

Streams-Fish Habitat Question 2a – Aquatic Habitat Condition: Reference Reach

Goal: Maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.

Objectives: Use baseline fish habitat objectives, identified in the Forest Plan Standards and Guidelines, to evaluate the relative condition of riparian and aquatic habitat. Monitor representative fish populations to determine whether trends attributable to current forest management are evident.

Background: Fish and aquatic resources on the Tongass National Forest provide major subsistence, commercial, and sport fisheries. Abundant rainfall and watersheds with high densities of streams provide a high quantity and diversity of freshwater fish habitats. The Tongass National Forest provides spawning and rearing habitat for the majority of wild fish produced in Southeast Alaska. Maintenance of this habitat and associated waters is a focal point for the public, state and federal agencies, and Native organizations.

Streams- Fish Habitat Question 2a: Is the range and frequency of aquatic habitat conditions maintained?

Reference Reach Indicator Project Synopsis

The baseline fish habitat objectives are a suite of descriptive statistics for selected variables taken from reference stream systems. These statistics, put forth as ranges, quartiles and other descriptive measures for ten habitat variables (table 1) are broken out by geomorphic process group and channel type (Paustian 1992, rev. 2010). The fish habitat objectives represent the natural range of conditions present in streams and are used as a comparative reference to evaluate the health of channels affected by management activities. The original suite of descriptive statistics was published as an evaluation of the effect of sample size on statistical power (Bryant 2004).

In 2008, a re-evaluation of the descriptive statistics (Tucker and Caouette 2008) identified several channel types where small samples sizes limited their value. We proposed a four year project beginning in 2010 to focus field data collection in reference reaches for the specific purpose of increasing sample size and improving the value of the statistics. The first three years of the project were focused on data collection while the fourth year (fiscal year 2013) would focus on analysis and reporting.

An additional aspect of this project was that the updated statistics would be run using the National Aquatic Surveys database to store the data and extract the summaries. This step was included to comply with national direction, provide an additional measure of data validation, and enable further statistical analysis of these data in the future.

Streams-Fish Habitat 2a Table 1. Fish Habitat Objectives 2012: Stream Characteristics by Channel Type

