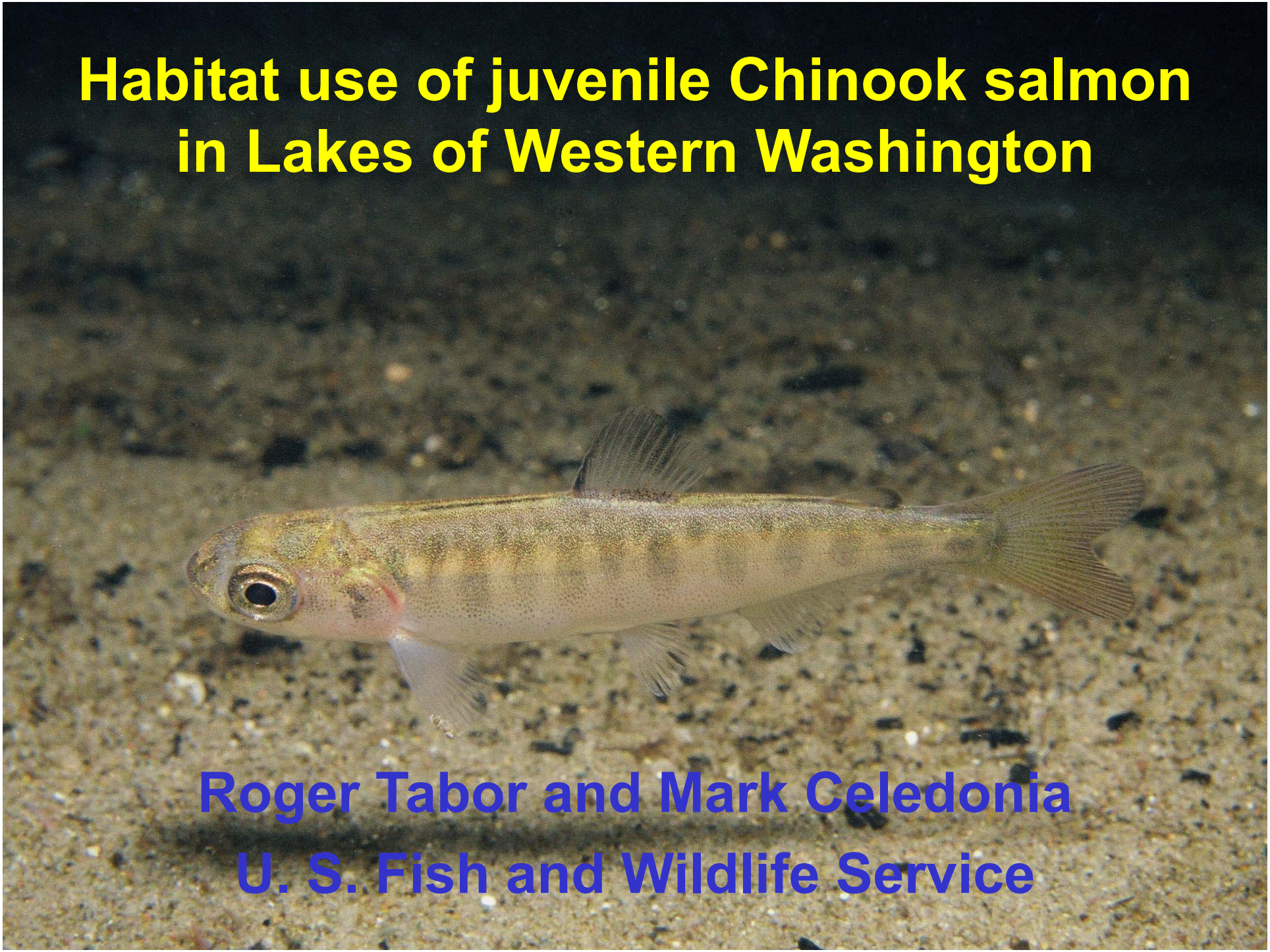
Habitat use of juvenile Chinook salmon in Lakes of Western Washington



Roger Tabor and Mark Celedonia
U. S. Fish and Wildlife Service

Acknowledgements

Seattle Public Utilities – SPU

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Washington State Department of Transportation – WSDOT

City of Mercer Island

Washington Department of Fish and Wildlife – WDFW

King County

University of Washington – UW

City of Renton

Hydroacoustic Technology Inc – HTI

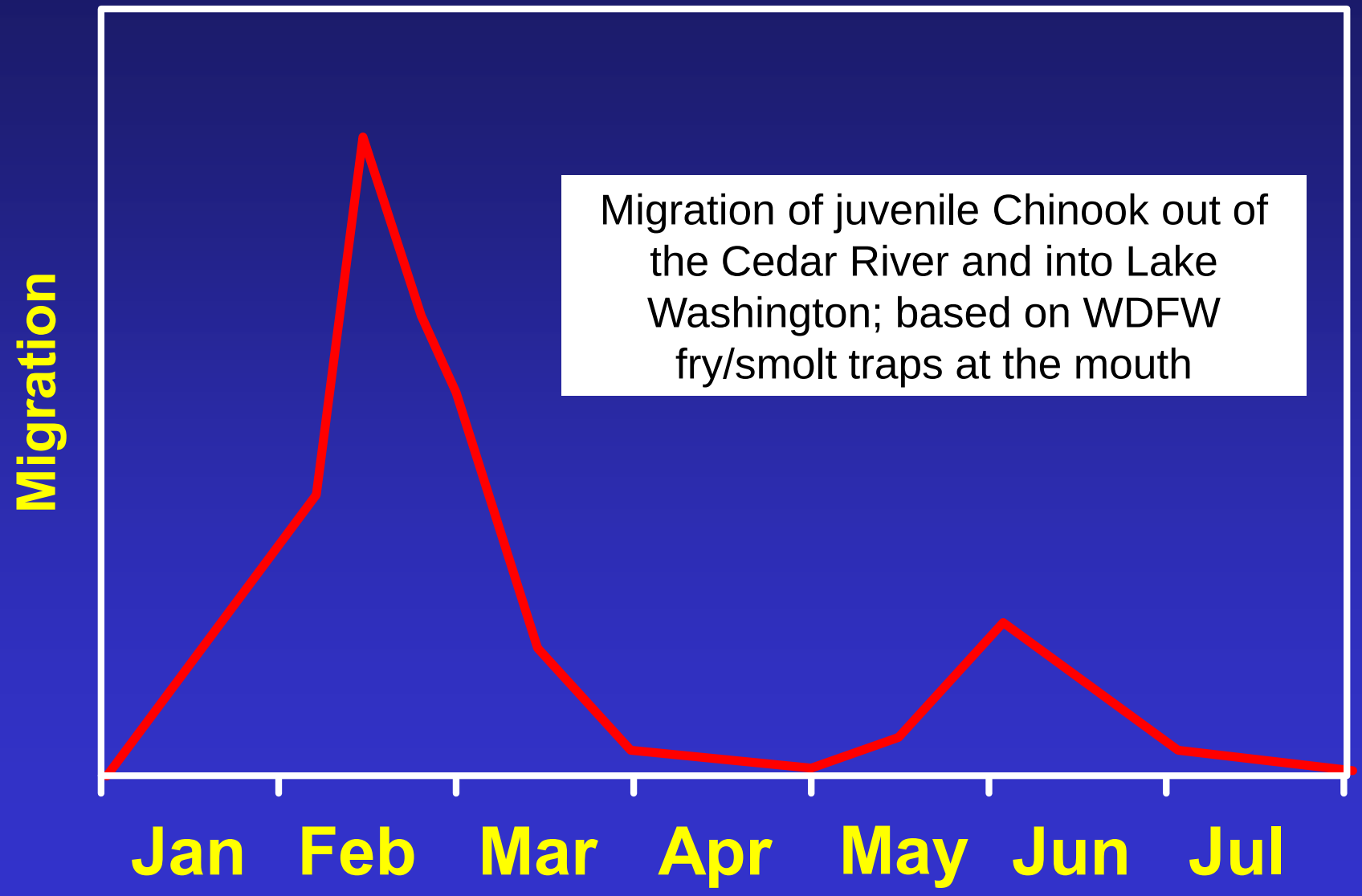
Muckleshoot Tribe – MIT

USFWS Employees

Outline

- Entry timing and nursery areas
- Depth selection
- Habitat use and shoreline development
- Non-natal tributaries
- Smolt movements and overwater structures
- Artificial lighting

Cedar River Chinook Outmigration



Juvenile Chinook groups

- Lake Washington
  - Cedar River fry - early migrants
  - Cedar River pre-smolts – late migrants
  - Bear Creek fry – early migrants
  - Bear Creek pre-smolts – late migrants
  - Issaquah Creek Hatchery pre-smolts
- Lake Sammamish
  - Issaquah Creek fry – early migrants
  - Isaquah Creek Hatchery pre-smolts

