Coho salmon smolt production from constructed and natural floodplain habitats



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Floodplain & Off-channel Habitats

- Critical habitats for a variety of species
- Highly threatened by development
- Focus of many restoration activities

Critical Habitat For Coho

Oncorhynchus kisutch

Seasonality of Use

fry migrate into off-channel habitats in fall

Relative Productivity

high portion of total basin smolt production

Growth & Survival

enhanced overwinter survival and growth

Natural Off-Channel Habitats

All riverine areas removed from the main channel -

Often formed on floodplains where abandoned channels are reoccupied by runoff, overflow of water from the mainstem, and/or by groundwater (Peterson & Reid 1984)

Side channels

Sloughs

Beaver ponds

Common Types of Rehabilitation

Reconnected

Constructed Channels

Dammed Ponds

Gravel Pit/Mill Pound

How to design?

- Which projects effective?
  - Size,
  - Shape
  - Depth
  - Complexity
  - Other factors

Objectives

Study 1
- Use existing smolt trapping data to compare production among different types

Study 2
- Examine relationships smolts and physical variables

Study 3
- Compare natural and constructed groundwater channels

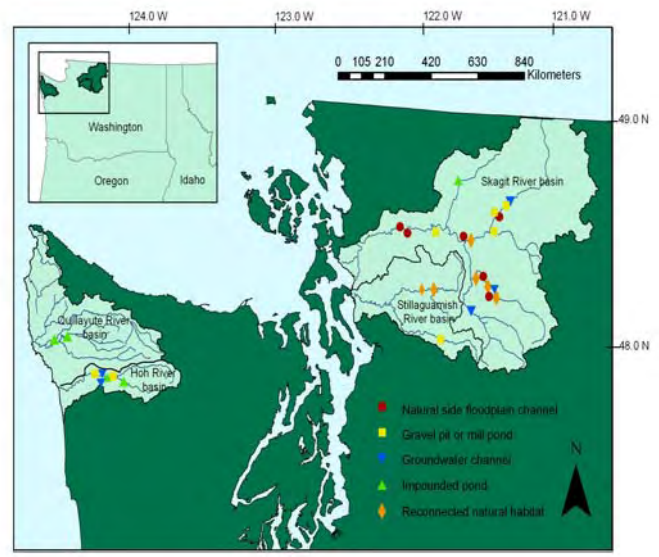
Methods – Study 1. Existing Smolt Data

- Hundreds of existing projects
- Many individual evaluations
- 70+ with smolt trapping data

Methods – Existing Smolt Data

- Coho number, density, length
- Only 30 of 70 met criteria
  - No hatchery plants
  - > 3 yrs of data
  - Data from 90s
  - No trap blowouts

