**Salmon Habitat Indicator Monitoring Project**
**Summary of Data, Methodology, Results, and Thresholds**
**For Pressure Indicator: Riparian Disturbance**

Riparian disturbance is rated of high value by the Wild Salmon Policy Habitat Working Group. Riparian disturbance is also rated high throughout the literature for its assessment in salmon habitat health.

## 1. GIS Data

- Fish Habitat Data (BC Environment Culvert Assessment Project)
- Salmon presence and spawning data produced by SkeenaWild 2010-2012
- Digital Road Atlas (DRA)
- NTS railway and existing pipeline
- Forest Tenure Roads (FTEN roads)
- FTEN Cut Blocks
- RESULTS Silviculture Polygons
- Freshwater Atlas Streams (1:20,000)
- Freshwater Atlas Lakes (1:20,000)
- Freshwater Atlas Assessment Watersheds (edited by K. Rabnett Nov 2012)
- Wet'suwet'en House Territory boundaries
- Morice Watershed Management Area

## 2. Methodology

The buffer tool in Manifold GIS was used to create a 30 m buffer[1] around all streams with fish presence (observed and inferred), as well as streams with no inferred fish presence. Disturbance factors buffered include roads[2], pipelines[3], and the CN railway.

| Feature | Corridor width (m) |
|---|---|
| Stream | 60 |
| Road – mainline | 30 |
| Road – operational | 18 |
| Road – in-block | 10 |
| Railway ROW | 30 |
| Pipeline – existing | 75 |
| Pipeline – proposed | 75 |

The riparian corridors were intersected with the various linear development features as well as areal features such as cutblocks. The resultant tables were exported to excel where a pivot table was generated to summarize results.

[1] B.C. Ministry of Forests (MOF). 1995a. Interior watershed assessment procedure guidebook (IWAP0. http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/iwap/iwap-toc.htm

[2] Coombs, T., A. Bernard, and G. Nigh. 2010. Forest access road widths in the Lakes Timber Supply Area. BC Journal of Ecosystems and Management 11 (1&2):84-90. http://jem.forrex.org/index.php/jem/article/view/15/29

[3] The 75 m pipeline buffer is intended to include not only a 25 m right of way but also allows for a 50 m construction zone to accommodate the construction of facilities.

## 3. Thresholds

Final thresholds to be determined. Report results use interm thresholds defined by the Pacific Salmon Foundation where <5% is low, 5% to less than 15% is medium, and 15% or greater is high level of disturbance.

## 4. Results

The results of the riparian disturbance indicator are reported out by analysis units including the Morice Watershed, eighteen subwatersheds and face units within the Morice Watershed, the Morice Watershed Management Area (designated through the Morice LRMP), and the ten Wet'suwet'en house territories within or partly within the Morice Watershed.

### 4.1. Morice Watershed

The Morice watershed contains 11.4% (499.18 $km^2$) of streamside riparian area. Currently 3.2% of the riparian buffers are situated along salmon bearing streams, and 7.3% along resident fish bearing streams. The remaining 89.4% of the riparian buffers are situated along streams with inferred fish presence or streams with no (inferred) fish presence.

**Table 4.1.1 Riparian Buffer ($km^2$) by Fish Presence**

| Salmon Presence - Observed | Fish Presence - Observed | Fish Presence - Inferred | No Fish Habitat-Inferred | Total Riparian |
|---|---|---|---|---|
| 16.04 | 36.63 | 295.32 | 151.18 | 499.18 |

Across the Morice watershed 7.98% of the riparian area has been altered by harvesting or road development. Road development contributes 2.9% to the riparian disturbance, while harvesting contributes 97.1%.