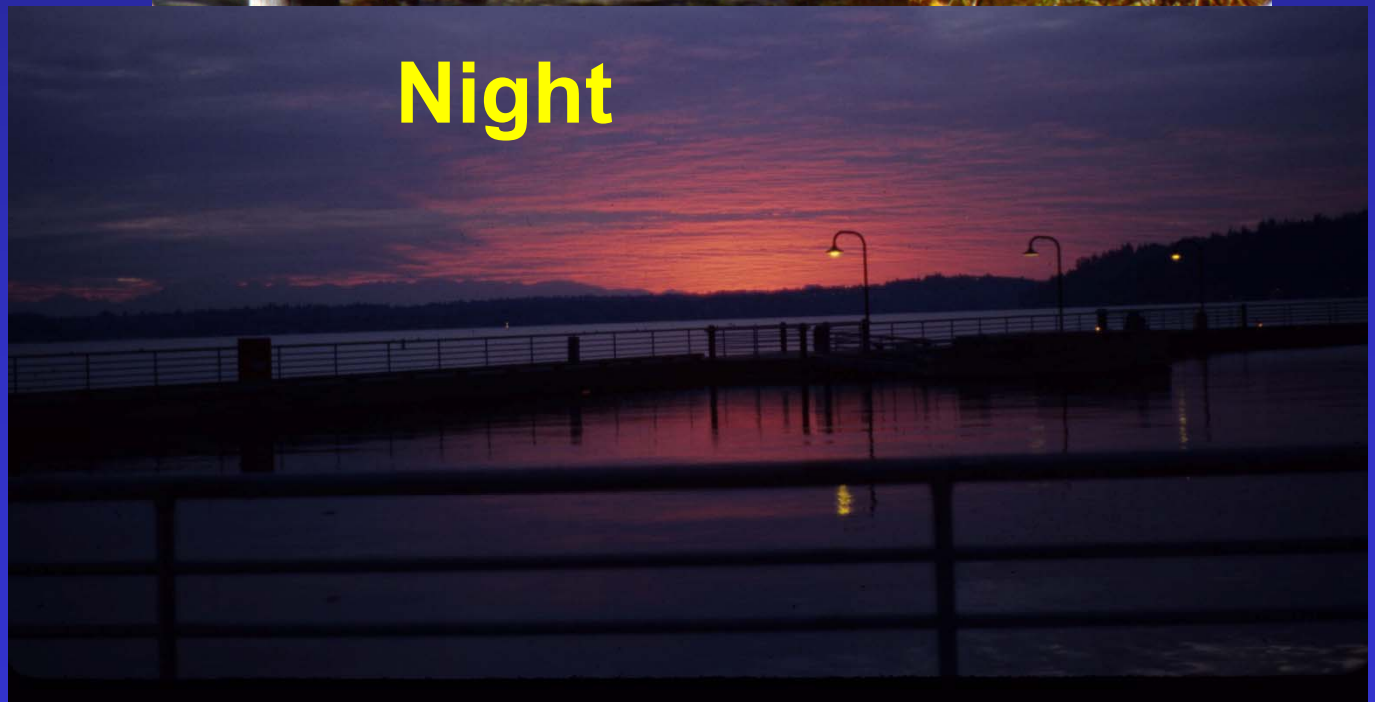
Juvenile Chinook Salmon

Snorkeling

Snorkeling

Acoustic tracking

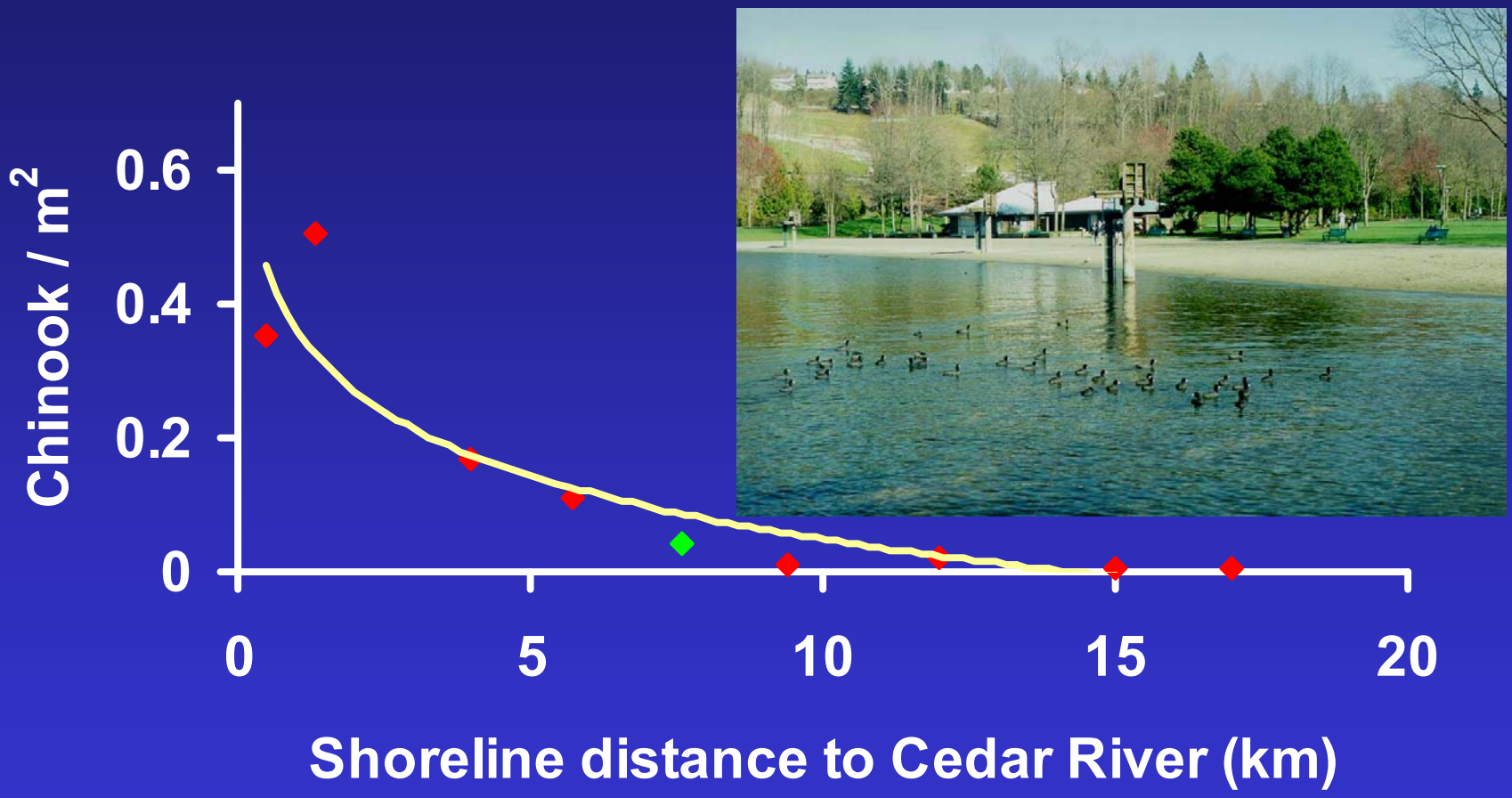
Day


Night

Chinook distribution

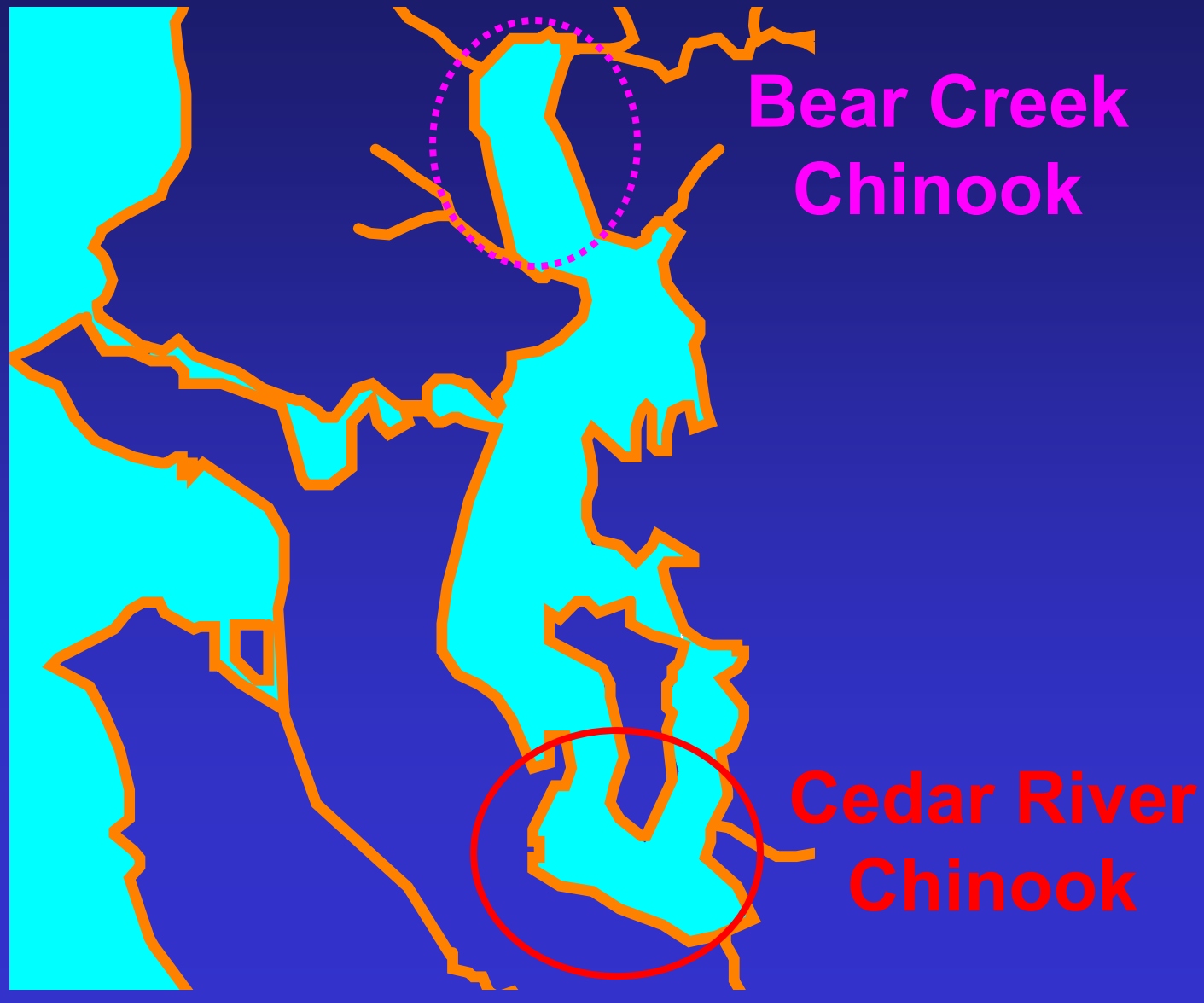
South Lake Washington - night snorkeling

February 4 – May 27, 2003

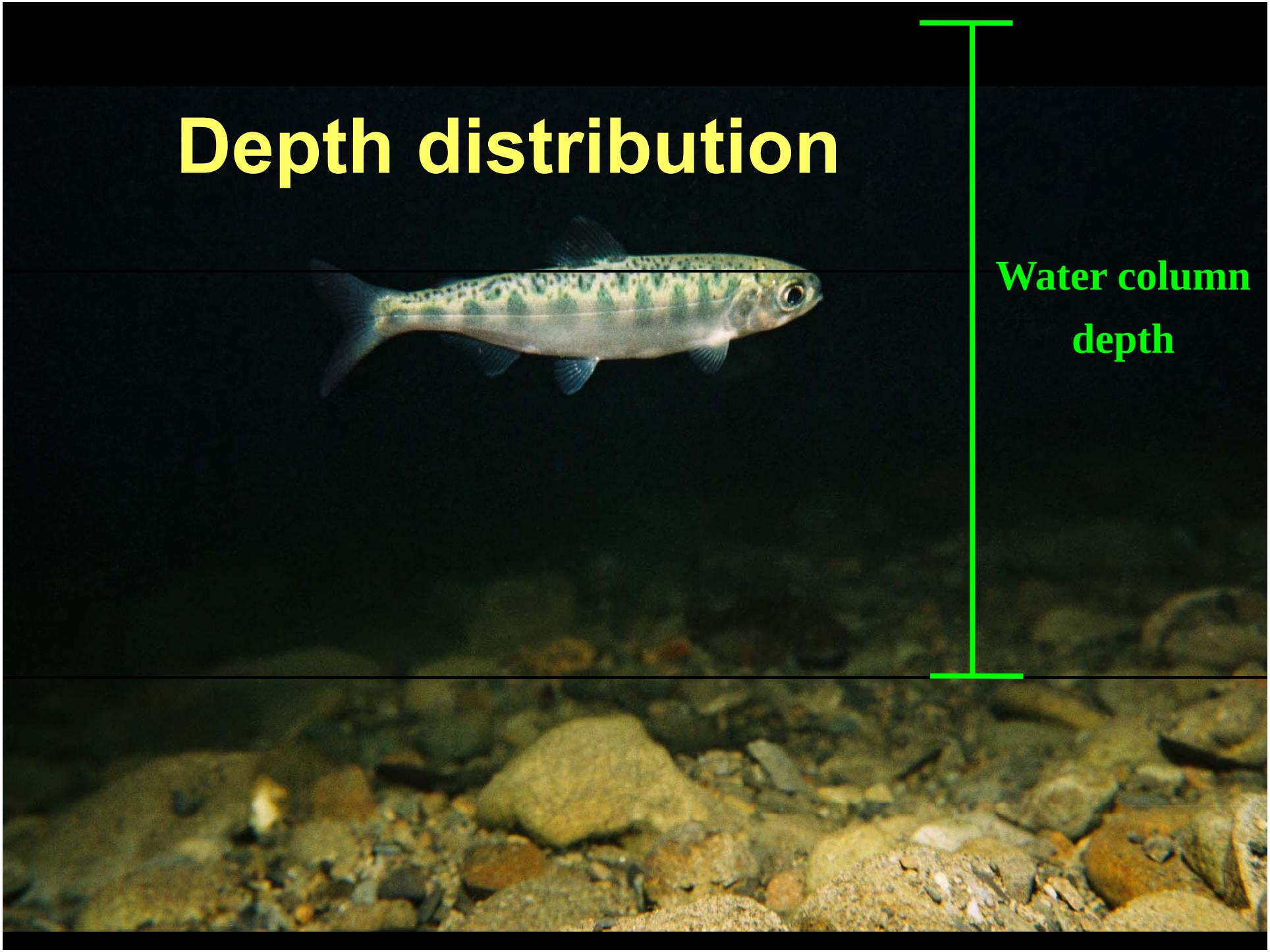


Chinook Salmon Nursery Areas

February to mid May

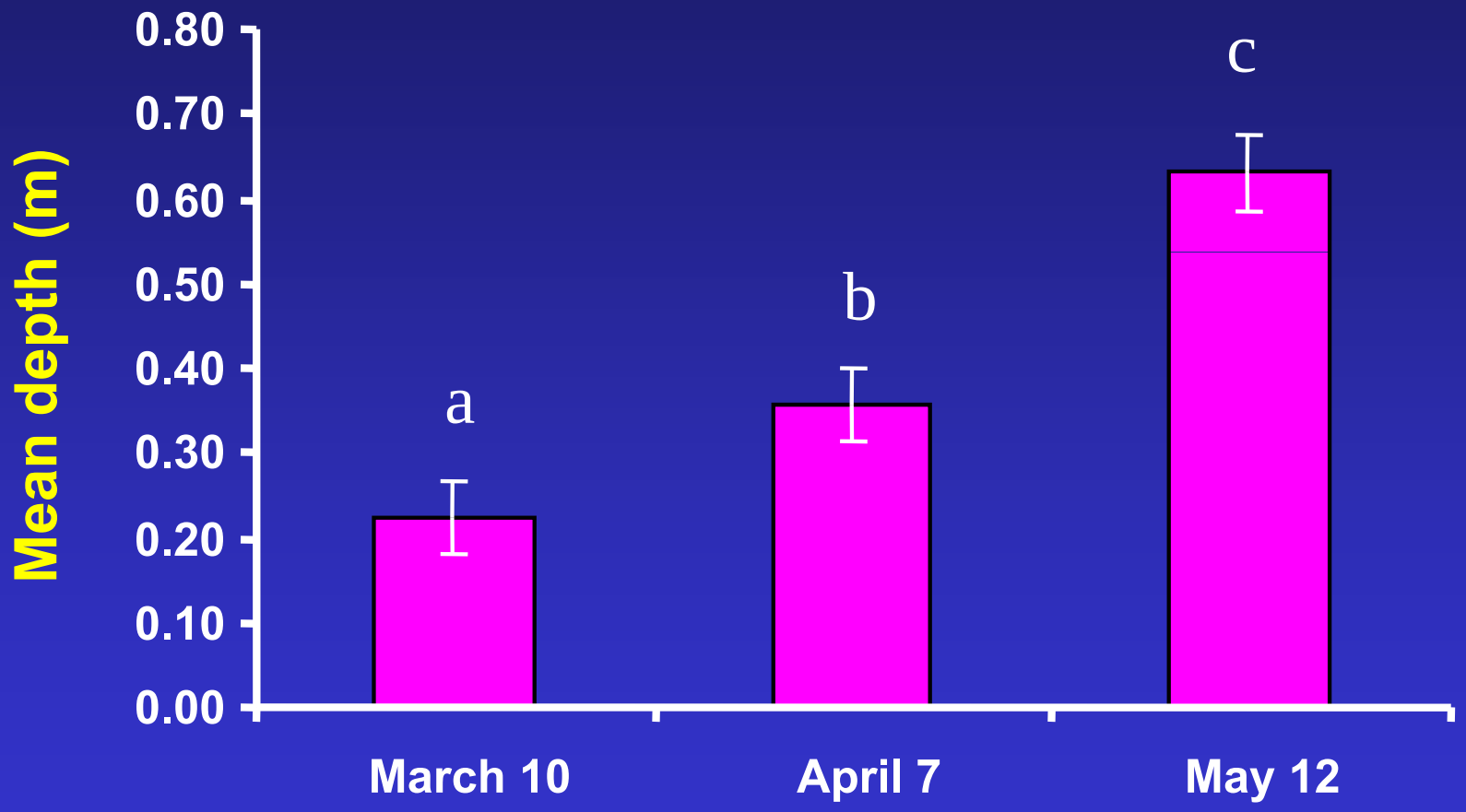


Depth distribution



South Lake Washington

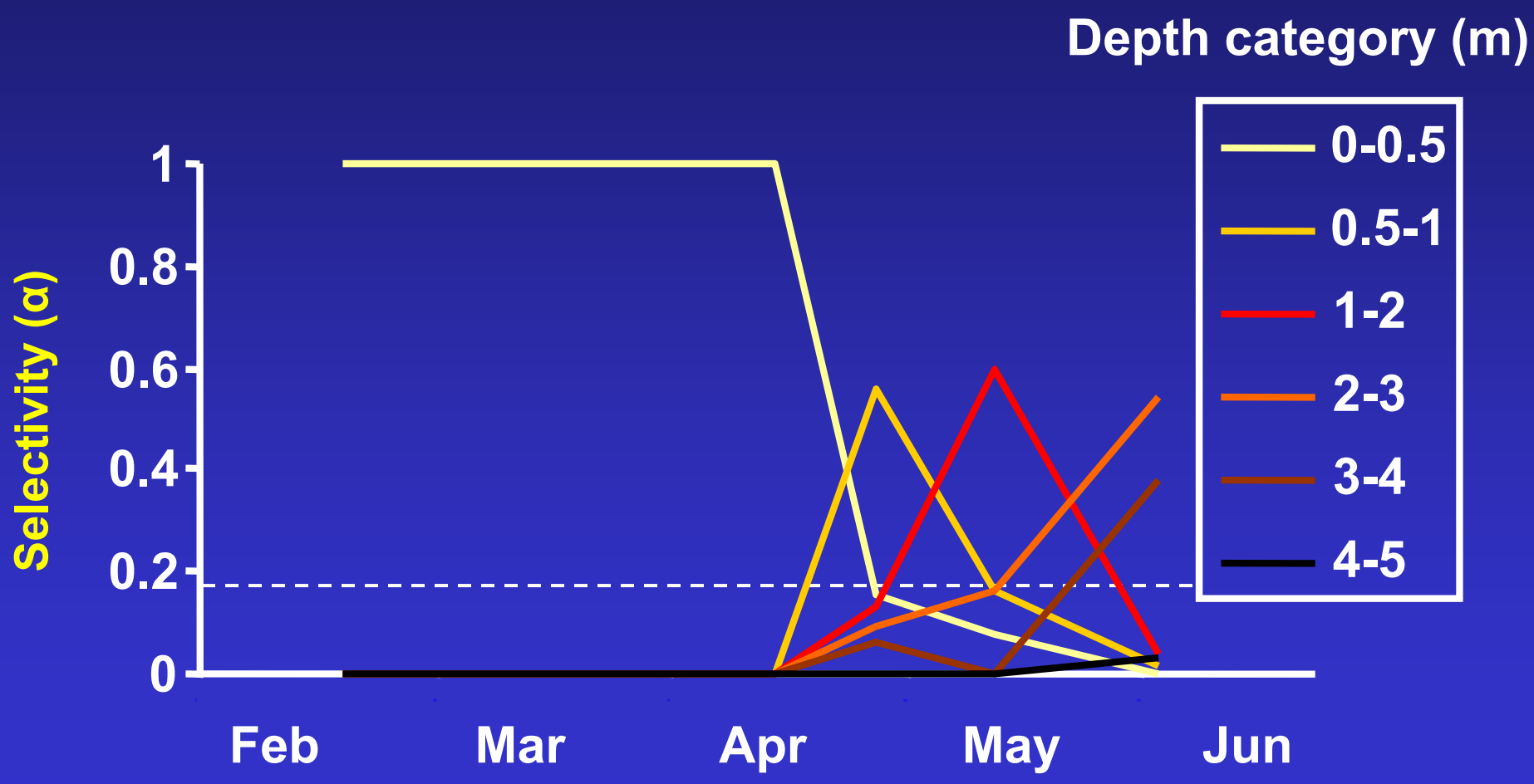
Night snorkeling/scuba diving: 0–3 m deep