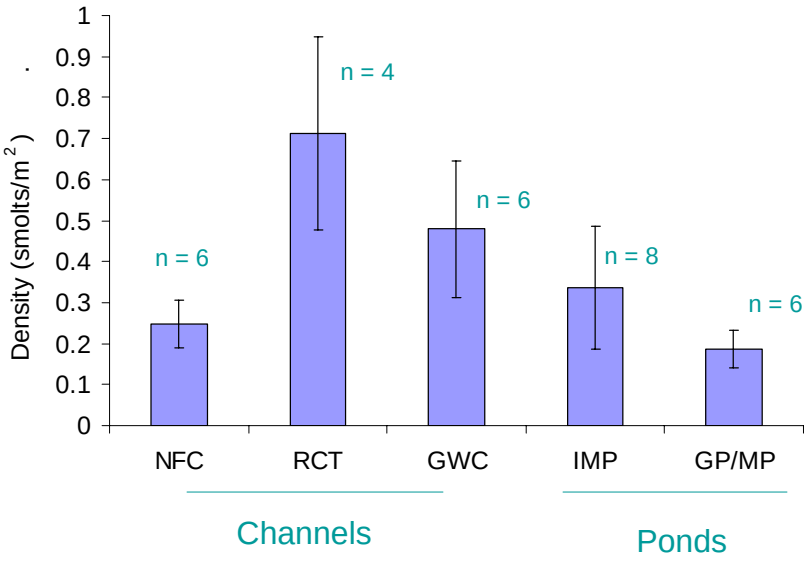
Study Site Locations



Physical data

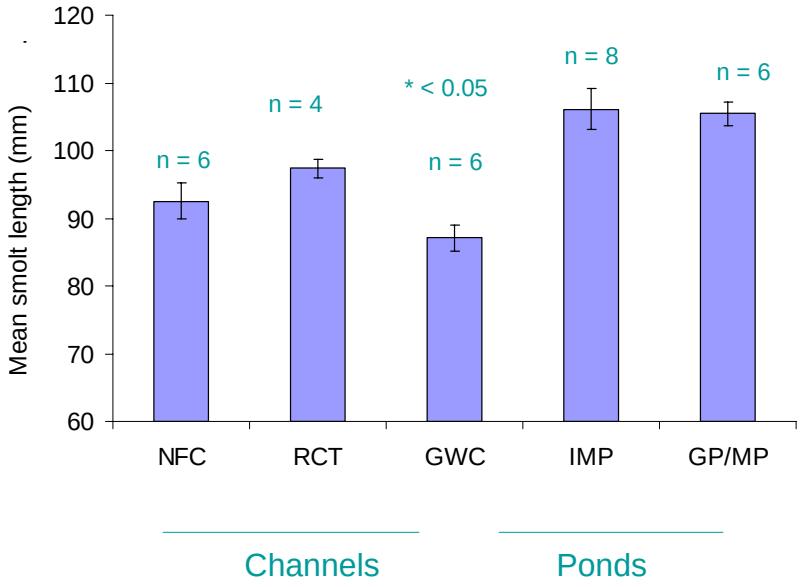
- Physical data collected/available
  - wetted area,
  - distance from saltwater (river kilometer)
  - project type
  - total basin spawner escapement

