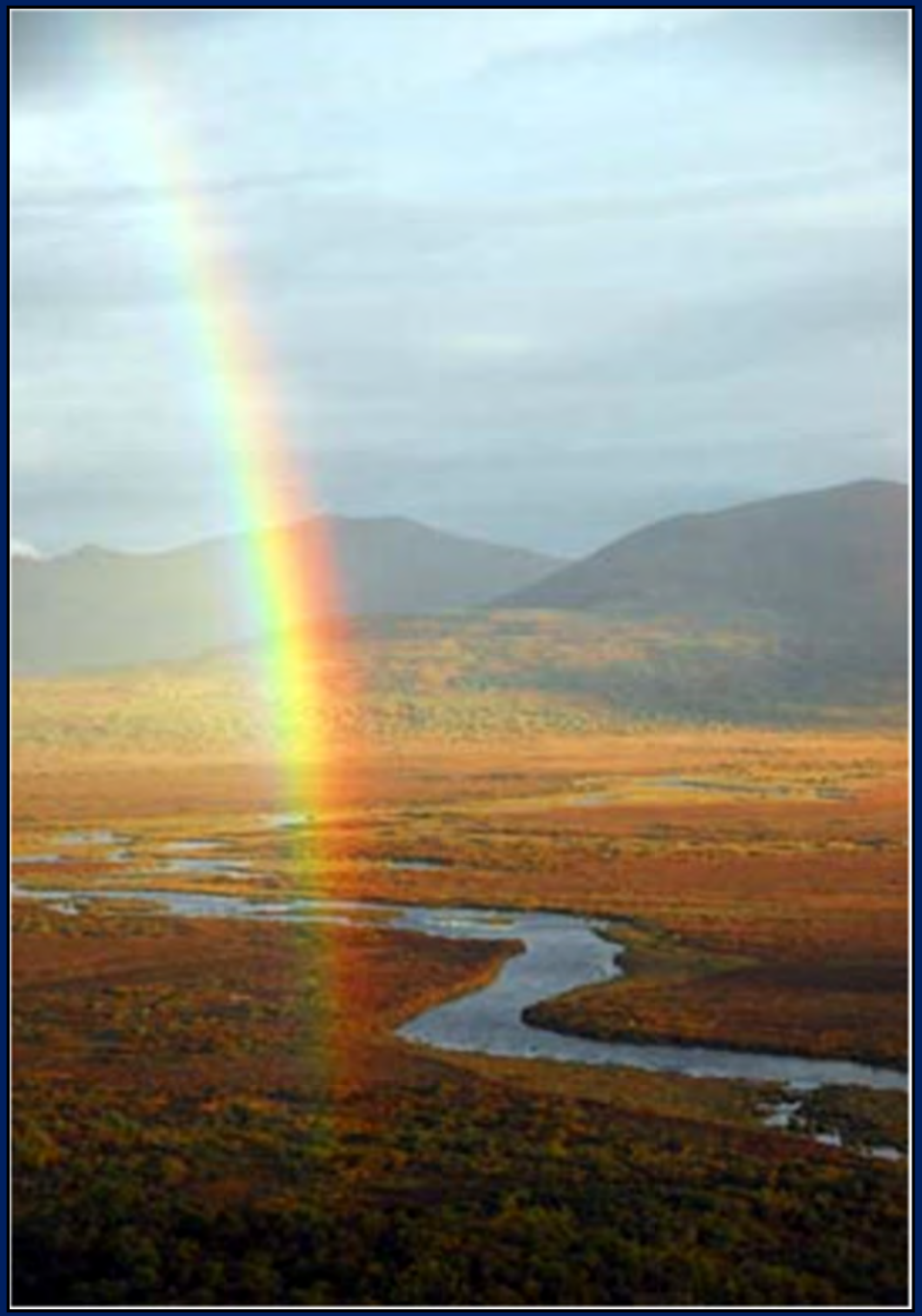
Effects of Spatiotemporal Variation in Resource Availability on Movements, Habitat Use, and Reproductive Fitness of Kodiak Brown Bears



Today's Presentation:

- Background
- Objectives
- Justification/Concerns
- Methods
- Preliminary Results

Goals of KNWR

Established in 1941 "…for the purpose of protecting the natural feeding and breeding ranges of the brown bears and other wildlife,…"

The KNWR CCP states: "The Brown bear, fish and other wildlife populations will continue to thrive on KNWR in their natural diversity, living in pristine habitats.