	March 10	April 7	May 12
N =	31	40	46
Mean length (mm) =	43	50	92

South Lake Washington

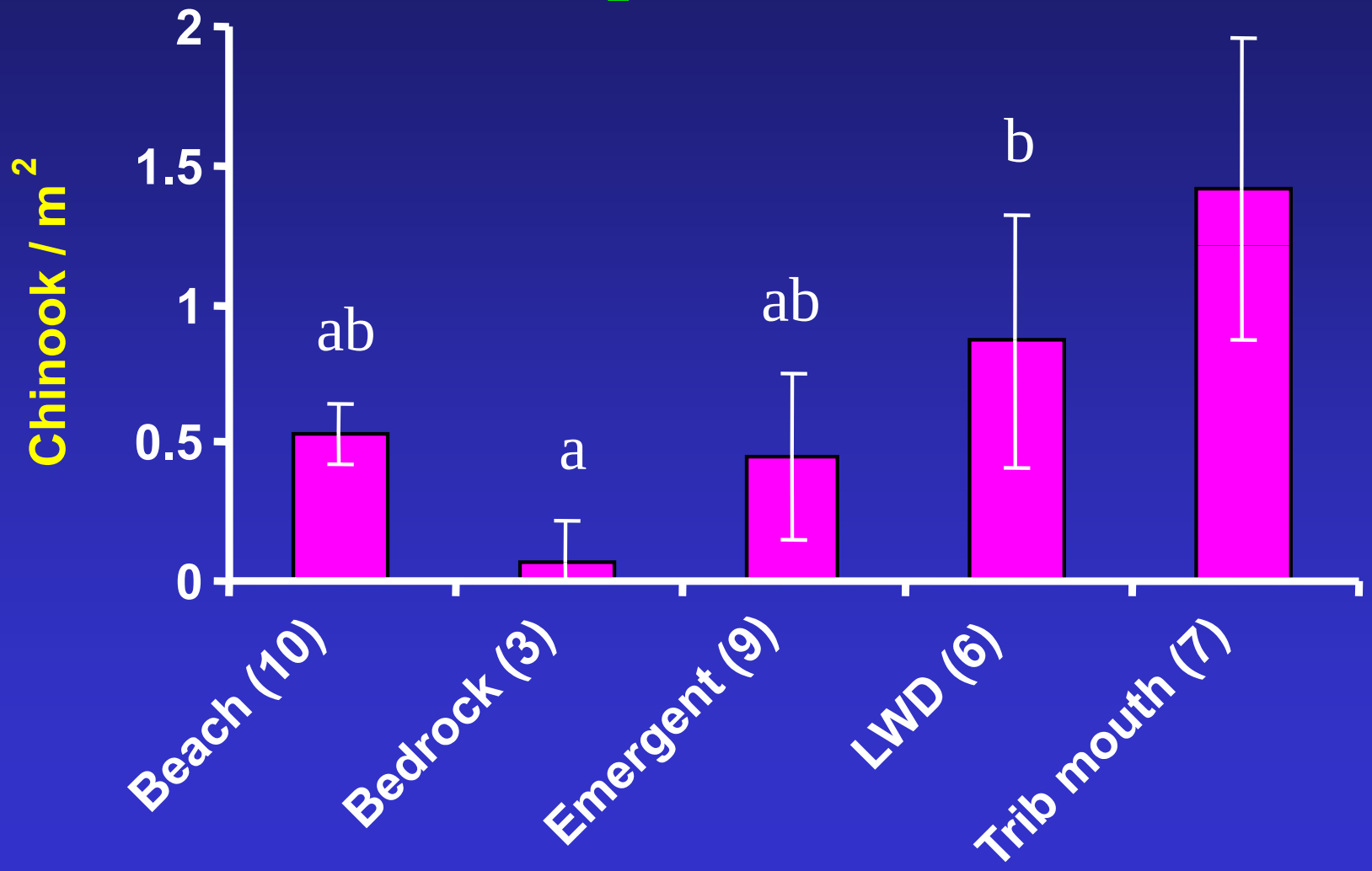
Dawn surface feeding activity



Lake Quinault – Habitat Use

Lake Quinault results

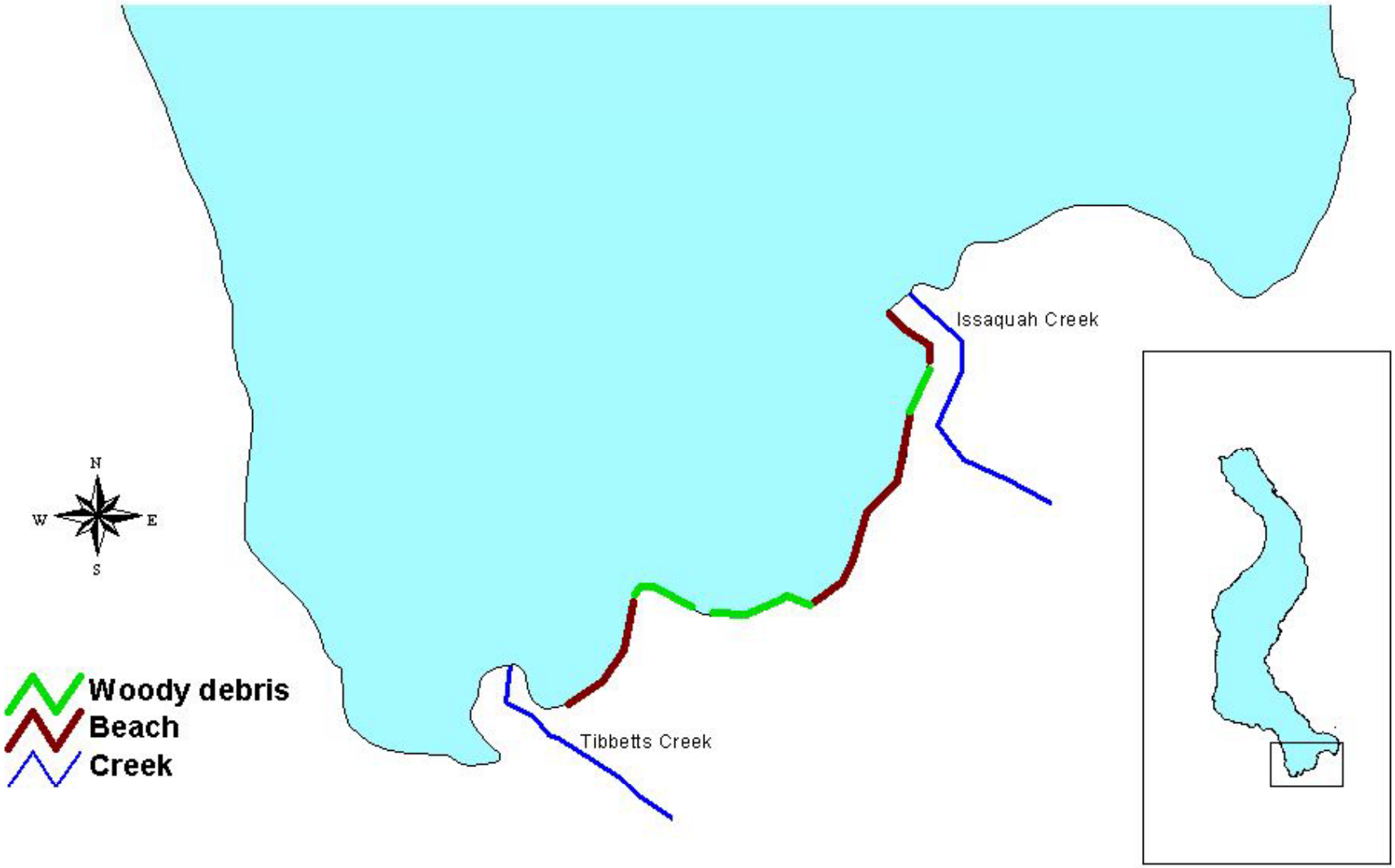
April 2003



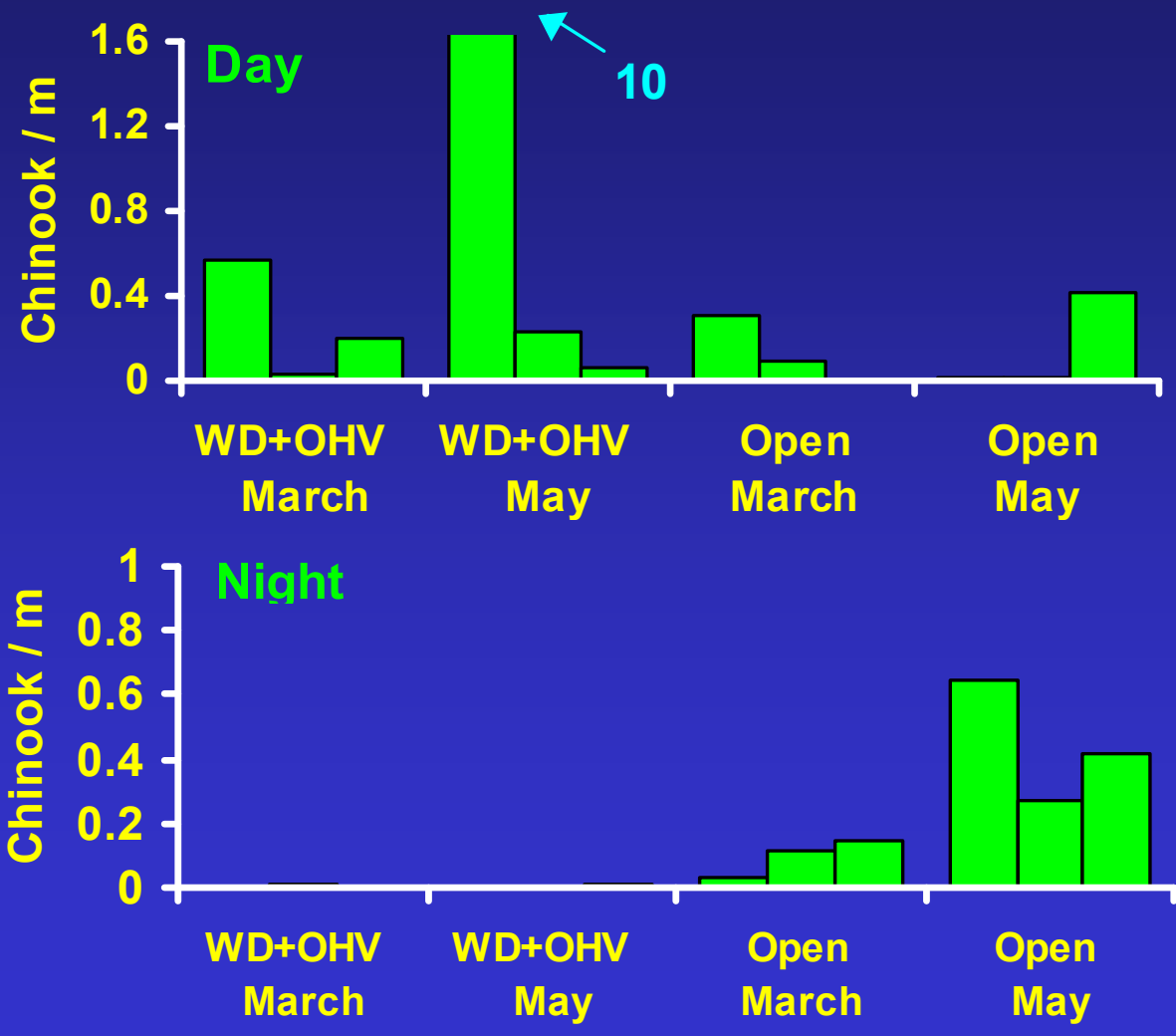
Woody Debris/Overhanging Vegetation

- Lake Sammamish
- Compared 3 complex sites with 3 open sites

Lake Sammamish – south shoreline



Lake Sammamish – south shoreline

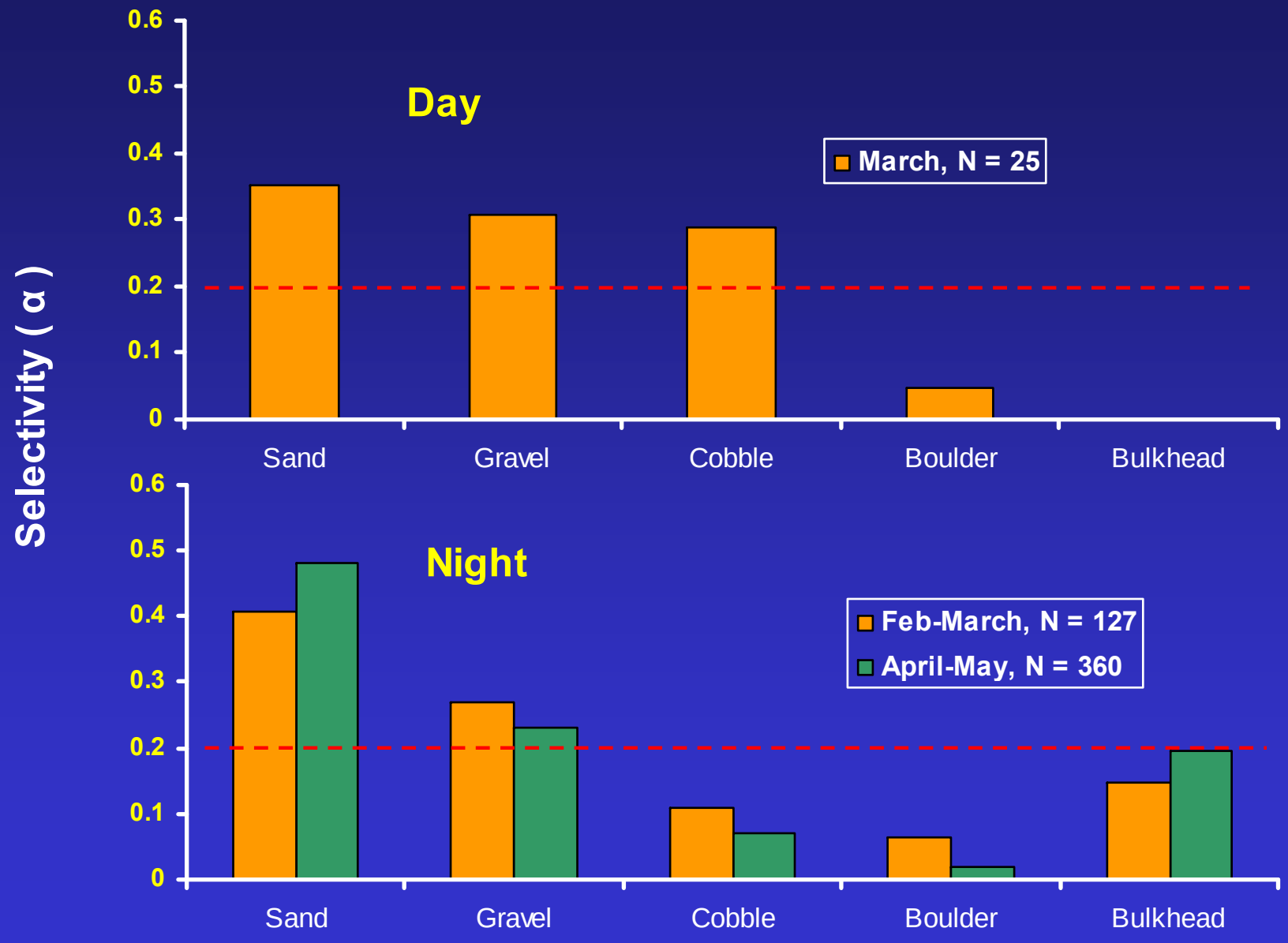


South Lake Washington

Variables include:

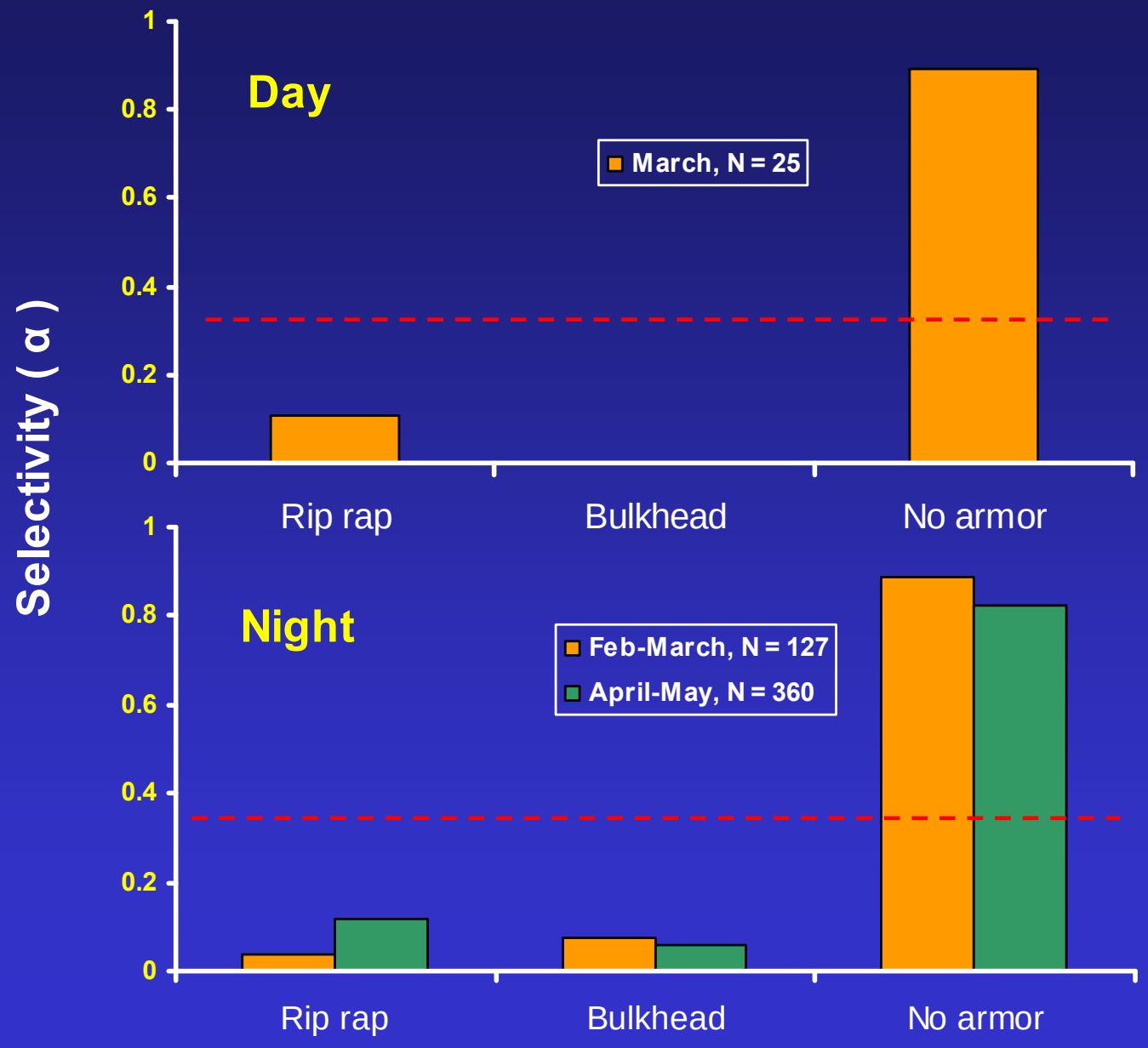
- **Substrate use**
- **Use of armored shorelines**
- **Use of overwater structures**

Substrate selection

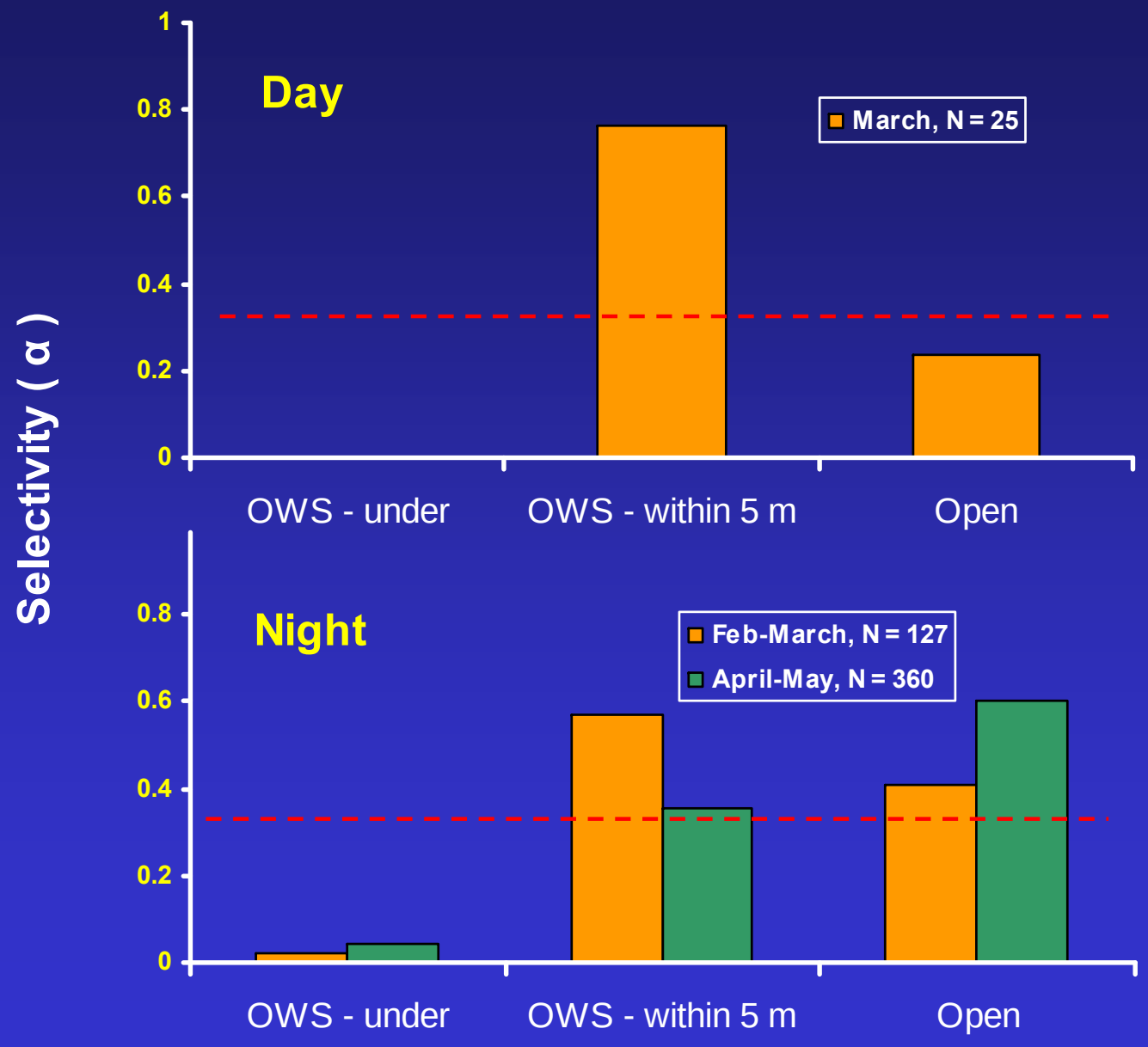


Juvenile Chinook – Night

Shoreline Armoring



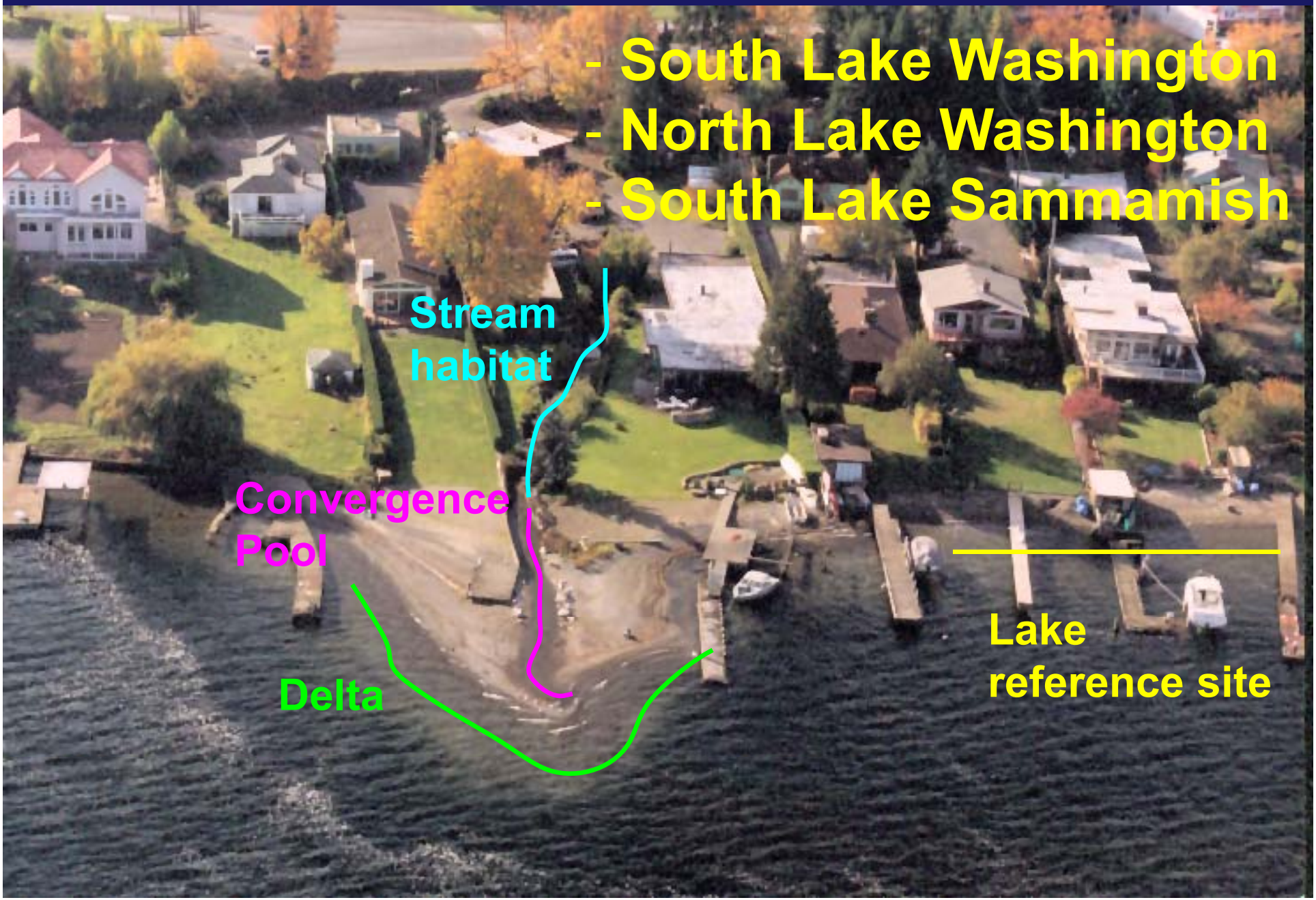
Overwater Structures



Rainier Beach Restoration Site

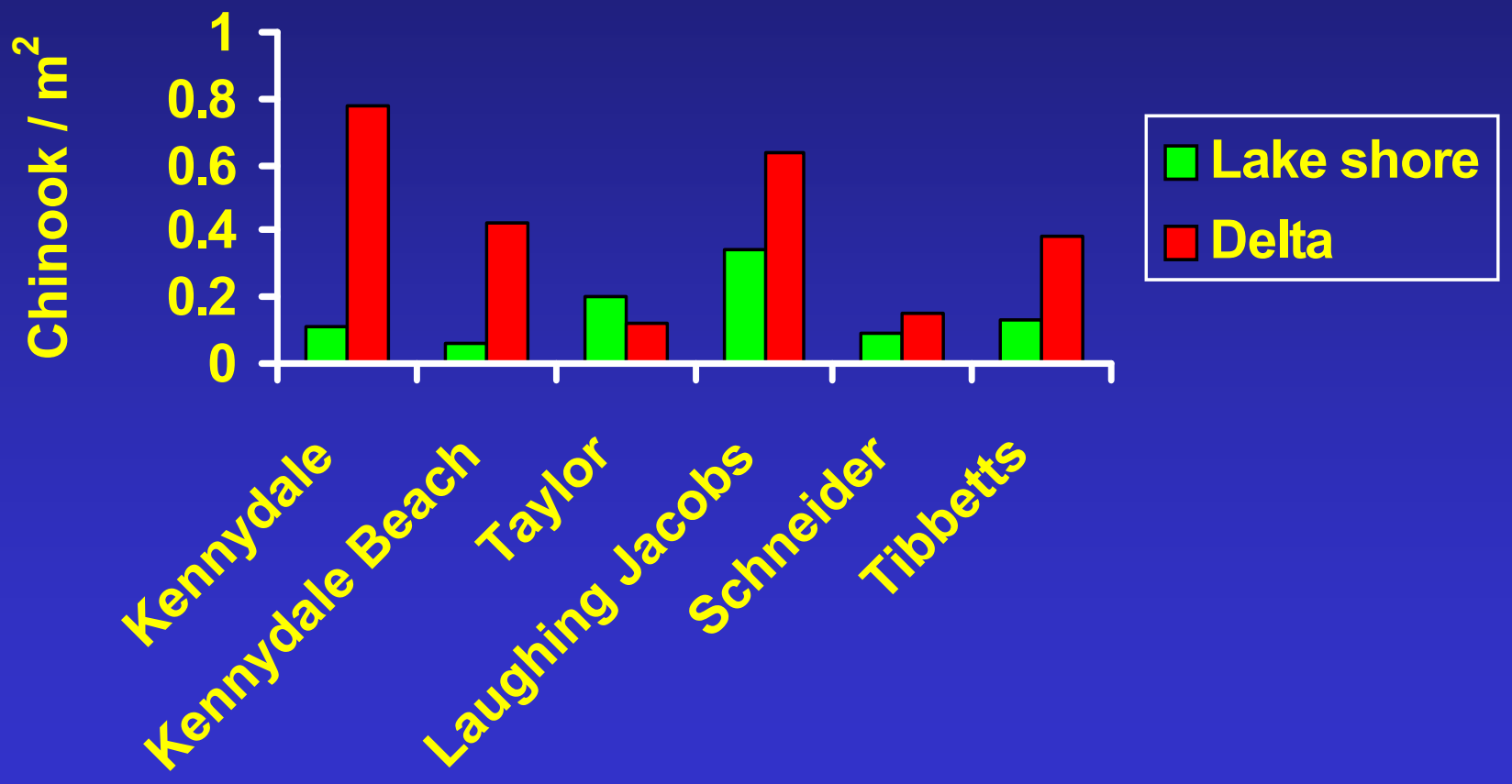
Marina and rip rap replaced with gravel beach

