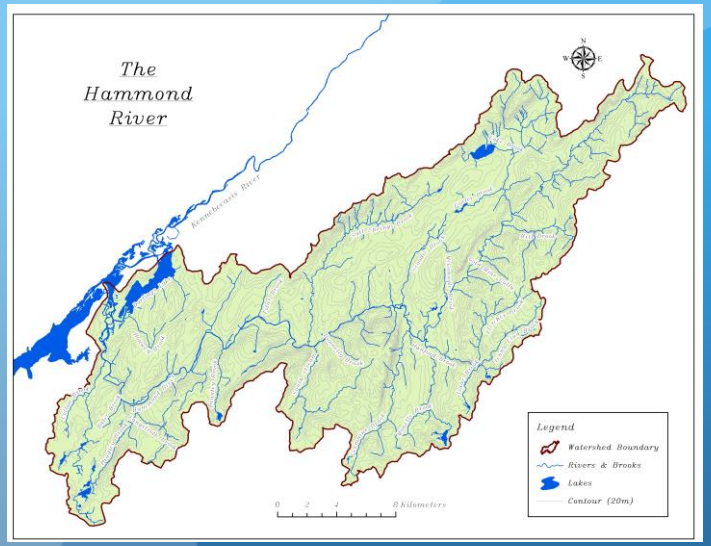
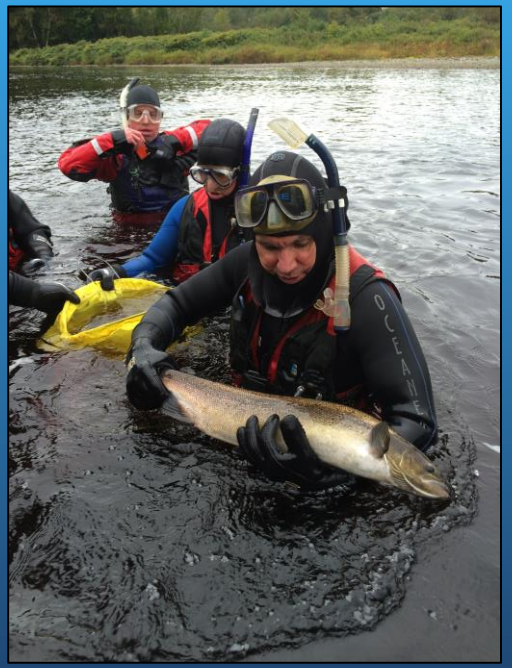




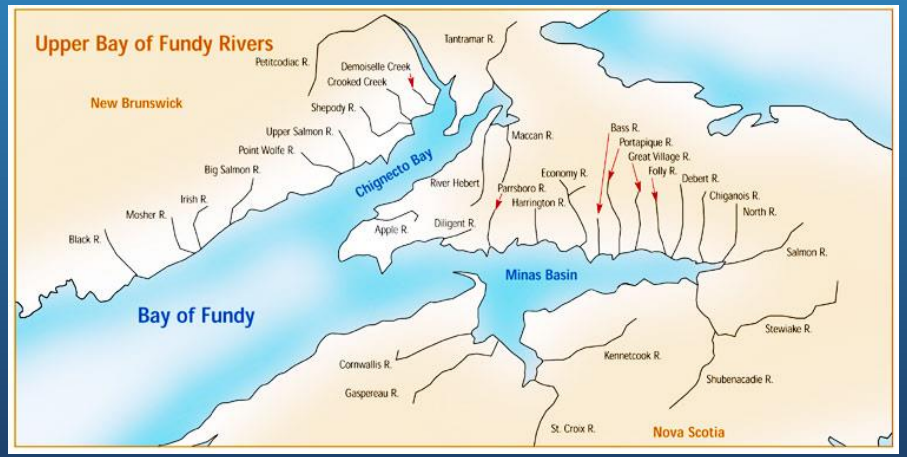
Recovery Strategy Decision Matrix

Nathan Wilbur

15 February 2017

Overview

- Identifying freshwater root cause issues → flow chart
- How well do you know your river and its salmon population?
- Examples of issues and tools to solve problems



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Connectivity	Continuity between critical habitats is essential
Biological Community	Healthy, balanced ecosystem is necessary to support a robust Atlantic salmon population

Stage-Specific Indices of Abundance

Stage-specific indices of abundance

- How well do you know the salmon population status?
- Is your salmon population healthy?
- Is it within natural variation?
- Are there mortality issues at various life stages?
- If yes, what are the key causes and can you eliminate them?

