



ENVIRONNEMENT
ILLIMITÉ INC.



Mitigation measures for Lake Sturgeon associated to new hydroelectric generating stations in the James Bay territory (Québec, Canada)

Frédéric Burton

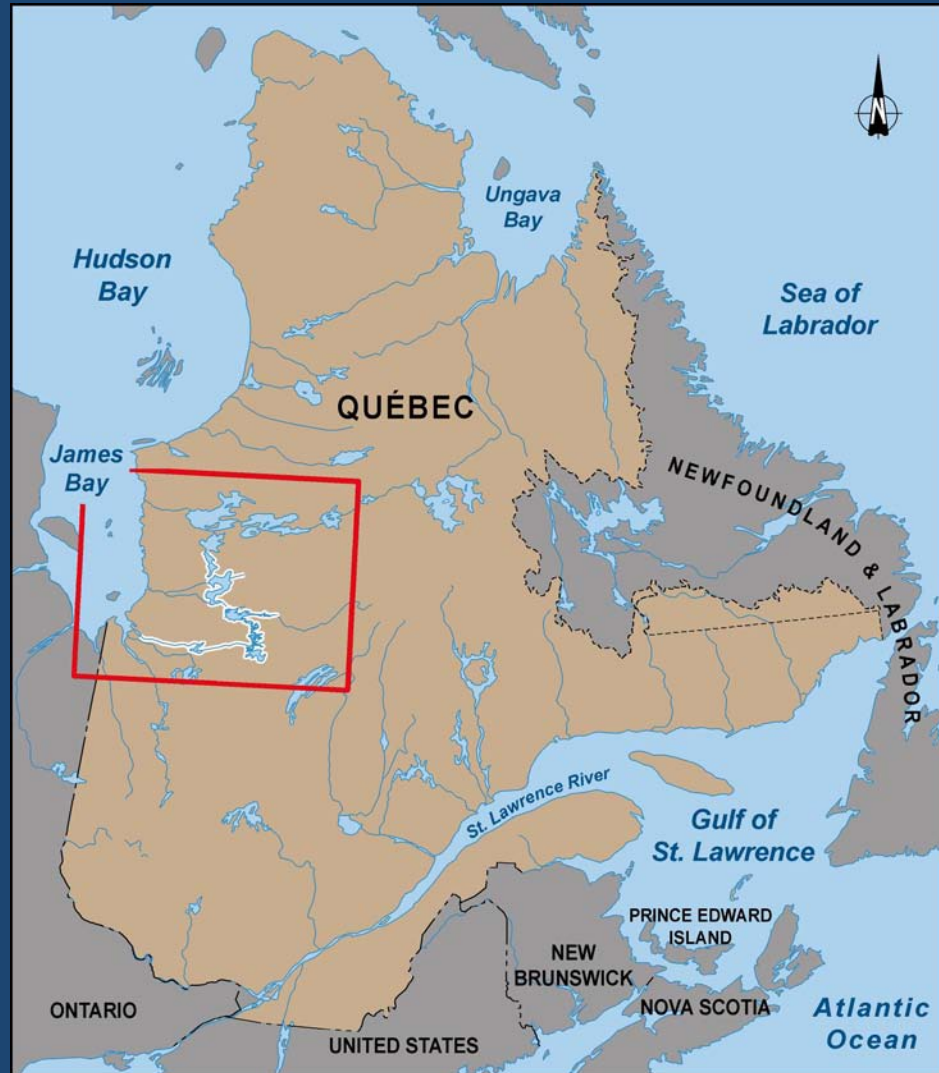
Biologist and Project manager
Environnement Illimité inc.



