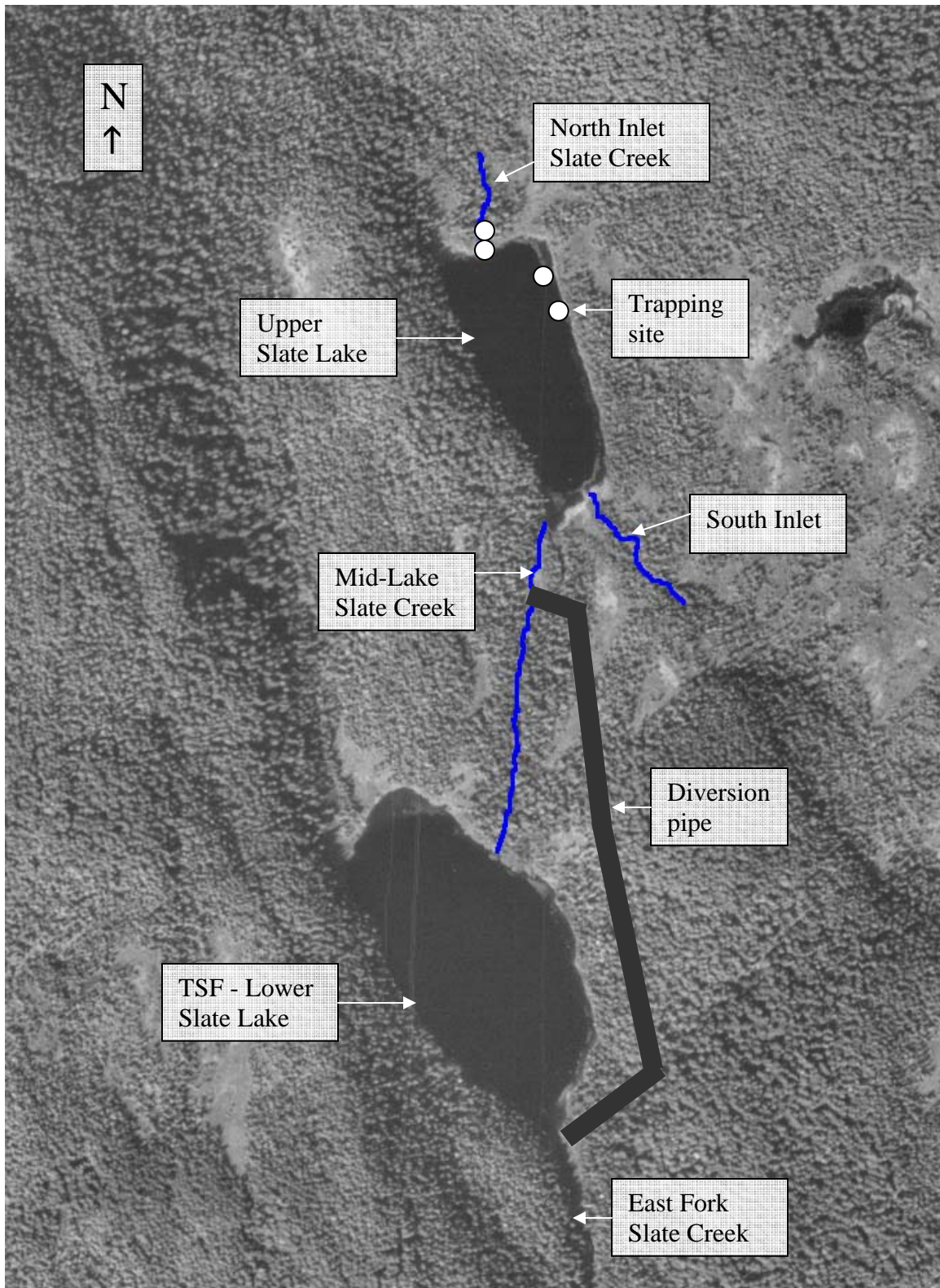


Figure 1: Upper Slate Aerial View. Mid-Lake Slate Creek is now diverted around the TSF through a pipe. Trapping sites for spawner surveys are shown by white circles.



Figure 2: Mid-Lake Slate Creek with water restored to the channel.



Figure 3: Diversion dam; water enters a 36 inch pipe underneath yellow railing.

2.1 Methods

Minnow traps were set in Mid-Lake Slate Creek (Figure 2) in August 2009, prior to reconstruction of the diversion, to check the presence of fish in the restored stream channel after water was returned there in September 2008. Four minnow traps were set in the creek on August 3, 2009 and seven traps were set on August 27. Following diversion of the creek again, there was still some flow seeping into the creek downstream of the diversion structure and six minnow traps were set on October 5 and 6 to capture any fish remaining in the creek. These potentially stranded fish were transported by truck and released to Slate Creek downstream of the TTF. All traps were baited with cured salmon eggs and set in deeper areas of low flow. Captured fish were anesthetized in a solution of MS222 (Tricane methane Sulphonate), weighed to the nearest 0.1g and their total length measured to the nearest 1mm.

Coeur Alaska is working with the Alaska Department of Fish and Game to determine the suitability of the diversion structure for fish passage. The objective is that the final diversion structure will be suitable for downstream fish passage, allowing fish to migrate from Upper Slate Lake to Lower Slate Creek and obviating the need to transport fish by hand.

2.2 Mid-Lake Slate Creek Results

All fish captured in Mid-Lake Slate Creek in 2009 were Dolly Varden. Seven fish were captured on August 3, although three escaped before being measured (Table 1). Total length of the fish measured ranged from 96 to 122mm. These fish were released back into Mid-Lake Slate Creek after recovering from anesthetic. Nine fish were captured on August 27 ranging from 59 to 130mm. On October 5, after diversion of most of the water in the creek, some larger fish were captured with a total of eight fish ranging from 98 to 272mm (Table 2). After soaking traps overnight, 21 fish were captured on October 6 ranging from 53 to 265mm. The 45 fish caught on August 27 and October 5 and 6 were transported to Lower Slate Creek, just downstream of the dam.

Some fish were still observed in Mid-Lake Slate Creek after the final trapping survey. The results indicate that at least 50 fish were present in the creek and must have relocated to the creek during the previous year from Upper Slate Lake. 10 inches of rain fell between August 10 and 26 and a further 17.8 inches fell between August 31 and the October 5 minnow trapping event (measured at Jualin rain gauge). High flows may have brought more fish into the creek and also flushed some fish into Lower Slate Lake.

Date	Length (mm)	Weight (g)	Transported
8/3/2009 4 traps set for 5 hours	103	7.9	no
	105	10.1	no
	122	13.9	no
	96	7.8	no
Total 7 fish captured, 3 not meas.			
8/27/2009 7 traps set for 1 hour	130	na	yes
	68	na	yes
	64	2.0	yes
	112	12.3	yes
	108	10.7	yes
	109	10.3	yes
	63	1.8	yes
	59	1.6	yes
63	1.4	yes	

Table 1: Length and weights of fish captured before water diversion.