Smolt Densities

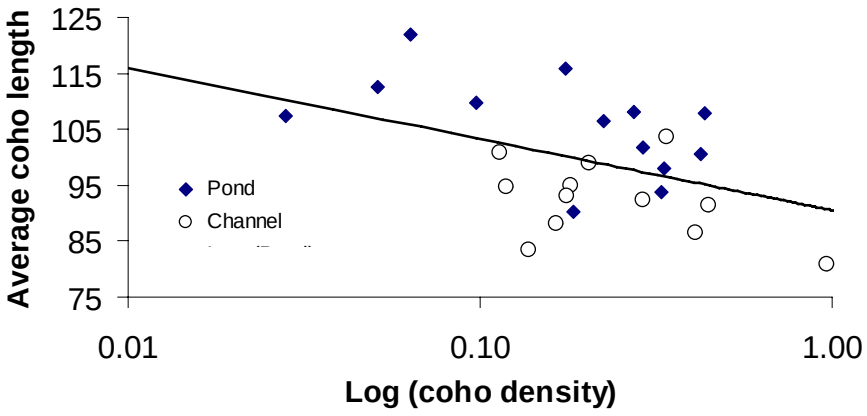


> 0.05

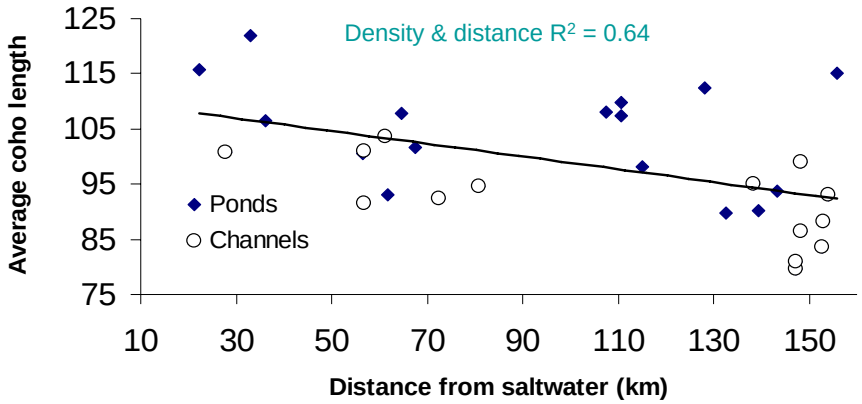
Smolt Size



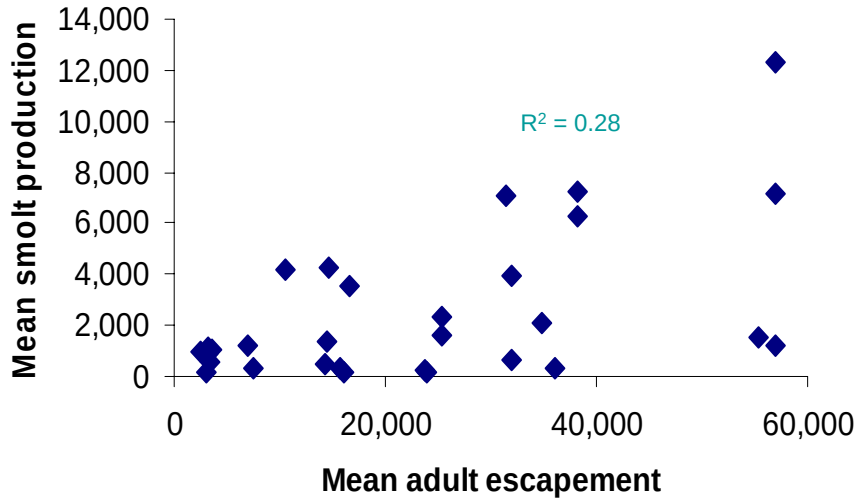
Length vs. density



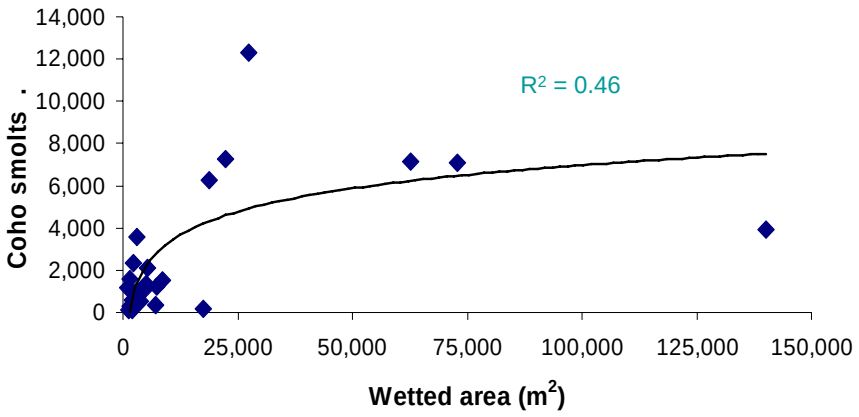
Smolt Length and River Km



Smolt Production & Escapement



Smolt Production and Wetted Area



Multiple regression – Existing Smolt Trapping Data

Density

- Not correlated with habitat type, area, distance from saltwater, escapement

Length

- Differs by project/habitat
- 75% explained by hab. type, distance, density

Total smolt production

- Habitat (pond) area

Study 2 – Intensive surveys

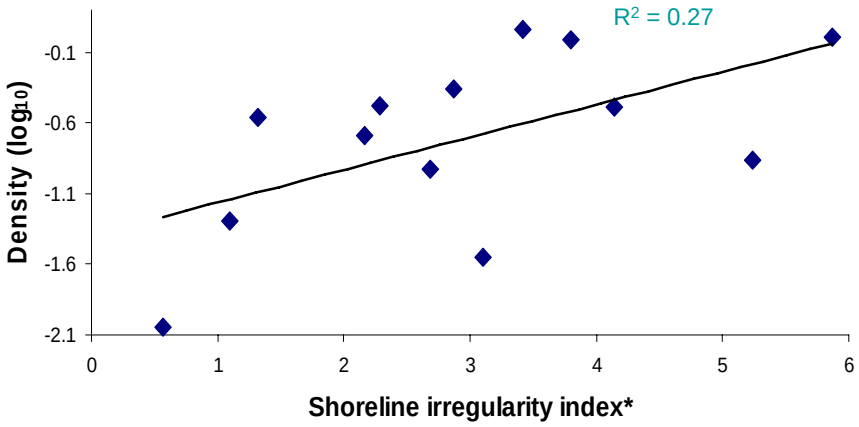
Subsample n = 13

Field Survey

