IN THE MATTER OF :

ENBRIDGE NORTHERN GATEWAY PROJECT

JOINT REVIEW PANEL

NORTHERN GATEWAY PIPELINES INC.

Application for

ENBRIDGE NORTHERN GATEWAY PROJECT

Certificate of Public Convenience and Necessity

Hearing Order: HO-4-2011

"…it's going to gain for somebody, but it's not going to gain for any of us that live here"*

WRITTEN EVIDENCE OF THE INTERVENORS

UNITED FISHERMEN AND ALLIED WORKERS'UNION-CAW

(UFAWU-CAW)

January 2012

Submission: UFAWU-CAW 2.4 Fish and Fisheries: Pipeline Spill

Pages 175-185

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PIPELINE SPILL: IMPACTS ON FRESH WATER LIFE STAGES OF SALMONIDS

745 Previous sections of the Union's submission have reported on Conservation Units (CUs) under the Wild Salmon Policy. The Conservation Units are the groupings of salmon that DFO has determined cannot be lost to future generations. DFO will conserve Conservation Units and, as we have shown, is managing at a much finer scale.

746 The location of CUs are taken from where the fish spawn, not from where they rear or hold prior to spawning.

747 The proposed pipeline pathway would run through a number of CUs and many important spawning areas. It would run through important rearing and holding habitat as well. A spill would have the great likelihood of impacting many different species and stocks.

748 The Wild Salmon Policy describes CUs as the following:

> A CU is a group of wild salmon sufficiently isolated from other groups that, if extirpated is very unlikely to recolonize naturally within an acceptable timeframe, such as a human lifetime or a specified number of salmon generations. There are important implications to this definition of a Conservation Unit. The persistence of salmon within the CU, and its associated production, demand responsible management of its population structure and habitats, as well as the ability of fish to move among habitat areas (connectivity). The loss of a CU for the length of a human lifetime would clearly have serious consequences for the people and other ecosystem components that benefit from or depend on it.[437](WSP)

749 We have mapped the pipeline route through the Skeena watershed, from Burns Lake to Kitimat. We have labeled the major salmon systems on the pipeline route to show what species a pipeline spill would impact. We have also given a general description of which life stage would be impacted.

750 The salmon systems impacted are taken from the pipeline route as presented by Enbridge Northern Gateway Project Response to Request for Additional Information from the JRP Session Results and Decision dated January 12, 2011.

751 There are three life stages when salmonids are in fresh water: Adults returning to spawn, eggs, and juvenile salmon. Evidence presented in earlier sections of the Union's report described in some detail the various life stories of the different species of juvenile salmon in fresh water. We also described food, feeding habits and habitat needs. The following is our evidence regarding the presence of salmonids in the lakes, marshes and ponds, creeks, streams and rivers that are habitat critical to salmon.

752 The following tables are the Conservation Units that the proposed pipeline route would pass through. The streams listed are those that make up the CU. The highlighted streams are those that the proposed pipeline route would cross. The tables are by species.

SPAWNING SITES impacted by a pipeline spill (Adults and Eggs)

PINK STOCKS - CUS AT RISK

Spawning populations - Even-year Pink Salmon. The highlighted are spawning sites at risk from a spill.