Figure 4: Mid-Lake Slate Creek prior to diversion of water.

Date	Length (mm)	Weight (g)	Transported
10/5/2009 6 traps set for 1 hour	157	28.5	yes
	154	26.8	yes
	147	27.1	yes
	272	140.2	yes
	250	109.2	yes
	109	10.3	yes
	107	9.8	yes
	98	7.0	yes
10/6/2009 6 traps left overnight	98	8.0	yes
	75	3.3	yes
	53	1.1	yes
	77	4.1	yes
	50	0.8	yes
	70	3.0	yes
	54	1.2	yes
	265	147.9	yes
	146	27.7	yes
	94	3.2	yes
	112	9.9	yes
	111	9.7	yes
	100	7.1	yes

Table 2: Length and weights of fish captured after water diversion.



Figure 5: Mid-Lake Slate Creek after water diverted; photo: ADFG.

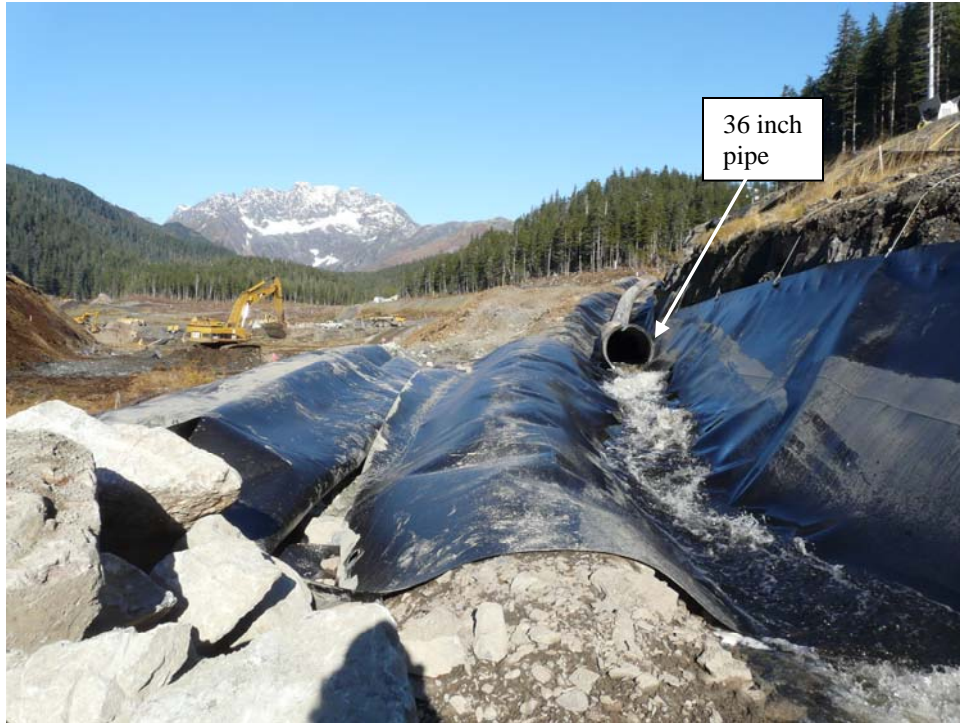


Figure 6: Discharge from the new diversion structure at the TTF.



Figure 7: North inlet to Upper Slate Creek contains suitable spawning gravel.

3.0 Dolly Varden Spawner Surveys

Potential Dolly Varden spawning habitat occurs mostly in North Inlet Slate Creek and along the eastern shore of Upper Slate Lake (Figures 1, 2). Suitably sized gravel for spawning and flow from inlet streams is present in these areas (Figure 7). Spawner surveys were conducted in October and November 2009 to help gain more understanding of the variability in recruitment of Dolly Varden to the Slate Creek basin from the Upper Slate area in accordance with the Ecological Monitoring Plan for the TSF. The plan states that surveys will be conducted from July through September, however, Dolly Varden in South-East Alaska are known to spawn in late Fall (Armstrong 1965, Armstrong & Morrow 1980, Blackett 1973, Heiser 1966) therefore surveys were adapted accordingly.

3.1 Methods

Dark-colored tannins in the water in fall prevent direct observation of the lake bed along the shore, therefore minnow trapping was used to capture and examine fish for signs of spawning coloration and milt production. Surveys were conducted by setting minnow traps near likely spawning areas, namely gravel beds at the mouth of small streams running into Upper Slate Lake and the North Inlet Slate Creek (Figure 1). A new design of minnow trap was adopted in 2008. The traps are made of soft ¼ inch mesh with flat openings that allow large fish to enter, but prevent them escaping (Figure 5).

Traps baited with salmon eggs were set near potential spawning areas on October 8, 12, 20 and 27 and on November 2, 10 and 17 and left to soak overnight. Between four and ten traps were set on each occasion. Captured fish were anesthetized in a solution of MS222 (Tricainemethane Sulphonate), weighed to the nearest 0.1g and their total length measured to the nearest 1mm. Fish were also examined for any spawning coloration or milt production (Figure 8). The fish were allowed to recover in a container of aerated stream water and released back into the habitat from which they captured.

3.2 Spawning Survey Results

The lengths and weights of Dolly Varden captured in Upper Slate Lake are presented in Appendix 1. Lengths and weights were used to calculate Fulton's condition factor (K) using the equation given in Anderson & Neumann (1996):

$$K = W/L^3 \times 10,000$$

W = weight in g; L = total length in mm

Table 3 summarizes the minimum and maximum lengths and condition factors of all Dolly Varden captured compared to spawners. The size distribution of fish captured is displayed in histograms in Figure 9. Spawning signs included bright orange belly, bright red to orange spots, and milt production. Figure 8 shows a Dolly Varden with spawning coloration. A total of 428 Dolly Varden were captured over the six week sampling period and 144 of these showed spawning sign. The percentage of spawners captured varied from 31% on October 8 to 35% on October 27 and 46% on November 10 back to 33% on November 17.

The smallest fish captured with spawning sign was 143mm and 22.5g and the largest was 250mm and 120.2g. This was the largest fish captured in 2009, but did not match the record of 258mm captured in 2008. (A 272mm fish was found in Mid-Lake Slate Creek in October). No milt was found in any of the fish examined throughout the spawning period.



Figure 8: Dolly Varden with red spots, bright orange belly, spawning colors.