Mapping

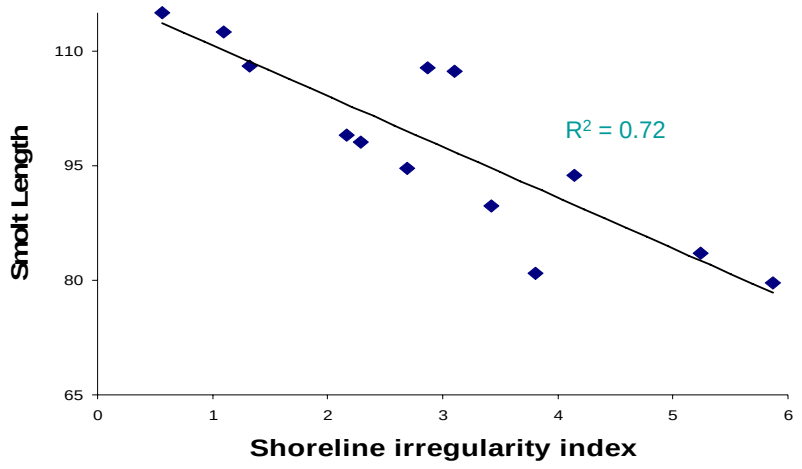
Study parameters: morphology, complexity, depth

Smolt Density and Shoreline Irregularity Index



*perimeter length/perimeter of circle of similar area

Smolt Length and Shoreline Irregularity Index

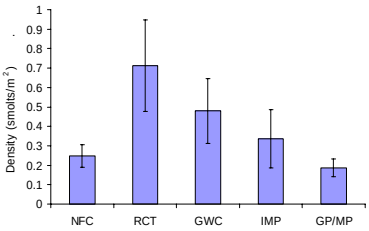


Summary of Intensive Surveys

	Depth	Cover	Shoreline Irregularity
Density	0	0	**Positive***
Size	0	0	**Negative***
Smolt production	0	0	0

Constructed Groundwater Channels?

- High fish densities
- Artificial vs. natural?



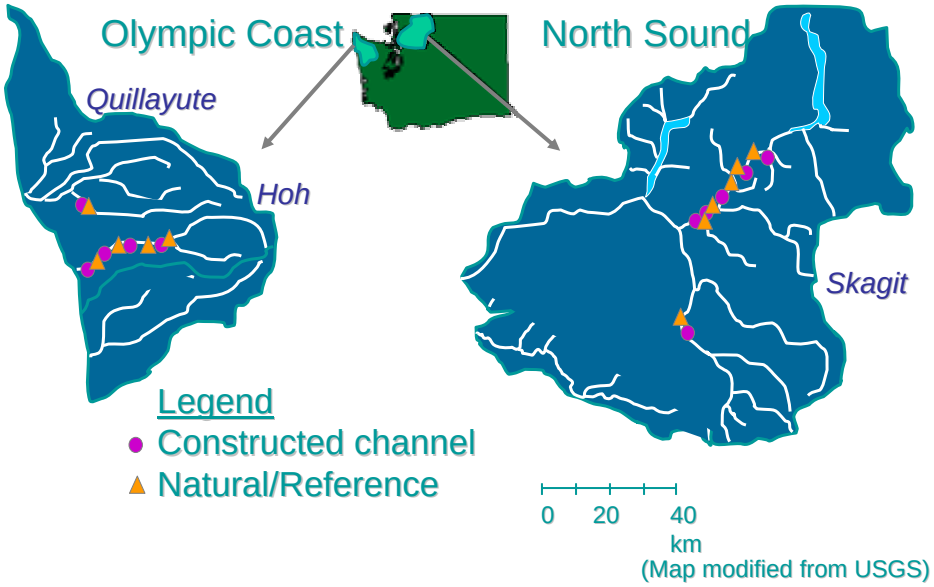
Constructed groundwater channel study

Objective: compare differences in constructed and naturally side channels in terms of -

