Seasonal and Diurnal Habitat Suitability Criteria for Juvenile Chinook Salmon in the Cedar River, Washington

Roger J. Peters, Daniel L. Lantz, and Howard A. Gearns

U.S. Fish and Wildlife Service

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Overall Study Objectives

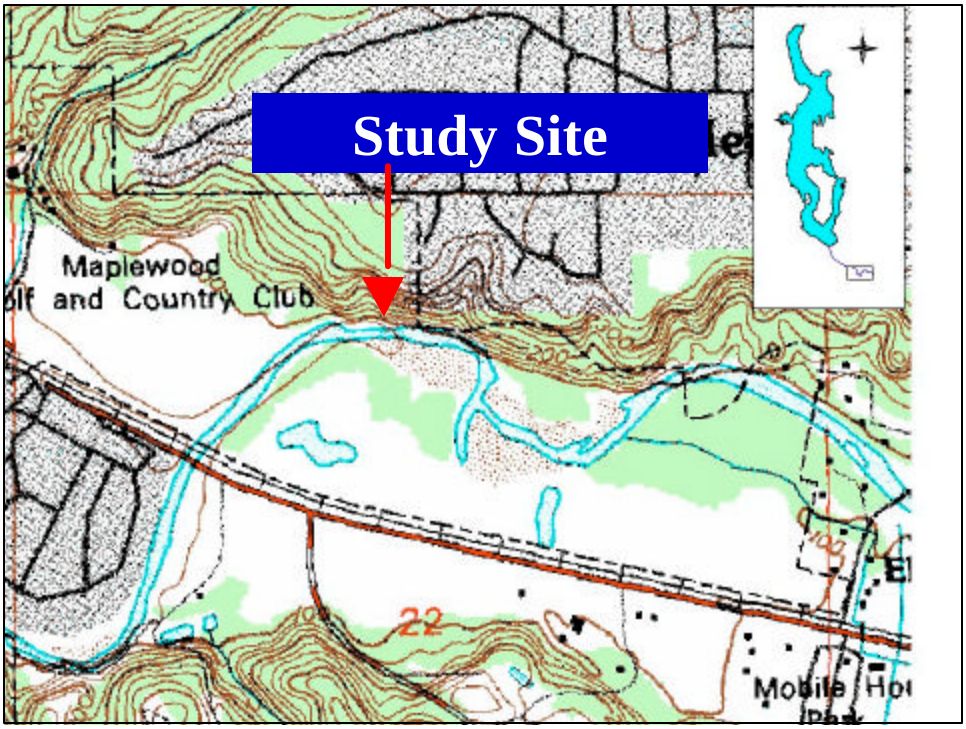
- Determine Habitat Use
  - Spatial and Temporal Scales
    - Reach, Macrohabitat, Mesohabitat, **Microhabitat**
    - Seasonal and Diurnal
- Develop statistical models
  - Identify important habitat variables
  - Predict distribution and abundance
- Evaluate the influence of flow on habitat use

Overall Study Objectives

- Test statistical models
  - Important variables
  - Predictive capability
- Evaluate the influence of flow on habitat availability

Microhabitat Objectives

- Develop habitat suitability criteria (HSC)
  - Examine seasonal variation (February and April)
  - Examine diurnal variation
  - Examine variation with discharge (April/Main Channel – 575 & 800 cfs)
  - Channel type (Main Channel & Side Channel)



Habitat Use & Availability

Habitat Variables

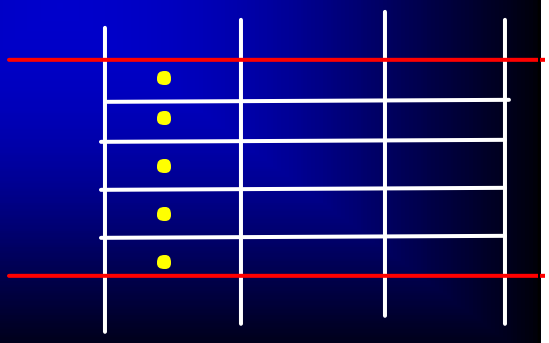
Depth

Velocity

Substrate

(Distance to bank)