All Fish							
Date	Number	Min Length	Max Length	Mean K	95% Conf K	Min K	Max K
10/08/09	62	90	230	0.717	0.012	0.542	0.883
10/12/09	75	88	238	0.716	0.014	0.455	0.845
10/20/09	75	90	240	0.625	0.020	0.511	0.779
10/27/09	128	91	248	0.709	0.010	0.509	0.935
11/02/09	25	72	249	0.708	0.029	0.581	0.884
11/10/09	39	103	238	0.708	0.028	0.563	1.052
11/17/09	24	108	250	0.724	0.016	0.615	0.774

Spawners								
Date	Number	% spawn colors	Min Length	Max Length	Mean K	95% Conf K	Min K	Max K
10/08/09	19	30.6	146	230	0.718	0.076	0.624	0.883
10/12/09	21	28.0	149	238	0.719	0.021	0.587	0.791
10/20/09	24	32.0	159	240	0.621	0.026	0.511	0.745
10/27/09	45	35.2	143	248	0.712	0.019	0.586	0.932
11/02/09	9	36.0	156	249	0.689	0.051	0.581	0.847
11/10/09	18	46.2	147	238	0.721	0.021	0.646	0.831
11/17/09	8	33.3	154	250	0.717	0.036	0.615	0.773

Table 3: Summary statistics for all captured fish and spawners.

3.3 Discussion

Fewer fish were captured in 2009 than the previous year simply because fewer traps were deployed and it was felt that a sample of 400 fish was more than sufficient. The large number of fish captured in 2008 was due to the new trap design that prevented fish escaping. The same traps design was used in 2009, but fewer traps were deployed to prevent so many fish from being captured. The overall percentage (33.6%) of captured fish in spawning colors was greater in 2009 than in 2008 (19.3%) or 2007 (12.2%). This may partly be due to the sites now targeted for capturing spawners. The north end of the lake appears to yield more spawners than the south end presumably due to the proximity of spawning habitat at the north end. In 2009, all trapping was conducted at the north end of the lake, while in previous years, other sites were sampled. No milt was found in fish in 2009, but was found in a few fish in 2008. This may have been due to the larger sample size collected in 2008.

Van Alen (1983) found evidence from the Indian Lake system in Southeast Alaska that Dolly Varden females spawn every year, but males apparently only spawned every 2 years. This would explain the lower number of spawners found in 2007 compared to 2008 or 2006, despite capturing fish in the same size range. The size range of Dolly Varden spawners was similar in 2009 (143-250mm) to 2006 and 2008. In 2007 the size range was narrower (195 to 240mm) but this may have been due to a small sample size (total of 42 fish captured).

Condition factor of fish in spawning colors in 2009 was not significantly different from non-spawning fish ($p > 0.05$). In 2008, condition of spawners was significantly lower on two sampling dates (October 23 and November 14). If it is assumed that fish with spawning coloration actually spawn, then a wide size range of fish are capable of spawning. The size of spawners did not appear to vary much over time. The largest size range of spawners was found near the end of October, but this was also the largest sample size of fish captured so a wider size range might be expected. Spawning coloration was evident in fish from early October to mid-November and may continue beyond this, but colder temperatures seem to affect trapping rates as fish are moving around less.

There is variation in spawning coloration varying from deep red spots and bright orange belly typical of larger fish and occasionally observed on smaller fish, to the presence of a few orange spots, still distinct from the normal non-spawning coloration seen on resident Dolly Varden at other times of year. The age of fish present in Upper Slate Lake has not been examined. Dolly Varden seldom live longer than 8-10 years, unless their diet is supplemented by kokanee (landlocked sockeye salmon) which can increase their lifespan to 19 years (Armstrong 1991). Van Alen (1983) reported Dolly Varden of 14 years in a Southeast Alaska lake where kokanee were present, but these were over 550mm in length whereas the largest fish found in Upper Slate Lake was 250mm. The presence of three-spine stickleback (*Gasterosteus aculeatus*) might increase Dolly Varden life span beyond 10 years, but no studies have been conducted to determine age.

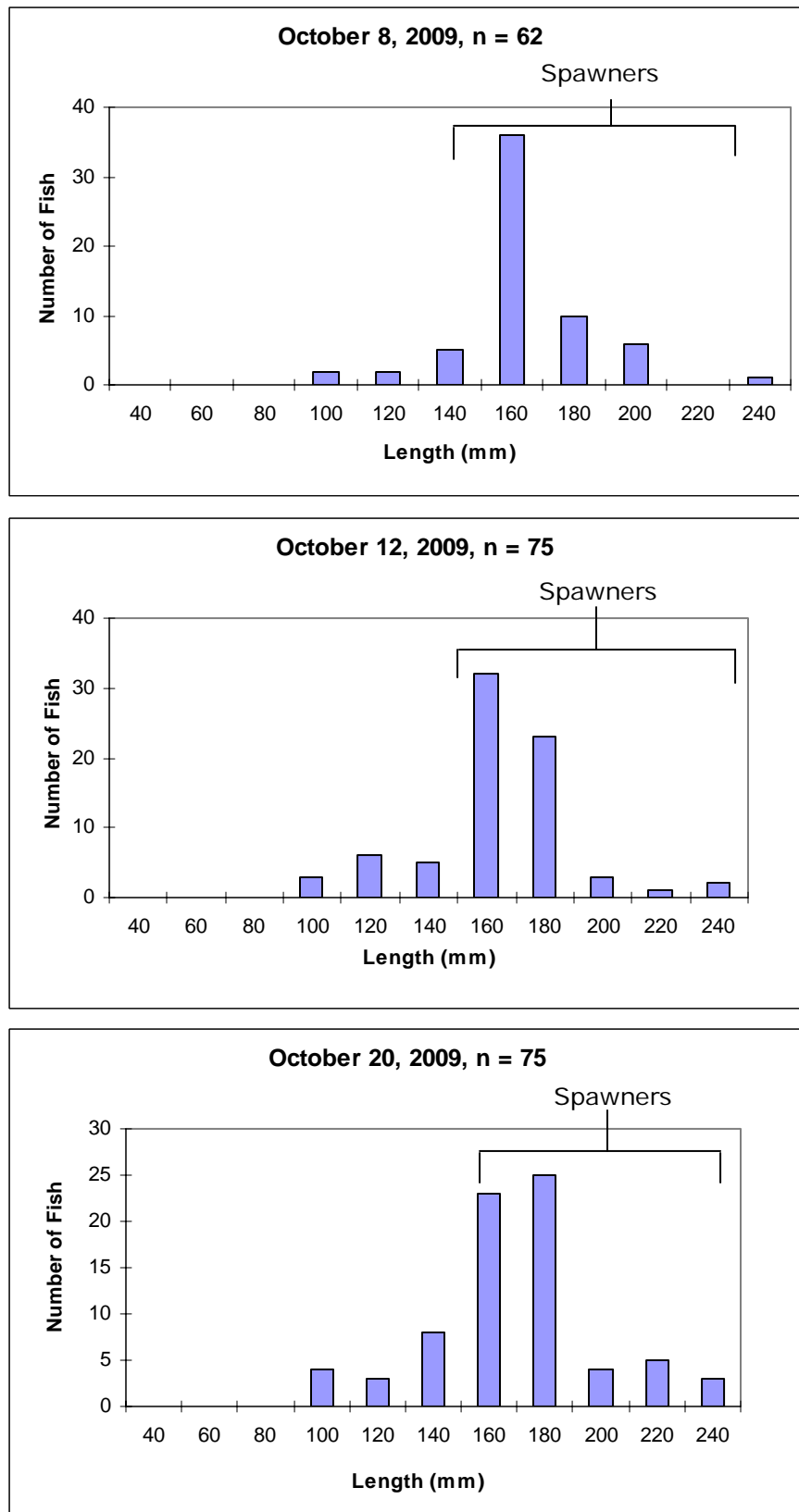


Figure 9: Length-Frequency Histograms of fish captured during spawning surveys.

