



**Fish Habitat Management System  
for Yukon Placer Mining**

**Aquatic Health Report (2013)**

*Prepared by*

**The Yukon Placer Secretariat**

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## Introduction

The Adaptive Management Framework for Yukon placer mining is complemented by traditional knowledge and monitoring of water quality objectives, aquatic health, and economic health. The Aquatic Health Monitoring program is governed by the Aquatic Health Monitoring Protocol. The Protocol describes the locations, timing, frequency and methods employed during sampling, as well as the methods used to analyze sampling data. The Reference Condition Approach (RCA) is the method chosen for assessing the health of freshwater ecosystems in the Yukon, and an RCA model was developed for bioassessment based upon benthic macroinvertebrates.

An RCA model was first adopted for assessing watershed health under the FHMS for Yukon placer mining in 2007. In January 2008, this model was re-calibrated incorporating data collected in 2007. Further development of the model was undertaken in 2010 using new data collected in 2008 and 2009. In 2013, site data collected in 2010-2012 was incorporated into the model and additional data collected in 2007 and 2008 resulted in the expansion of the geographic range of the model. Current analyses and this report rely on a recalibrated 2013 Yukon model developed from a suite of 286 Reference Sites gathered from across the Yukon Territory by Fisheries and Oceans Canada, the Yukon Government and the University of Western Ontario from 2006 to 2012

([https://www.researchgate.net/publication/281067514\\_Revision\\_of\\_the\\_Yukon\\_CABIN\\_Invertebrate\\_Bioassessment\\_Model\\_using\\_2004-12\\_Reference\\_Site\\_Data](https://www.researchgate.net/publication/281067514_Revision_of_the_Yukon_CABIN_Invertebrate_Bioassessment_Model_using_2004-12_Reference_Site_Data)).

**Please note that subsequent to the issuance of the first Draft 2013 Aquatic Health Monitoring Report fixes were made to the model used to produce the site assessment results. As such, the final site assessment reports published here may differ from the draft site assessment results originally distributed.**

There are two fundamental steps in the process of developing the predictive model. The first is to classify the reference sites based on their biological characteristics. This requires defining a number of community types based on the taxonomic composition. The second step is to determine a subset of habitat attributes that are associated with those community types. Following this step the number and type of organisms expected to occur at any given site can be determined from habitat attributes.

The first step resulted in five community groups being defined for reference sites in the Yukon River basin. There are 23 sites in Group 1, 98 sites in Group 2, 44 sites in Group 3, 108 sites in Group 4, and 13 sites in Group 5.

The following is a summary of the general characteristics of each Reference Group:

*Group 1.* Sites have very low abundance and richness, with a community dominated by Chironomids (34%) which represent over a third of the community with Lumbriculidae and Naidid as the other main characteristic families (4%). However this is a quite variable community. These sites tend to be the lowest altitude and have larger drainage basins. The channels are deeper, velocity slower and have the finest substrate.

*Group 2.* Also has low abundance but higher taxonomic richness, this is again a community where Chironomids are dominant (39.7%) but Baetid and Heptaegiid mayflies also have high relative abundance (20%). Six families representing the Diptera, Ephemeroptera and Plecoptera characterise this community type. These are streams in the eastern Yukon but tend to be intermediate with regard to their habitat characteristics.

*Group 3.* These sites have reasonable abundance and have the highest family richness (> 15 families per site). The dominant families are mayflies (Heptageniidae) and stoneflies (Nemouridae) which together comprise almost 50% of the community, Chironomids are less abundant (15%) but occur at all sites. The same six families as Community 2 characterise this assemblage. These are higher altitude sites in the eastern portion of the study area and with smaller drainage areas, with the highest spring precipitation and also warmer spring temperatures and the largest substrate.

*Group 4.* This is a more abundant community with 10 times more organisms per sample than communities 1 and 2. The community also has the high taxonomic richness. Chironomids are again the most common family (44%), however the Baetidae are also common (11% relative abundance) and found at more than 80% of the sites. This is the most frequently occurring assemblage (38% of Reference Sites) and also the most variable in terms of habitat attributes.

*Group 5.* This is a small community representing less than 5% of the Reference Sites. This community has the greatest number of organisms and is again dominated by Chironomids (56%) but Baetid mayflies (22%) are also abundant. These are shallow streams with high stream velocity. They also have the coolest spring and summer temperatures and the least amount of spring precipitation. These sites are located in the northern part of the study area.

Forty sites were sampled under the aquatic health monitoring program in 2013. All sites were in the Yukon River Basin; two of the sites were sampled as potential reference sites, seven were sampled as repeat reference sites, 31 were test sites (the results of reference site revisits are not presented here). Of the test sites sampled in 2013, eight were new and 23 were re-assessments of sites that were sampled in previous years. Our increased focus on revisiting test sites is beginning to allow investigations of temporal trends in site results.

The following table summarizes the 2013 test site results.

More detailed information is found in the individual test site assessment reports, which are appended to this report.

Table 1. 2013 Aquatic Health Monitoring results collected under the Yukon Placer Secretariat's Aquatic Health Monitoring Protocol.