CU index	CU name	Sites in CU
6	Hecate Strait-Fjords	Aaltanhash River; Airport Side Channel; Allard Creek; Amback Creek; Anderson Creek; Angler Cove Creek; Arnoup Creek; Ashlulm Creek; Asseek River; Atnarko River; Atnarko Spawning Channel; Bella Coola River; Big Bay Creek; Big Creek; Big Tillhorn Creek; Bish Creek; Bolin Bay Creek; Brim River; Buie Creek; Camp Creek; Canoona River; Carter River; Cascade River; Cecil Creek; Chist Creek; Chuckwalla River; Clayton Falls Creek; Clyak River; Crab River; Dala River; Dallery Creek; Dally Creek; Dean River; Deep Bay Creek; Draney Creek; Duthie Creek; Eagle Bay Creek; East Arm Creek; Elcho Creek; Emsley Creek; Evelyn Creek; Falls River; Fifer Cove Creek; Fish Creek; Fishtrap Bay Creek; Foch River; Frenchman Creek; Garbage Dump Creek; Genesee Creek; George Hall Creek; Gilttoyees Creek; Goat River; Green River; Gribbell Island Creek; Hawksbury Island Creek; Head Creek; Hirsch Creek; Hotspring Creek; Hugh Creek; Humphrys Creek; James Bay Creek; Jenny Bay Creeks; Kainet Creek; Kamin Creek; Kemano River; Khutze River; Kihess Creek; Kilbella River; Kildala River; Kiltuish River; Kimsquit River; Kitimat River; Kitkiata Creek; Kitlope River; Klekane River; Korich Creek; Kowesas River; Kwatna River; Lard Creek; Lee Creek; Little Tillhorn Creek; Little Wedeene River; Lockhart Gordon Creek; Marmot Cove Creek; Marshall Creek; Martin River; McKay Creek; Milton River; Minette Bay Creek; Mussel River; Nalbeelah Creek; Nascall Creek; Necleetsconnay River; Neechanz River; Nekite River; Nekite Spawning Channel; Nias Creek; Nicknaqueet River; Niel Creek; Nieumiamus Creek; Noeick River; Noohalk Creek; Nooseseck River; Nusash Creek; Otty Creek; Paril River; Pike Creek; Pine River; Poison Cove Creek; Quaal River; Quartcha Creek; Quatlena River; Riordan Creek; Ronald Creek; Roscoe Creek; Salloomt River; Sandell River; Scow Bay Creek; Sheemahant River; Skowquiltz River; Snootli Creek; Soda Creek; Steelhead Creek; Taleomey River; Tastsquan Creek; Taylor Creek; Thorsen Creek; Thorwald Creek; Tsaytis River; Tzeo River; Verney Passage Creek; Wahoo Creek; Walkum Creek; Wannock River; Washwash River; Wathl Creek; Wathlsto Creek; Wedeene River; Weewanie Creek; West Arm Creek; Whalen Creek; Windy Bay Creek; Woran Creek; Young River
7	Nass-Skeena Estuary	Alpha Creek; American Bay Creek; Andesite Creek; Ansedagan Creek; Bear River; Belle Bay Creek; Big Falls Creek; Billy Creek; Boat Harbour Creek; Brundige Creek; Brundige Creek-west; Cedar Creek; Cedar River; Chambers Creek; Chimdemash Creek; Chismore Creek; Clay Creek; Clear Creek; Clearwater Creek; Coldwater Creek; Crag Creek; Crow Lagoon Creek; Deep Creek; Denise Creek; Diana Lake Creek; Diskangieq Creek; Dog Tag Creek; Dogfish Bay Creek; Donahue Creek; Ecstall River; Ensheshese River; Erlandsen Creek; Exchamsiks River; Exstew River; Exstew Slough; Fiddler Creek; Flewin Creek; Foote Creek; Fortune Creek; Furlong Creek; Georgie River; Gingit Creek; Ginlulak Creek; Gitnadoix River; Gitzyon Creek; Hatchery Creek; Hays Creek; Hayward Creek; Head Creek; Herman Creek; Humpback Creek; Hunt Inlet Creek; Illiance River; Johnston Creek; Kadeen Creek; Kasiks River; Khutzeymateen River; Khyex River; Kitkatla Creek; Kitsault River; Kitsumkalum River-lower; Kitsumkalum

