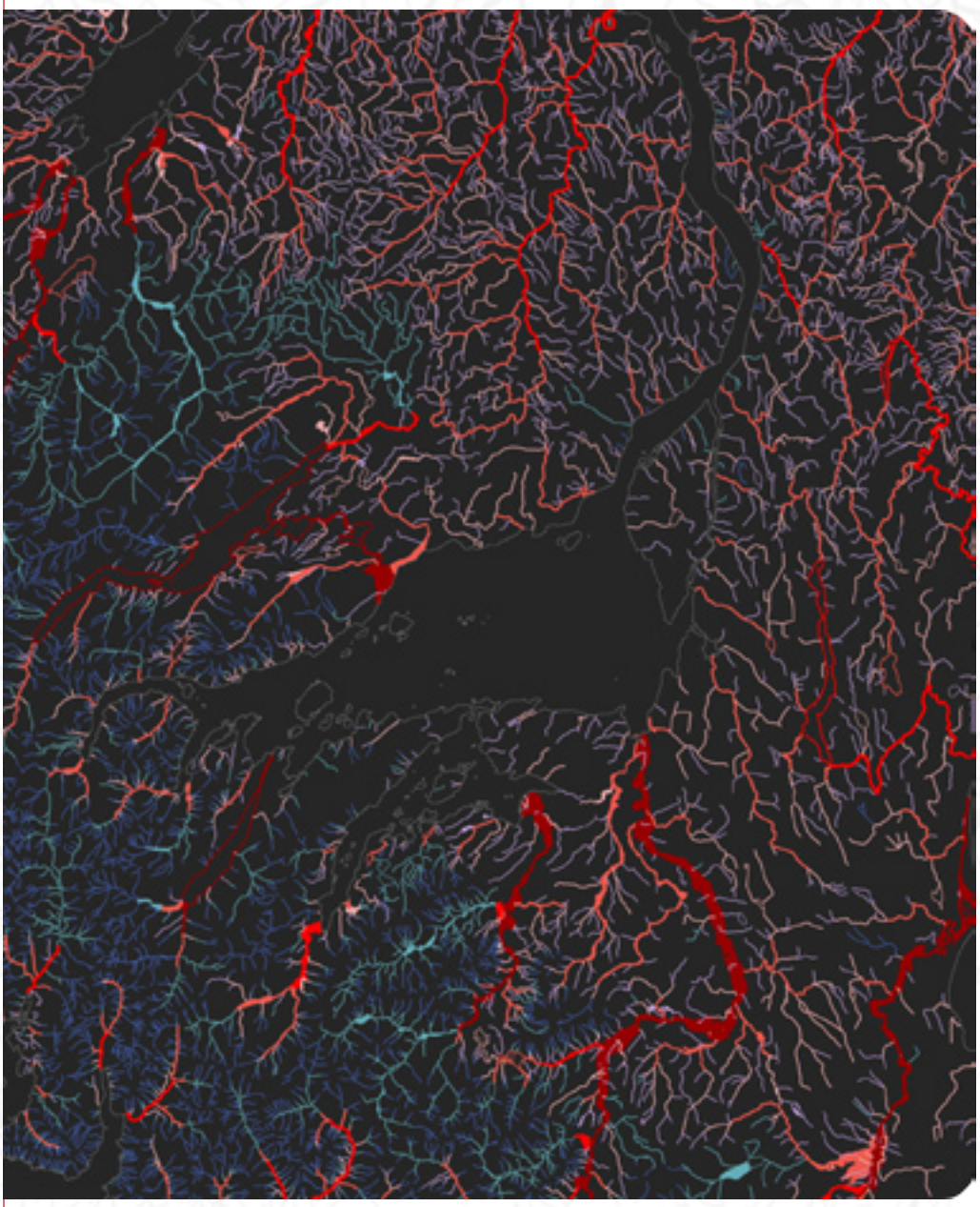
The Riparian Fish Forest



There are 1,068 different salmon populations on Haida Gwaii – 11 percent of the total variation in Pacific salmon stocks in Canada, from just 1/100th of their range.

A Portrait of Salmon and Other Freshwater Fish Habitat on Haida Gwaii

Around the perimeter of the north Pacific Ocean, the web of life connecting land and sea together has created one of the most productive ecosystems on the planet.

For example, up to 70 percent of the nitrogen in the cells of riparian plants, trees, insects, birds and bears comes from the ocean via the life history of the salmon.[1]

For the people who live on Haida Gwaii, the well-being of salmon and the forests they inhabit is a crucial issue. Their importance to the health of people, cultures and economies, including the forest industry, cannot be overstated.

The Riparian Fish Forest model is a map of the forests that grow along the banks of streams and lakes. It enables us to understand their pattern and distribution, measure the extent to which logging has disturbed them, identify watersheds at risk and priorities for protection and restoration.