Non-natal tributaries



Delta / Lake shore

South L.Washington and L. Sammamish

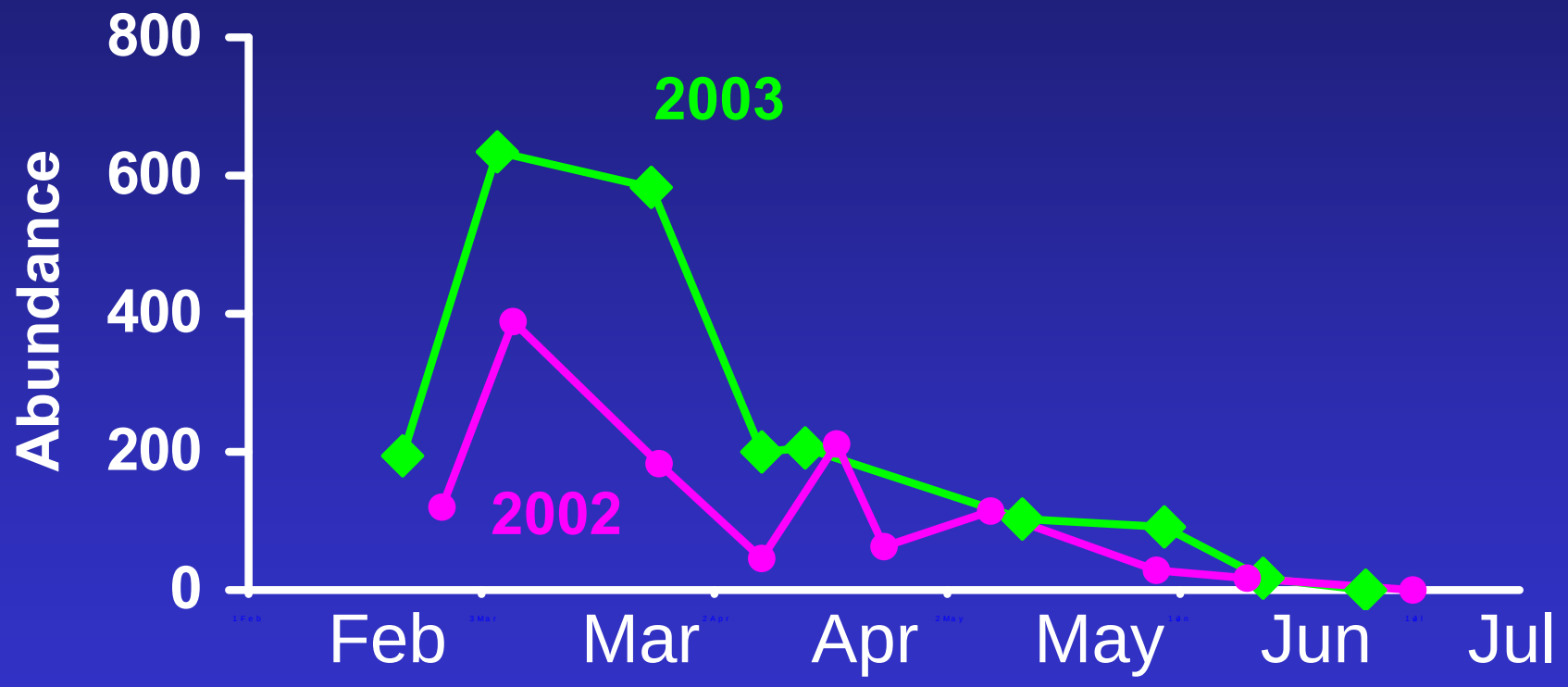


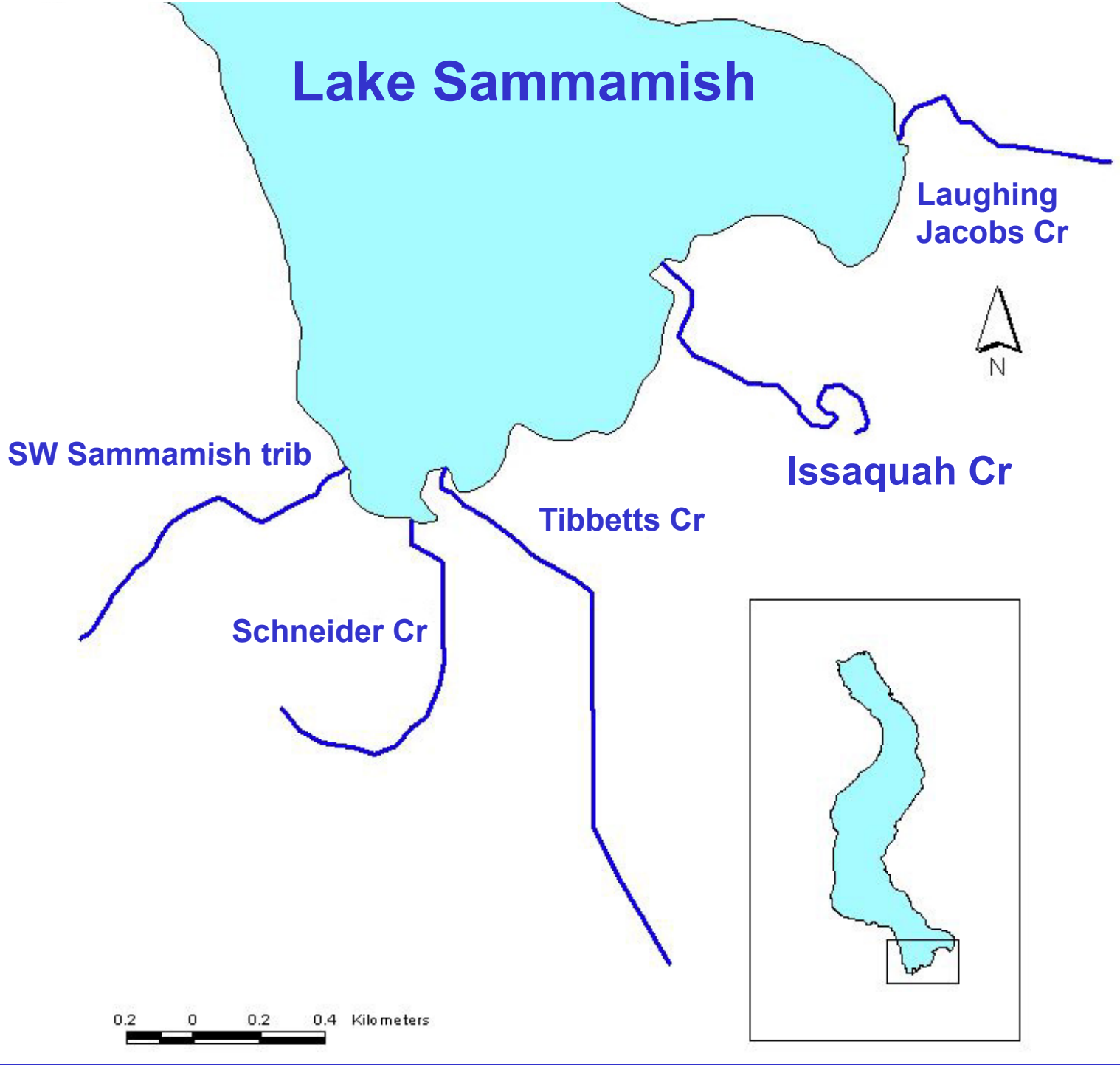
Johns Creek

- Close to Cedar River
- Low gradient
- Small to medium-sized
- Few other fish present