- Morphology and physical habitat complexity
- Temperature regime and nutrient availability
- Fish and invertebrate taxa diversity and density

Constructed and Natural Channels

(N = 11 pairs)



(Map modified from USGS)

Methods – Groundwater channels

Physical Habitat

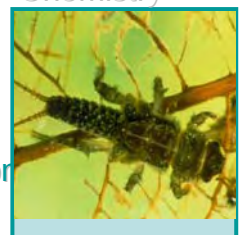
- morphology
- LWD density
- temp. regime

Water Chemistry

- nutrients
- N & P
- DOC

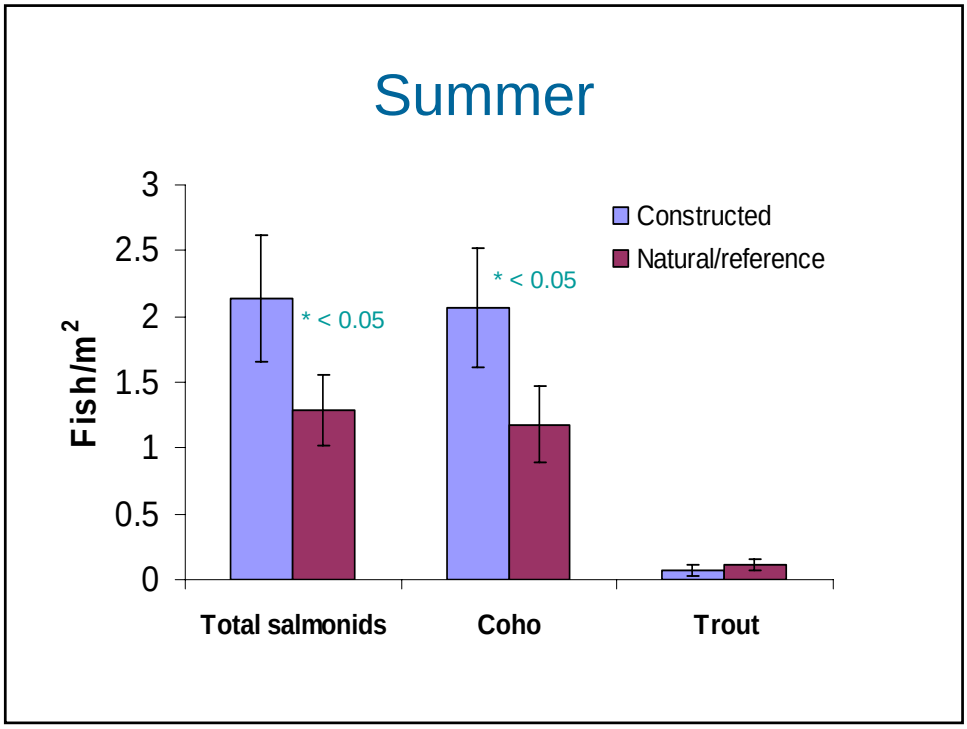
Fish Use

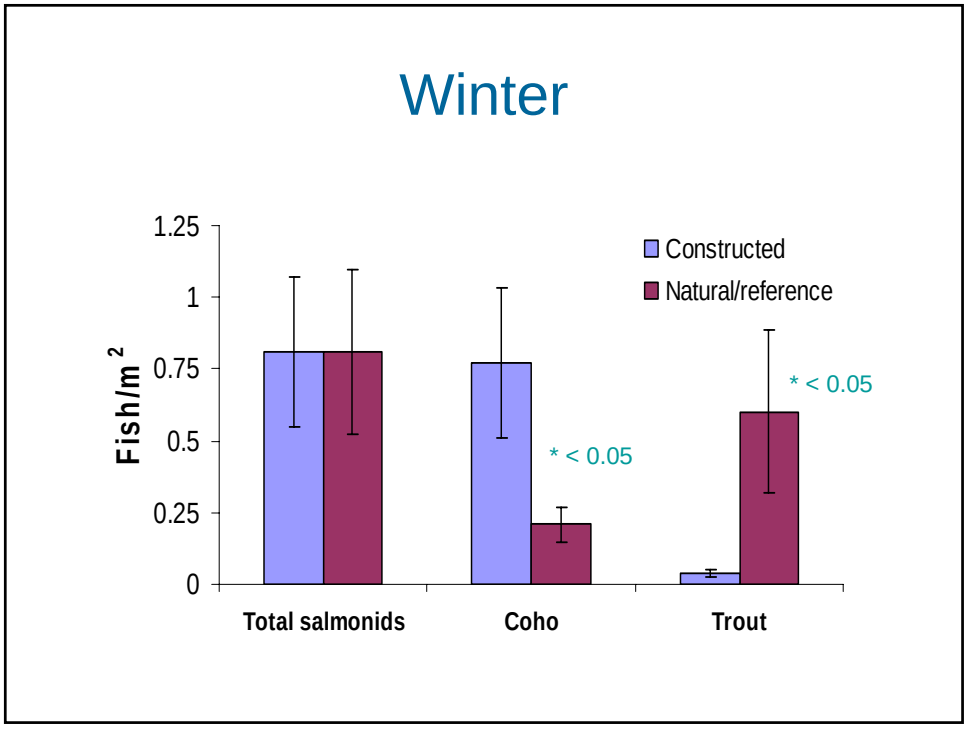
- taxa diversity
- density
- size & condition



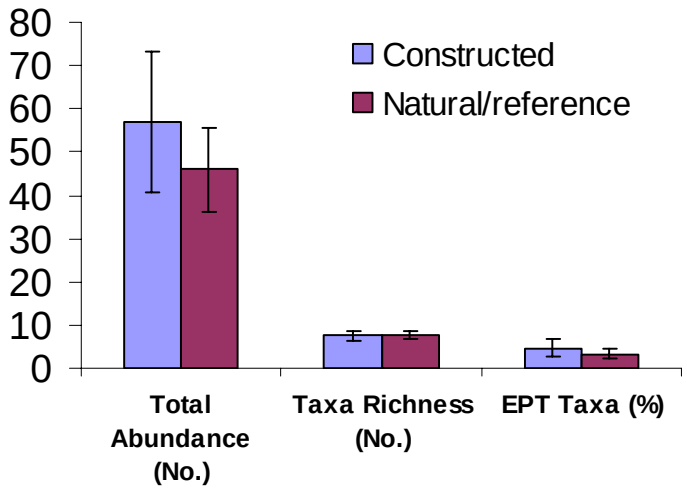
Invertebrates

- taxa diversity
- density
- fish gut content

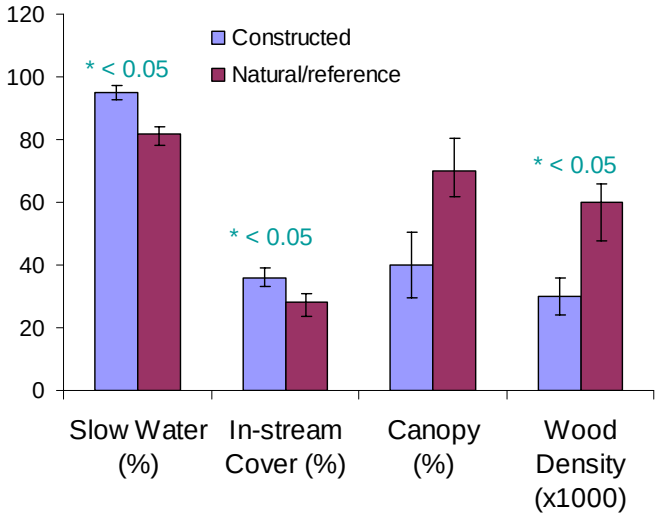

Summer
3
2.5
2
1.5
1
0.5
0
Fish/m2
Constructed
Natural/reference
* < 0.05
* < 0.05
Total salmonids
Coho
Trout