Adults

Sonar Cameras

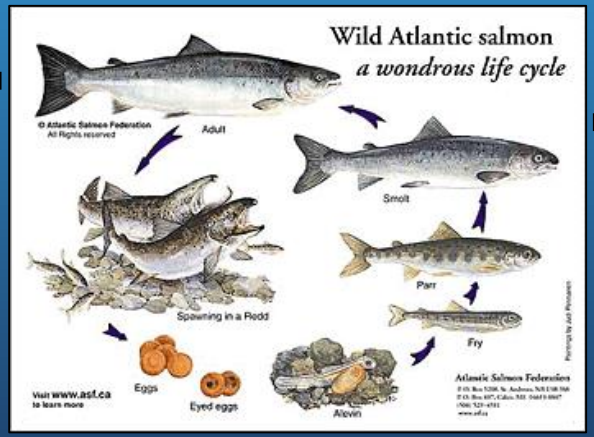
Counting Fence

Trapnets

Swim Through

Redd Counts

Index Rivers Nearby



Smolt

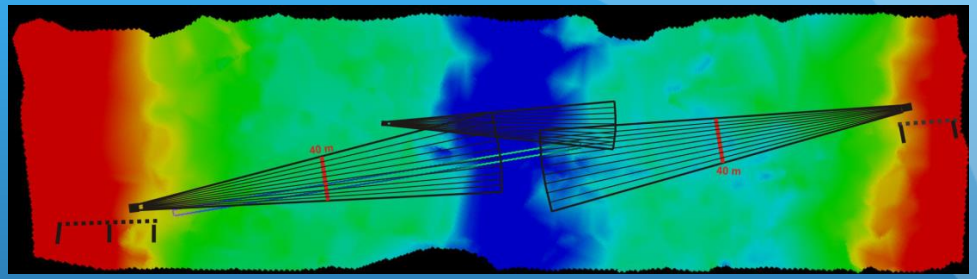
Rotary Screw Trap (smolt wheel)

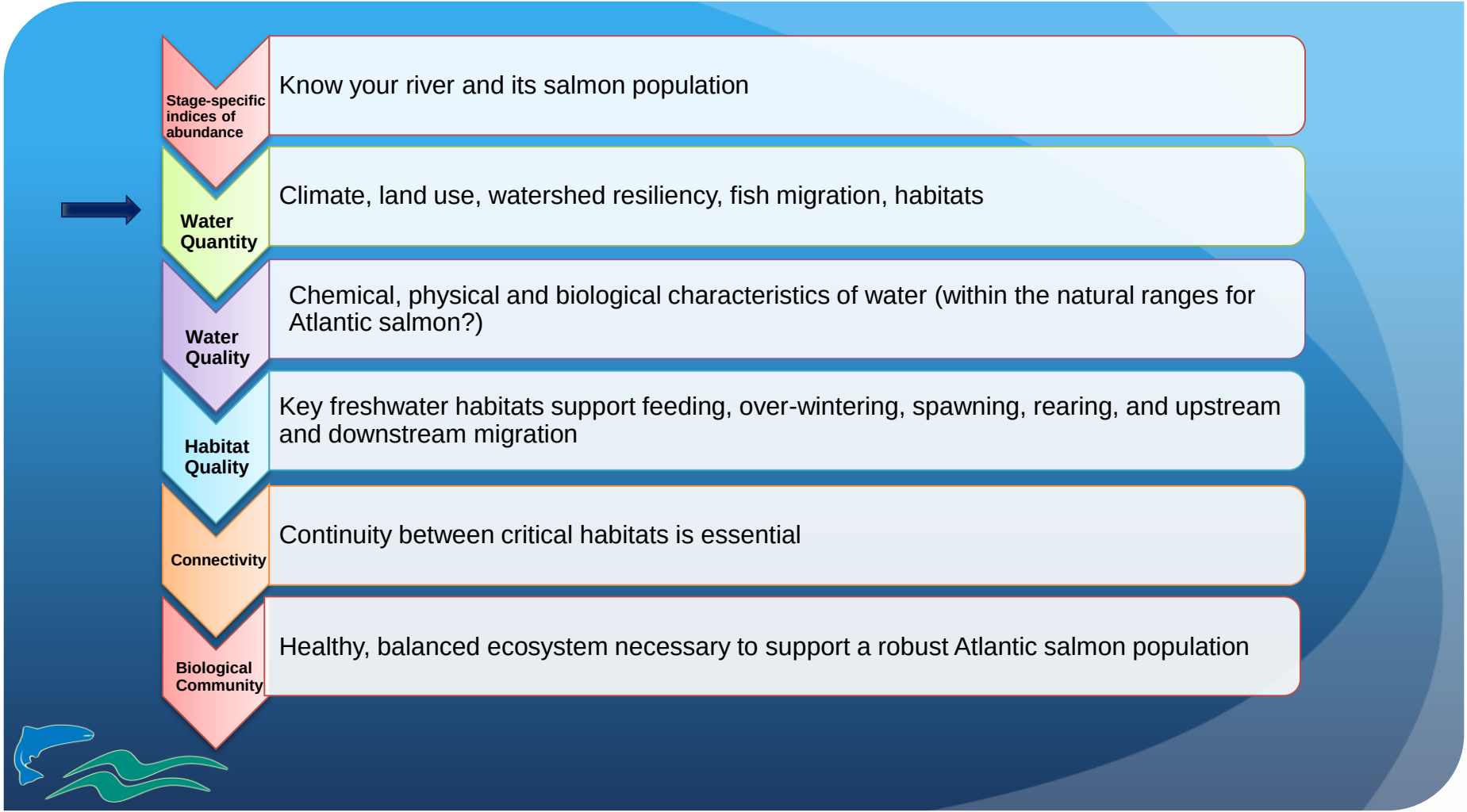
Fyke Nets

Fry & Parr

Electrofishing


Dual-frequency IDentification SONar:
DIDSON (ARIS)
Luke


40 m
40 m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Healthy, balanced ecosystem necessary to support a robust Atlantic salmon population