Channel Type		FP		FPS		FPM		FPL			MM		MMS		
Harvest Status		no	yes	no	yes	no	yes	no	yes		no	yes	no	yes	
	n w/data	43	28	16	9	19	12	8	7		n w/data	49	39	45	27
W/D	0	4.8	9.2	4.8	9.4	15.5	9.2	18.4	30.9		0	3.48	1.56	3.5	1.6
	0.25	16.5	18.5	11.6	13.7	18.7	21.3	24.2	32.0		0.25	10.57	12.35	10.3	13.2
	0.5	19.3	27.8	14.9	18.8	20.2	27.8	27.2	38.6		0.5	15.34	17.29	14.2	16.7
	0.75	26.0	38.8	18.5	22.2	30.7	33.5	41.8	52.8		0.75	22.27	25.15	21.8	22.5
	1	77.8	79.1	24.7	46.1	46.0	79.1	77.8	76.7		1	52.61	44.55	52.6	37.9
	mean	23.1	31.0	15.0	20.3	24.8	30.8	15.0	20.3		mean	17.83	19.54	17.4	18.2
	stdev	12.9	18.5	5.4	11.0	9.1	18.5	5.4	11.0		stdev	10.98	9.48	11.4	8.3
	cv %	55.6	59.6	36.0	54.3	36.7	60.0	36.0	54.3		cv %	61.6	48.5	65.6	45.6
	n w/data	44	83	16	27	23	26	5	29		n w/data	41	35	39	25
TLW/M	0	0.10	0.00	0.19	0.00	0.13	0.09	0.10	0.00		0	0.08	0.03	0.08	0.15
	0.25	0.26	0.21	0.25	0.25	0.31	0.22	0.15	0.10		0.25	0.27	0.29	0.28	0.36
	0.5	0.36	0.39	0.39	0.45	0.37	0.48	0.17	0.32		0.5	0.38	0.39	0.38	0.46
	0.75	0.50	0.60	0.53	0.58	0.50	0.61	0.46	0.60		0.75	0.50	0.53	0.51	0.57
	0.9	0.64	0.77	0.64	0.66	0.62	0.79	0.48	0.79		0.9	0.71	0.78	0.73	0.98
	1	1.68	1.31	0.68	0.78	1.68	1.31	0.49	1.19		1	1.03	4.74	1.03	4.74
	mean	0.41	0.41	0.41	0.41	0.45	0.46	0.41	0.41		mean	0.41	0.54	0.43	0.67
	stdev	0.25	0.28	0.17	0.21	0.31	0.29	0.17	0.21		stdev	0.24	0.77	0.24	0.88
	cv %	61.12	67.32	42.5	51.4	67.6	62.2	42.5	51.4		cv %	56.7	142.7	55.5	132.9
	n w/data	41	73	17	25	20	21	4	26		n w/data	42	27	39	20
TKW/M	0	0.01	0.00	0.02	0.00	0.01	0.00	0.01	0.00		0	0.01	0.00	0.02	0.00
	0.25	0.04	0.01	0.04	0.02	0.06	0.01	0.02	0.00		0.25	0.06	0.02	0.07	0.06
	0.5	0.10	0.03	0.10	0.05	0.10	0.03	0.03	0.01		0.5	0.11	0.07	0.12	0.10
	0.75	0.15	0.08	0.17	0.11	0.15	0.09	0.06	0.03		0.75	0.14	0.12	0.14	0.13
	0.9	0.23	0.15	0.23	0.16	0.20	0.16	0.09	0.08		0.9	0.19	0.19	0.19	0.21
	1	0.25	0.30	0.25	0.30	0.25	0.27	0.12	0.26		1	0.27	0.23	0.27	0.23
	mean	0.11	0.06	0.12	0.08	0.11	0.06	0.12	0.08		mean	0.11	0.08	0.11	0.10
	stdev	0.07	0.07	0.08	0.07	0.07	0.07	0.08	0.07		stdev	0.06	0.07	0.06	0.07
	cv %	64.93	123.60	62.52	93.32	59.89	117.58	62.52	93.32		cv %	59.93	88.41	57.03	70.75
	n w/data	52	86	19	27	25	29	8	29		n w/data	49	38	45	27
POOLS/KM	0	7.85	0.00	23.81	0.00	8.07	8.92	7.85	0.00		0	0.01	0.02	0.01	0.03
	0.25	30.23	17.59	50.10	33.44	31.01	28.20	9.69	7.02		0.25	0.04	0.04	0.05	0.05
	0.5	44.98	32.15	66.67	50.63	41.02	38.14	18.37	16.79		0.5	0.06	0.06	0.06	0.07
	0.75	66.38	50.47	75.47	69.13	57.48	49.18	22.59	24.61		0.75	0.07	0.09	0.07	0.09
	1	118.00	171.04	118.00	171.04	76.69	113.64	49.61	130.43		1	0.16	0.13	0.16	0.13
	mean	48	39	65.41	56.67	44.13	42.10	65.41	56.67		mean	0.06	0.06	0.06	0.07
	stdev	25	33	24.72	40.04	18.04	22.72	24.72	40.04		stdev	0.03	0.03	0.03	0.03
	cv %	52.36	83.11	37.80	70.67	40.89	53.98	37.80	70.67		cv %	43.03	50.51	39.73	38.11
	n	52	81	19	25	25	28	8	27		n w/data	47	36	43	26