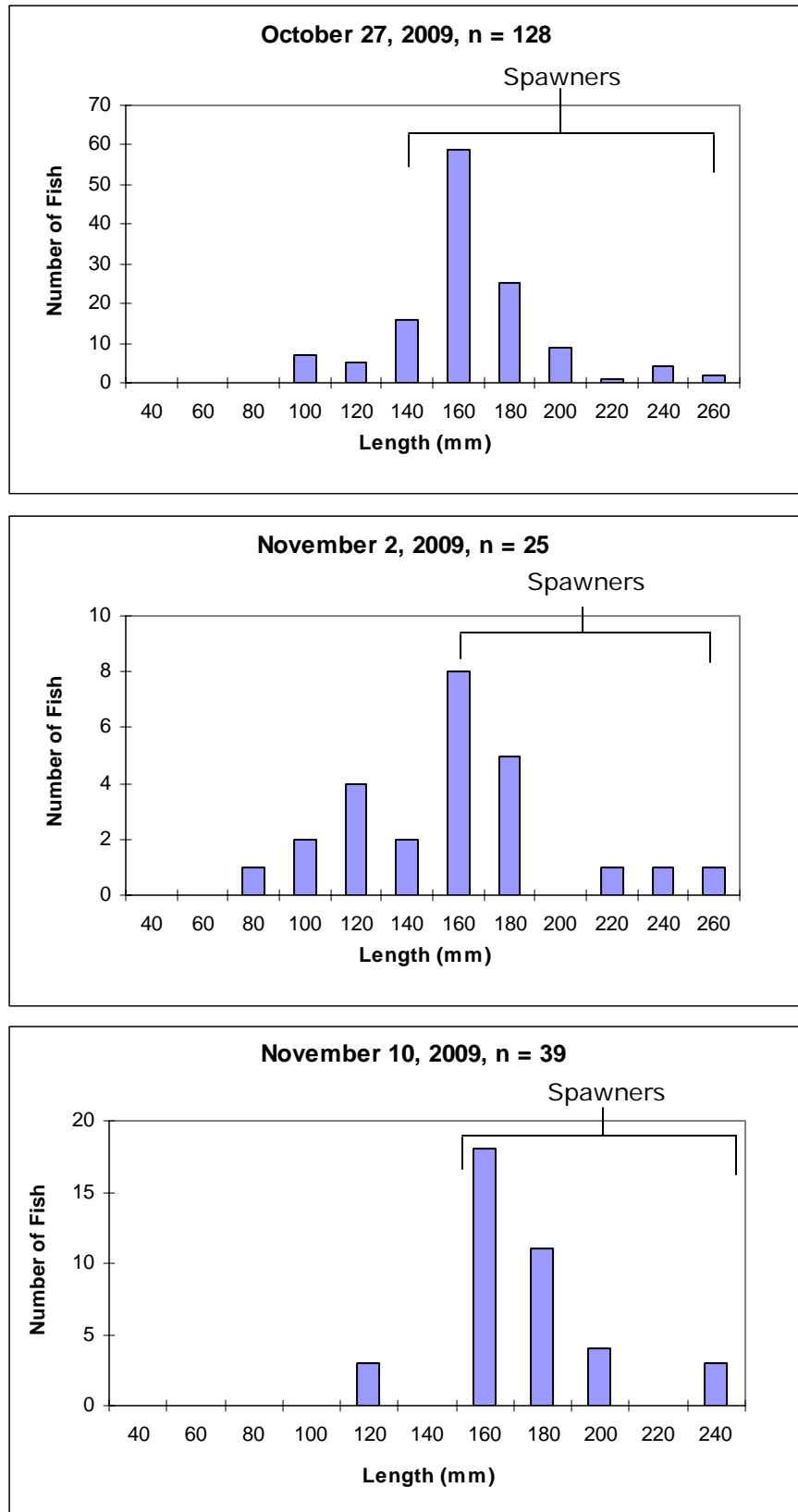


Figure 9: Length-Frequency Histograms continued.

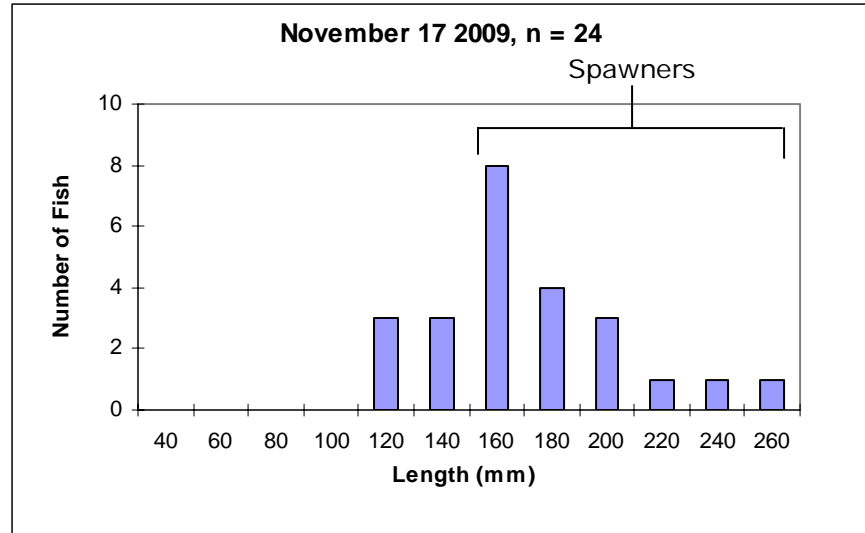


Figure 9: Length-Frequency Histograms continued.

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Appendix 1: Length, weight, condition and spawning color of Dolly Varden captured during 2009.