Water Quantity

- Driven by climate, land use, geology
- Driver of geomorphic processes and channel form
  - Erosion
  - Aggradation
  - Channel widening
  - Incising
- Key component of freshwater habitat
- Impacts to fish migration, spawning, critical habitats

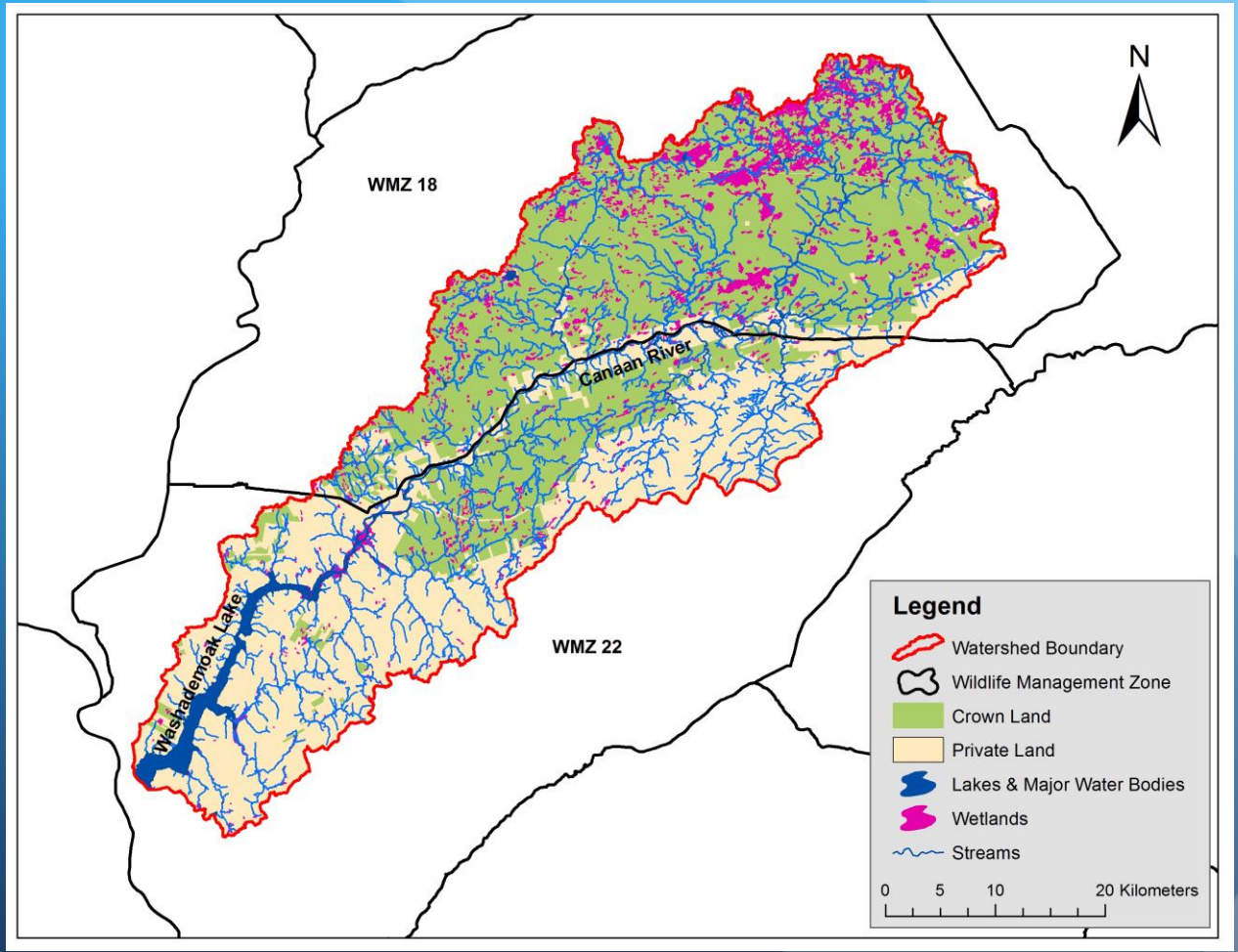
Key Questions

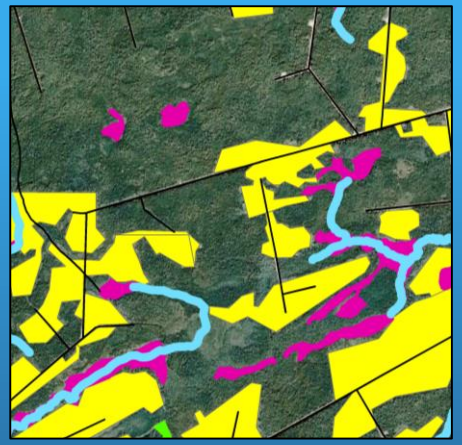
- Are hydrologic patterns natural?
- How resilient is your watershed?