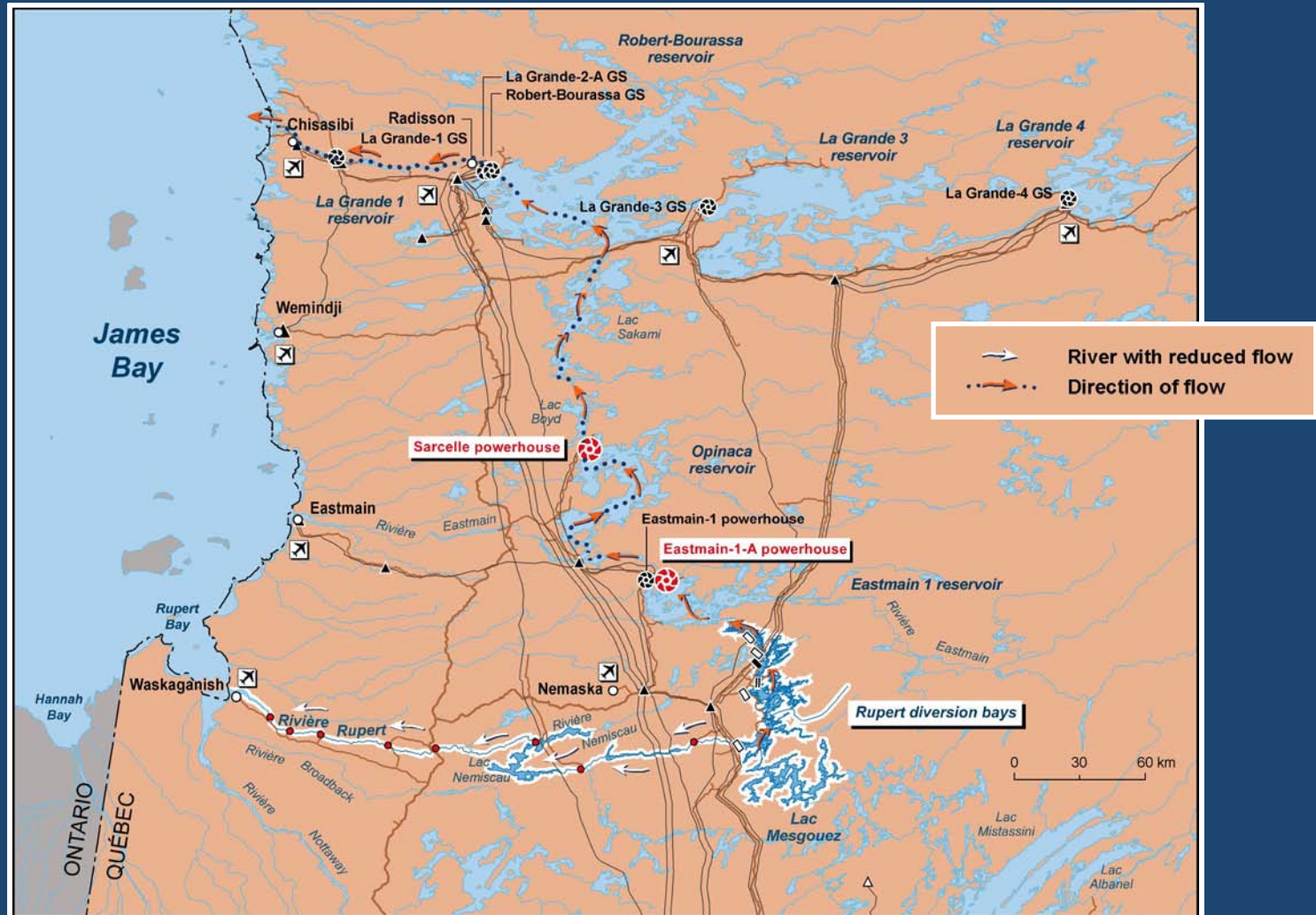
National Hydropower Association
Annual Conference

April 27, 2010 • Washington D.C.

Study area



Eastmain-1 Hydroelectric Development / Eastmain 1-A and La Sarcelle generating stations and Rupert Diversion