Winter
1.25
1
0.75
0.5
0.25
0
Fish/m2
Constructed
Natural/reference
* < 0.05
* < 0.05
Total salmonids
Coho
Trout

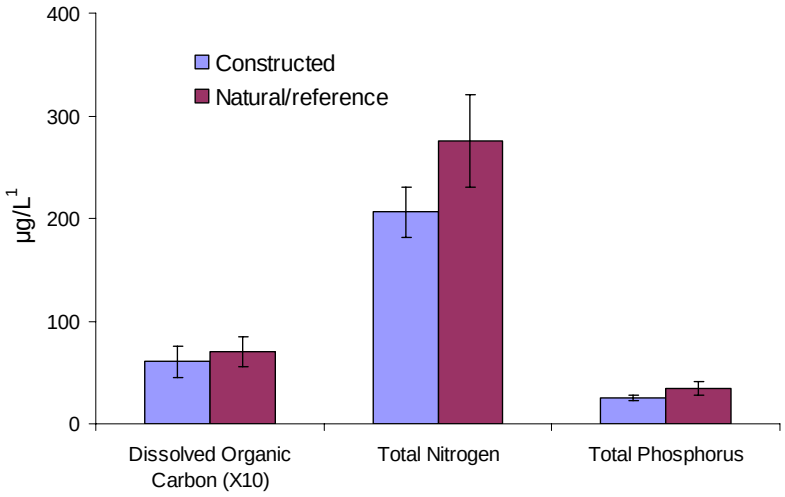
Benthic Invertebrates - Summer



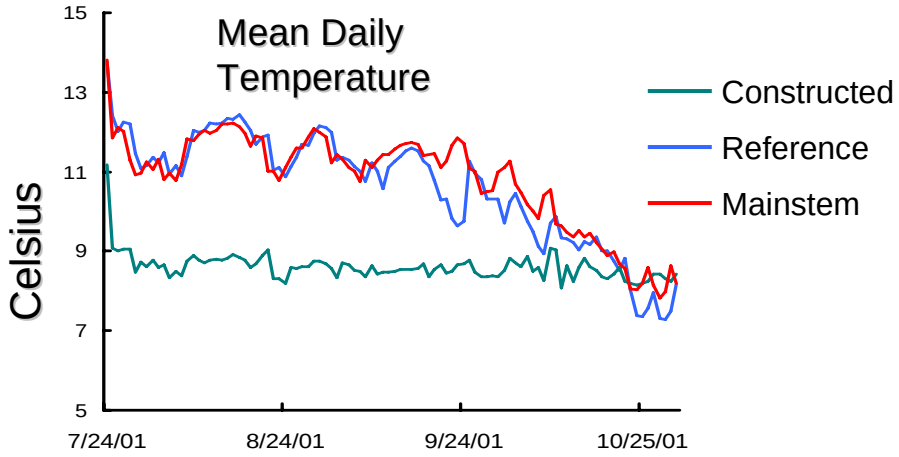
Habitat



Nutrients



Summer - temperature



Summary – Groundwater Channels

Constructed channels had

- higher coho density
- lower trout density (winter only)
- lower summer temp/higher winter temp.
- deeper
- lower habitat diversity, wood, canopy cover

Overall Summary

Study 1

- Constructed = natural, no difference among types
- Habitat size <= few hectares most productive

Study 2

- Shoreline irregularity important

Study 3

- Constructed groundwater >= natural

Future Research

- Survival and escapement
- Other factors
  - Temperature
  - location within basin
  - Predation
  - Other species

Design Considerations?

- Morphology
  - Shoreline irregularity
  - Channel shape
- Habitat
  - Complexity/Cover (LWD)
  - Heterogeneity/diversity

Acknowledgements

WDFW: B. Barkdull, C. Detrick, D. King,T. Powell

Skagit System Co-op: E. Beamer

UW: J. Hall, J. Toft, K. Rein

WDNR: W. Scarlett

Watershed Program for field assistance

Photo courtesy of Dan Bottom