Water Quantity

What to look for

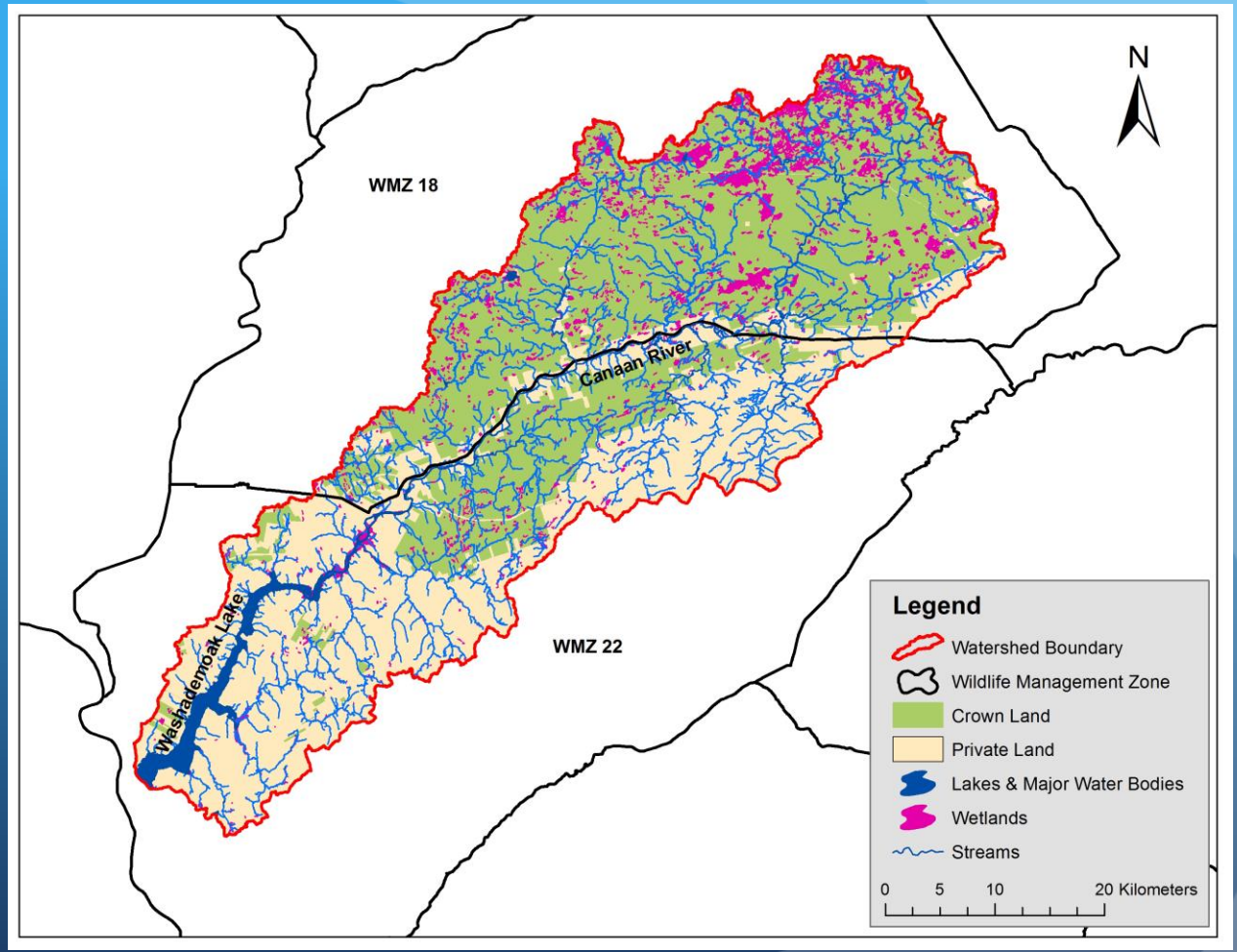
- Climate (rainfall) & discharge records
- Surrogate watershed records
- Land use, geology
- Geomorphic indicators