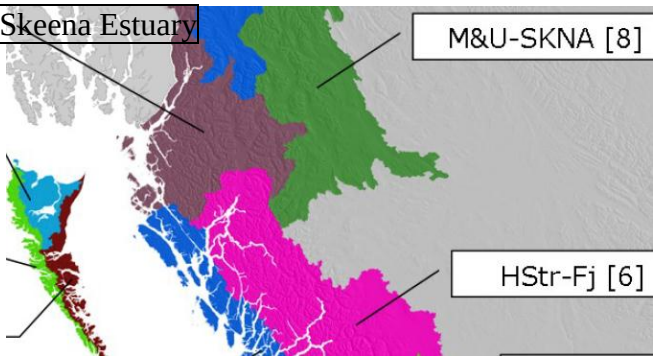
		River-upper; Kleanza Creek; Kloiya River; Ksemamaith Creek; Ksga'maal; Ksgyukwsa'a; Kshwan River; Ksi Gingolx; Ksi Hlginx; Ksi Mat'in; Ksi Sgasginist; Ksi Sii Aks; Ksi Ts'oohl Ts'ap; Ksi X'anmas; Kubas Creek; Kwinitsa Creek; La Hou Creek; Lachmach River; Lakelse River; Larch Creek; Lean-to Creek; Leverson Creek; Little Useless Creek; Lizard Creek; Lockerby Creek; Lowrie Creek; Madeline Creek; Magar Creek; Manzanita Cove Creek; McNeil River; McNichol Creek; Middle Creek; Molybdenum Creek; Moore Cove Creek; Mouse Creek; Nasoga Gulf Creek; Nass River; North Granite Creek; North Kumealon Creek; Oldfield Creek; Olh Creek; Oona River; Pearse Canal Creek; Perry Bay Creek; Phoenix Creek; Pirate Cove Creek; Porcher Creek; Roberson Creek; Salmon Cove Creek; Sam Bay Creek; Sandy Bay Creek; Schulbuckhand Creek; Scotia River; Shames River; Shames Slough; Shawatlan River; Silver Creek; Singlehurst Creek; Skeena River-west; Snass Creek; Sparkling Creek; Spiller River; Spring Creek; Stagoo Creek; Star Creek; Stumaun Creek; Thornhill Creek; Toon River; Tracy Bay Creek; Tracy Bay Creek #2; Trail Bay Creek; Turk Creek; Useless Creek; Vetter Creek & Slough; Wegiladap Creek; Welda Creek; West Creek; White Creek; Whitly Point Creek; Wilauks Creek; Williams Creek; Wilson Creek; Wilyayaanooth Creek; Wolf Creek; Xnukw; Zymagotitz River; Zymoetz River-lower
8	Middle-Upper Skeena	Babine River-section 4; Babine River-section 5; Babine River-sections 1 To 3; Bear River; Boucher Creek; Buck Creek; Bulkley River-lower; Bulkley River-upper; Burdick Creek; Causqua Creek; Chicago Creek; Clifford Creek; Comeau Creek; Cullon Creek; Date Creek; Fulton River; Glen Vowell Creek; Gosnell Creek; Harold Price Creek; Hazelton Creek; Hevenor Creek; Ironside Creek; Kathlyn Creek; Kispiox River; Kitseguecla River; Kitwanga River; McCully Creek; Moonlit Creek; Morice River; Morrison Creek; Nangeese River; Nanika River, Nichyeskwa Creek; Nine Mile Creek; Owen Creek; Pinkut Creek; Price Creek; Shandilla Creek; Shegunia River; Skunsnat Creek; Station Creek; Suskwa River; Sweetin River; Toboggan Creek; Trout Creek; Tsezakwa Creek

DFO CU

sites[438]

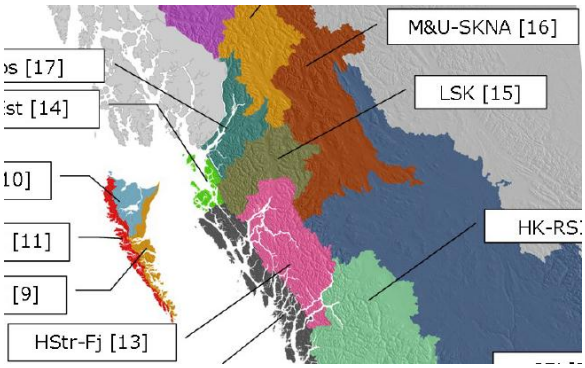
Even year pink CU

7] Nass Skeena Estuary



(DFO CU sum list)[439]

Odd year pink CU



Spawning populations - Odd-year Pink Salmon. The highlighted are spawning sites at risk from a spill.