(Distance to Cover)



Preference Curve Development

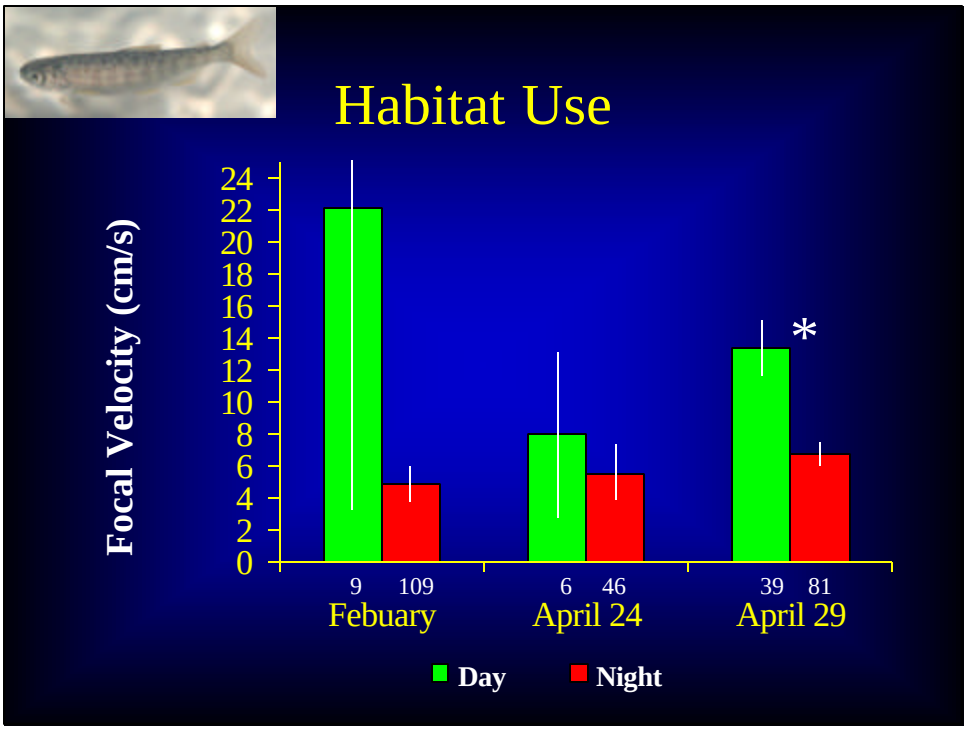
- Establish variable ranges (i.e. 0-20, 20-40 cm/s)
- Calculate proportion of habitat available in each range
- Calculate numbers of fish expected to be observed in each variable range
  - Number fish observed * proportion available in variable range (Expected values > 5)