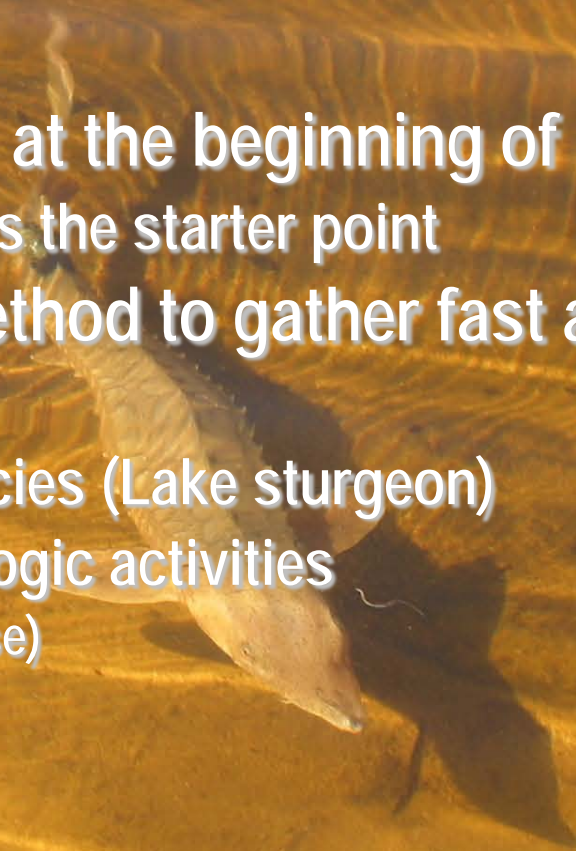


Context

- Large study area
 - More than 850 km of river
 - Reduced flow on 325 km
 - 950 km² of flooded surface area
- Relatively short period of time to study, suggest, find agreement with land users and authorities, and realize mitigation measures
- Lake Sturgeon
 - Species valued by the land users
 - Species at risk (proposed by COSEWIC: special concern)
 - Partial information about the populations

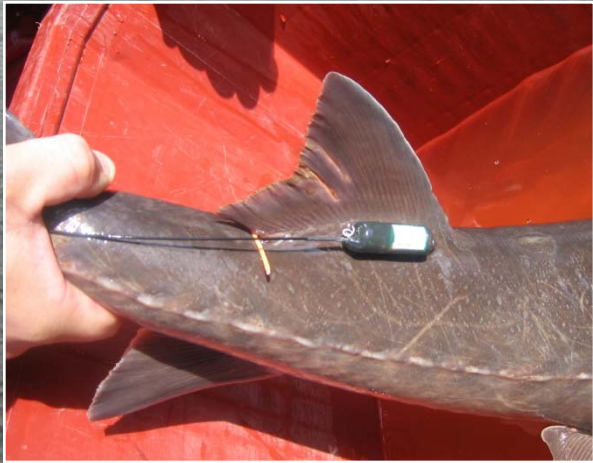
Impact study: Strategy

- Include land users at the beginning of the process
 - Local knowledge is the starter point
- Select effective method to gather fast and useful information
 - Focus on key species (Lake sturgeon)
 - Focus on key biologic activities
 - Migration (area use)
 - Spawning habitat
 - Feeding habitat
 - Wintering habitat