CU index	CU name	Sites in CU
13	Hecate Strait-Fjords	Aaltanhash River; Anderson Creek; Angler Cove Creek; Arnoup Creek; Big Bay Creek; Big Creek; Big Tillhorn Creek; BishCreek; Bolin Bay Creek; Brim River; Canoona River; Carter River; Cascade River; Cecil Creek; Chist Creek; Crab River; Dala River; Dally Creek; Deep Bay Creek; Duthie Creek; Eagle Bay Creek; East Arm Creek; Elcho Creek; Emsley Creek; Evelyn Creek; Fifer Cove Creek; Fishtrap Bay Creek; Foch River; Frenchman Creek; Gilttoyees Creek; Goat River; Grantham Creek; Green River; Gribbell Island Creek; Hawksbury Island Creek; Head Creek; Hirsch Creek; Home Bay Creeks; Hotspring Creek; Hugh Creek; Humphrys Creek; James Bay Creek; Jenny Bay Creeks; Kainet Creek; Kemano River; Khutze River; Kihess Creek; Kildala River; Kiltuish River; Kimsquit River; Kitimat River; Kitkiata Creek; Kitlope River; Klekane River; Korich Creek; Kowesas River; Kwatna River; Lard Creek; Lee Creek; Little Tillhorn Creek; Little Wedeene River; Marmot Cove Creek; Marshall Creek; Martin River; McKay Creek; Minette Bay Creek; Mussel River; Nalbeelah Creek; Nascall Creek; Nias Creek; Paril River; Pike Creek; Pine River; Poison Cove Creek; Quaal River; Quartcha Creek; Quatlena River; Rainbow Creek; Riordan Creek; Ronald Creek; Roscoe Creek; Scow Bay Creek; Skowquiltz River; Soda Creek; Steelhead Creek; Taylor Creek; Tsaytis River; Verney Passage Creek; Wahoo Creek; Wathl Creek; Wedeene River; Weewanie Creek; West Arm Creek; Whalen Creek; Windy Bay Creek; Woran Creek
15	Lower Skeena| River	Andesite Creek; Big Falls Creek; Cedar River; Chimdemash Creek; Clay Creek; Clearwater Creek; Coldwater Creek; Deep Creek; Dog Tag Creek; Ecstall River; Erlandsen Creek; Exchamsiks River; Exstew River; Exstew Slough; Fiddler Creek; Furlong Creek; Gitnadoix River; Hayward Creek; Herman Creek; Johnston Creek; Johnston Lake; Kadeen Creek; Kasiks River; Khyex River; Kitsumkalum River-lower; Kleanza Creek; Kwinitsa Creek; Lakelse River; Lockerby Creek; Lorne Creek; Lowrie Creek; Madeline Creek; Magar Creek; McNeil River; Middle Creek; Molybdenum Creek; Muddy Creek; North Granite Creek; Schulbuckhand Creek; Scotia River; Shames River; Shames Slough; Shannon Creek; Singlehurst Creek; Skeena River-west; Sockeye Creek; Sparkling Creek; Spring Creek; Star Creek; Thornhill Creek; White Creek; Wilson Creek; Zymagotitz River; Zymoetz River-lower
16	Middle & Upper Skeena River	Babine River-section 4; Babine River-section 5; Babine River-sections 1 To 3; Bear River; Boucher Creek; Buck Creek; Bulkley River-lower; Bulkley River-upper; Burdick Creek; Causqua Creek; Chicago Creek; Clifford Creek; Comeau Creek; Cullon Creek; Date Creek; Fulton River; Fulton Spawning Channel-below Weir; Glen Vowell Creek; Gosnell Creek; Hazelton Creek; Hevenor Creek; Ironside Creek; Kathlyn Creek; Kispiox River; Kitseguecla River; Kitwanga River; McCully Creek; Moonlit Creek; Morice River; Morrison Creek; Murder Creek; Nangeese River; Nichyeskwa Creek; Nine Mile Creek; Pierre Creek; Pinkut Creek; Price Creek; Shandilla Creek; Shegunia River; Skunsnat Creek; Slamgeesh River; Station Creek; Suskwa River; Sweetin River; Tachek Creek; Thautil River; Toboggan Creek; Trout Creek; Tsezakwa Creek

(DFO CU sites)[440]

SPAWNING SITES impacted by a pipeline spill (Adults and Eggs)

CHUM STOCKS/ CUS AT RISK

CU index CU name Sites in CU

20	Douglas-Gardner	Aaltanhash River; Anderson Creek; Angler Cove Creek; Aveling Creek; Big Tillhorn Creek; Bish Creek; Brim River; Canoona River; Cecil Creek; Chist Creek; Crab River; Dala River; Duck Creek; Eagle Bay Creek; Emsley Creek; Evelyn Creek; Falls River; Fishtrap Bay Creek; Foch River; Gilttoyees Creek; Goat River; Goose Creek; Gribbell Island Creek; Hawksbury Island Creek; Head Creek; Hirsch Creek; Hotspring Creek; Hugh Creek; Humphrys Creek; Hunter Creek; Kemano River; Khutze River; Kihess Creek; Kildala River; Kiltuish River; Kitimat River; Kitkiata Creek; Kitlope River; Klekane River; Kowesas River; Little Tillhorn Creek; Little Wedeene River; Lone Wolf Creek; Marmot Cove Creek; Marshall Creek; McKay Creek; Nalbeelah Creek; Paril River; Pike Creek; Quaal River; Raley Creek; Riordan Creek; Scow Bay Creek; Tetlock Creek; Tsaytis River; Verney Passage Creek; Wahoo Creek; Wathl Creek; Wedeene River; Weewanie Creek; Whalen Creek
27	Lower Skeena	Andesite Creek; Big Falls Creek; Clay Creek; Deep Creek; Dog Tag Creek; Ecstall River; Erlandsen Creek; Exchamsiks River; Exstew River; Exstew Slough; Fiddler Creek; Gitnadoix River; Herman Creek; Johnston Creek; Johnston Lake; Kadeen Creek; Kasiks River; Khyex River; Kitsumkalum River-lower; Kitsumkalum River-upper; Kleanza Creek; Lakelse River; Lockerby Creek; Madeline Creek; Magar Creek; Middle Creek; Shames River; Shames Slough; Skeena River-west; Sparkling Creek; Whitebottom Creek; Zymagotitz River; Zymoetz River-lower