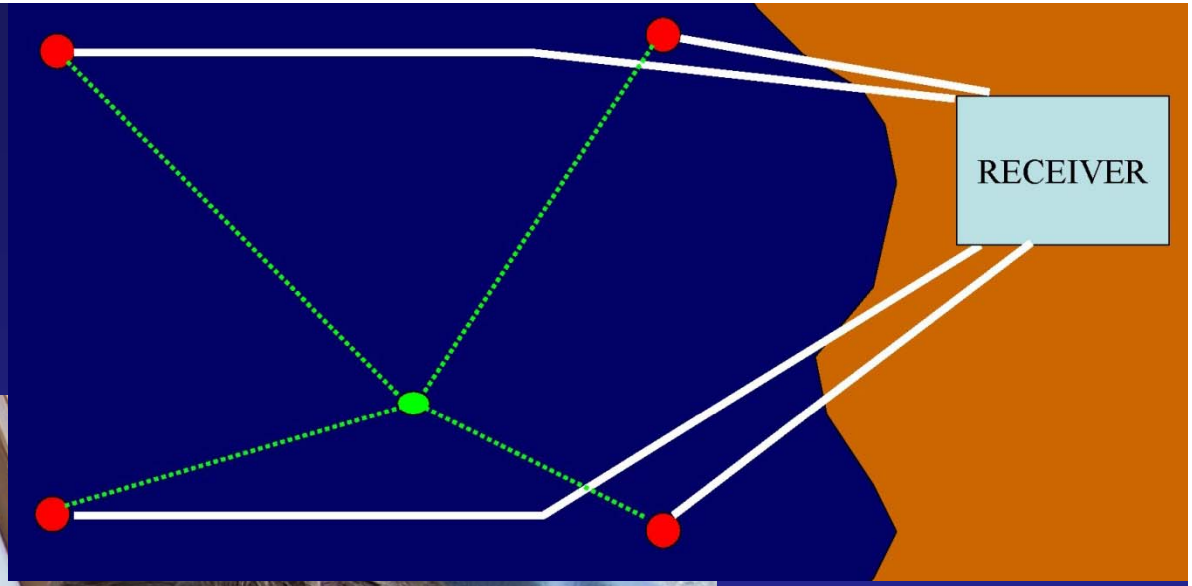
Chinook Abundance in Johns Creek

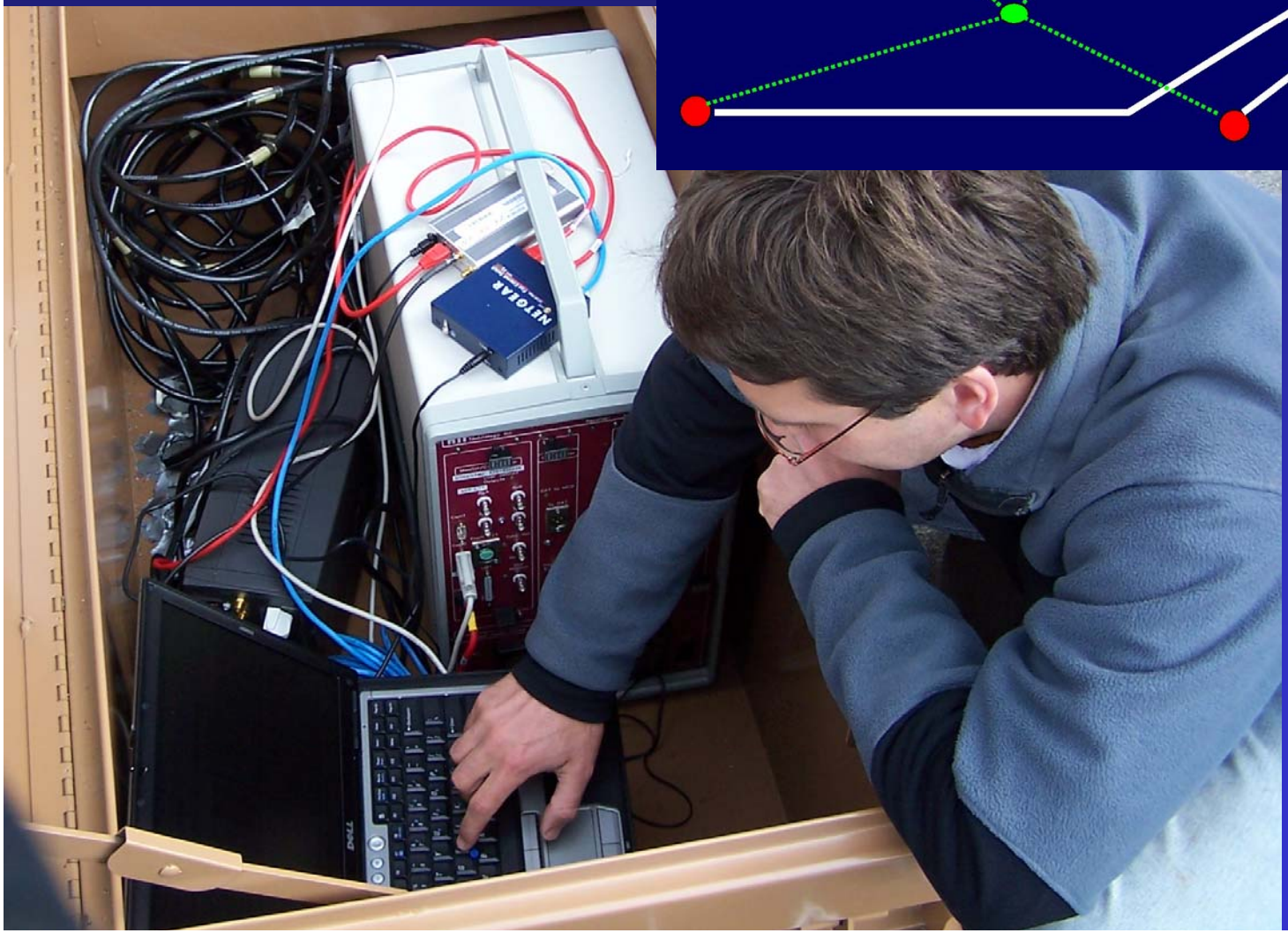
lower 260 m



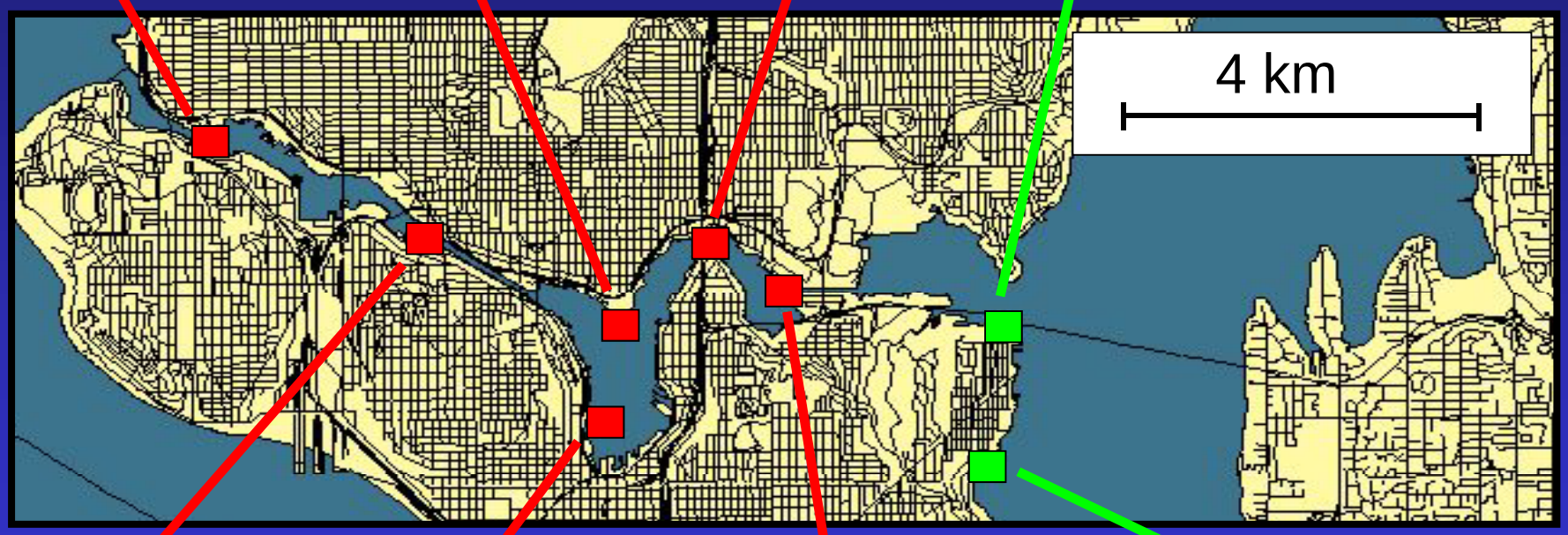

Lake Sammamish
Laughing Jacobs Cr
N
SW Sammamish trib
Issaquah Cr
Tibbetts Cr
Schneider Cr
0.2 0 0.2 0.4 Kilometers

Use of Acoustic Tags


RECEIVER


NETGEAR
DELL

2004 - 2008 Study Sites



Ballard Locks
2006-2008

N. Lake Union
2005-2008

University &
I5 Bridges
2006-2008

520 Bridge
2007-2008

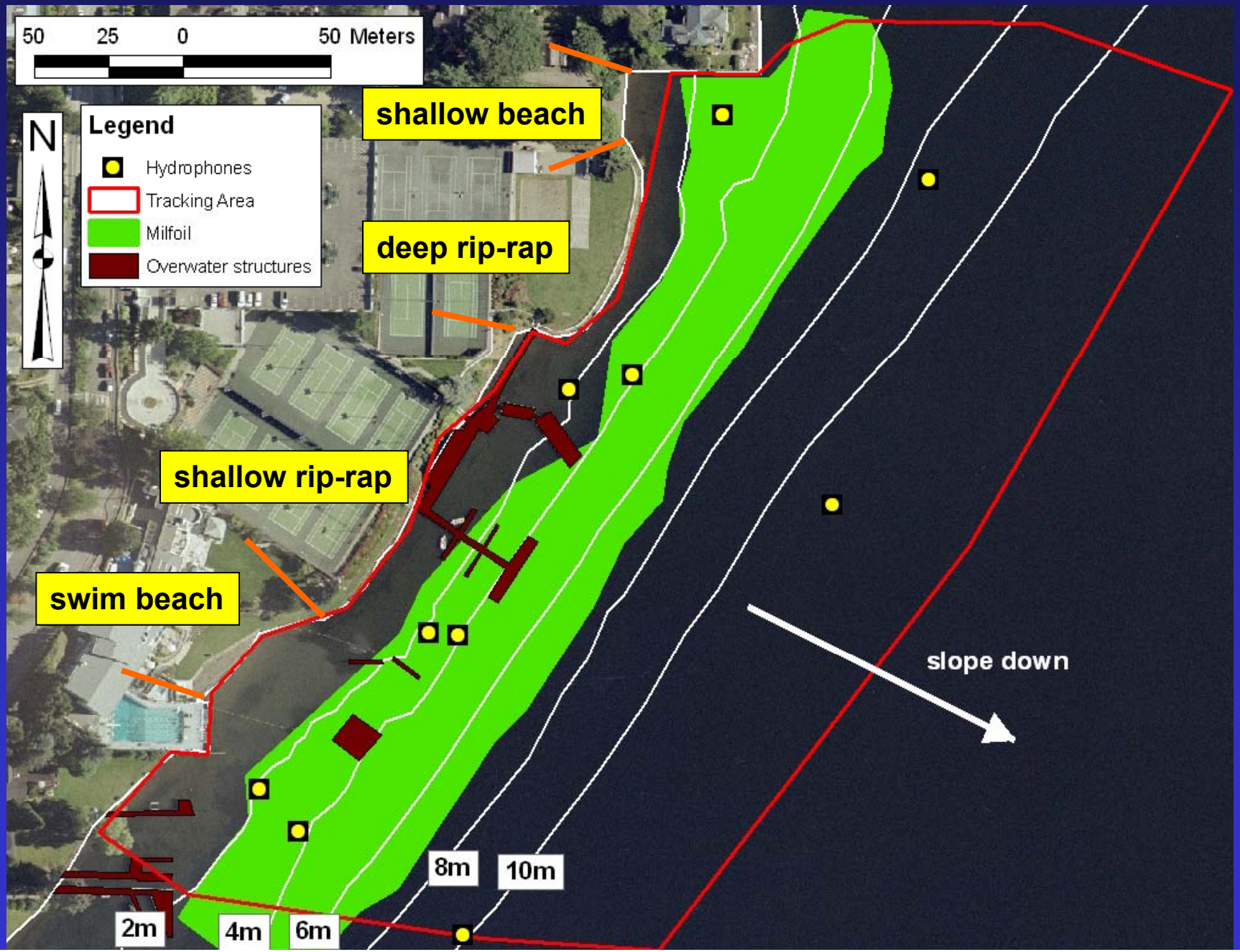
Fremont Cut
2007-2008

S. Lake Union
2006-2008

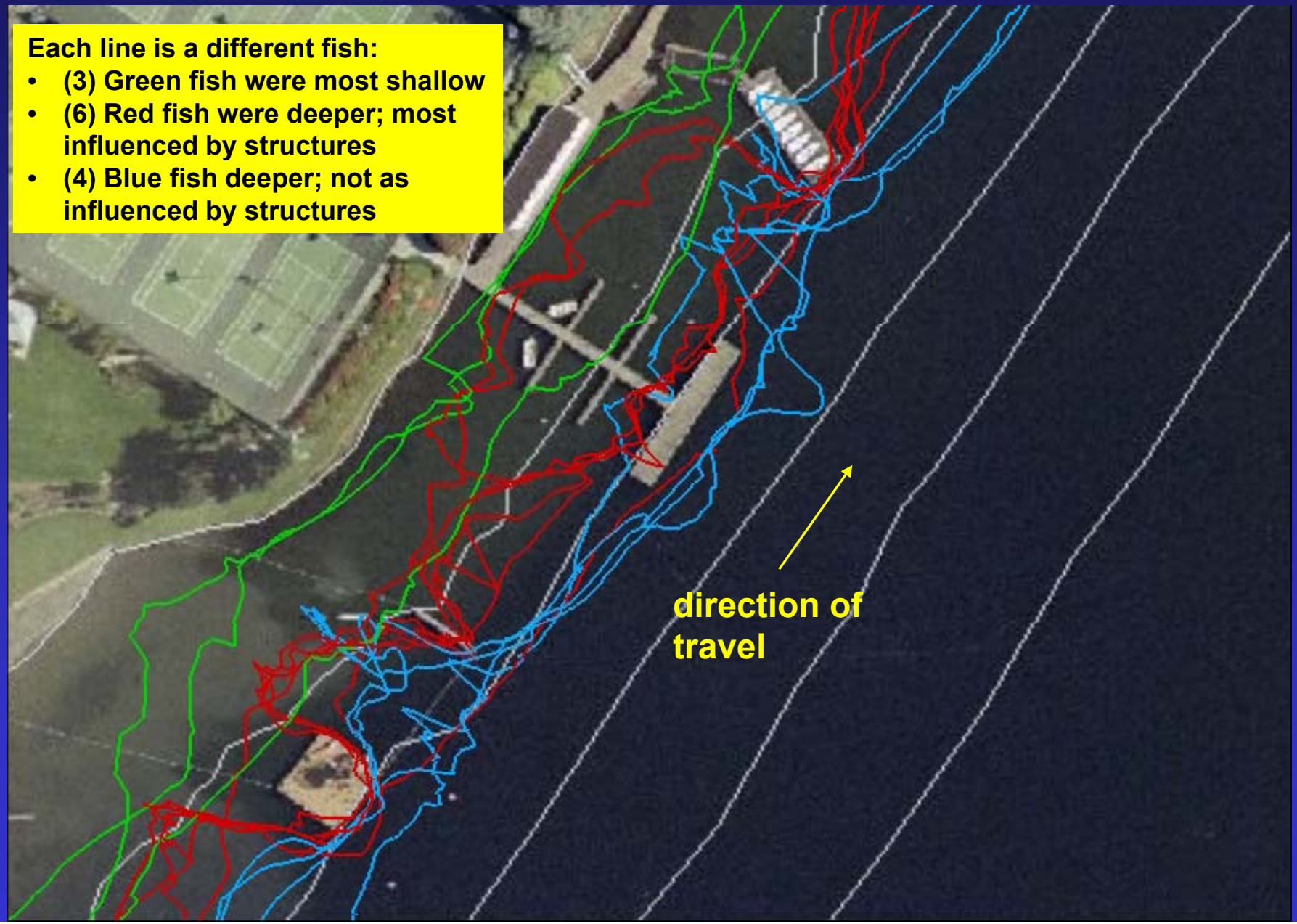
Portage Bay
2004-2005

Seattle Tennis Club
2005

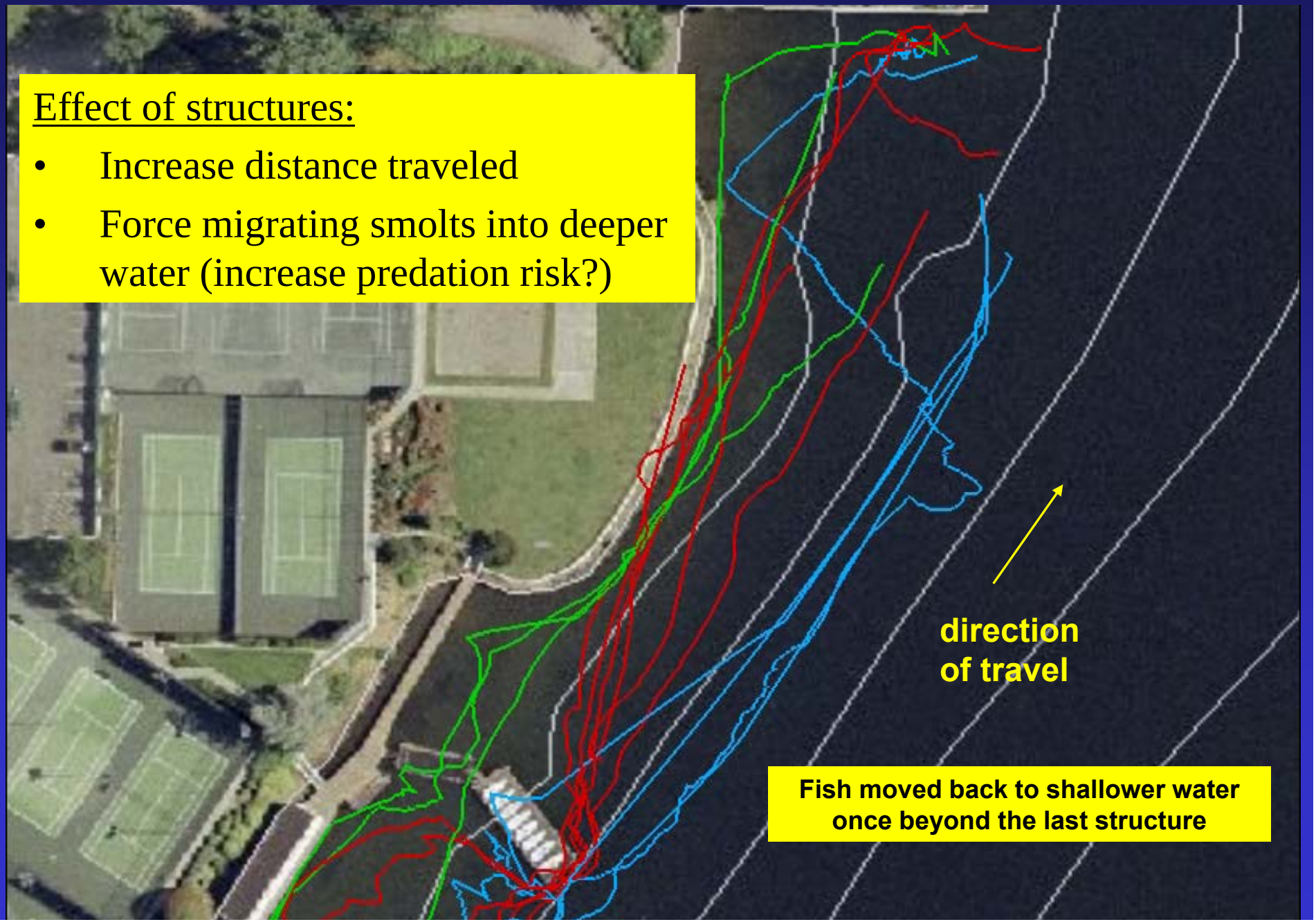
Seattle Tennis Club (2005)