Impact study: Methods

Area use studied by telemetry



External radio transmitters for adults from 2002 to 2004

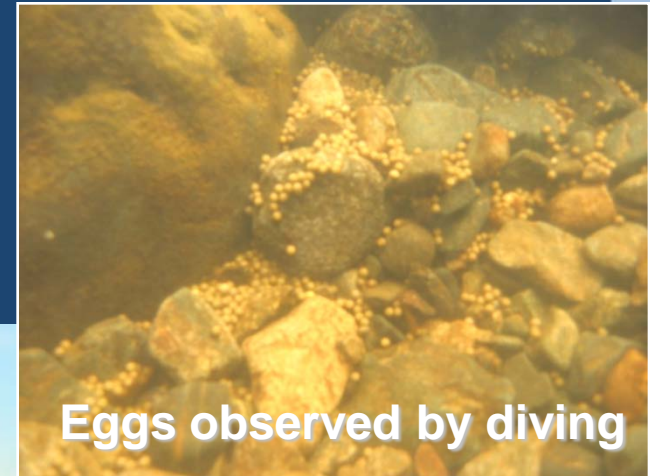
277 tagged Lake sturgeon



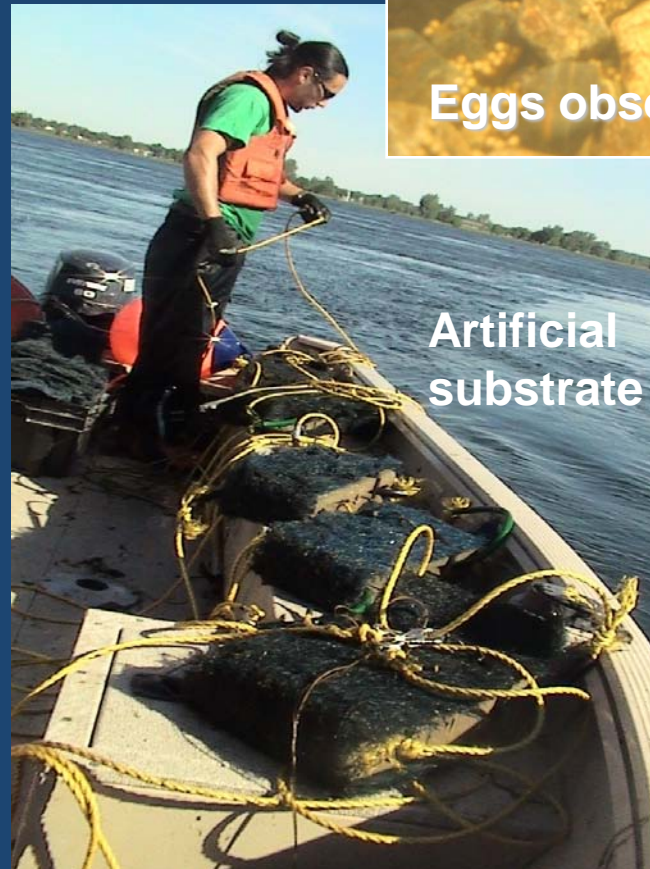
Impact study: Methods

Confirm spawning ground