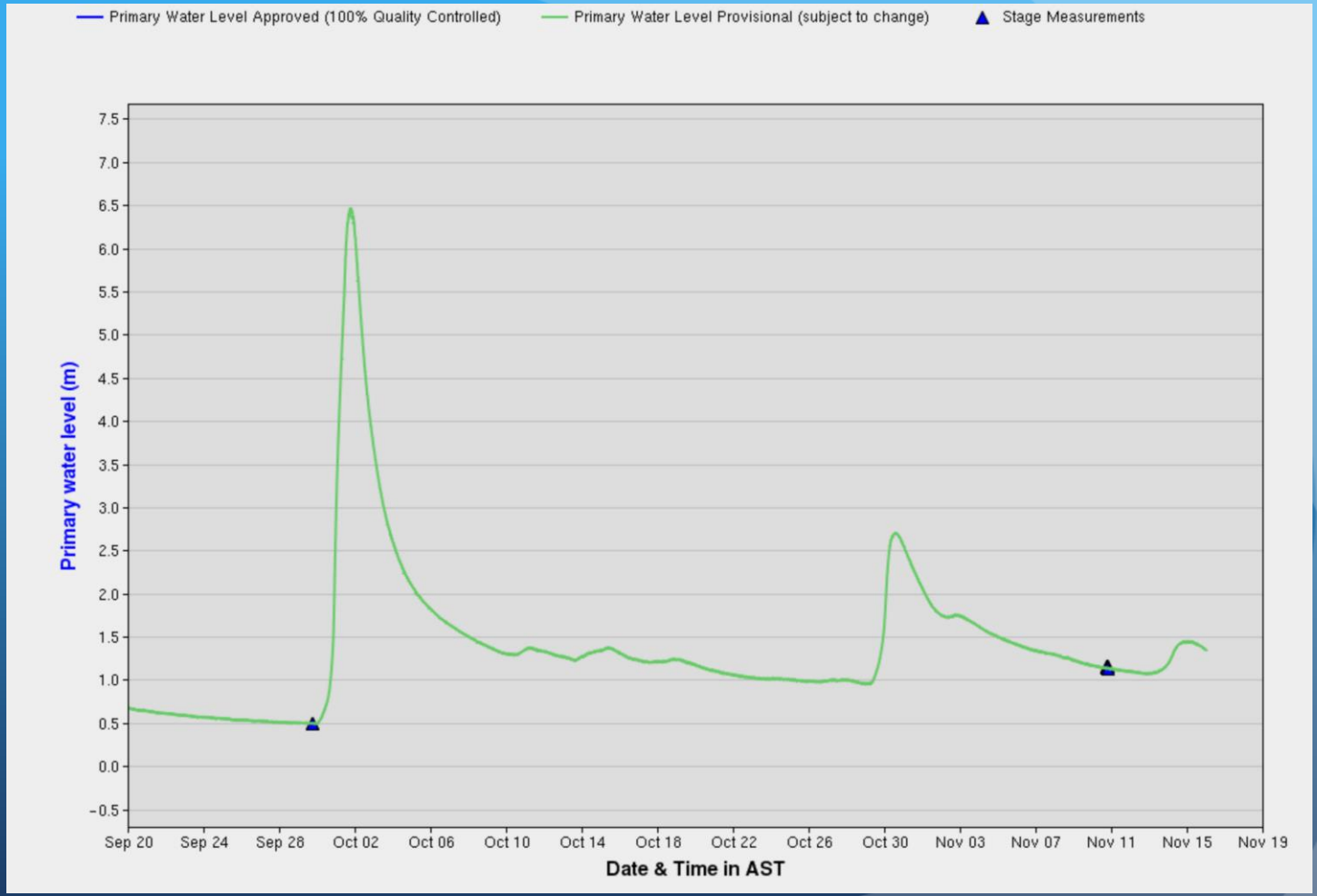

N
WMZ 18
WMZ 22
Canaan River
Washademoak Lake
Legend
Watershed Boundary
Wildlife Management Zone
Crown Land
Private Land
Lakes & Major Water Bodies
Wetlands
Streams
0 5 10 20 Kilometers