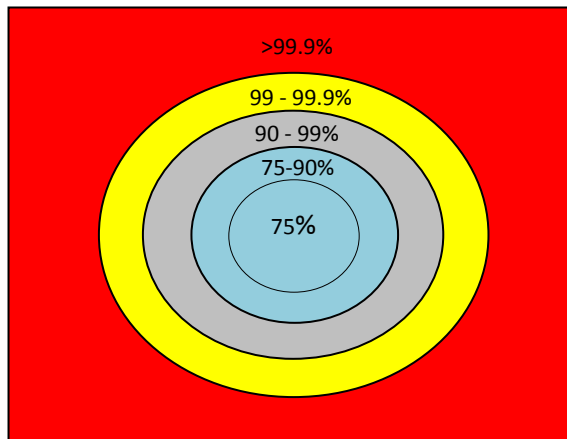
Site Code	Group	Group Probability (%)	Watershed	Watercourse	RCA Model Results for Benthic Macroinvertebrates	Reason for Benthic Macroinvertebrate Results
YPS-016	4	43.3	Klondike River	Bonanza Creek	Similar to Reference	
YPS-052	2	39.6	Klondike River	Hunker Creek	Mildly Divergent from Reference Condition	Low total abundance, particularly in Chironomidae, three characteristic families absent.
YPS-078	4	44.4	Klondike River	Hunker Creek	Mildly Divergent from Reference Condition	Low total abundance, higher than expected richness.
YPS-081	2	42.9	Klondike River	Bonanza Creek	Similar to Reference	
YPS-083	4	42.8	Klondike River	Eldorado Creek	Similar to Reference	
YPS-090	4	41.7	Indian River	Indian River	Mildly Divergent from Reference Condition	Low total abundance (particularly within characteristic families), much higher than expected richness.
YPS-093	4	44.0	Indian River	Nine Mile Creek	Mildly Divergent from Reference Condition	Much lower than expected richness, low abundance within characteristic families.
YPS-094	4	46.5	Indian River	Indian River	Mildly Divergent from Reference Condition	Absence of a characteristic family (Nemouridae), shift in relative abundance of Chironomidae and Baetidae.
YPS-096	4	41.7	Indian River	Indian River	Mildly Divergent from Reference Condition	Much higher than expected richness, low abundance (particularly Simuliidae and Nemouridae).
YPS-104	4	44.2	Indian River	Dominion Creek	Similar to Reference	
YPS-107	4	47.9	Klondike River	Eldorado Creek	Mildly Divergent from Reference Condition	Low total abundance, particularly low abundance in Chironomidae and Simuliidae, Empididae absent.
YPS-164	4	35.9	Yukon River South	Thistle Creek	Highly Divergent from Reference Condition	Very low total abundance, richness well below expected.
YPS-165	4	40.0	McQuesten River	Vancouver Creek	Mildly Divergent from Reference Condition	Low total abundance, shift in relative abundance.
YPS-166	4	36.5	McQuesten River	Vancouver Creek	Mildly Divergent from Reference Condition	Low total abundance, richness much higher than expected, shift in relative abundance.
YPS-174	4	48.9	Stewart River	Independence	Divergent from	Low total abundance, particularly within

Site Code	Group	Group Probability (%)	Watershed	Watercourse	RCA Model Results for Benthic Macroinvertebrates	Reason for Benthic Macroinvertebrate Results
				Creek	Reference Condition	characteristic families.
YPS-426	2	40.9	Stewart River	Valley Creek	Mildly Divergent from Reference Condition	Very low total abundance, particularly within characteristic families.
YPS-428	2	41.1	Stewart River	Black Hills Creek	Divergent from Reference Condition	Extremely low total abundance, extremely low richness, absence of several characteristic families.
YPS-429	4	48.5	Stewart River	Black Hills Creek	Divergent from Reference Condition	Low total abundance, low numbers of Chironomidae.
YPS-431	4	41.2	Stewart River	Scroggie Creek	Mildly Divergent from Reference Condition	Low total abundance, low numbers of Chironomidae.
YPS-432	4	40.8	Stewart River	Barker Creek	Mildly Divergent from Reference Condition	Low total abundance, low numbers of Chironomidae.
YPS-433	4	37.4	Stewart River	Brewer Creek	Mildly Divergent from Reference Condition	Low total abundance, low numbers of Chironomidae.
YPS-435	4	41.9	Stewart River	Clear Creek	Similar to Reference	
YPS-535	1	37.7	Yukon River South	Thistle Creek	Similar to Reference	
YPS-544	2	38.8	Klondike River	Hunker Creek	Mildly Divergent from Reference Condition	Low total abundance, lower than expected richness, low numbers of Chironomidae, absence of three characteristic families.
YPS-546	4	46.6	Indian River	Quartz Creek	Highly Divergent from Reference Condition	Extremely low total abundance.
YPS-547	2	43.1	Indian River	Dominion Creek	Similar to Reference	
YPS-565	3	34.0	White River	Quill Creek (lower)	Highly Divergent from Reference Condition	Extremely low total abundance, much lower than expected richness. Very high flows and poor site location; this may not be a representative sample.
YPS-566	5	34.9	White River	Maple Creek	Highly Divergent from Reference Condition	Very low total abundance. High stream flows and potential issue with CABIN model inputs; this may not be an accurate result.

Site Code	Group	Group Probability (%)	Watershed	Watercourse	RCA Model Results for Benthic Macroinvertebrates	Reason for Benthic Macroinvertebrate Results
YPS-567	5	54.6	White River	Nickel Creek	Highly Divergent from Reference Condition	Very low total abundance. Potential issue with CABIN model inputs; this may not be an accurate result.
YPS-568	5	52.6	White River	Tatamagouche Creek	Highly Divergent from Reference Condition	Low total abundance. Very high flows and poor site location; this may not be a representative sample.
YPS-569	4	42.8	Klondike River	Allgold Creek	Different than Reference Condition	Low total abundance, much lower than expected richness.

Probability bands and legend for the test sites results

(as determined from site assessment graphs - see detailed site assessments)



*Highly Divergent from Reference Condition* = outside 99.9% probability band

*Divergent from Reference Condition* = between 99% and 99.9% probability band

*Mildly Divergent from Reference Condition* = between 90% and 99% probability band

*Similar to Reference Condition* = inside the 90% & 75% probability band