Eggs collected with drift nets



Eggs observed by diving



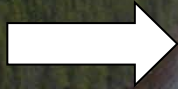
Artificial
substrate

Dip net



Impacts and mitigation measures

- Reduce flow sections



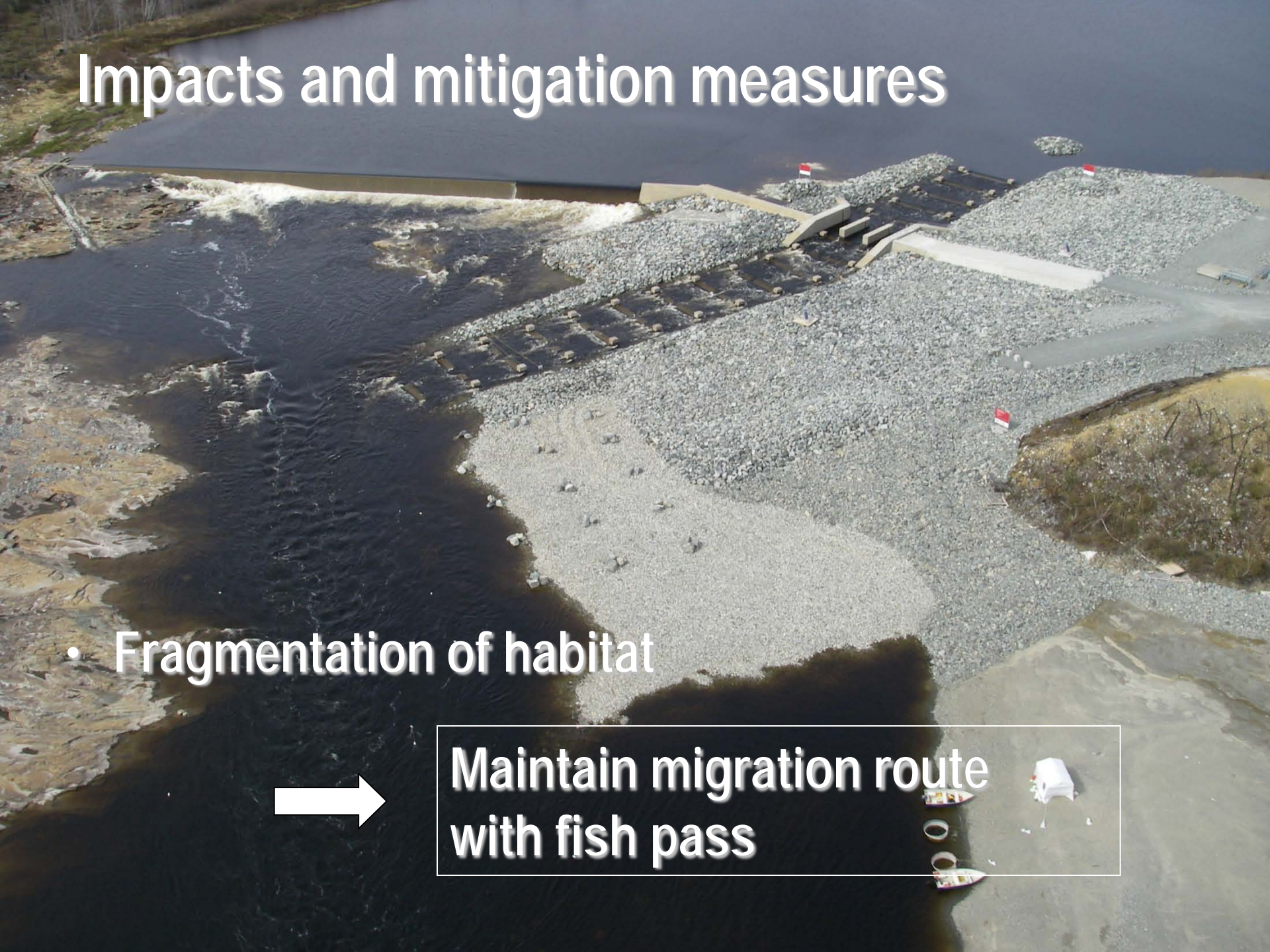
Maintain an ecological flow
Maintain water level with weirs