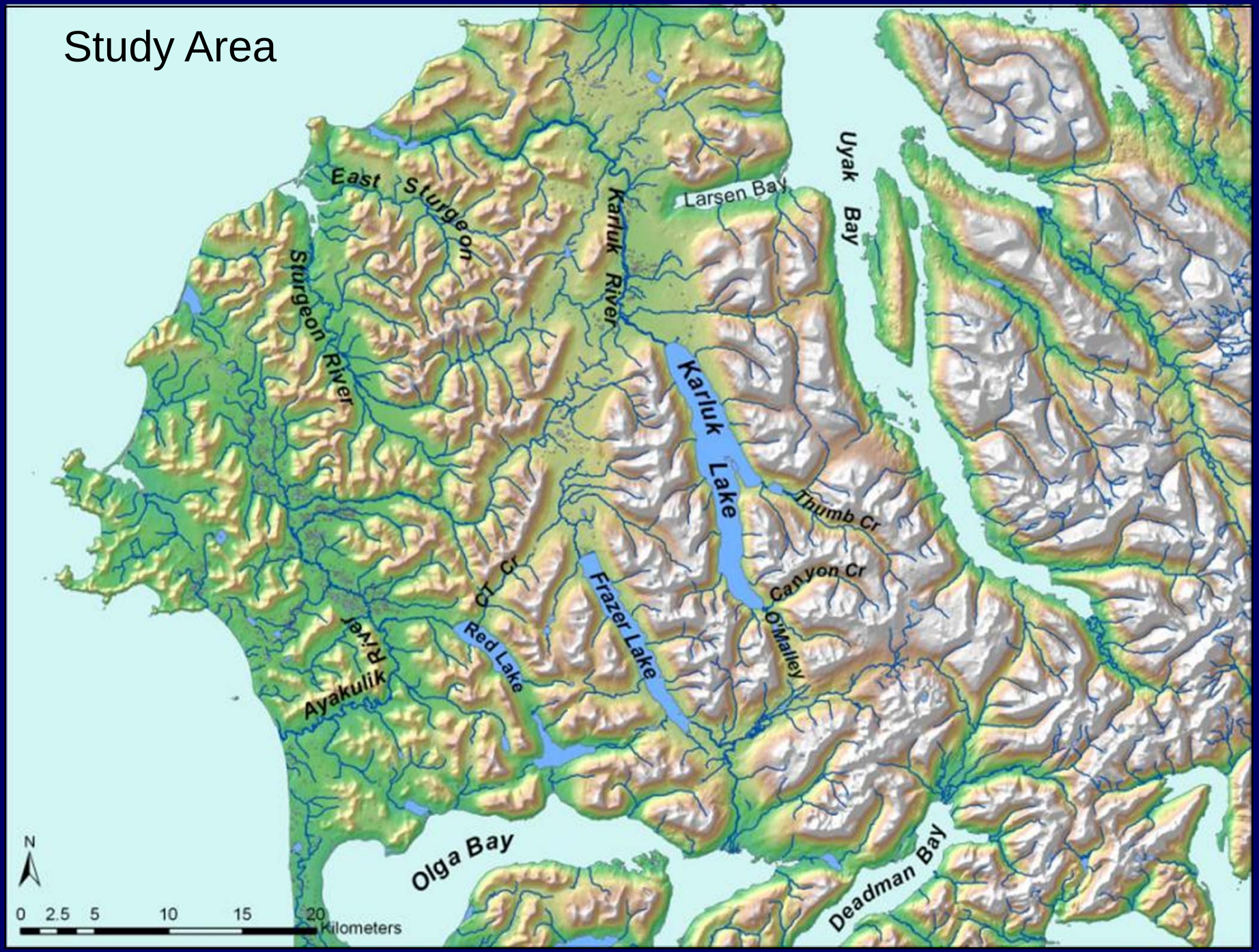
Karluk Lake Basin & SW Kodiak NWR

<u>Ultimate Aim</u>: Conduct a long-term study to quantify the effects of changes in resource availability, whether due to natural variability, climate change or other anthropogenic stressors on movements, habitat use, and reproductive fitness.