Upper Slate Lake		Dolly Varden 10/8/2009					
Spawning Coloration	length (mm)	weight (g)	L power 3		K	mean	0.717
red spots and orange belly	192	51	7077888	7.2055E-06	0.721	ST dev	0.049
red spots	167	35.6	4657463	7.6436E-06	0.764	n	62
	161	28.2	4173281	6.7573E-06	0.676	95% CI	0.012
red spots and orange belly	190	45.1	6859000	6.5753E-06	0.658	min k	0.542
	146	21.9	3112136	7.0370E-06	0.704	max k	0.883
	141	21.4	2803221	7.6341E-06	0.763	# spawners	19
some orange spots	151	30.4	3442951	8.8296E-06	0.883	% spawners	30.6
	182	32.7	6028568	5.4242E-06	0.542	min L	82
few orange spots	230	90	12167000	7.3971E-06	0.740	max L	257
bright orange spots and belly	182	47.3	6028568	7.8460E-06	0.785		
	151	22.4	3442951	6.5060E-06	0.651		
few orange spots	161	28.4	4173281	6.8052E-06	0.681		
some orange spots	172	34.3	5088448	6.7408E-06	0.674		
	139	18.5	2685619	6.8885E-06	0.689		
	144	20.7	2985984	6.9324E-06	0.693		
	159	25.4	4019679	6.3189E-06	0.632		
light orange spots	172	36.7	5088448	7.2124E-06	0.721		
few orange spots	181	37	5929741	6.2397E-06	0.624		
	143	22.5	2924207	7.6944E-06	0.769		
	153	25.5	3581577	7.1198E-06	0.712		
few orange spots	149	24	3307949	7.2553E-06	0.726		
	147	23.5	3176523	7.3980E-06	0.740		
	141	21.7	2803221	7.7411E-06	0.774		
	149	23.7	3307949	7.1646E-06	0.716		
	155	28.7	3723875	7.7070E-06	0.771		
	147	24.1	3176523	7.5869E-06	0.759		
few orange spots	152	24.4	3511808	6.9480E-06	0.695		
	179	39.4	5735339	6.8697E-06	0.687		
few orange spots	152	24.1	3511808	6.8626E-06	0.686		
	179	39.4	5735339	6.8697E-06	0.687		
red spots	155	26.4	3723875	7.0894E-06	0.709		
	137	18.2	2571353	7.0780E-06	0.708		
	154	26.8	3652264	7.3379E-06	0.734		
	170	36.4	4913000	7.4089E-06	0.741		
	161	32.8	4173281	7.8595E-06	0.786		
	151	24.4	3442951	7.0869E-06	0.709		
	155	26.5	3723875	7.1162E-06	0.712		
few orange spots	158	28.3	3944312	7.1749E-06	0.717		
	142	21.3	2863288	7.4390E-06	0.744		
	139	20.4	2685619	7.5960E-06	0.760		
	95	6.2	857375	7.2314E-06	0.723		
	150	24.2	3375000	7.1704E-06	0.717		
red spots	162	31.4	4251528	7.3856E-06	0.739		
	186	39.8	6434856	6.1851E-06	0.619		
	149	23.6	3307949	7.1343E-06	0.713		
	151	24.6	3442951	7.1450E-06	0.715		
red spots	146	22.5	3112136	7.2298E-06	0.723		
	143	22.2	2924207	7.5918E-06	0.759		
few orange spots slight orange belly	159	29	4019679	7.2145E-06	0.721		
	101	7.7	1030301	7.4735E-06	0.747		
	150	25.7	3375000	7.6148E-06	0.761		
	152	24	3511808	6.8341E-06	0.683		
	90	5.3	729000	7.2702E-06	0.727		
some red spots	160	27.9	4096000	6.8115E-06	0.681		
	143	21.2	2924207	7.2498E-06	0.725		
	149	24	3307949	7.2553E-06	0.726		
	147	25	3176523	7.8702E-06	0.787		
	120	12.7	1728000	7.3495E-06	0.735		
	145	21.4	3048625	7.0196E-06	0.702		
	141	18.5	2803221	6.5996E-06	0.660		
	128	14.8	2097152	7.0572E-06	0.706		
	135	18	2460375	7.3160E-06	0.732		

TSF Ecological Monitoring: Dolly Varden 2009

Upper Slate Lake Dolly Varden 10/12/2009							
Spawning Coloration	Length(mm)	Weight(g)	L	power 3	K	mean	0.716
	140	22.3	2744000	8.1268E-06	0.813	ST dev	0.063
	178	37.8	5639752	6.7024E-06	0.670	n	75
	105	8	1157625	6.9107E-06	0.691	95% CI	0.014
	161	31.5	4173281	7.5480E-06	0.755	min k	0.455
few pink spots	215	72.5	9938375	7.2950E-06	0.729	max k	0.845
	97	6.7	912673	7.3411E-06	0.734	# spawners	21
few pink spots	158	29.5	3944312	7.4791E-06	0.748	% spawners	28.0
	160	27.8	4096000	6.7871E-06	0.679	min L	88
	178	38.5	5639752	6.8265E-06	0.683	max L	238
	151	24.6	3442951	7.1450E-06	0.715		
	165	31.9	4492125	7.1013E-06	0.710		
	162	33.4	4251528	7.8560E-06	0.786		
orange spots	162	30.9	4251528	7.2680E-06	0.727		
	156	29	3796416	7.6388E-06	0.764		
orange spots	228	87.1	11852352	7.3488E-06	0.735		
	88	5.1	681472	7.4838E-06	0.748		
	110	10.3	1331000	7.7385E-06	0.774		
few orange spots	149	24.9	3307949	7.5273E-06	0.753		
	162	28.6	4251528	6.7270E-06	0.673		
red spots	170	35.1	4913000	7.1443E-06	0.714		
orange spots	162	32.2	4251528	7.5737E-06	0.757		
	135	20	2460375	8.1288E-06	0.813		
	158	28.9	3944312	7.3270E-06	0.733		
	159	18.3	4019679	4.5526E-06	0.455		
orange spots	161	30.6	4173281	7.3324E-06	0.733		
bright red spots orange belly	238	101.3	13481272	7.5141E-06	0.751		
	140	19.2	2744000	6.9971E-06	0.700		
	144	20.2	2985984	6.7649E-06	0.676		
few orange spots	169	35.8	4826809	7.4169E-06	0.742		
	145	21.7	3048625	7.1180E-06	0.712		
	163	26.7	4330747	6.1652E-06	0.617		
	183	34.4	6128487	5.6131E-06	0.561		
	192	55.4	7077888	7.8272E-06	0.783		
few pale orange spots	173	30.4	5177717	5.8713E-06	0.587		
few pale orange spots	193	54	7189057	7.5114E-06	0.751		
	138	19.3	2628072	7.3438E-06	0.734		
	170	33.2	4913000	6.7576E-06	0.676		
	148	22.5	3241792	6.9406E-06	0.694		
	158	24.6	3944312	6.2368E-06	0.624		
	171	34.6	5000211	6.9197E-06	0.692		
	156	24.2	3796416	6.3744E-06	0.637		
	150	26.6	3375000	7.8815E-06	0.788		
pale orange spots	155	28.4	3723875	7.6265E-06	0.763		
	143	19.7	2924207	6.7369E-06	0.674		
	171	29.1	5000211	5.8198E-06	0.582		
	150	23.2	3375000	6.8741E-06	0.687		
orange spots	158	31.2	3944312	7.9101E-06	0.791		
red spots	160	28.5	4096000	6.9580E-06	0.696		
orange and one red spot	173	35	5177717	6.7597E-06	0.676		
	152	23.7	3511808	6.7487E-06	0.675		
	100	6.8	1000000	6.8000E-06	0.680		
	118	11.8	1643032	7.1818E-06	0.718		
red spots	157	26.5	3869893	6.8477E-06	0.685		
	170	36.2	4913000	7.3682E-06	0.737		
	125	16.5	1953125	8.4480E-06	0.845		
few orange spots	165	33.7	4492125	7.5020E-06	0.750		
	120	13.2	1728000	7.6389E-06	0.764		
	180	43.8	5832000	7.5103E-06	0.751		
	148	24.3	3241792	7.4959E-06	0.750		
	150	25.3	3375000	7.4963E-06	0.750		
	141	23	2803221	8.2048E-06	0.820		
	154	25.6	3652264	7.0094E-06	0.701		
	164	32.4	4410944	7.3454E-06	0.735		
	113	10.2	1442897	7.0691E-06	0.707		
	151	27.5	3442951	7.9873E-06	0.799		
	158	29.2	3944312	7.4031E-06	0.740		
few orange spots	158	29	3944312	7.3524E-06	0.735		
	150	24.1	3375000	7.1407E-06	0.714		
	119	13.2	1685159	7.8331E-06	0.783		
	150	24.1	3375000	7.1407E-06	0.714		
orange spots	177	33.7	5545233	6.0773E-06	0.608		
	152	24.6	3511808	7.0049E-06	0.700		
red spots	177	40.5	5545233	7.3036E-06	0.730		
	155	27.7	3723875	7.4385E-06	0.744		
	160	28.3	4096000	6.9092E-06	0.691		