Channel Type		FP		FPS		FPM		FPL			MM		MMS		
	w/data														
Pool spacing	0	0.88	0.25	1.17	1.30	0.88	0.61	1.07	0.25		0	0.77	1.03	1.4	1.0
	0.25	1.43	1.59	2.19	2.70	1.26	1.47	1.92	1.41		0.25	2.87	2.67	2.9	2.7
	0.5	2.20	2.46	3.22	4.36	1.78	2.01	2.67	2.16		0.5	3.95	3.98	4.0	3.9
	0.75	3.44	4.18	5.06	7.41	2.23	2.38	3.11	3.01		0.75	5.72	5.12	5.7	5.1
	1	9.56	44.68	7.32	44.68	9.56	6.12	6.32	10.74		1	15.16	12.33	15.2	12.3
	mean	2.82	4.15	3.60	7.52	2.22	2.19	3.60	7.52		mean	5.00	4.19	5.10	4.19
	stdev	1.86	5.91	1.74	9.31	1.85	1.17	1.74	9.31		stdev	3.57	2.17	3.66	2.40
	cv %	65.86	142.27	48.46	123.87	83.03	53.55	48.46	123.87		cv %	71.33	51.86	71.78	57.40
	n w/data	52	32	19	9	25	13	8	10		n w/data	46	29	42	23
RPD/CBW	0	0.00	0.03	0.00	0.05	0.00	0.03	0.00	0.03		0	0.00	0.00	0.00	0.02
	0.25	0.03	0.03	0.05	0.06	0.04	0.04	0.02	0.03		0.25	0.06	0.05	0.06	0.05
	0.5	0.04	0.04	0.06	0.07	0.04	0.04	0.03	0.03		0.5	0.07	0.06	0.08	0.08
	0.75	0.06	0.05	0.09	0.08	0.05	0.04	0.03	0.03		0.75	0.10	0.10	0.10	0.11
	1	0.13	0.11	0.13	0.11	0.08	0.05	0.04	0.04		1	0.17	0.18	0.17	0.18
	mean	0.05	0.05	0.07	0.07	0.04	0.04	0.07	0.07		mean	0.08	0.08	0.08	0.09
	stdev	0.03	0.02	0.04	0.02	0.01	0.00	0.04	0.02		stdev	0.04	0.04	0.04	0.04
	cv %	60.64	42.57	55.27	27.08	34.30	11.19	55.27	27.08		cv %	53.01	56.10	46.57	49.83
	n w/data	43	32	18	10	19	13	6	9		n w/data	44	28	40	22
D50	0	1.04	2.23	5.21	14.00	6.00	2.23	1.04	5.95		0	7.76	7.07	7.8	7.1
	0.25	16.68	17.35	22.77	17.52	14.93	21.73	17.29	17.80		0.25	26.98	24.81	26.5	23.8
	0.5	24.00	26.56	27.16	26.59	19.10	25.47	19.69	27.11		0.5	34.83	33.50	34.8	30.5
	0.75	36.24	38.84	36.89	35.48	31.62	38.00	44.79	50.00		0.75	55.31	50.21	52.0	46.0
	1	109.00	86.00	56.00	86.00	109.00	68.00	109.00	59.00		1	122.00	210.00	103.0	178.0
	mean	31.39	31.33	28.81	31.55	32.20	31.66	28.81	31.55		mean	44.15	52.14	42.19	40.52
	stdev	25.63	19.53	12.53	21.23	30.63	20.20	12.53	21.23		stdev	26.83	51.13	24.72	36.45
	cv %	81.66	62.33	43.48	67.27	95.11	63.78	43.48	67.27		cv %	60.78	98.08	58.59	89.95
	n w/data	32	24	15	9	12	8	5	7		n w/data	41	29	39	24
POOL LENGTH/M	0	0.11	0.02	0.20	0.35	0.11	0.02	0.12	0.10		0	0.07	0.15	0.1	0.2
	0.25	0.34	0.39	0.36	0.39	0.43	0.52	0.18	0.39		0.25	0.28	0.29	0.3	0.3
	0.5	0.51	0.54	0.58	0.50	0.54	0.60	0.42	0.51		0.5	0.42	0.35	0.4	0.3
	0.75	0.69	0.59	0.66	0.55	0.70	0.84	0.44	0.55		0.75	0.47	0.45	0.5	0.5
	1	0.84	1.21	0.84	0.70	0.75	1.21	0.69	0.64		1	0.80	0.67	0.8	0.7
	mean	0.50	0.53	0.53	0.50	0.52	0.64	0.53	0.50		mean	0.41	0.38	0.41	0.38
	stdev	0.21	0.24	0.20	0.11	0.21	0.36	0.20	0.11		stdev	0.19	0.14	0.19	0.14
	cv %	41.17	45.52	37.17	22.01	39.75	56.20	37.17	22.01		cv %	46.08	36.28	46.49	36.54