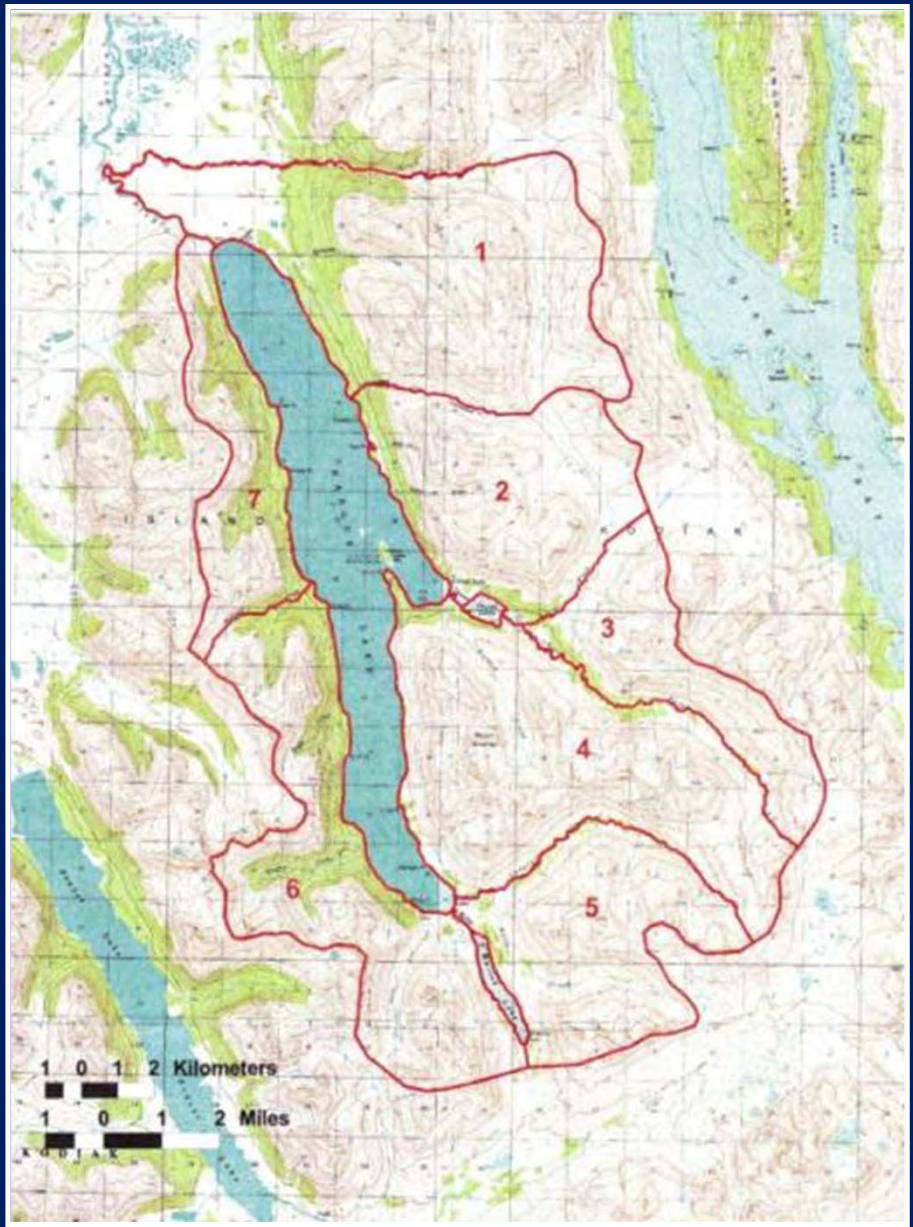
As a first step towards launching this long-term project we're supporting a more modest Masters Degree project:

- **Selection of non-salmon foraging sites.**
- **Selection of bedding sites.**
- **Protocol development to quantify salmon runs on tributaries.**
- **Develop and evaluate models to describe and analyze habitat use and movements at various scales through the development of Resource Selection Functions (RSFs).**

Study Area


East Sturgeon
Sturgeon River
Karluk River
Larsen Bay
Uyak Bay
Karluk Lake
Thumb Cr
Canyon Cr
O'Malley
Frazer Lake
CT Cr
Red Lake
Ayakulik River
Olga Bay
Deadman Bay
N
0 2.5 5 10 15 20
Kilometers

Karluk Lake Intensive Aerial Survey 2010

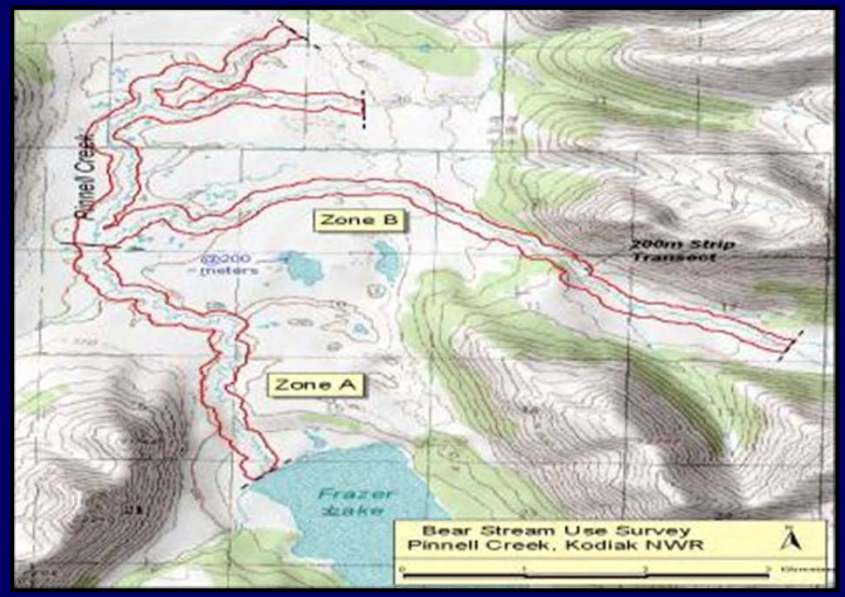


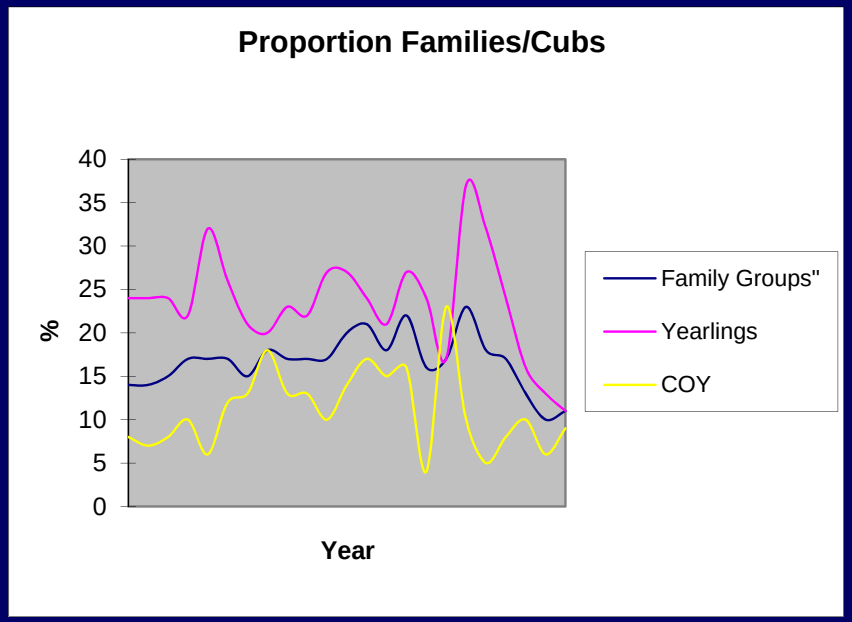
- **Bear density has decreased:**

  <u>2003</u>: 483 independent bears/1000 km^2

  <u>2010</u>: 252 independent bears/1000 km^2