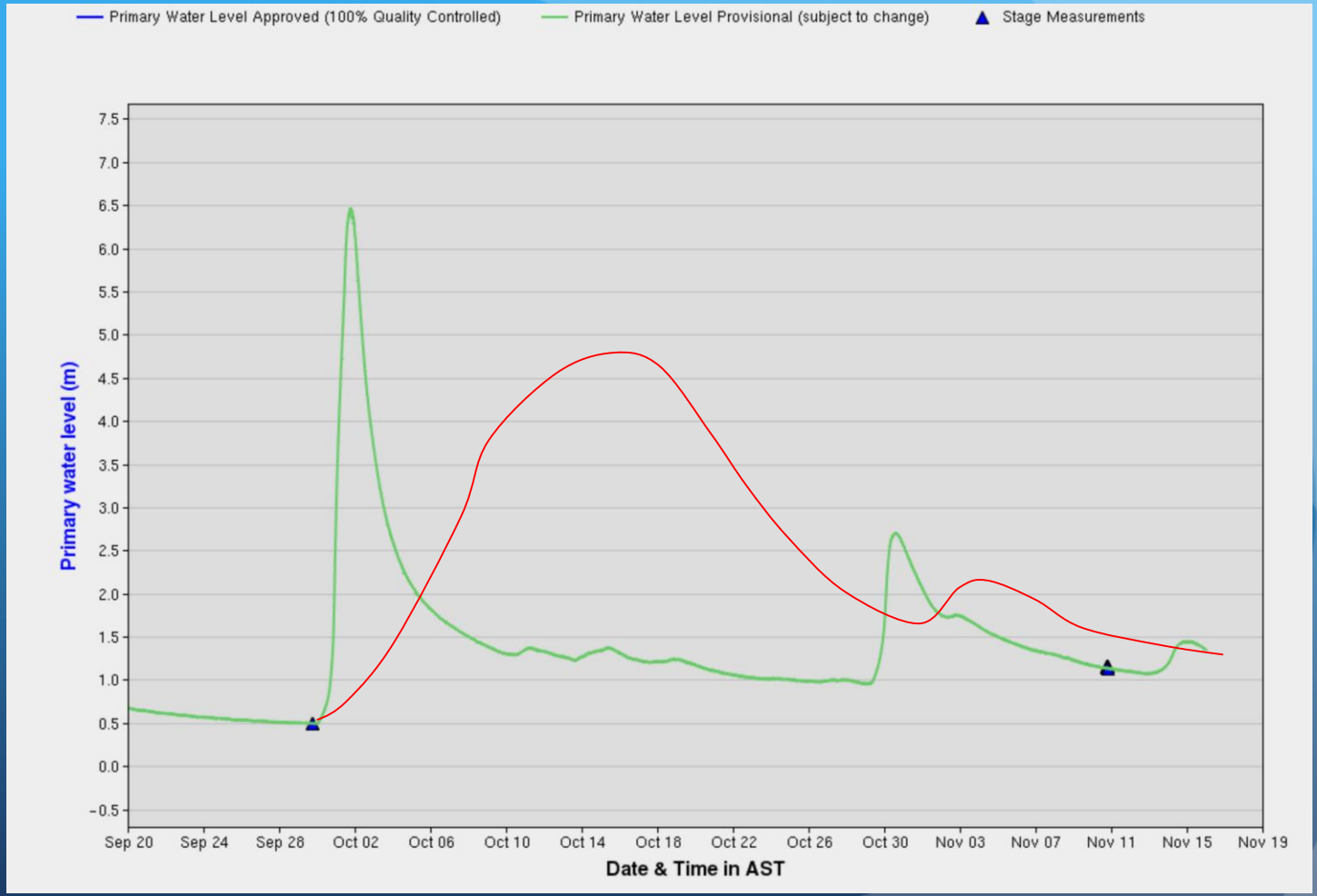


Land Use

Road Density
% Clearcuts
% Forested
% Agriculture




Primary Water Level Approved (100% Quality Controlled)
Primary Water Level Provisional (subject to change)
Stage Measurements
Primary water level (m)
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
Sep 20
Sep 24
Sep 28
Oct 02
Oct 06
Oct 10
Oct 14
Oct 18
Oct 22
Oct 26
Oct 30
Nov 03
Nov 07
Nov 11
Nov 15
Nov 19
Date & Time in AST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Water Quality

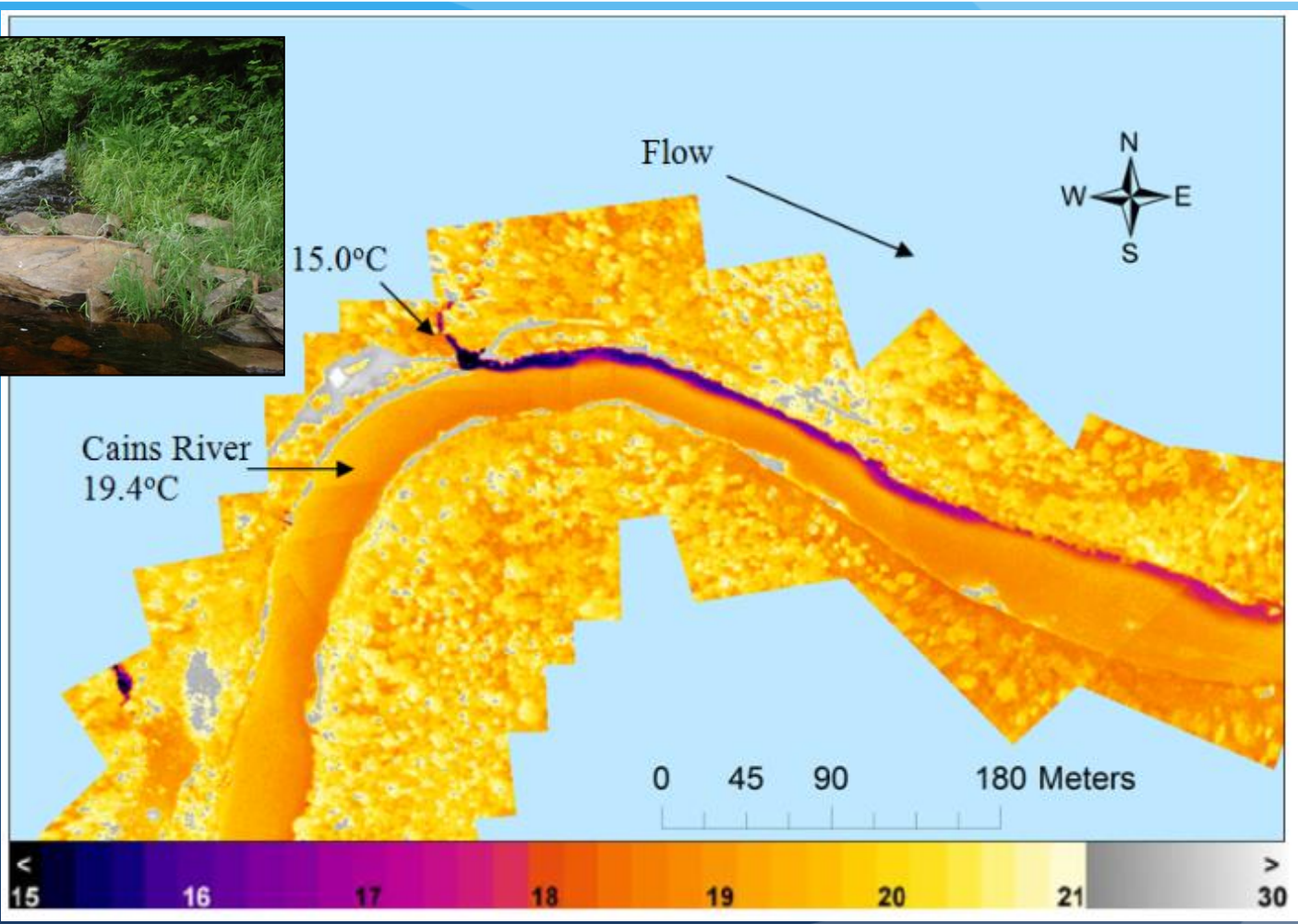
- Chemical, physical, biological
- Temperature, pH, dissolved oxygen, turbidity
- Need to be within acceptable ranges