**Table 4.1.2 Existing Development within 30 m Riparian Buffer ($km^2$)**

| Total Riparian | Roads | Harvesting | Pipelines | Total Riparian Altered | % Altered |
|---|---|---|---|---|---|
| 499.18 | 1.17 | 38.65 | N/A | 39.82 | 7.98 |

## 4.2. Morice Watershed Management Area

The Morice Watershed Management Area contains 12.4% (422.14 $km^2$) of streamside riparian areas. Currently 2.1% of the riparian buffers are situated along salmon bearing streams, and 5.7% along resident fish bearing streams. The remaining 92.2% of the riparian buffers are situated along streams with inferred fish presence or streams with no (inferred) fish presence.

**Table 4.2.1 Riparian Buffer ($km^2$) by Fish Presence**

| Salmon Habitat | Fish Presence - Observed | Fish Presence - Inferred | No Fish Habitat (Inferred) | Total Riparian |
|---|---|---|---|---|
| 9.00 | 24.03 | 238.62 | 150.50 | 422.14 |

Across the Morice Watershed Management Area 4.31% of the riparian area has been altered by harvesting and road development. Harvesting contributes 97.3% of the disturbance to riparian areas with road development contributing 2.7%.

**Table 4.2.2 Existing Development within 30 m Riparian Buffer ($km^2$)**

| Total Riparian | Roads | Harvesting | Pipelines | Total Riparian Altered | % Altered |
|---|---|---|---|---|---|
| 422.14 | 0.50 | 17.70 | N/A | 18.20 | 4.31 |

### 4.3. Wet'suwet'en House Territories within Morice Watershed

The ten Wet'suwet'en House Territories within the Morice watershed contain 11.28% (665.73 $km^2$) of streamside riparian area. Currently 2.8% of the riparian buffers are situated along salmon bearing streams, and 8.2% along resident fish bearing streams. The remaining 88.9% of the riparian buffers are situated along streams with inferred fish presence or streams with no (inferred) fish presence.

**Table 4.3.1 Riparian Buffer ($km^2$) by Fish Presence**

| House Territory | Salmon Habitat | Fish Presence - Observed | Fish Presence - Inferred | No Fish Habitat - Inferred | Total Riparian Area | Riparian as % of Total Watershed Area |
|---|---|---|---|---|---|---|
| Talhdzi Wiyez Bin (T01) | 0.00 | 3.90 | 44.09 | 23.16 | 71.15 | 14.38 |
| C'iniggit Nenikekh (G02) | 1.96 | 2.66 | 79.55 | 69.15 | 153.32 | 11.85 |
| Nelgi'l'at (L07) | 0.13 | 6.16 | 32.20 | 19.32 | 57.81 | 14.93 |
| Bikh C'idilyiz Ts'anli (W05) | 0.31 | 2.29 | 10.43 | 5.20 | 18.23 | 12.79 |
| Talbits Kwah (G06) | 6.18 | 10.84 | 50.83 | 19.47 | 87.32 | 12.29 |
| Lhudis Bin (W02) | 3.21 | 8.32 | 60.63 | 24.10 | 96.26 | 9.73 |
| C'idi To Stan (S03) | 1.27 | 6.09 | 31.98 | 15.15 | 54.49 | 10.78 |
| Bi Wini (W04) | 3.00 | 9.51 | 49.60 | 20.55 | 82.66 | 9.36 |
| Ts'in K'oz'ay (W06) | 1.39 | 2.84 | 16.80 | 2.15 | 23.18 | 8.27 |
| Nelgi Cek (L09) | 1.34 | 2.11 | 15.08 | 2.78 | 21.31 | 9.91 |
| **Total** | **18.79** | **54.73** | **391.19** | **201.02** | 665.73 | 11.28 |

Across the ten Wet'suwet'en House Territories situated within the Morice Watershed, 7.67% of the riparian area has been altered by harvesting, roads, the CN railway, and the existing gas pipeline.