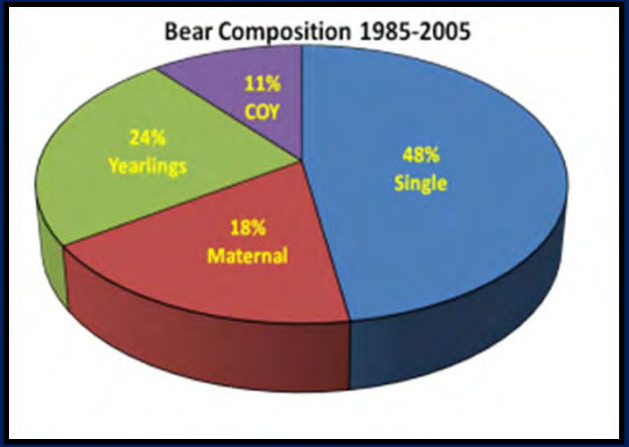
Brown Bear Stream Surveys

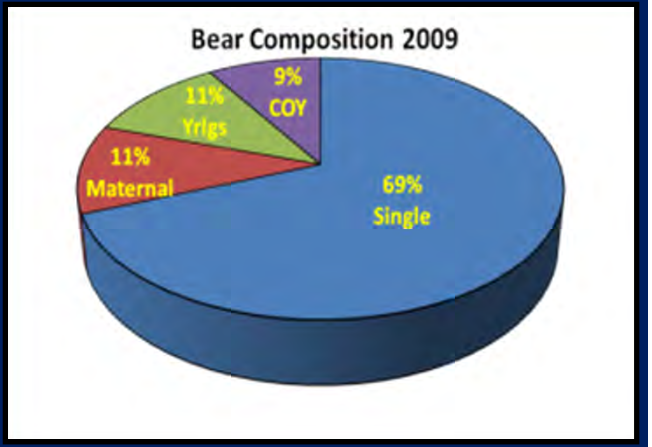




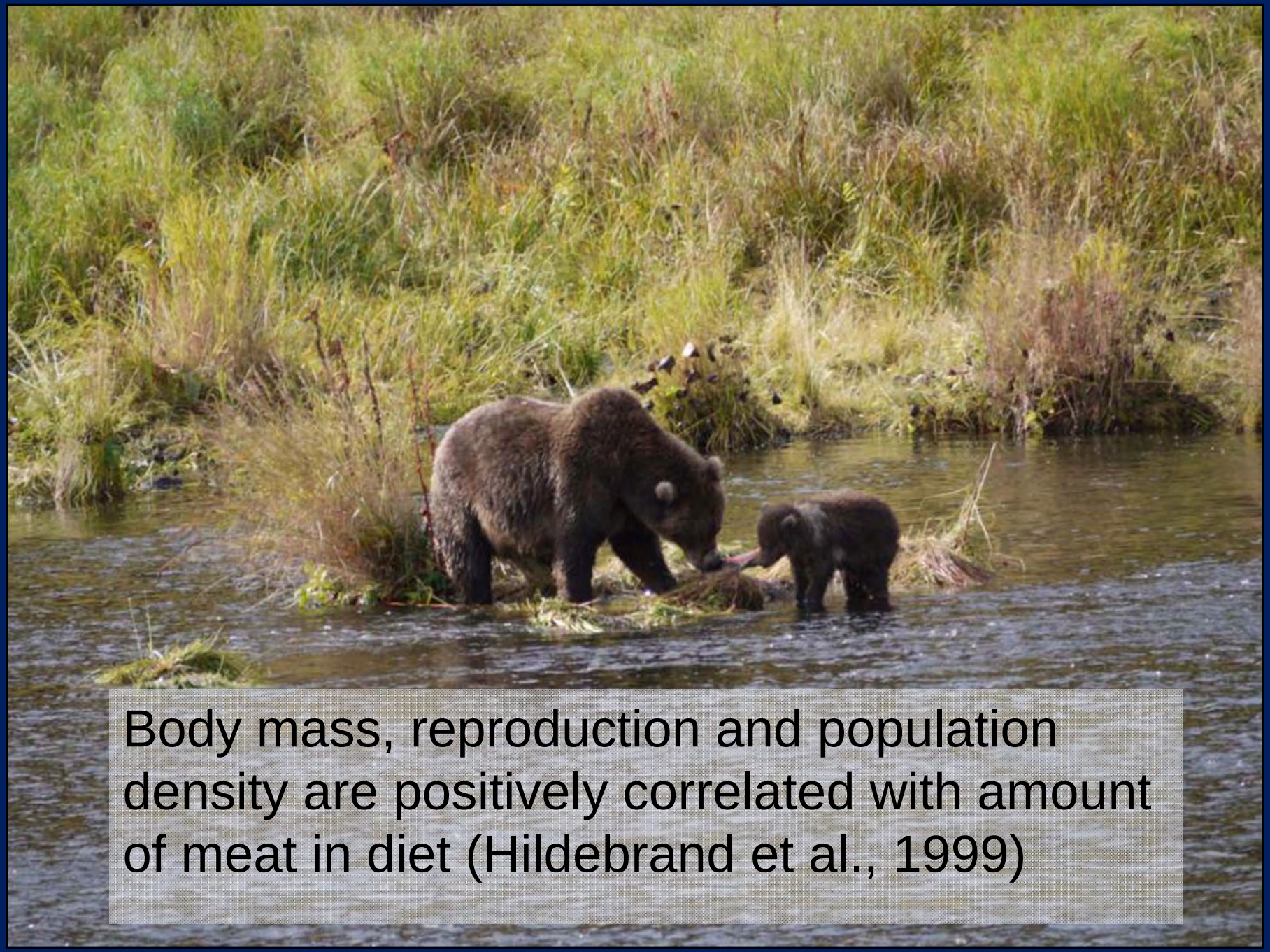
Composition within Southwest Network of Rivers

YEAR	SINGLE BEARS %	MATERNAL SOWS %	1-2 YR OLD CUBS %	COY %	BEARS/SURVEY
Ave. 1985-2005	47	18	24	11	85
2008	71	10	13	6	60
2009	69	11	11	9	58
2010	83	6	8	3	52
Range (1985-2005)	30-71	10-23	11-37	4-23	47-130