- Most salmon
- Many salmon
- Some salmon
- Few salmon
- Occasional salmon
- Resident fish & trout only
- No fish

During the recent *Land Use Plan* process on Haida Gwaii (also known as the Queen Charlotte Islands), most people said that the well-being of salmon and the riparian forest ecosystems they inhabit are one of the most important issues to address – a key indicator of environmental condition and a major contributing factor to the health and stability of the island communities that depend on them for economic and cultural well-being.

The *Community Planning Forum* voiced concerns about the accumulating impacts of logging over the past 60 years, and wanted to identify the problem areas, the salmon streams at risk, and so inform the application of watershed-specific management objectives to protect and restore them.

But there was no island-wide map of where fish actually do and don't live, no map of the riparian forests around them or the places where logging has disturbed them. Much of the information needed to make such a map existed – but it was scattered in different places, made by different agencies for different reasons, in different scales and formats.

The solution proposed by the Gowgaia Institute was a three-year project to collect, merge and map as much of the information as possible into a single geographic framework, to create a landscape-scale model of the distribution of salmon and other freshwater fish and the riparian forests and floodplains surrounding the streams and lakes of the archipelago.

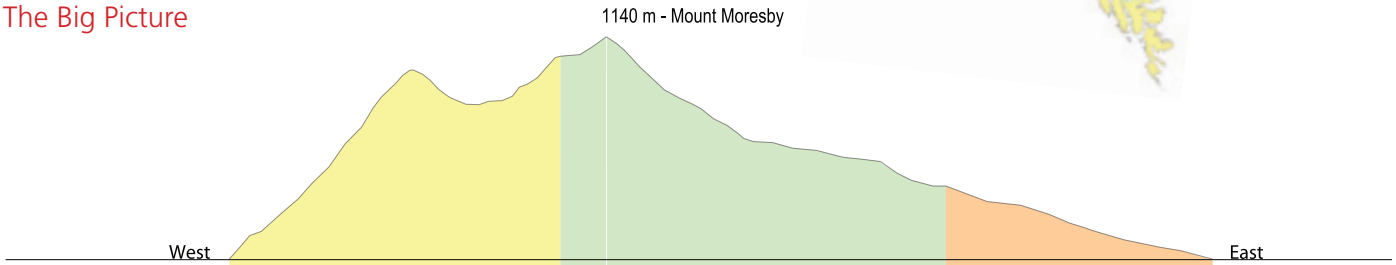
We used a computer geographic information system (GIS) to combine data sets in scales ranging from 1:5,000 to 1:50,000, merging them with a 1:20,000 scale network model consisting of 60,000 discreet line segments representing streams, lakes and watersheds. More than 2,000 survey records identifying eight species of fish collected in traps at wide-ranging locations on the islands were tied to point locations in the network model; as were over 450 known waterfalls and 16,000 computer-modelled gradient barriers to upstream fish passage. Spawning escapement data collected over the past 50 years for five species of salmon in about 300 streams were linked to the model through stream ID codes.

Once the data were cleaned and assembled, we used GIS queries to model the known and inferred presence and absence of eight species of fish. Streams and lakes were then colour-coded to indicate places either accessible to anadromous salmon and other fish, or places upstream of waterfalls and so inhabited only by resident trout, char and stickleback, or places too high or steep to be inhabited by any fish. Local experts with extensive field experience reviewed the accuracy of the map and errors were corrected.

The number of fish species present was combined with data about stream order, watershed size and salmon abundance to create a *fishy-ness* rankings table, with seven classes ranging from "no fish" to "most salmon" (see front page). Depending on its *fishy-ness*, each line segment was buffered from 20 to 80 metres to portray the general extent of riparian features associated with it. Finally, major floodplain features identified on Terrestrial Ecosystem Maps were added.

Analysis of how the Riparian Fish Forest is distributed across the islands' major geophysical units (ecosections) shows that the central Skidegate Plateau section contains the biggest salmon systems with the richest riparian features. Habitat conditions for fish are typically less optimal in the steep and rugged west coast mountains and in the eastern muskeg plains, where riparian features are generally less expansive or productive.

The Big Picture



	Windward	Plateau	Lowlands
area (hectares)	340,000	400,000	260,000
precipitation (mm)	3,900	2,500	1,600
slope	steep	rolling	flat
stream size	small	→	large
stream velocity	high	moderate	low
H_2O stain	light	moderate	heavy
pH	5 - 7.9	6 - 8.9	4 - 7.9
dissolved O_2	lots	moderate	little
major salmon runs	8	16	1
area of RFF (hectares)	48,200	56,700	38,000
percent RFF	14	14	16

Distribution by Ecosection (hectares)