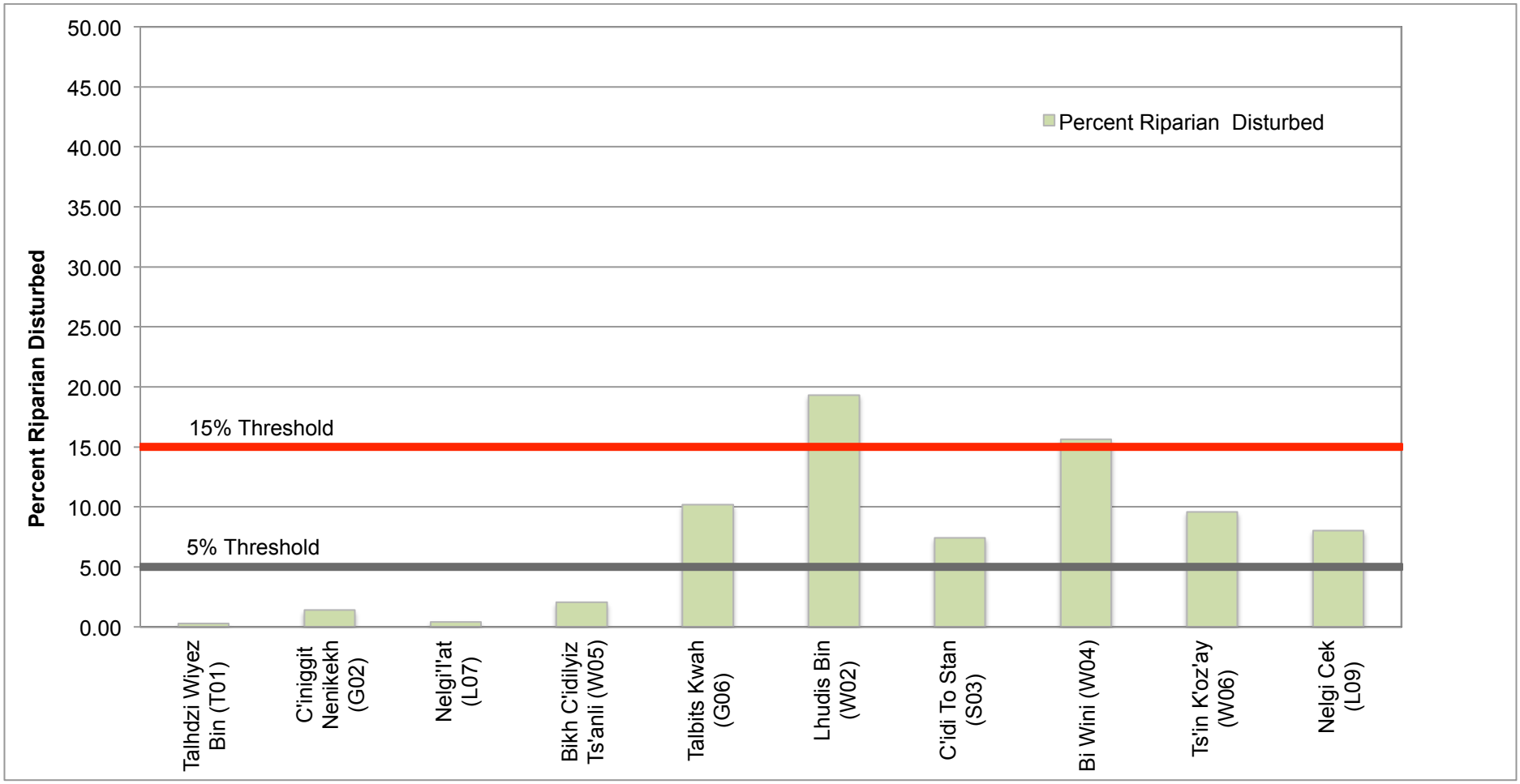
The majority of the disturbance to riparian areas, 95.9%, is due to harvesting. Roads, mainly forestry roads, contribute 3.48% to riparian disturbance, with the existing railway and pipeline contributing less than 1% to riparian disturbance.

The disturbance to riparian areas within the House Territories varies from 0.29 % in Talhdzi Wiyez Bin, to the highest disturbance value of 19.32% in Lhudis Bin House Territory.