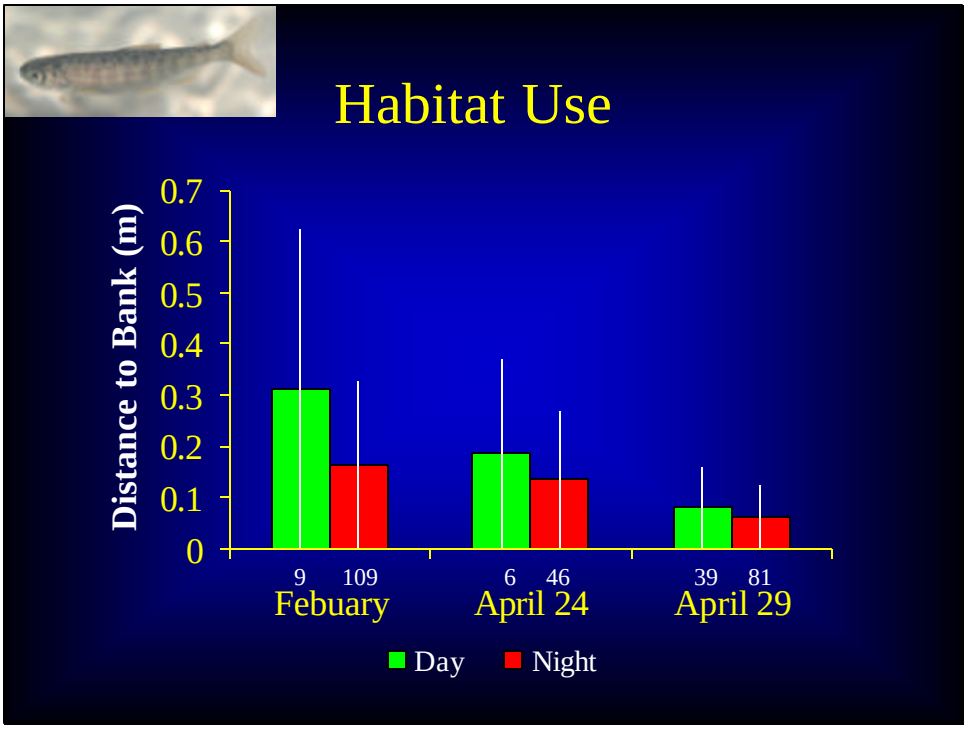
Preference Curve Development

- Calculate observed numbers of fish in each variable range
- Preference – observed/expected
- Normalized preference (0-1)
  - Preference/largest of non-normalized preference

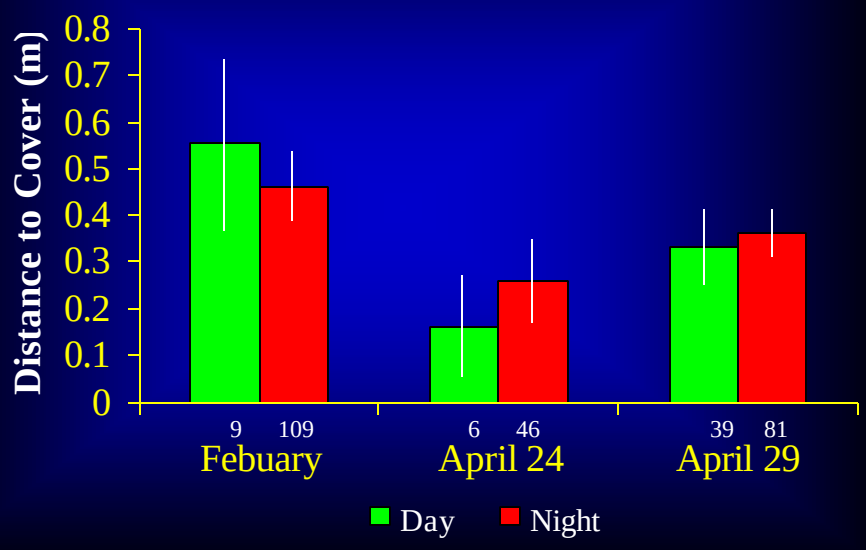
Evaluation of Preference Curves

- Calculate of usable area for our study reach (i.e. $\sum P(v)*\text{Cell Velocity}_i$)
  - Velocity
  - Depth
  - Substrate
  - Combined (V*D*S)


Habitat Use
Focal Velocity (cm/s)
24
22
20
18
16
14
12
10
8
6
4
2
0
*
9
109
Febuary
6
46
April 24
39
81
April 29
Day
Night