(DFO CU sites)[441]

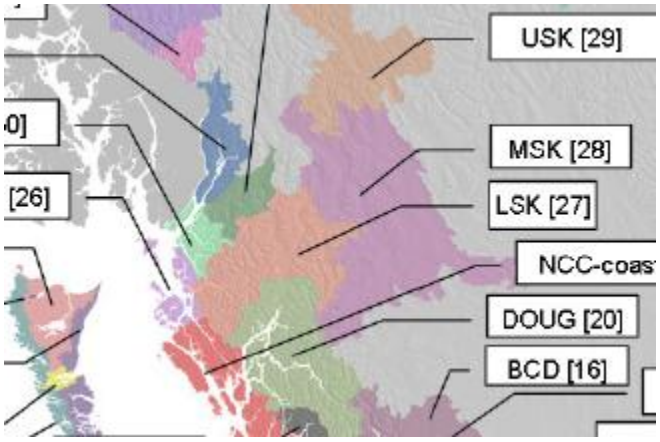
The two chum salmon Conservation Units that the pipeline passes through are :

Douglas Channel- Gardner Canal (20)

LSK – Lower Skeena (27)

The river systems within the CUs that the pipeline passes through or by are the highlighted creeks and rivers above. Chum adults and eggs are at risk in these systems.

(DFO CU sum list)[442]



SPAWNING SITES impacted by a pipeline spill (Adults and Eggs)

SOCKEYE STOCKS/ CUS AT RISK

Lake type Sockeye Salmon: The highlighted are spawning sites for lake type sockeye at risk of a spill (DFO CU sites)[443]

CU Index	Lake or Lake-timing*	Sites in CU
187	Atna	Atna River-Upper
189	Bulkley	Maxan Creek
192	Maxan	Maxan Creek-Upper
193	Morice	Atna River; Morice River; Nanika River

River type Sockeye Salmon: The highlighted are spawning sites for lake type sockeye at risk of a spill (DFO CU sites)[444]

CU Index	CU name	Sites in CU
R18	Skeena River	Bulkley River-Lower; Bulkley River-Upper; Exchamsiks River; Exstew River; Kasiks River; Kispiox River; Kleanza Creek; Nangeese River

Sockeye spawn in rivers and in lakes. The above typology differentiating Lake from River type is where the juveniles rear, not where the eggs are laid. Sockeye can spawn in lakes or rivers and yet be Lake-type sockeye because they spend their juvenile years rearing in lakes.

Spawning areas: Maxan sockeye lay their eggs both in the river and in the lake; these salmon are genetically very different and so they are in different CUs.

Morice Lake and Atna Lake have beach spawning salmon. Tagging studies show that up to 35% of the 'Morice-Nanika sockeye run' spawn in Morice and Atna Lakes. The Nanika River spawners make up the balance (65%) of the spawners.

Sockeye

Sockeye lake type:

The first map depicts the north coast sockeye CUs for lake type sockeye.

The second is an enlarged map of the Skeena Bulkley area.

The small lower map is of the 4 sockeye CUs at immediate risk from an oil spill, although any sockeye feeding and out-migrating down the Skeena will also be at risk.

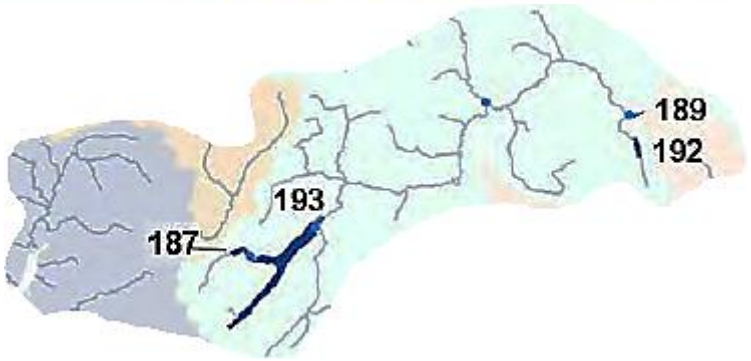
4 Skeena sockeye Lake -type CUs are at risk:

Bulkley (189),

Maxan (192) ,

Morice(193),

Atna (187) (DFO CU sum list)[445]

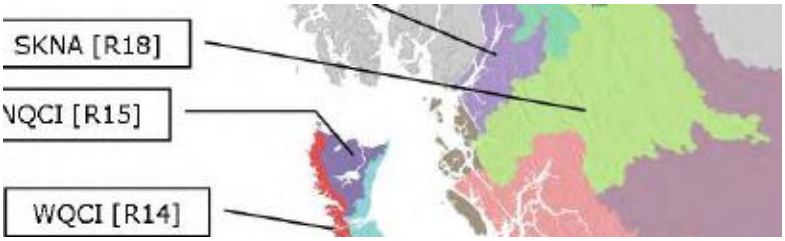


River type sockeye Skeena River Conservation Unit:

2 river-type stocks at risk in 1 CU (SKNA R18)

Bulkley River-Lower

Bulkley River-Upper



(DFO CU sum list)[446]

SPAWNING SITES impacted by a pipeline spill (Adults and Eggs)

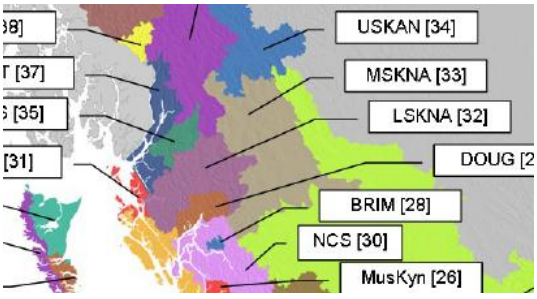
COHO STOCKS/ CUS AT RISK

CU index	CU name	Sites in CU
29	Douglas Channel-Kitimat Arm	Anderson Creek; Aveling Creek; Bish Creek; Cablecar Creek; Cecil Creek; Chist Creek; Cordella Creek; Deception Creek; Duck Creek; Eleven Mile Creek; Emsley Creek; Foch River; Gilttoyees Creek; Goose Creek; Hirsch Creek; Humphrys Creek; Kihess Creek; Kitimat River; Little Wedeene River; Lone Wolf Creek; McKay Creek; McNeil Creek; Minette Bay Creek; Moore Creek; Nalbeelah Creek; Pine Creek; Powerlines Creek; Raley Creek; Trout Creek; Wathl Creek; Wedeene River
32	Lower Skeena	Alastair Lake; Alice Creek; Alwyn Creek; Andalas Creek; Blackwater Creek; Cedar River; Clay Creek; Clear Creek; Clearwater Creek; [Clore River - Gottesfield and Rabnett 2008][447] Cohoe Creek; Coldwater Creek; Cole Creek; Cote Creek; Culp Creek; Deep Creek; Dog Tag Creek; Dry Creek; Ecstall River; Elf Creek; Erlandsen Creek; Exchamsiks River; Exstew River; Fiddler Creek; Furlong Creek; Gitnadoix River; Glacier Creek; Goat Creek; Gossen Creek; Hadenschild Creek; Hatchery Creek; Hayward Creek; Herman Creek; Hotspring Creek; Johnston Creek; Johnston Lake; Kadeen Creek; Kasiks River; Khyex River; Kitsumkalum River-lower; Kitsumkalum River-upper; Kleanza Creek; Kwinitsa Creek; Lakelse River; Lean-to Creek; Lockerby Creek; Lorne Creek; Luncheon Creek; Magar Creek; Mayo Creek; McNeil River; Middle Creek; Molybdenum Creek; North Granite Creek; Pontoon Creek; Salmon Run Creek; Schulbuckhand Creek; Scotia River; Shames River; Shames Slough; Singlehurst Creek; Sockeye Creek; Southend Creek; Sparkling Creek; Spring Creek; Star Creek; Thomas Creek; Thornhill Creek; Westside Creek; White Creek; Williams Creek; Wilson Creek; Zymagotitz River; Zymoetz River-lower; Zymoetz River-upper
33	Middle Skeena	Atna River; Babine Lake; Babine River-section 4; Babine River-section 5; Babine River-sections 1 To 3; Babine River-unaccounted; Beaverlodge Creek; Big Fish Creek; Big Loon Creek; Boucher Creek; Brown Paint Creek; Buck Creek; Bulkley River-lower; Bulkley River-upper; Burdick Creek; Canyon Creek; Chicago Creek; Clifford Creek; Club Creek-lower [between Club Lake And Stephens Lake]; Club Creek-upper; Comeau Creek; Cullon Creek; Date Creek; Driftwood Creek; Falls Creek; Footsore Lake Creek; Footsore Lake Creek-upper; Fulton River; Fulton Spawning Channel-below Weir; Glen Vowell Creek; Gosnell Creek; Harold Price Creek; Hazelton Creek; Hevenor Creek; Hodder Lake Creek; Ironside Creek; Kathlyn Creek; Kispiox River; Kitseguecla River; Kitwanga River; Little Fish Creek; Maxan Creek; McCully Creek; Morice Lake; Morice River; Morrison Creek; Murder Creek; Nangeese River; Nanika River; Nichyeskwa Creek; Nilkitkwa River; Nine Mile Creek; Owen Creek; Pierre Creek; Pinkut Below Weir; Pinkut Creek; Price Creek; Reiseter Creek; Richfield Creek; Shass Creek; Shegunia River; Skunsnat Creek; Station Creek; Steep Canyon Creek; Stephens Creek; Suskwa River; Sweetin River; Tachek Creek; Tahlo Creek-lower; Telkwa River; Thautil River; Toboggan Creek; Trout Creek; Tsezakwa Creek; Twin Lake Creek