TSF Ecological Monitoring: Dolly Varden 2009

Upper Slate Lake Dolly Varden 10/20/2009							
Spawning Coloration	Length (mm)	Weight (g)	L power 3		K	mean	0.637
few orange spots	161	27.6	4173281	6.6135E-06	0.661	ST dev	0.068
	143	20.1	2924207	6.8737E-06	0.687	n	75
orange spots	175	36.4	5359375	6.7918E-06	0.679	95% CI	0.015
	182	32.3	6028568	5.3578E-06	0.536	min k	0.511
few orange spots	178	28.8	5639752	5.1066E-06	0.511	max k	0.779
	135	18.8	2460375	7.6411E-06	0.764	# spawners	21
	166	29	4574296	6.3398E-06	0.634	% spawners	28.0
	139	15.8	2685619	5.8832E-06	0.588	min L	90
	183	44.4	6128487	7.2449E-06	0.724	max L	240
	190	40.5	6859000	5.9047E-06	0.590		
	147	22.5	3176523	7.0832E-06	0.708		
	229	78.8	12008989	6.5618E-06	0.656		
Some orange spots	140	19.2	2744000	6.9971E-06	0.700		
	143	18	2924207	6.1555E-06	0.616		
	173	31.8	5177717	6.1417E-06	0.614		
	240	77.7	13824000	5.6207E-06	0.562		
orange belly, red spots	167	27.2	4657463	5.8401E-06	0.584		
	156	24.1	3796416	6.3481E-06	0.635		
orange spots	207	51.1	8869743	5.7612E-06	0.576		
	157	25.5	3869893	6.5893E-06	0.659		
orange belly, bright red s	240	103	13824000	7.4508E-06	0.745		
few orange spots	162	29.8	4251528	7.0092E-06	0.701		
	170	28.2	4913000	5.7399E-06	0.574		
	183	33.7	6128487	5.4989E-06	0.550		
	160	31.9	4096000	7.7881E-06	0.779		
	157	24.5	3869893	6.3309E-06	0.633		
	171	29.8	5000211	5.9597E-06	0.596		
few orange spots	145	20	3048625	6.5603E-06	0.656		
	164	27.7	4410944	6.2798E-06	0.628		
few orange spots	153	26	3581577	7.2594E-06	0.726		
	160	25	4096000	6.1035E-06	0.610		
	172	28.6	5088448	5.6206E-06	0.562		
	90	5.2	7290000	7.1331E-06	0.713		
	144	20.9	2985984	6.9994E-06	0.700		
	162	23.3	4251528	5.4804E-06	0.548		
red spots	179	38.2	5735339	6.6605E-06	0.666		
orange belly, red spots	218	70.2	10360232	6.7759E-06	0.678		
few orange spots	171	27.2	5000211	5.4398E-06	0.544		
	170	27.2	4913000	5.5363E-06	0.554		
orange spots	176	32.2	5451776	5.9063E-06	0.591		
red spots, orange belly	203	56.6	8365427	6.7659E-06	0.677		
	151		no data collected				
	135						
	159						
some orange spots	95						
	204						
	207						
	158						
	150						
	133						
	162						
	140						
	170						
	142						
few orange spots	160						
	118						
few orange spots	159						
	177						
	165						
	160						
	144						
	123						
	153						
	103						
	95						
	106						
some orange spots	165						
	162						
	159						
	164						
orange spots	150						
	161						
orange spots, red belly	174						
	132						
	90						