Point Source Impacts

Mining
Sewage
Toxic discharge
Road runoff

Non-Point Source Impacts

Climate
Land use
Agriculture
Forestry
Herbicide/Pesticide
Urban runoff
Acid rain


Flow
N
W
E
S
15.0°C
Cains River
19.4°C
0 45 90 180 Meters
< 15
16
17
18
19
20
21
> 30

Cold Water Refuge Enhancement

Photos: Parish Aquatic Services

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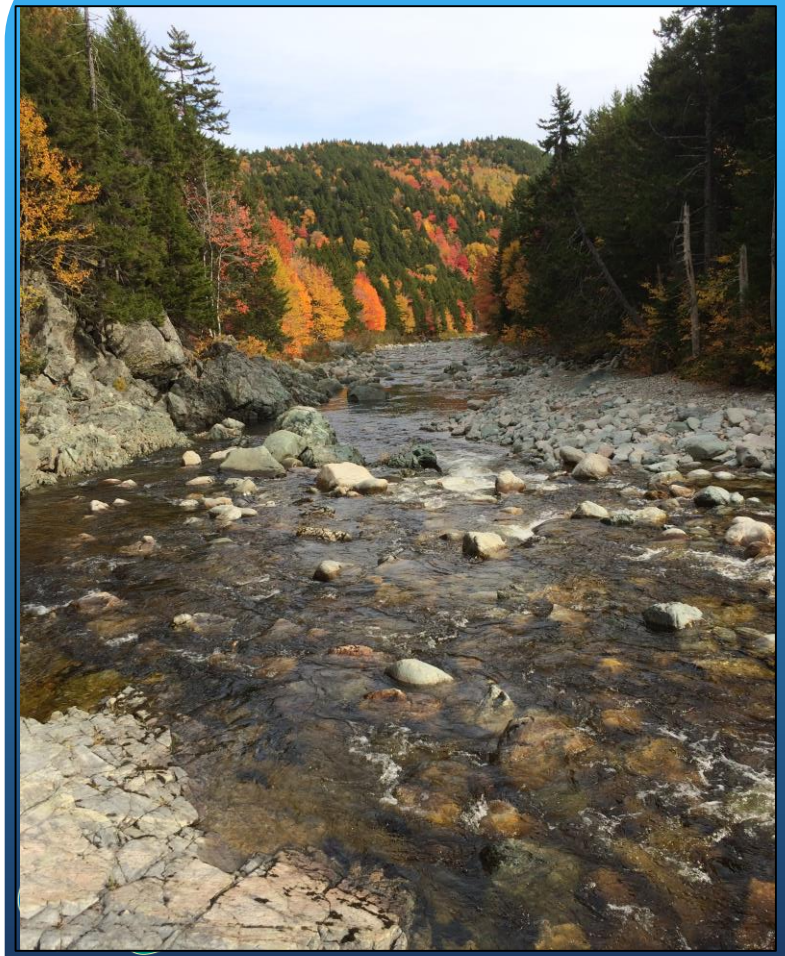
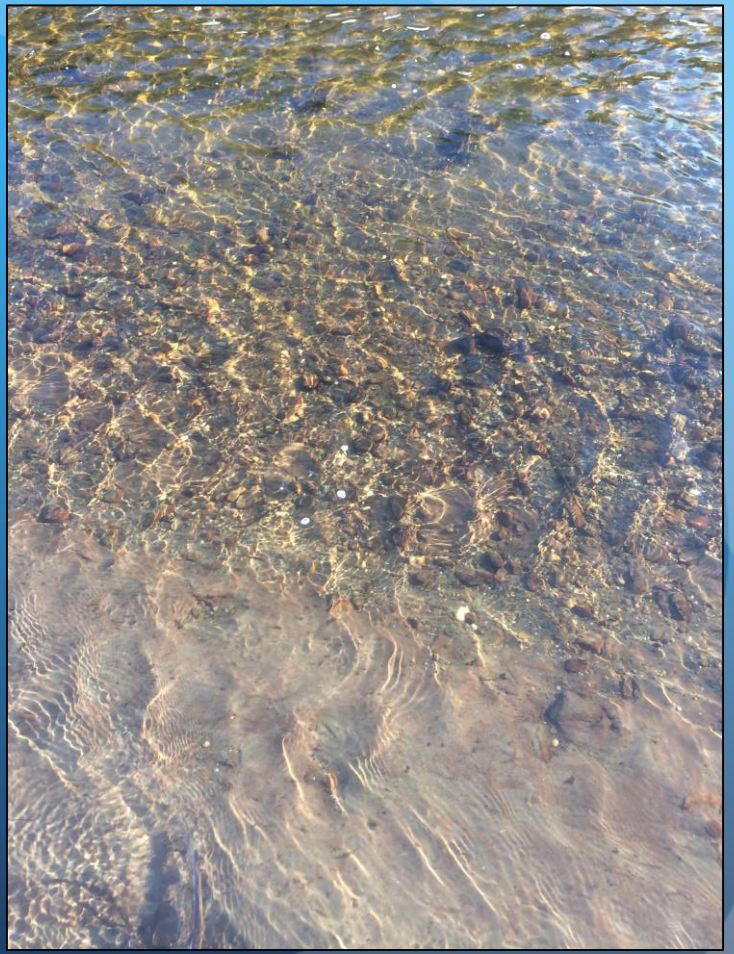
Habitat Quality