Impacts and mitigation measures

- Fragmentation of habitat

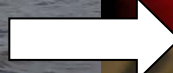


Maintain migration route
with fish pass

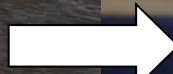


Impacts and mitigation measures

- Temporary decrease of fish recruitment



Production and stocking of young sturgeon

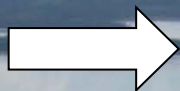


Introduction in newly created reservoir

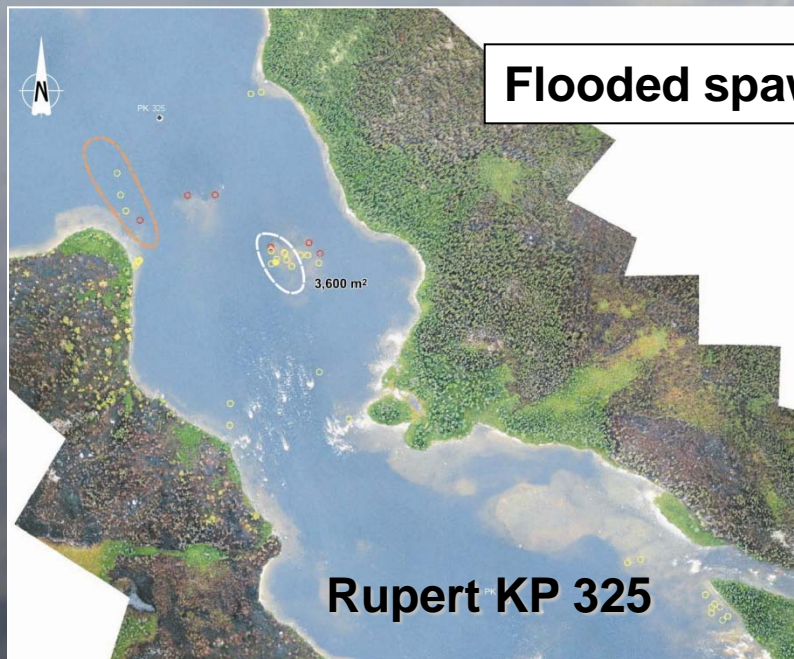


Impacts and mitigation measures

- Drying out and flooding of spawning grounds



Create new spawning ground



Flooded spawning grounds



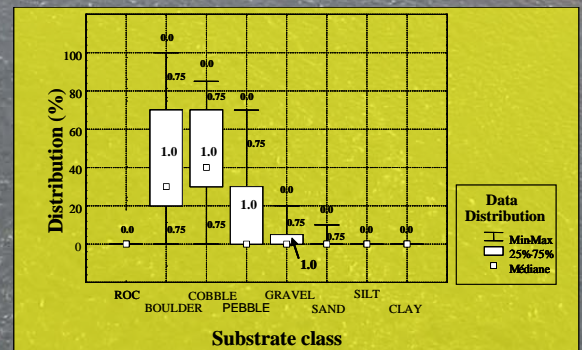
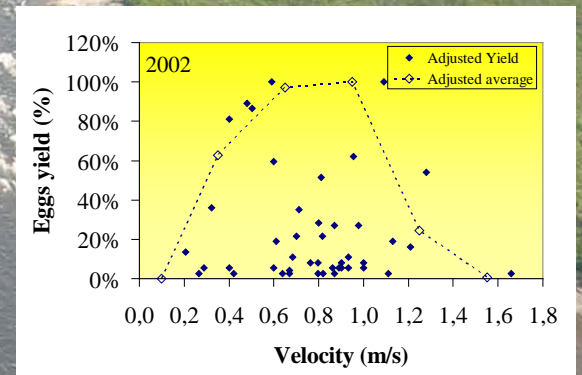
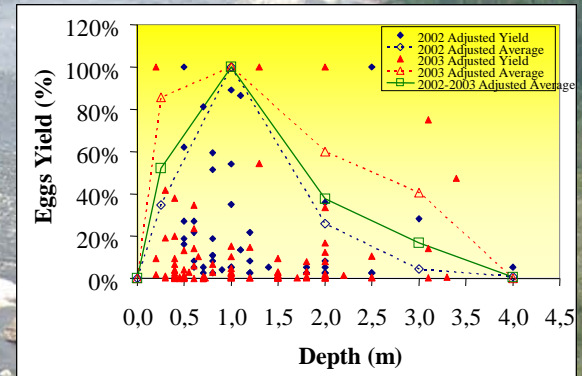
Spawning habitat — Design and construction

Gather information on natural sites



650 m²

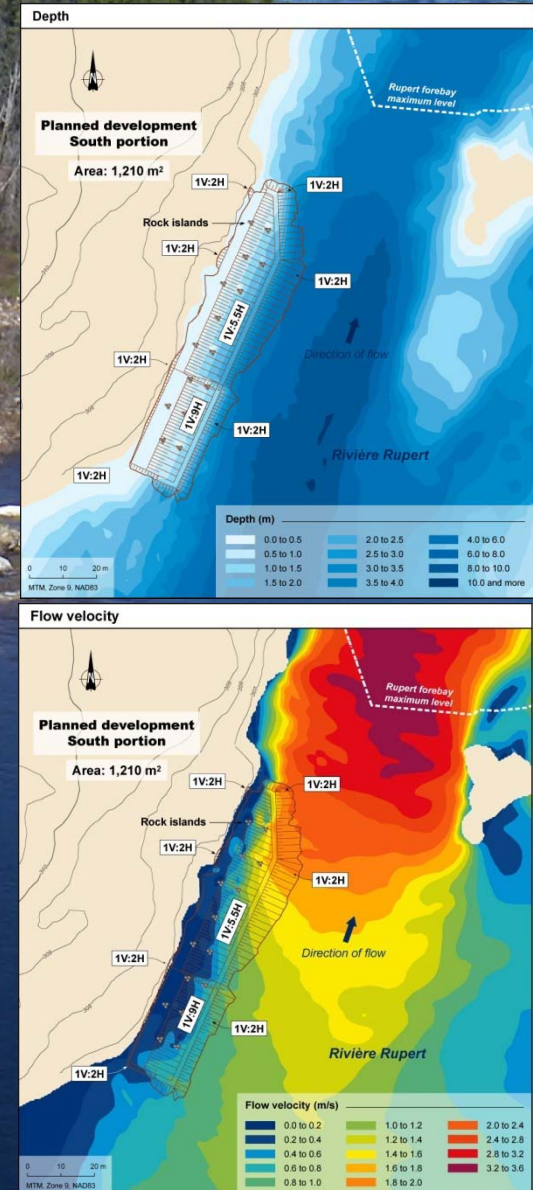
Dried spawning ground
Eastmain river KP 215