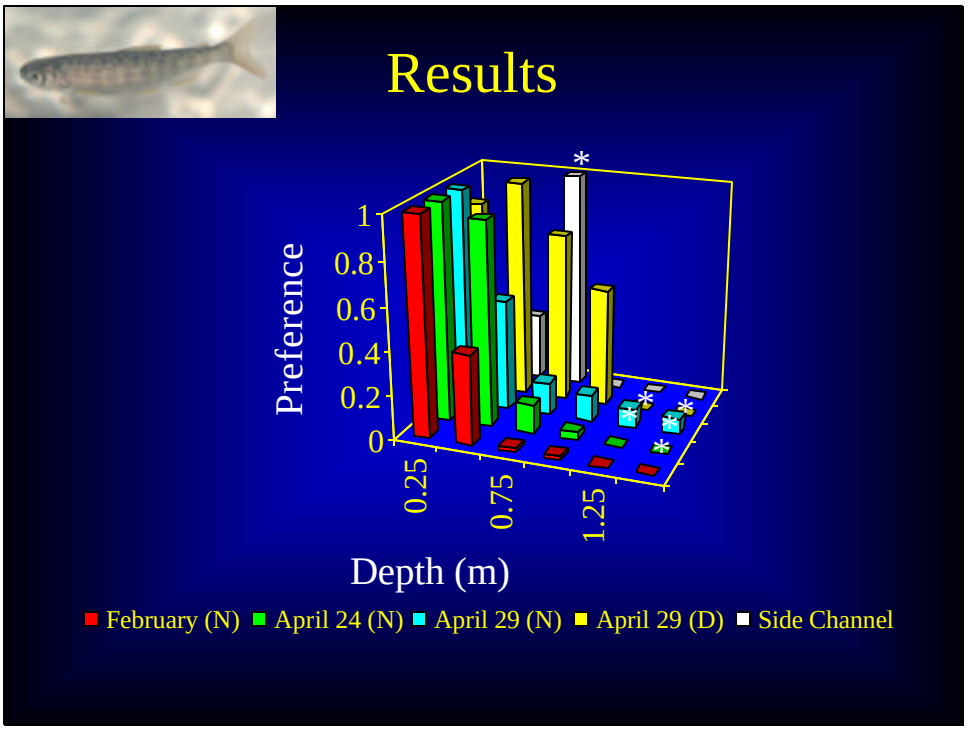

Habitat Use
Distance to Bank (m)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
109
Febuary
6
46
April 24
39
81
April 29
Day
Night