**Table 4.3.2 Existing Development within 30 m Riparian Buffer ($km^2$)**

| House Territory | Total Riparian Area | Roads | Railway | Pipelines | Harvesting | Total Riparian Altered | % Altered |
|---|---|---|---|---|---|---|---|
| Talhdzi Wiyez Bin (T01) | 71.15 | 0.01 | | | 0.19 | 0.20 | 0.29 |
| C'iniggit Nenikekh (G02) | 153.32 | 0.10 | | | 2.04 | 2.14 | 1.40 |
| Nelgi'l'at (L07) | 57.81 | 0.04 | | | 0.20 | 0.24 | 0.41 |
| Bikh C'idilyiz Ts'anli (W05) | 18.23 | 0.04 | | | 0.33 | 0.37 | 2.04 |
| Talbits Kwah (G06) | 87.32 | 0.23 | | | 8.65 | 8.89 | 10.18 |
| Lhudis Bin (W02) | 96.26 | 0.43 | | | 18.17 | 18.60 | 19.32 |
| C'idi To Stan (S03) | 54.49 | 0.23 | 0.09 | 0.06 | 3.67 | 4.05 | 7.43 |
| Bi Wini (W04) | 82.66 | 0.35 | | | 12.57 | 12.91 | 15.62 |
| Ts'in K'oz'ay (W06) | 23.18 | 0.14 | 0.01 | | 2.08 | 2.22 | 9.59 |
| Nelgi Cek (L09) | 21.31 | 0.21 | 0.04 | 0.08 | 1.38 | 1.71 | 8.04 |
| **Total** | **665.73** | **1.79** | **0.14** | **0.14** | **49.28** | **51.34** | **7.71** |

**Figure 4.3.1. Percent of Riparian Disturbed by House Territory**



## 4.4. Sub-watersheds

The eighteen sub-watersheds within the Morice watershed contain 11.4% (499.10 $km^2$) of potential riparian areas adjacent to fish bearing streams.

**Table 4.4.1 Riparian Buffer ($km^2$) by Fish Presence**

| Sub-watershed | Salmon Habitat | Fish Presence - Observed | Fish Presence - Inferred | No Fish Presence - Inferred | Total Riparian Area | Riparian as % of Total Watershed Area |
|---|---|---|---|---|---|---|
| Crystal Creek | 0.00 | 1.71 | 2.52 | 2.89 | 7.12 | 11.40 |
| Shea Creek | 0.25 | 2.03 | 23.23 | 2.19 | 27.70 | 14.21 |
| Gosnell Creek | 2.47 | 4.51 | 16.32 | 14.51 | 37.82 | 13.53 |
| **Gosnell Total** | **2.72** | **8.25** | **42.07** | **19.60** | **72.64** | **13.53** |
| | | | | | | |
| Atna River | 1.14 | 0.00 | 18.59 | 12.15 | 31.88 | 11.23 |
| Houston Tommy Creek | 0.27 | 3.44 | 18.64 | 8.50 | 30.85 | 12.43 |
| Lamprey Creek | 0.52 | 3.97 | 16.12 | 0.09 | 20.70 | 8.61 |
| McBride Creek | | 1.46 | 6.04 | 0.00 | 7.50 | 6.52 |
| Nanika River | 1.43 | 5.97 | 65.74 | 44.73 | 117.87 | 13.25 |
| Owen Creek | | 3.49 | 9.30 | 4.36 | 17.15 | 8.08 |
| Thautil River | 1.63 | 5.71 | 42.97 | 12.58 | 62.90 | 14.87 |
| Morice Lake | 0.79 | 0.00 | 23.44 | 34.86 | 59.10 | 9.86 |
| | | | | | 0.00 | |
| MR R1 East | 0.59 | 0.75 | 4.20 | 0.08 | 5.61 | 7.83 |
| MR R1 West | 0.45 | 0.21 | 3.49 | 0.00 | 4.15 | 10.11 |
| MR R2 North | 1.64 | 2.57 | 13.88 | 0.09 | 18.18 | 8.82 |
| MR R2 SE | 1.06 | 0.54 | 2.44 | 4.42 | 8.47 | 8.33 |
| MR R2 SW | 0.68 | 0.33 | 3.65 | 0.50 | 5.15 | 8.36 |
| MR R3 West | 1.02 | 2.57 | 12.18 | 5.20 | 20.97 | 12.65 |
| MR R3 East | 1.16 | 0.00 | 11.58 | 3.22 | 15.96 | 8.77 |
| **Morice Face Units Total** | **6.59** | **6.97** | **51.42** | **13.52** | **78.50** | **9.46** |
| **Total** | **15.10** | **39.26** | **294.34** | **150.40** | **499.10** | **11.40** |