Spawning habitat — Design and construction

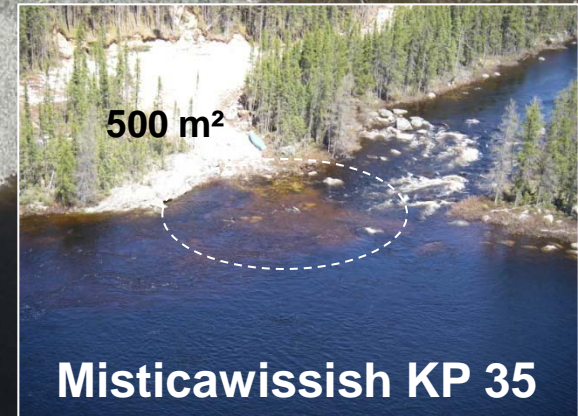
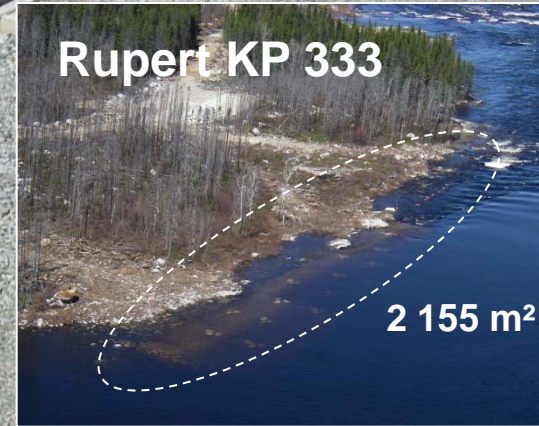
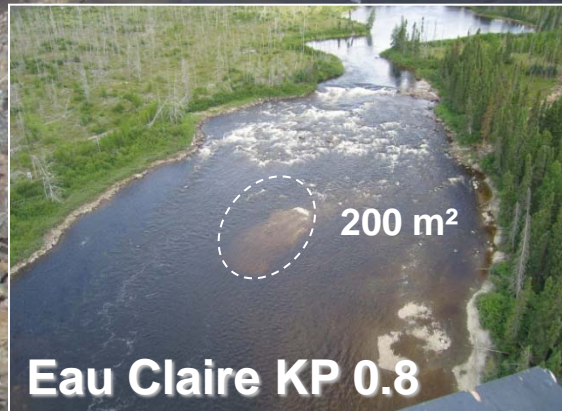
- Selection of sites
 - Proximity of impacted sites
 - Adequate flowing conditions
 - Access for construction
- Design of spawning ground
 - Bathymetric data
 - Flow model

Rupert KP 333



Spawning habitat — Design and construction

Spawning ground construction



Eastmain KP 207

2 000 m²

Spawning habitat — Effectiveness assessment

A large fish, likely a salmon, is shown in the process of spawning in a shallow, rocky stream. The fish is positioned diagonally across the frame, with its head towards the top left and its tail towards the bottom right. Its body is silvery and wet, reflecting light. The surrounding water is clear, revealing the dark, wet rocks and pebbles on the stream bed. The water surface is rippled, and there are some white foam or bubbles near the fish's head, indicating the spawning activity. The overall scene is natural and captures a key moment in the fish's life cycle.

- Follow the spawning ground stability
 - Bathymetry and surveying
- Validate the hydraulic conditions
 - Water velocity measures

Spawning habitat — Effectiveness assessment

- Confirm use



Spawning habitat — Results for Eastmain-1

Rivière Eastmain

- Stability: Minimal material movement
- Adequate spawning conditions at KP 207
- Spawning activity
 - Use of KP 207 site 2 years after construction
- Larval drift
 - One year comparable to natural conditions
 - Three years lower than natural conditions

Fish pass

Weir

Spawning ground

25,000 eggs

31,000 eggs

18,000 eggs

Concrete/
blocks



Lake sturgeon eggs

Photo: June 5, 2008 (flow 73 m³/s)

Spawning habitat — Discussion

- Plan a minimum of 5 years of follow up
 - Success is not always immediate
- Be prepared for corrective work
 - Keep access to your site
 - Keep extra spawning material near the site (20%)



Keep sufficient budget for the follow up !



The Crees
of Waskaganish
First Nation



Mistissini



Nemaska