TSF Ecological Monitoring: Dolly Varden 2009

Upper Slate Lake		Dolly Varden		10/27/2009			
Spawning Coloration	Length (mm)	Weight (g)	L	power 3	K	mean	0.709
Some orange spots	195	58.5	7414875	7.8895E-06	0.789	ST dev	0.060
	172	33.7	5088448	6.6228E-06	0.662	n	128
	105	9.4	1157625	8.1201E-06	0.812	95% CI	0.010
	93	5.7	804357	7.0864E-06	0.709	min k	0.509
	96	6	884736	6.7817E-06	0.678	max k	0.935
	167	26.5	4657463	5.6898E-06	0.569	# spawners	45
	161	25.5	4173281	6.1103E-06	0.611	% spawners	35.2
	133	22	2352637	9.3512E-06	0.935	min L	91
	94	5.1	830584	6.1403E-06	0.614	max L	248
	144	17.8	2985984	5.9612E-06	0.596		
Few orange spots	154	28	3652264	7.6665E-06	0.767		
	130	16.5	2197000	7.5102E-06	0.751		
Orange spots	177	32.5	5545233	5.8609E-06	0.586		
Orange spots	166	33.9	4574296	7.4110E-06	0.741		
Orange spots	167	33	4657463	7.0854E-06	0.709		
Orange spots	229	97	12008989	8.0773E-06	0.808		
Orange spots	230	84.5	12167000	6.9450E-06	0.695		
Red Spots	200	48	8000000	6.0000E-06	0.600		
	168	31.5	4741632	6.6433E-06	0.664		
	156	24.5	3796416	6.4535E-06	0.645		
	151	24.9	3442951	7.2322E-06	0.723		
	179	41.7	5735339	7.2707E-06	0.727		
Red Spots Orange Belly	182	45.1	6028568	7.4810E-06	0.748		
Few orange spots	172	33.5	5088448	6.5835E-06	0.658		
Red Spots Orange Belly	240	101	13824000	7.3061E-06	0.731		
	162	29	4251528	6.8211E-06	0.682		
Orange spots	248	113	15252992	7.4084E-06	0.741		
	143	20.1	2924207	6.8737E-06	0.687		
	154	24.4	3652264	6.6808E-06	0.668		
Some orange spots	171	33.2	5000211	6.6397E-06	0.664		
Few orange spots	190	49.5	6859000	7.2168E-06	0.722		
Few orange spots	150	24.2	3375000	7.1704E-06	0.717		
Few orange spots	153	26.1	3581577	7.2873E-06	0.729		
	144	23	2985984	7.7027E-06	0.770		
	148	23.4	3241792	7.2182E-06	0.722		
Red Spots Orange Belly	248	109.1	15252992	7.1527E-06	0.715		
	140	18.9	2744000	6.8878E-06	0.689		
	141	19.9	2803221	7.0990E-06	0.710		
	150	26.1	3375000	7.7333E-06	0.773		
	151	24.5	3442951	7.1160E-06	0.712		
	163	31.6	4330747	7.2967E-06	0.730		
	147	22.5	3176523	7.0832E-06	0.708		
OS Orange Belly	174	35.6	5268024	6.7578E-06	0.676		
Orange spots	160	29.5	4096000	7.2021E-06	0.720		
	151	22.5	3442951	6.5351E-06	0.654		
	153	24.8	3581577	6.9243E-06	0.692		
	183	31.2	6128487	5.0910E-06	0.509		
	156	26.2	3796416	6.9012E-06	0.690		
Few orange spots	151	24.4	3442951	7.0869E-06	0.709		
	97	6.2	912673	6.7932E-06	0.679		
Few orange spots	159	28.1	4019679	6.9906E-06	0.699		
	134	17.2	2406104	7.1485E-06	0.715		
	179	37.5	5735339	6.5384E-06	0.654		
	200	60	8000000	7.5000E-06	0.750		
	160	28.8	4096000	7.0313E-06	0.703		
	156	24.1	3796416	6.3481E-06	0.635		
	155	29.1	3723875	7.8144E-06	0.781		
	107	9.7	1225043	7.9181E-06	0.792		
	151	27.9	3442951	8.1035E-06	0.810		
Red Spots	161	28.6	4173281	6.8531E-06	0.685		
	154	25.9	3652264	7.0915E-06	0.709		

TSF Ecological Monitoring: Dolly Varden 2009

Upper Slate Lake Dolly Varden 10/27/2009 continued					
Spawning Coloration	Length (mm)	Weight (g)	L power 3		K
	137	17.5	2571353	6.8058E-06	0.681
Few orange spots	169	33.2	4826809	6.8783E-06	0.688
Few orange spots	157	24.5	3869893	6.3309E-06	0.633
	91	5.6	753571	7.4313E-06	0.743
	145	22.8	3048625	7.4788E-06	0.748
	133	16.8	2352637	7.1409E-06	0.714
OS Orange Belly	167	39	4657463	8.3737E-06	0.837
	169	32.5	4826809	6.7332E-06	0.673
	200	53	8000000	6.6250E-06	0.663
	150	25.3	3375000	7.4963E-06	0.750
Few orange spots	146	29	3112136	9.3184E-06	0.932
	95	6.5	857375	7.5813E-06	0.758
	150	24.5	3375000	7.2593E-06	0.726
	143	22.3	2924207	7.6260E-06	0.763
	151	24	3442951	6.9708E-06	0.697
Few orange spots	160	28	4096000	6.8359E-06	0.684
	171	36.5	5000211	7.2997E-06	0.730
Few orange spots	150	23.2	3375000	6.8741E-06	0.687
	152	23.7	3511808	6.7487E-06	0.675
	150	23.9	3375000	7.0815E-06	0.708
Orange spots	223	76	11089567	6.8533E-06	0.685
	145	21.3	3048625	6.9868E-06	0.699
Few orange spots	162	29.8	4251528	7.0092E-06	0.701
	130	16.9	2197000	7.6923E-06	0.769
	132	17	2299968	7.3914E-06	0.739
Few orange spots	162	31.8	4251528	7.4797E-06	0.748
	159	28.7	4019679	7.1399E-06	0.714
	118	11.4	1643032	6.9384E-06	0.694
red spots	158	28.1	3944312	7.1242E-06	0.712
	148	23.8	3241792	7.3416E-06	0.734
	142	20.5	2863288	7.1596E-06	0.716
	143	19.9	2924207	6.8053E-06	0.681
	159	26.1	4019679	6.4931E-06	0.649
	140	20.3	2744000	7.3980E-06	0.740
	146	21.2	3112136	6.8120E-06	0.681
Few orange spots	143	22.5	2924207	7.6944E-06	0.769
	131	16.2	2248091	7.2061E-06	0.721
	104	8	1124864	7.1120E-06	0.711
	143	19.6	2924207	6.7027E-06	0.670
Few orange spots	175	32.3	5359375	6.0268E-06	0.603
Red Spots Orange Belly	209	72.2	9129329	7.9086E-06	0.791
Few orange spots	159	26.9	4019679	6.6921E-06	0.669
	138	18.5	2628072	7.0394E-06	0.704
	106	8.2	1191016	6.8849E-06	0.688
	151	22.6	3442951	6.5641E-06	0.656
	91	5.1	753571	6.7678E-06	0.677
	160	28.9	4096000	7.0557E-06	0.706
Few orange spots	173	37.7	5177717	7.2812E-06	0.728
	156	28.2	3796416	7.4281E-06	0.743
	146	21.4	3112136	6.8763E-06	0.688
Few orange spots	156	26.2	3796416	6.9012E-06	0.690
	135	18.5	2460375	7.5192E-06	0.752
Orange spots	162	30.1	4251528	7.0798E-06	0.708
	128	14.9	2097152	7.1049E-06	0.710
Few orange spots	160	26.6	4096000	6.4941E-06	0.649
	136	18	2515456	7.1558E-06	0.716
Orange spots	181	38.5	5929741	6.4927E-06	0.649
Few orange spots	182	48.5	6028568	8.0450E-06	0.805
Few orange spots	155	27.7	3723875	7.4385E-06	0.744
	148		no data collected		
	162				
	152				
Few orange spots	145				
	138				
Few orange spots	157				
	128				
	153				