Behavior around structures Tennis Club



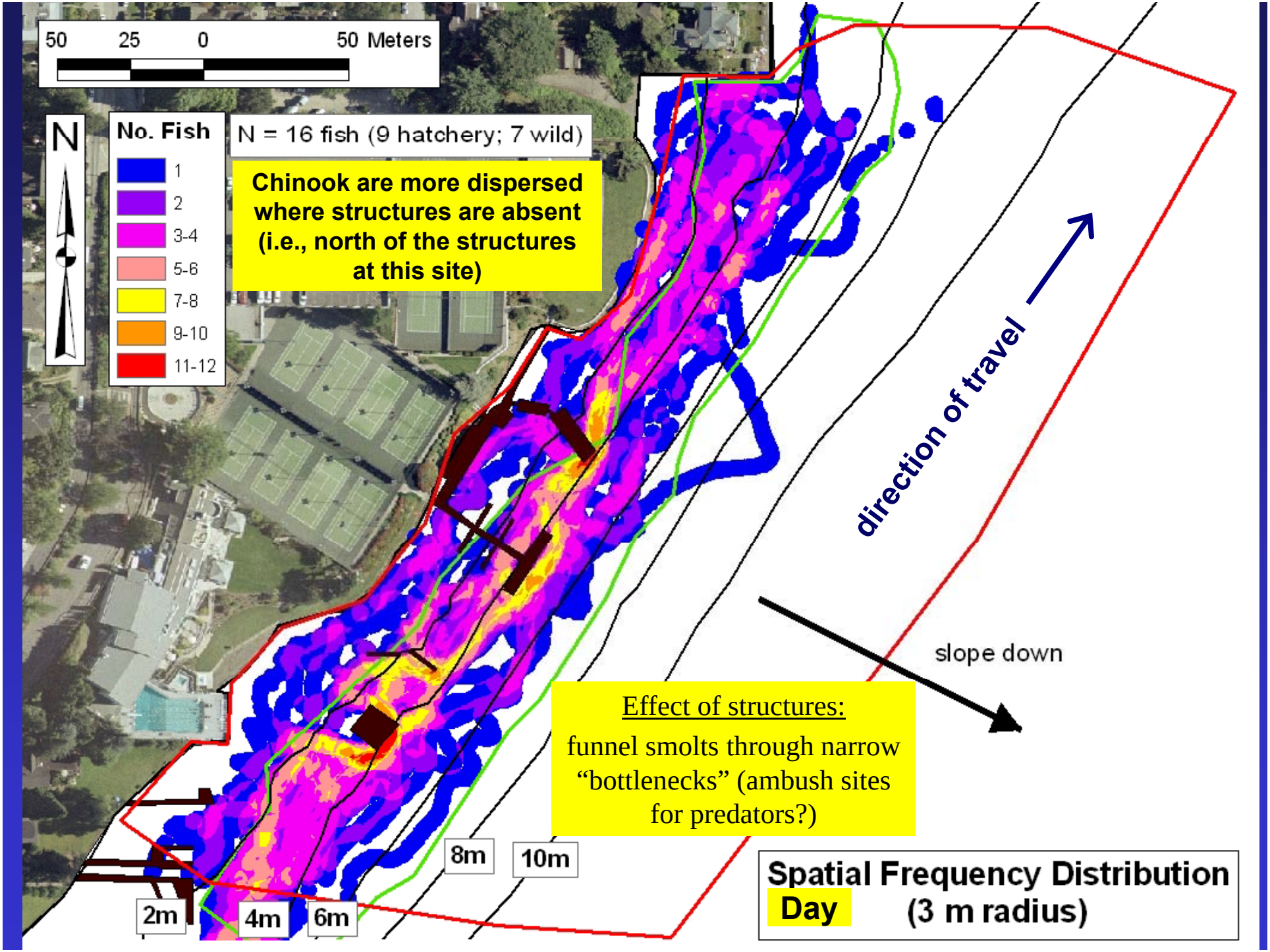
Behavior around structures Tennis Club

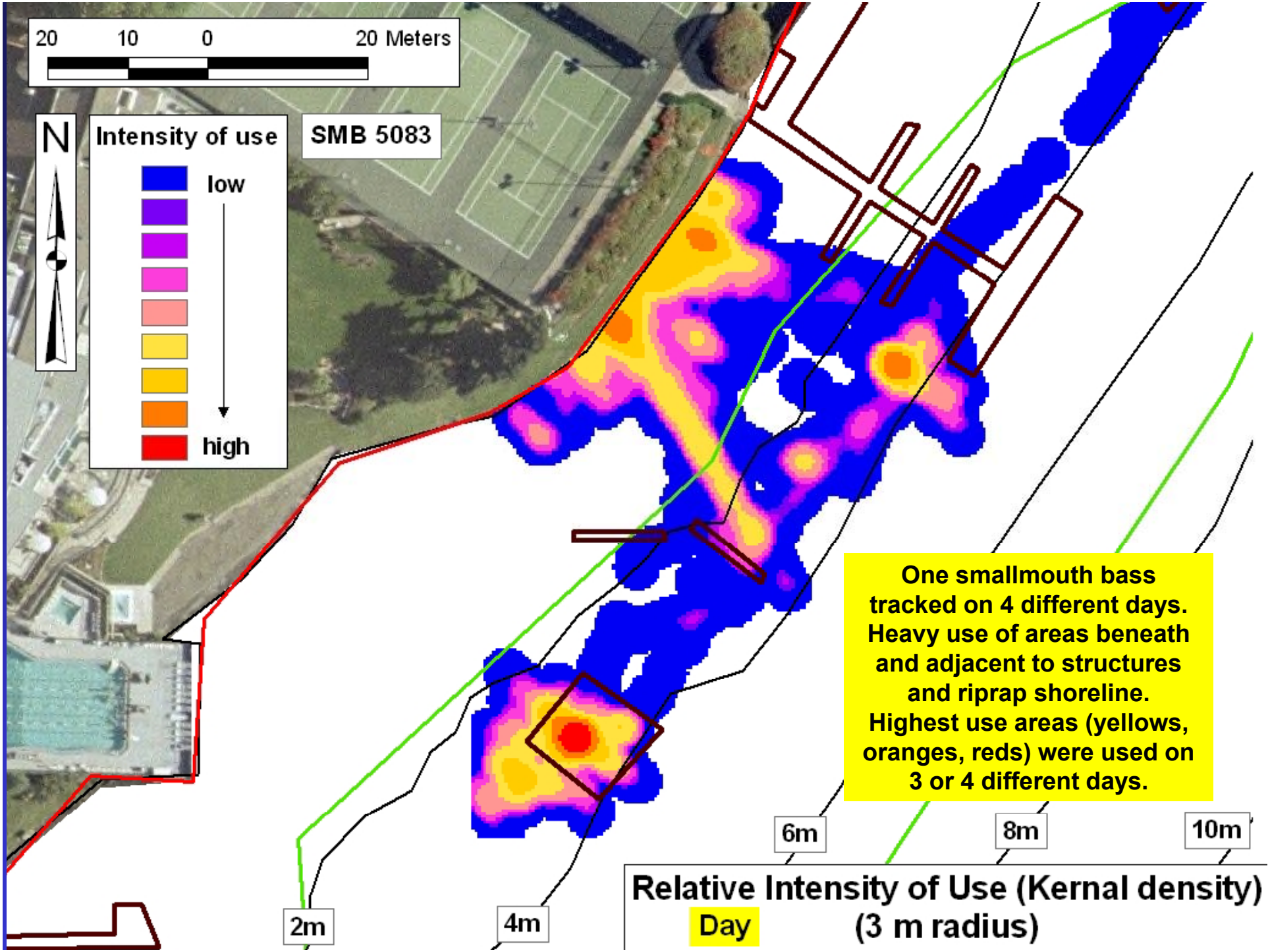


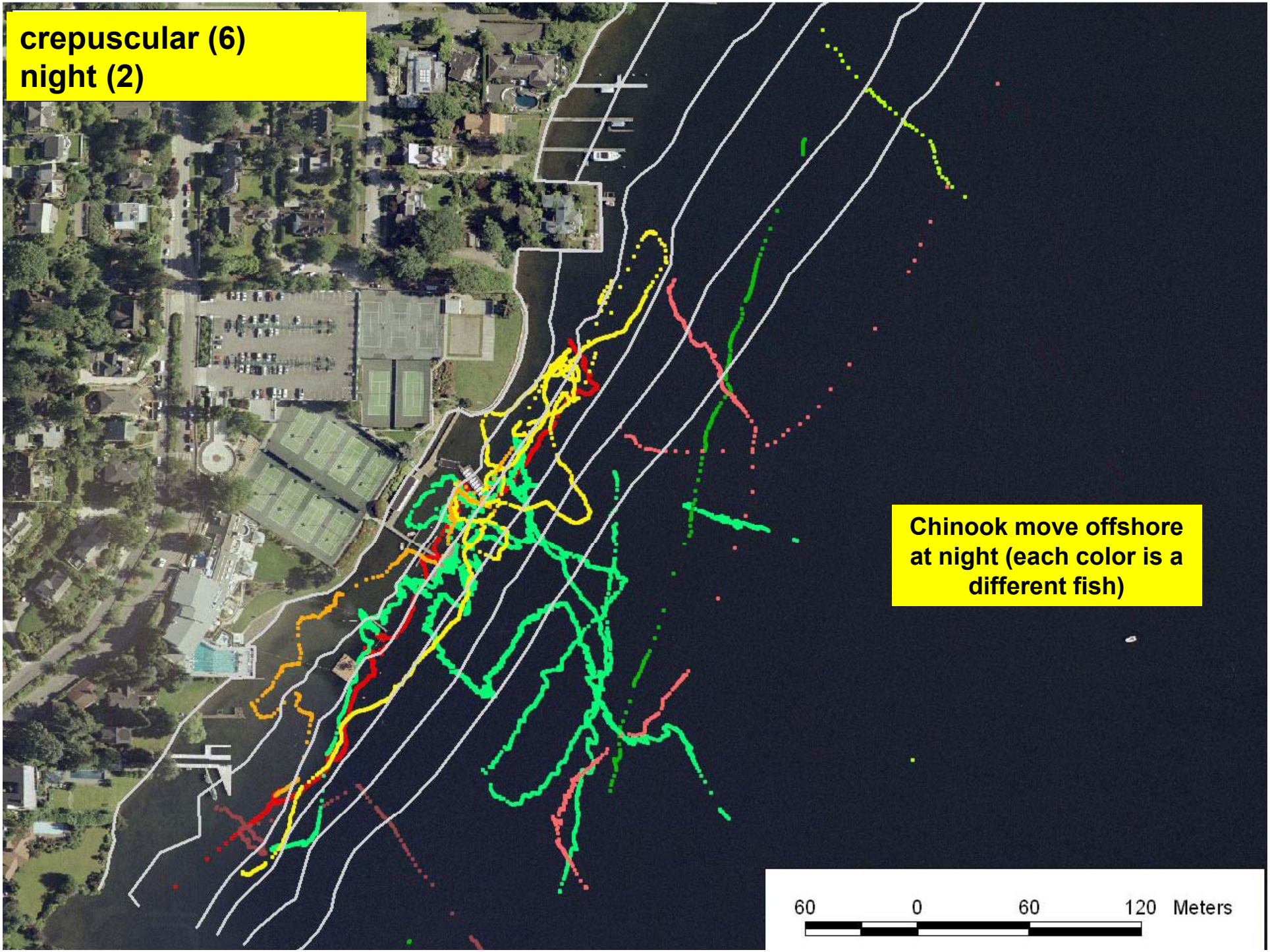
<u>Effect of structures:</u>

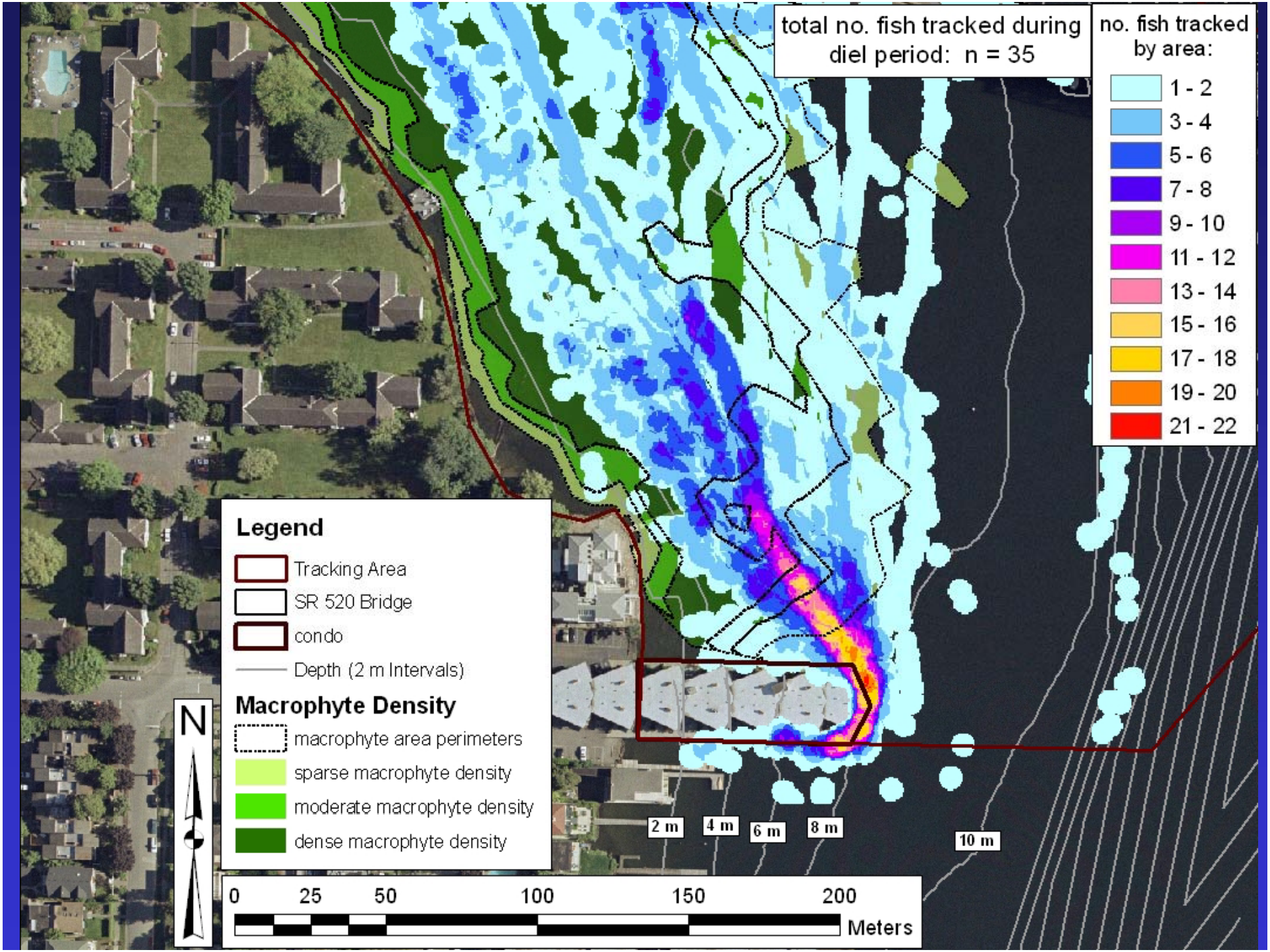
- Increase distance traveled
- Force migrating smolts into deeper water (increase predation risk?)