*Definitions of Fish Habitat Objectives (see Tucker and Caouette, unpublished, for complete definitions):

WD = channel width-to-depth ratio (Bankfull width / mean bankfull depth)

TLW/M = Total Large Wood pieces / meter (Total Pieces / meters surveyed)

TKW/M = Total Key pieces Large Wood/meter (Total Key pieces / meters surveyed)

POOLS/KM = Pools/Km (Total number of Pools / meters surveyed * 1,000)

POOL SPACE = Pool Spacing (Length of stream surveyed / channel bed width / total number of pools)

RPD/CBW = Residual Pool Depth/Channel Bed width (Average of all pool residual depth / average channel bed width)

D50 = median particle size of streambed

For each group (Process Group or Channel Type) there are two columns representing harvest status upstream or adjacent to the study reach. Each variable shows the number of streams (n) that went into the calculations. Percentiles are also calculated for each variable including 0 and 1 the minimum and maximum values respectively. We also report the mean, standard deviation and coefficient of variation (expressed as a percent of the mean) for each variable.

REL_SUBMRG = Relative Submergence (Mean bankfull depth / D50)

POOL_SIZE = Pool Size (Average residual pool depth / average bankfull depth)

PLNGTH/M = Pool Length/meter (Total pool length / total length of stream surveyed)

Columns: FP = Floodplain Process Group, (FPS, FPM, FPL are Small, Medium and Large Floodplain channels respectively)

MM = Moderate Gradient Mixed Control Process Group (MMS is the Small MM channel)

Evaluation Criteria

In each year our target was to sample ten sites. During the 2012 field season we were only able to sample six sites, primarily due to scheduling conflicts with other project work. The data from the six sites were entered to the corporate National Resources Information System (NRIS) Aquatic Surveys database in preparation for analysis and reporting.

Streams-Fish Habitat 2a Table 2. Site samples in 2012

Site Name	Location	Channel Type
Sumner	Mitkof Island	HCL
Staney Fen	Prince of Wales Island – Staney Creek	FPS
Upper Towers	Kupreanof Island	MMS
Kake 13 mile	Kupreanof Island	AFM
Three Lakes	Mitkof Island	AFM
Central Kupreanof	Kupreanof Island	HCL

Sampling/Reporting Period

Sampling: annual; reporting: five year

Monitoring Results

The 2012 field season focused efforts on two toe-slope channel types (HCL and AFM) that are commonly encountered adjacent to timber harvest and road building activities (see Paustian 1992 referenced; HCL = Low incision – High Gradient Contained channel; AFM = Moderate Gradient Alluvial Fan Channel). We were also able to add data from fourteen management indicator species (MIS) monitoring project sites that were sampled in 2012. While those channel types were not targeted specifically in the reference reach project, increases in sample size, especially when they improve our geographic distribution of reference reach sites, improve the strength of the overall data set.

Evaluation of Results

This project set aside fiscal year 2013 to focus on data entry and analysis. The data were first entered into the Forest Service national resource database (NRIS). This step standardizes and validates the data, enabling queries to extract the summary metrics. Currently we are working to incorporate legacy habitat data into the NRIS environment.

Action Plan

In fiscal year 2013 we will focus on data entry and analysis ending with an independent report in the winter of 2013-2014. The goal for this project is to produce an interactive suite of statistics generated from data relevant to project needs. As any new site is surveyed it will be compared to the existing suite of statistics and added to the overall dataset. The complete dataset summary, currently a static product, will be a user-generated output.

Citations

Paustian, S. J., 1992. A channel type user's guide for the Tongass National Forest, Southeast Alaska. Technical Paper 26, U.S. Department of Agriculture, Forest Service, Alaska Region, Juneau. Revised 2010.

Bryant, Mason D., J. Caouette, B. Wright, 2004. Evaluating Stream Habitat Survey Data and Statistical Power Using an Example from Southeast Alaska. *North American Journal of Fisheries Management* 24:1353-1362.

Tucker, Emil, J. Caouette, 2008. Statistical Analyses of Aquatic Habitat Variables in the Tongass National Forest. Unpublished report on file at USDA Forest Service, Tongass National Forest, Petersburg, Alaska.