Upper Slate Lake Dolly Varden 11/2/2009					
Spawning Coloration	Length (mm)	Weight (g)	L power 3		K
orange spots	249	113.1	15438249	7.3260E-06	0.733
	137	18.8	2571353	7.3113E-06	0.731
orange spots	229	101.7	12008989	8.4687E-06	0.847
	108	8.4	1259712	6.6682E-06	0.667
few orange spots	163	30.6	4330747	7.0658E-06	0.707
few orange spots	160	27.4	4096000	6.6895E-06	0.669
orange spots	177	33.1	5545233	5.9691E-06	0.597
	157	23.6	3869893	6.0984E-06	0.610
	152	24.8	3511808	7.0619E-06	0.706
	140	19.5	2744000	7.1064E-06	0.711
	160	23.8	4096000	5.8105E-06	0.581
orange spots orange bell	173	33.8	5177717	6.5280E-06	0.653
	152	25.1	3511808	7.1473E-06	0.715
few orange spots	156	26.9	3796416	7.0856E-06	0.709
	153	28.1	3581577	7.8457E-06	0.785
	118	12.3	1643032	7.4862E-06	0.749
	91	5.5	753571	7.2986E-06	0.730
	173	33.8	5177717	6.5280E-06	0.653
	89	5.6	704969	7.9436E-06	0.794
	119	11.1	1685159	6.5869E-06	0.659
few orange spots	162	29.1	4251528	6.8446E-06	0.684
red spots orange belly	204	57.5	8489664	6.7729E-06	0.677
	120	13.8	1728000	7.9861E-06	0.799
	72	3.3	373248	8.8413E-06	0.884
	155	24.3	3723875	6.5255E-06	0.653

Summary stats.

mean	0.708
ST dev	0.073
n	25
95% CI	0.029
min k	0.581
max k	0.884
# spawners	9
% spawners	36.0
min L	72
max L	249

Upper Slate Lake Dolly Varden 11/10/2009					
Spawning Coloration	Length (mm)	Weight (g)	L power 3		K
red spots orang belly	173	35.9	5177717	6.9336E-06	0.693
	108	11.8	1259712	9.3672E-06	0.937
	109	8.6	1295029	6.6408E-06	0.664
	141	20.7	2803221	7.3844E-06	0.738
	152	22.6	3511808	6.4354E-06	0.644
	163	30.2	4330747	6.9734E-06	0.697
	154	27	3652264	7.3927E-06	0.739
orange spots	229	93	12008989	7.7442E-06	0.774
	184	37.5	6229504	6.0197E-06	0.602
	158	22.2	3944312	5.6284E-06	0.563
	142	19.2	2863288	6.7056E-06	0.671
orange spots	166	31.9	4574296	6.9738E-06	0.697
	144	24	2985984	8.0376E-06	0.804
red spots orange belly	173	35.9	5177717	6.9336E-06	0.693
	155	24.4	3723875	6.5523E-06	0.655
few orange spots	190	47.6	6859000	6.9398E-06	0.694
few orange spots	159	30.4	4019679	7.5628E-06	0.756
orange spots	159	30	4019679	7.4633E-06	0.746
	186	39.6	6434856	6.1540E-06	0.615
red spots	183	43.6	6128487	7.1143E-06	0.711
few orange spots	163	31.9	4330747	7.3659E-06	0.737
few orange spots	174	38.1	5268024	7.2323E-06	0.723
red spots orange belly	226	95.9	11543176	8.3079E-06	0.831
orange spots	170	34.2	4913000	6.9611E-06	0.696
	160	27.8	4096000	6.7871E-06	0.679
	161	27.1	4173281	6.4937E-06	0.649
few orange spots	163	33.7	4330747	7.7816E-06	0.778
	141	19.5	2803221	6.9563E-06	0.696
	103	11.5	1092727	1.0524E-05	1.052
	146	21.5	3112136	6.9084E-06	0.691
	238	99.2	13481272	7.3584E-06	0.736
bright red spots very ora	158	23.8	3944312	6.0340E-06	0.603
	148	21.5	3241792	6.6321E-06	0.663
orange spots	147	22.1	3176523	6.9573E-06	0.696
	159	23.3	4019679	5.7965E-06	0.580
few orange spots	152	25	3511808	7.1188E-06	0.712
	173	34.8	5177717	6.7211E-06	0.672
	148	21.8	3241792	6.7247E-06	0.672
few orange spots	175	34.6	5359375	6.4560E-06	0.646

Summary Stats

mean	0.708
ST dev	0.090
n	39
95% CI	0.028
min k	0.563
max k	1.052
# spawners	18
% spawners	46.2
min L	103
max L	238

Upper Slate Lake		Dolly Varden 11/10/2009			
Spawning Coloration	Length (mm)	Weight (g)	L power 3		K
	151	23.4	3442951	6.7965E-06	0.680
	136	18.7	2515456	7.4340E-06	0.743
	141	20.2	2803221	7.2060E-06	0.721
	114	11.4	1481544	7.6947E-06	0.769
	108	9.3	1259712	7.3826E-06	0.738
	168	33.7	4741632	7.1073E-06	0.711
red spots orange belly	230	94	12167000	7.7258E-06	0.773
	141	20	2803221	7.1346E-06	0.713
few orange spots	193	51.8	7189057	7.2054E-06	0.721
	114	11	1481544	7.4247E-06	0.742
few orange spots	190	47.2	6859000	6.8815E-06	0.688
orange spots	179	35.3	5735339	6.1548E-06	0.615
red spots orange belly	190	50.5	6859000	7.3626E-06	0.736
	142	19.8	2863288	6.9151E-06	0.692
	138	18.9	2628072	7.1916E-06	0.719
	152	24	3511808	6.8341E-06	0.683
	145	23.4	3048625	7.6756E-06	0.768
	132	17.8	2299968	7.7392E-06	0.774
few orange spots	154	27	3652264	7.3927E-06	0.739
	155	28.2	3723875	7.5728E-06	0.757
	169	37	4826809	7.6655E-06	0.767
red spots orange belly	203	57.9	8365427	6.9213E-06	0.692
	180	38.8	5832000	6.6529E-06	0.665
orange spots	250	120.2	15625000	7.6928E-06	0.769

Summary stats.

mean	0.724
ST dev	0.040
n	24
95% CI	0.016
min k	0.615
max k	0.774
# spawners	8
% spawners	33.3
min L	108
max L	250