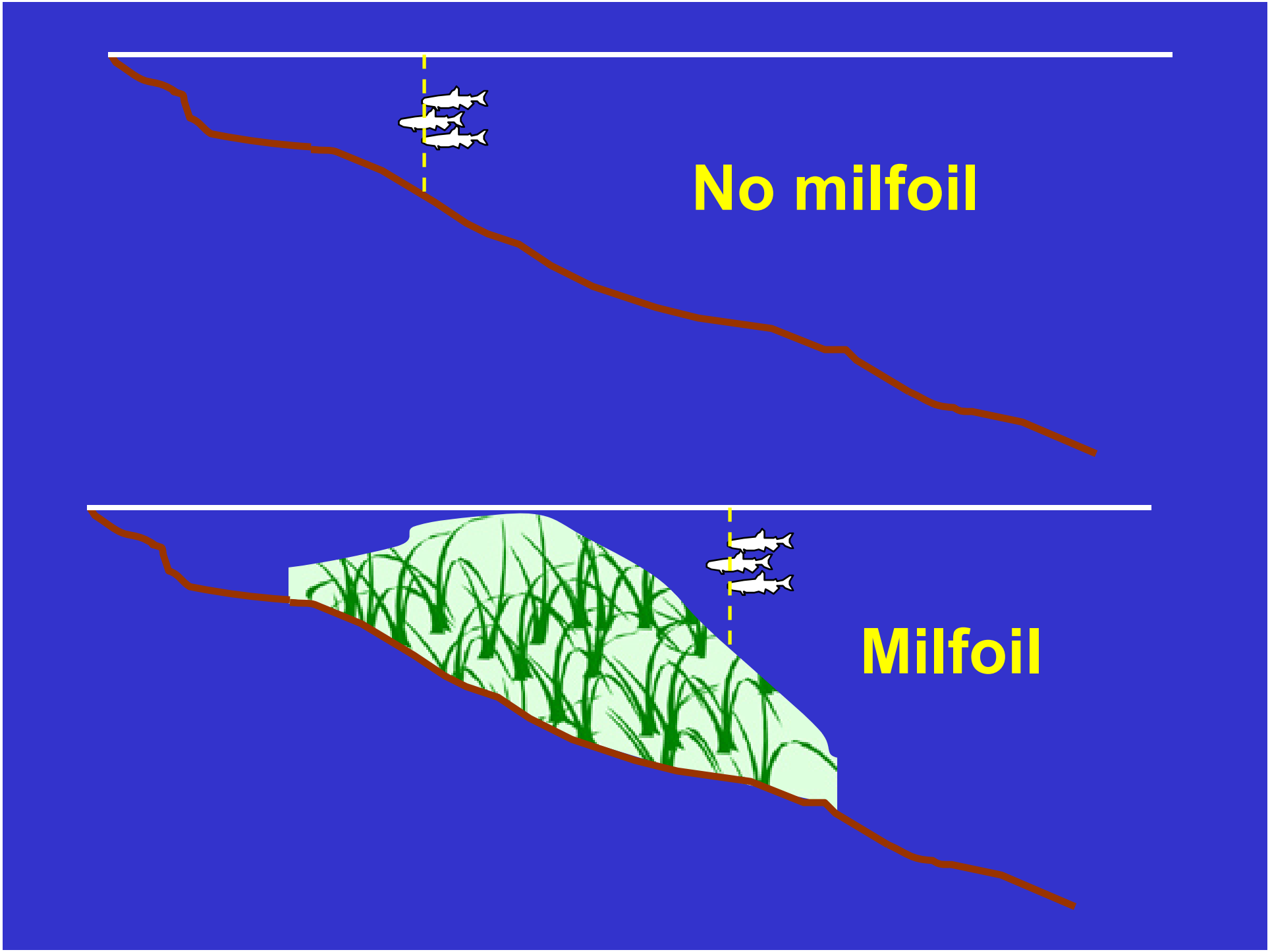
Fish moved back to shallower water once beyond the last structure


50 25 0 50 Meters
N
No. Fish
1
2
3-4
5-6
7-8
9-10
11-12
N = 16 fish (9 hatchery; 7 wild)
Chinook are more dispersed where structures are absent (i.e., north of the structures at this site)
direction of travel
slope down
Effect of structures:
funnel smolts through narrow "bottlenecks" (ambush sites for predators?)
2m
4m
6m
8m
10m
Spatial Frequency Distribution
Day
(3 m radius)


20 10 0 20 Meters
N
Intensity of use
low
high
SMB 5083
One smallmouth bass tracked on 4 different days. Heavy use of areas beneath and adjacent to structures and riprap shoreline. Highest use areas (yellows, oranges, reds) were used on 3 or 4 different days.
2m
4m
6m
8m
10m
Relative Intensity of Use (Kernal density)
Day
(3 m radius)


crepuscular (6)
night (2)
Chinook move offshore at night (each color is a different fish)
60
0
60
120
Meters


total no. fish tracked during diel period: n = 35
no. fish tracked by area:
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 12
13 - 14
15 - 16
17 - 18
19 - 20
21 - 22
Legend
Tracking Area
SR 520 Bridge
condo
Depth (2 m Intervals)
Macrophyte Density
macrophyte area perimeters
sparse macrophyte density
moderate macrophyte density
dense macrophyte density
N
2 m
4 m
6 m
8 m
10 m
0
25
50
100
150
200
Meters

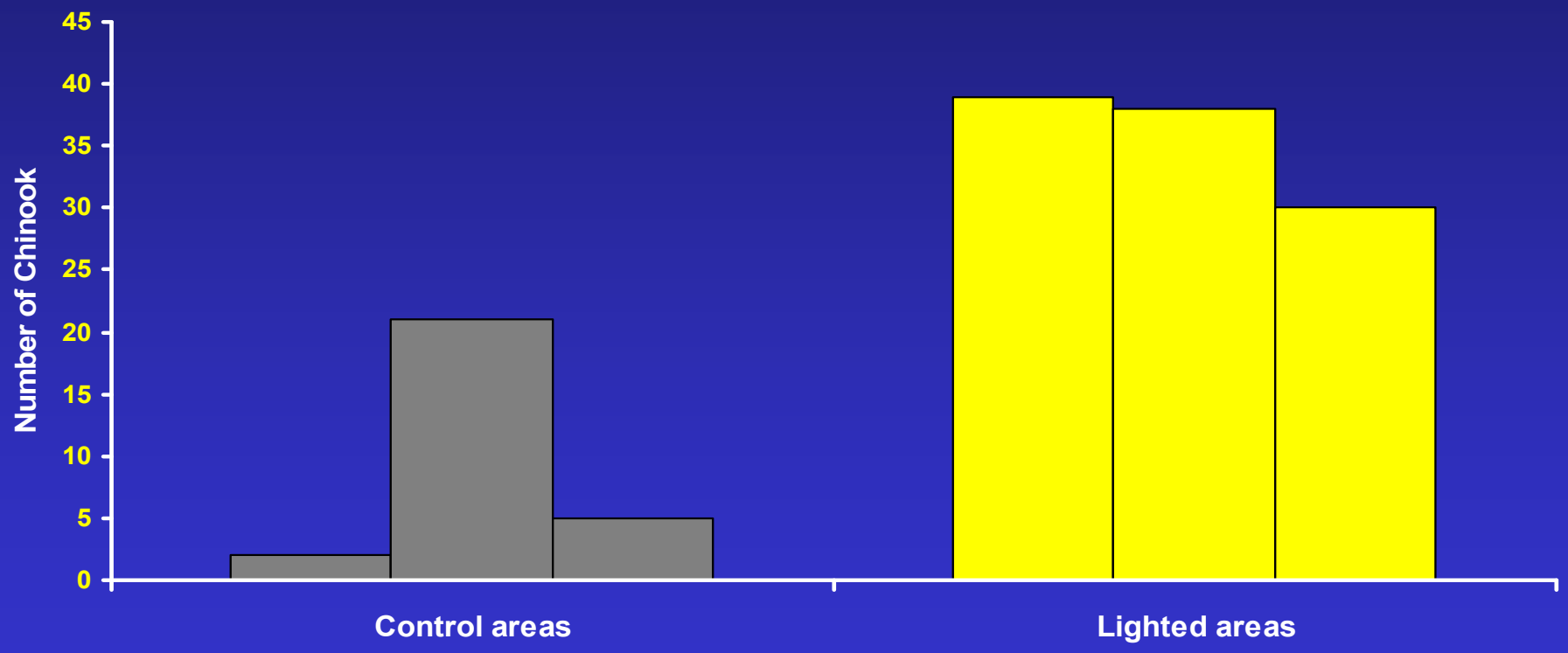

No milfoil
Milfoil

Artificial Lighting

Artificial Lighting Experiment

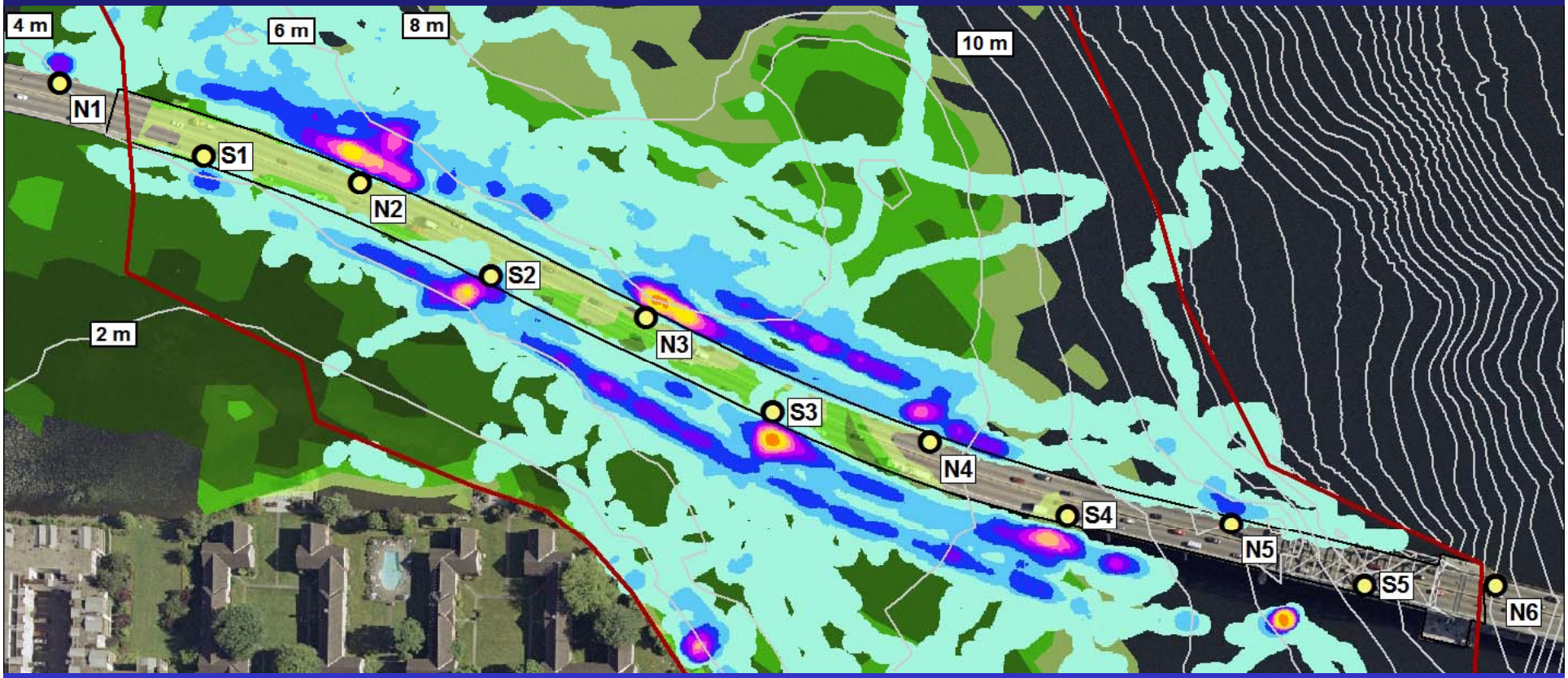
Gene Coulon Park

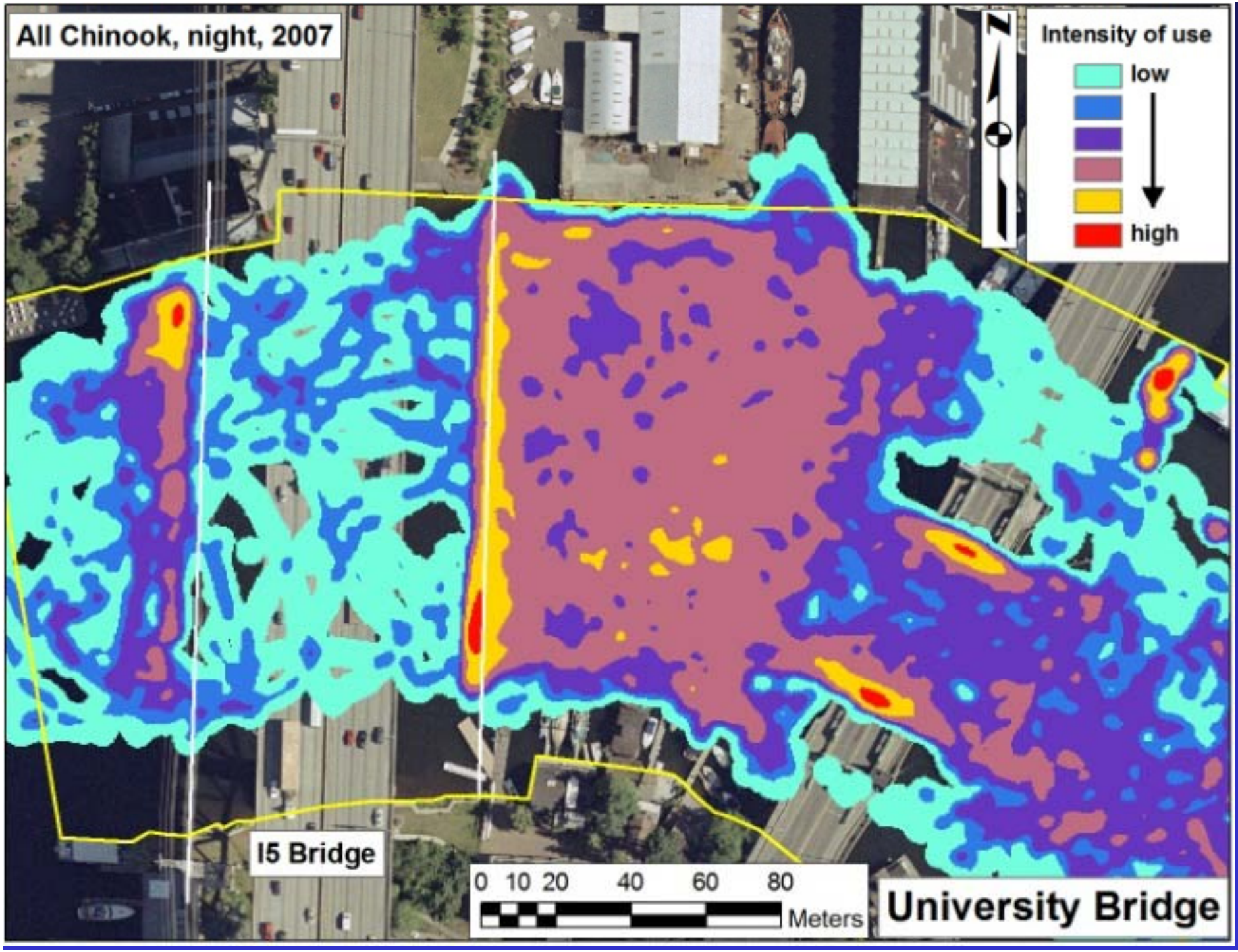
February 23, 2005



SR 520 Bridge – west end

June 12, 2008




All Chinook, night, 2007
Intensity of use
low
high
N
I5 Bridge
0 10 20 40 60 80
Meters
University Bridge

Questions ??