(DFO CU sites) [448]

Coho populations spawn in many small streams, making their eggs already susceptible to habitat issues like drought and flooding.

Coho utilize many small systems; there are a large number of spawning areas in a CU.



(DFO CU sum list) [449]

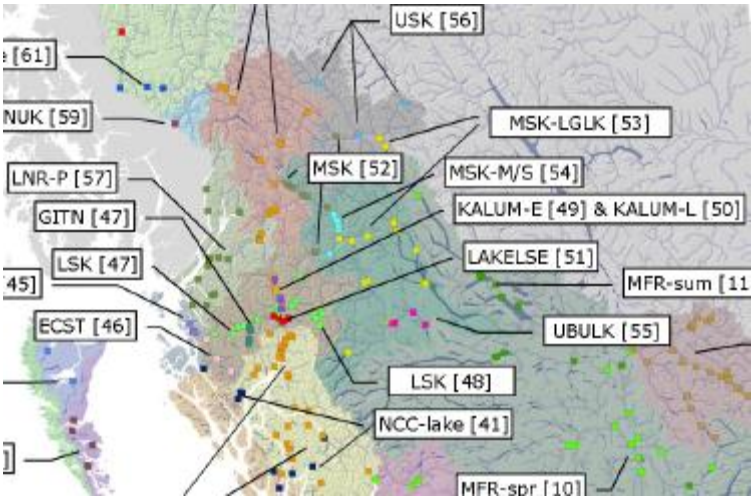
SPAWNING SITES impacted by a pipeline spill (Adults and Eggs)

CHINOOK STOCKS/ CUS AT RISK

CU index CU name Sites in CU

48	Lower Skeena	Alwyn Creek; Erlandsen Creek; Exchamsiks River; Exstew River; Fiddler Creek; Kasiks River; Khyex River; Kleanza Creek; Limonite Creek; Salmon Run Creek; Skeena River-west; Thomas Creek; Trapline Creek; Zymagotitz River; Zymoetz River-lower; Zymoetz River-upper [Clore River - Gottesfield and Rabnett 2008][450]
53	Middle Skeena-large lakes	Babine River-section 4; Babine River-section 5; Babine River-sections 1 To 3; Bear Lake; Bear River; Boucher Creek; Bulkley River-lower; Canyon Creek; Fulton River; Harold Price Creek; Morice River; Morrison Creek; Nangeese River; Nanika River; Nichyeskwa Creek; Simpson Creek; Tachek Creek
55	Upper Bulkley River	Buck Creek; Bulkley River-upper; Maxan Creek; Richfield Creek [Foxy Creek – Gottesfield and Rabnett 2008][451]

(DFO CU sites)[452]



(DFO CU sum list)[453]

Chinook spawners have great fidelity to the spawning site where they were hatched. They do not stray from one spawning area to another. Therefore, there are many CUs for a relatively small number of fish.

Chinook tend to spawn in larger rivers than other salmonids, although they can be found in small headwater tributaries at the ends of the Nass and Skeena watersheds. Their eggs must have lots of available oxygen, which requires good spawnig bed water flow because the eggs are so large.