Habitat Quality

- Atlantic salmon depend on several diverse habitats
- Driven by climate, geology, vegetation, geomorphic processes
- Freshwater habitats support feeding, over-wintering, spawning, rearing, upstream and downstream migration
- If key habitats are limited or unhealthy, productivity is limited
- Habitat quantity and quality will vary naturally (riffle, run, pool)
- Can also be impacted by human activity (e.g., poor land use practices that result in siltation of spawning habitat)





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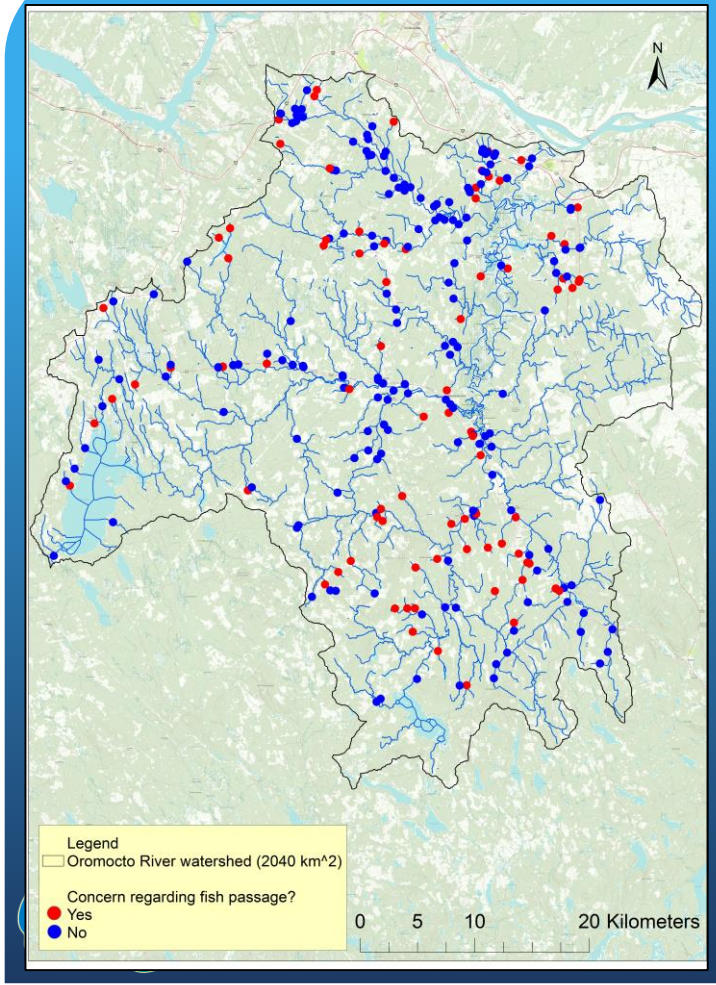
Connectivity

- Critical habitats need to be accessible

What to do:

- Map the watershed (GIS, aerial, ground surveys)
- Develop culvert and beaver dam inventories
- Identify barriers
- Develop obstruction removal program


N
Legend
Oromocto River watershed (2040 km^2)
Concern regarding fish passage?
Yes
No
0 5 10 20 Kilometers

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Biological Community

- Healthy, balanced ecosystem is paramount
- Native species have co-evolved

Examples:

- Smelt run in spring reconditions out-migrating kelts
- Marine-derived nutrients deposited in rivers (alewife)
- Alwevies provide cover for out-migrating smolts

What to do:

- Benthic surveys (also indicators of water quality)
- Stable isotopes – you are what you eat
- Understand and monitor predator prey dynamics
- Invasive species (smallmouth bass)

Photos: Robin Hanson

Summary

- Know your river and its salmon population
- Water quantity
- Water quality
- Habitat Quality
- Connectivity
- Biological community

Photo: Mike Bardsley