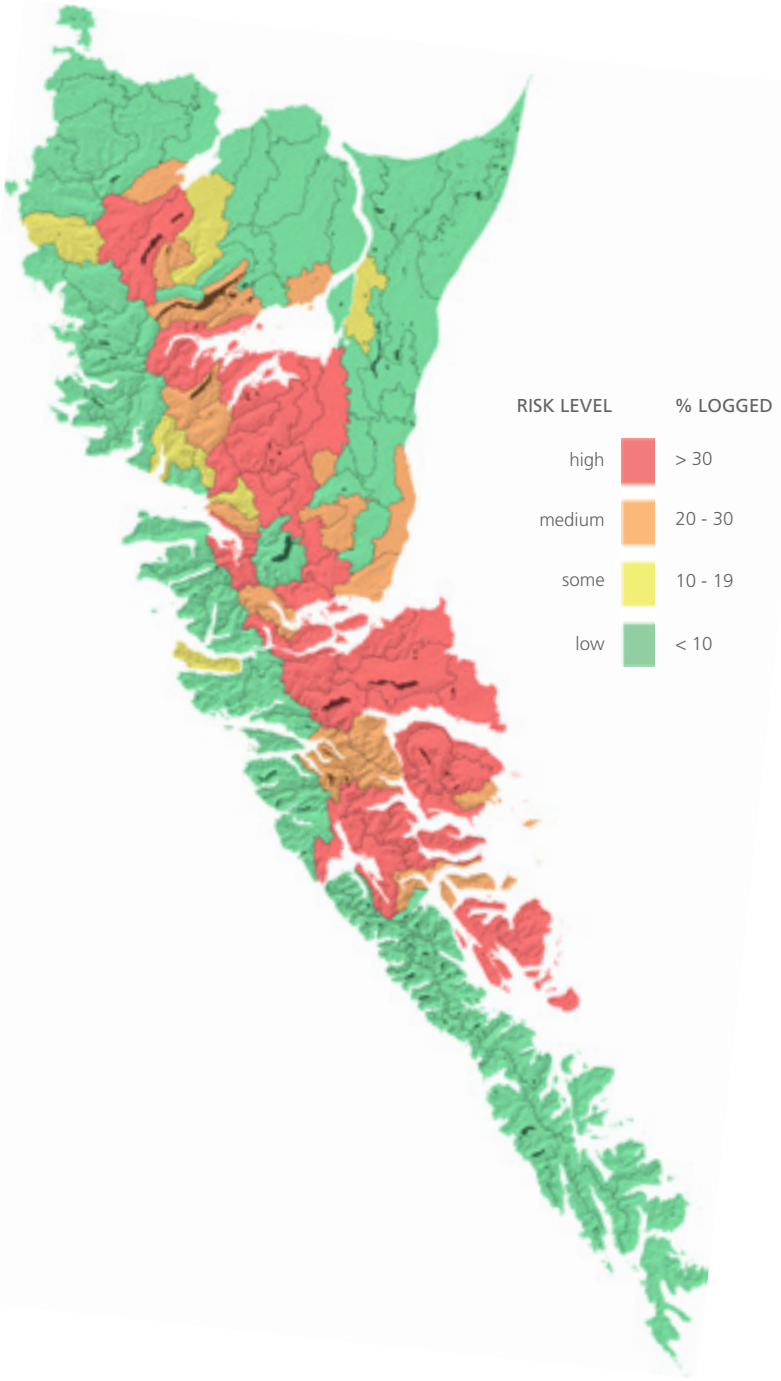
ECOSECTION	Most salmon	Many salmon	Some salmon	Few salmon	Occasional salmon	Resident only	No fish	Floodplain Ecosystems	Total
Windward Haida Gwaii	300	1,900	7,000	3,800	5,300	7,600	20,700	1,600	48,200
Skidegate Plateau	4,500	900	7,300	5,300	7,600	10,200	14,100	6,800	56,700
Queen Charlotte Lowlands	1,000	3,700	8,800	9,000	12,300	1,000	300	1,900	38,000
Total	5,800	6,500	23,100	18,100	25,200	18,800	35,100	10,300	142,900

Watershed Condition

The final stage of the project was to compare the Riparian Fish Forest map with a map of the islands' logging history to measure the spatial extent of disturbance and the level of risk to watershed integrity. The full results of this analysis are reported on the provincial government land use plan web site[2], and are briefly summarized here.

As logging progresses through valley bottoms and up hillsides, it changes the condition of watersheds and their ability to moderate the flow of clean water for salmon and other freshwater fish. When 30 percent or more of the Riparian Fish Forest in a watershed has been logged, there is a high risk that damage has occurred.

Overall, the impacts of logging have been greatest in the Skidegate Plateau where the larger salmon systems coincide with high timber values, and the terrain is more easily accessed by heavy equipment. Of the 25 best salmon streams, 44 percent are at high risk due to disturbance by logging. Since salmon escapement records began to be kept in the 1950s, returns of sockeye, chinook and coho have declined by half, chum salmon by 75 percent.



1 - Reimchen, T.E. 2004. Marine and Terrestrial Ecosystem Linkages: The Major Role of Salmon and Bears in Riparian Communities, *in* Botanical Electronic News, ISSN 1188-603X

2 - http://ilmbwww.gov.bc.ca/lup/lrmp/coast/qci/hgqci_env.htm

This document is a companion piece to a large format poster map of the Riparian Fish Forest, available from the Gowgaia Institute. A project technical report is also available by request.

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