Across the Morice watershed, 7.98% of the riparian area has been altered by harvesting and roads.

The majority of the disturbance to riparian areas, 97.1%, is due to harvesting. Roads, mainly forestry roads, contribute 2.9% of the disturbance of the riparian areas.

The disturbance to riparian areas within the sub-watersheds varies from no disturbance in Atna Rive to the highest amount of disturbance of 42.72% and 42.33%, respectively, in Lamprey Creek and McBride Creek.

**Table 4.4.2 Existing Development within 30 m Riparian Buffer ($km^2$)**

| Sub-watershed | Total Riparian Area | Roads | Pipelines | Harvesting | Total Riparian Altered | % Altered |
|---|---|---|---|---|---|---|
| Crystal Creek | 7.12 | 0.00 | | 0.24 | 0.24 | 3.38 |
| Shea Creek | 27.70 | 0.03 | | 0.56 | 0.59 | 2.12 |
| Gosnell Creek | 37.82 | 0.08 | | 3.66 | 3.74 | 9.90 |
| **Gosnell Total** | **72.64** | **0.12** | | **4.46** | **4.57** | **6.29** |
| | | | | | | |
| Atna River | 31.88 | | | | 0.00 | 0.00 |
| Houston Tommy Creek | 30.85 | 0.06 | | 2.66 | 2.72 | 8.81 |
| Lamprey Creek | 20.70 | 0.19 | | 8.65 | 8.84 | 42.72 |
| McBride Creek | 7.50 | 0.08 | | 3.09 | 3.17 | 42.33 |
| Nanika River | 117.87 | 0.16 | | 5.15 | 5.31 | 4.50 |
| Owen Creek | 17.15 | 0.09 | | 2.21 | 2.30 | 13.42 |
| Thautil River | 62.90 | 0.08 | | 1.58 | 1.65 | 2.63 |
| Morice Lake | 59.10 | 0.01 | | 0.43 | 0.43 | 0.73 |

**Continued..**

**Table 4.4.2 Existing Development within 30 m Riparian Buffer ($km^2$) – Continued**

| Sub-watershed | Total Riparian Area | Roads | Pipelines | Harvesting | Total Riparian Altered | % Altered |
|---|---|---|---|---|---|---|
| MR R1 East | 5.61 | 0.03 | | 1.62 | 1.65 | 29.36 |
| MR R1 West | 4.15 | 0.03 | | 1.23 | 1.26 | 30.29 |
| MR R2 North | 18.18 | 0.09 | | 4.21 | 4.30 | 23.65 |
| MR R2 SE | 8.47 | 0.05 | | 0.96 | 1.00 | 11.87 |
| MR R2 SW | 5.15 | 0.05 | | 0.69 | 0.74 | 14.39 |
| MR R3 West | 20.97 | 0.05 | | 0.61 | 0.66 | 3.17 |
| MR R3 East | 15.96 | 0.09 | | 1.10 | 1.19 | 7.48 |
| **Morice Face Units Total** | 78.50 | 0.38 | | 10.43 | 10.81 | 13.77 |
| | | | | | | |
| **Total** | **499.10** | **1.17** | | **38.65** | **39.81** | **7.98** |

**Figure 4.4.1 Percent Riparian Disturbed by Sub-Watershed**