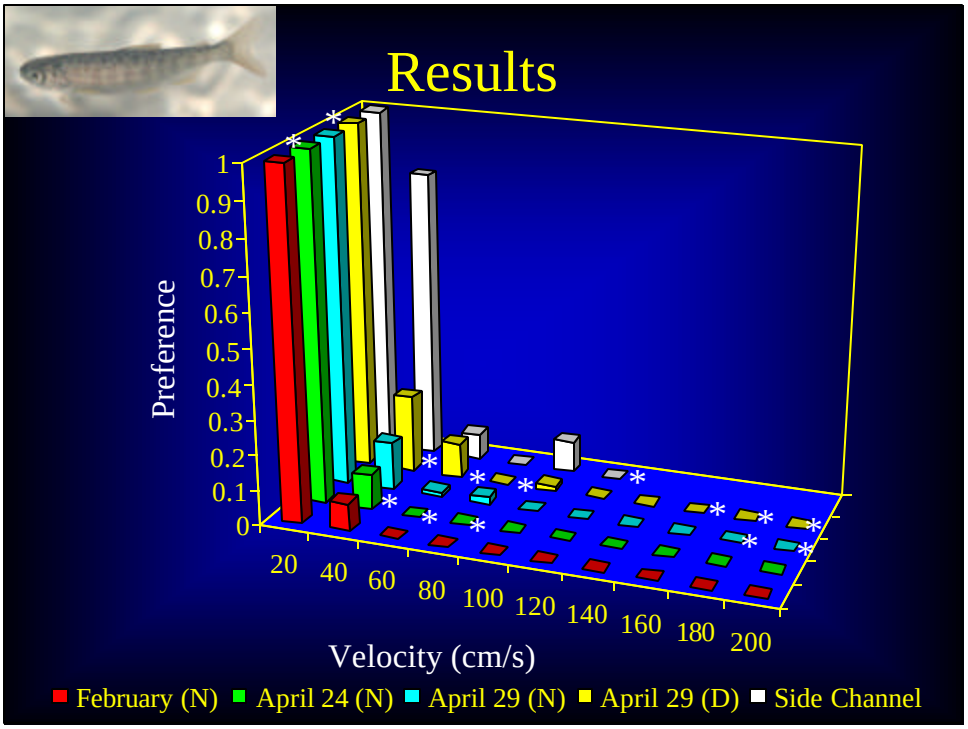
Habitat Use



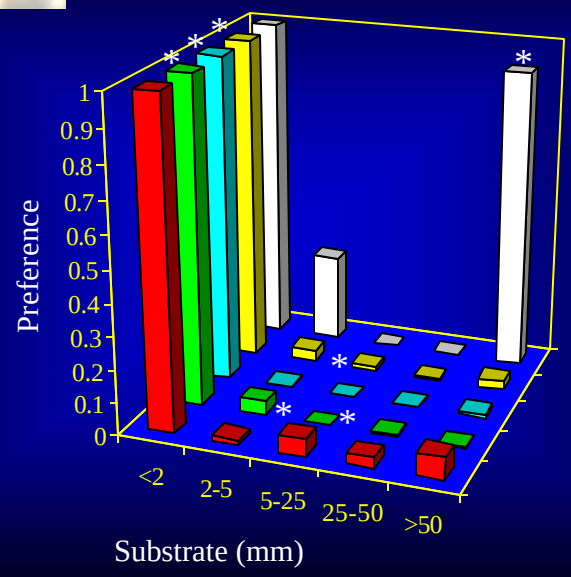
Results

	February	April 24	April 29	April 29	Side Channel
# Groups	109	51	81	39	48
# Fish	109	103	139	168	49
Period	Night	Night	Night	Day	Night
Discharge (cfs)	550	800	575	575	575


Results
Preference
1
0.8
0.6
0.4
0.2
0
0.25
0.75
1.25
Depth (m)
February (N)
April 24 (N)
April 29 (N)
April 29 (D)
Side Channel


Results
Preference
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
40
60
80
100
120
140
160
180
200
Velocity (cm/s)
February (N)
April 24 (N)
April 29 (N)
April 29 (D)
Side Channel

Results



% Change Usable Area

(P[x]: 800 to 575 cfs)

		Preference Curves		
Variable	Available	800 cfs	575 cfs	% Change
Depth	800 cfs	1377	1234	-10.4
	575 cfs	1414	1219	-13.8
	% Change	2.7	-1.2	
Velocity	800 cfs	238	255	7.1
	575 cfs	277	298	7.6
	% Change	16.4	16.9	
Substrate	800 cfs	133	145	9.0
	575 cfs	77.8	73.6	-5.4
	% Change	-41.5	-49.2	
P[D*V*S]	800 cfs	91.5	90.5	-1.1
	575 cfs	28.4	16.1	-43.3
	% Change	-69.0	-82.2	

Conclusions

- Habitat Use
  - Focal Velocities < 15 cm/s
  - Within 0.2 m of the bank
  - Within 0.5 m of cover
- Preference
  - Depth < 0.5 m
  - Velocity < 20 cm/s
  - Substrate < 2 mm

Conclusions

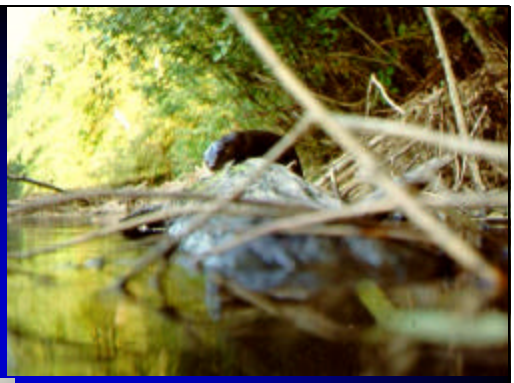
- Transferability of Preference Curves
  - Percent change generally around 10%, but up to 43%
- Influence of flow on availability
  - Dependent upon variable selected
    - Depth – no change
    - Velocity – increased with decreasing flow
    - Substrate – decreased with decreasing flow
    - Combined – decreased with decreasing flow

Important Findings

- Transferability of HSC to different flows is questionable

- Influence of flow on habitat availability is dependent upon variable selection

Information Needs

- Was influence of substrate (restrictive) on habitat use also a function of velocity or scale

- More evidence regarding transferability of HSC