STEELHEAD STOCKS / CUs AT RISK

Spawning sites impacted by a pipeline spill as shown by Enbridge volume

Buck Creek, Clore River, Gosnell Creek, Owen Creek, Lamprey Creek, Morice River, Shea Creek, Thautil River ,Upper Bulkley River (Gottesfield and Rabnett 2008)[454]

IMPACTS OF OIL ON JUVENILE SALMON

753 Oil can impact eggs:

"Eggs can take up residual PAHs from the substrates, even if the oil is weathered'

"Exposure of eggs and embryos to environmental PAH concentrations … can cause damage …observed as impairments to growth, genomic damage and lower survivability…

UFAWU-CAW Submission 2.2 Kennedy: Fate and Effects of Crude Oil page 38

For effects on pink salmon eggs see: UFAWU-CAW Submission 2.2 Kennedy: Fate and Effects of Crude Oil page 24

For effects on trout eggs and larvae see: UFAWU-CAW Submission 2.2 Kennedy: Fate and Effects of Crude Oil pages 35-36

754 Oil can impact juveniles:

"Exposure to naphthalene for up to 5 days altered the levels of monoaminergic neurotransmitters…and metabolites in the brain of immature rainbow trout"

UFAWU-CAW Submission 2.2 Kennedy: Fate and Effects of Crude Oil page 36

755 Oil can impact juveniles though their food:

"…juvenile Chinook were fed a diet …that was intended to mimic the types and concentrations that the fish would encounter in the natural aquatic environment…the food was intended to mimic contaminated prey items that the fish would consume…Overall this study demonstrated the detrimental effects of PAH on growth and metabolism, which the authors termed "toxicant-induced starvation" since the effects were similar as to what would be observed in starved fish."

UFAWU-CAW Submission 2.2 Kennedy: Fate and Effects of Crude Oil pages 35-36

"…similar findings of increased mortality following disease challenge…in the lab following the feeding of juvenile trout with food contaminated with predominantly HPAHs"

UFAWU-CAW Submission 2.2 Kennedy: Fate and Effects of Crude Oil page 35

756 Oil can impact juveniles through contaminated sediments:

"…juvenile coho salmon, caged in situ in an area with sediment PAH contamination, has higher chromosomal damage in both peripheral blood and liver measured using several different assay methods. The level of damage correlated with the sediment PAH concentration…"

Juvenile Pink and Chum salmon: Rearing habitat impacted by a pipeline spill

757 Pink and chum share similar fresh water life histories and habitat.

758 Pink and chum adults return to spawn and will normally spawn right away and not hold for very long in their spawning area.

759 Juvenile pink and chum hatch and immediately upon coming up through the gravel swim downstream to the estuary where they spend their time growing.

760 They would be impacted when in the gravel as eggs and as alvins before they emerge from the gravel.

761 They are very small when out-migrating and would be susceptible to oil in their natal creeks and then in the shorelines of the larger rivers until they make it to the ocean.

Juvenile Sockeye salmon: Rearing habitat impacted by a pipeline spill

762 Sockeye salmon adults will sometimes hold in the river or lake for weeks or months before spawning. The eggs inside the maternal fish would be effected by oil if the spill occurred when the fish were holding or ripening. Please refer to Dr. Kennedy's paper

763 Lake-type juvenile sockeye hatch and within a day begin to move upstream or downstream to their nursery lake. They are at risk in their natal stream and then in their nursery lake where they will spend up to three years growing. When the juvenile sockeye are young, they will spend much time in the littoral zone of the lake – near the shoreline in shallow water. They will move further out into the lake during the winter or to follow fresh water plankton which makes up their food source.

764 Not only will the sockeye be at risk directly from the spill, they will be at risk from toxic plankton.

765 When they migrate out to sea, they will be at risk from any oil spill that they may encounter.

Juvenile Coho, Chinook and Steelhead: Rearing habitat impacted by a pipeline spill

766 Chinook and steelhead adults will hold for some time before they spawn. Steelhead adults will hold the longest in fresh water, their eggs ripening and developing before they are ready to spawn. Summer steelhead enter the Skeena in July, August and September and don't spawn until April or May of the following year. Chinook will hold on the spawning grounds, guarding their redds for weeks. Coho are more likely to spawn shortly after reaching their spawning beds.

767 All three species will hatch and live in fresh water for at least a year. Coho juveniles can be found in lakes, ponds and small rivers, steelhead and chinook in larger river systems. All three will live in shallower water, making them very vulnerable during their fresh water phases.

Endnotes:

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