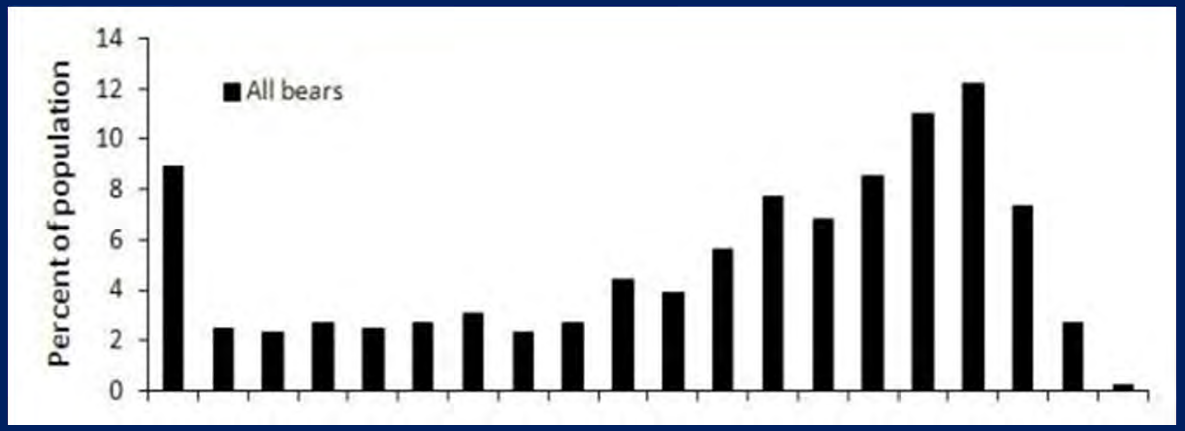


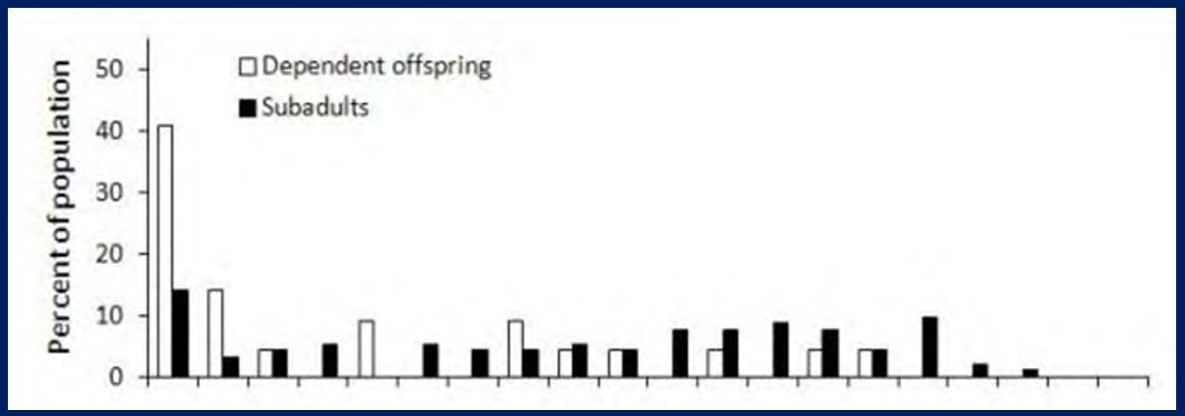


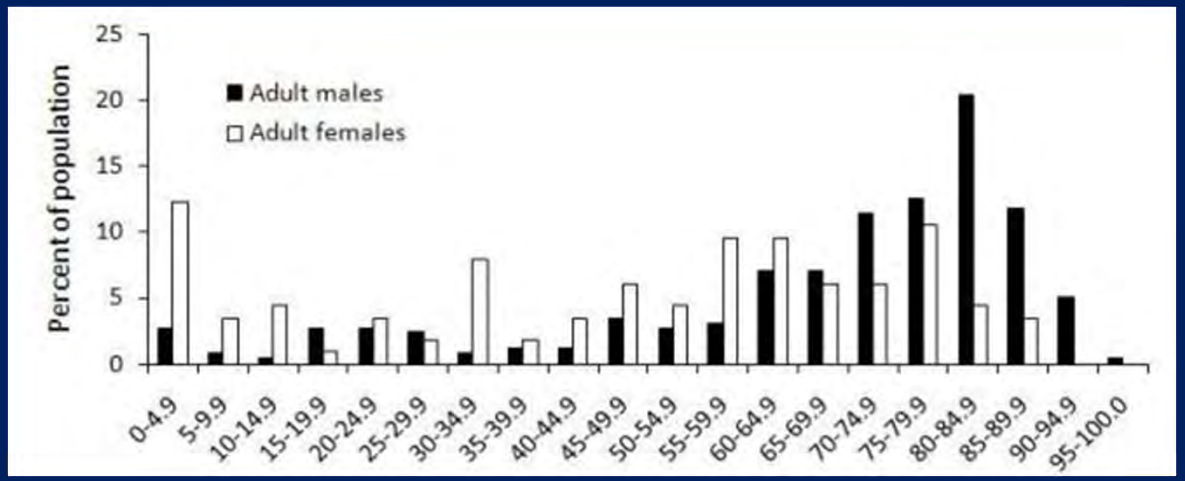
Increased Recreation Pressures



Body mass, reproduction and population density are positively correlated with amount of meat in diet (Hildebrand et al., 1999)







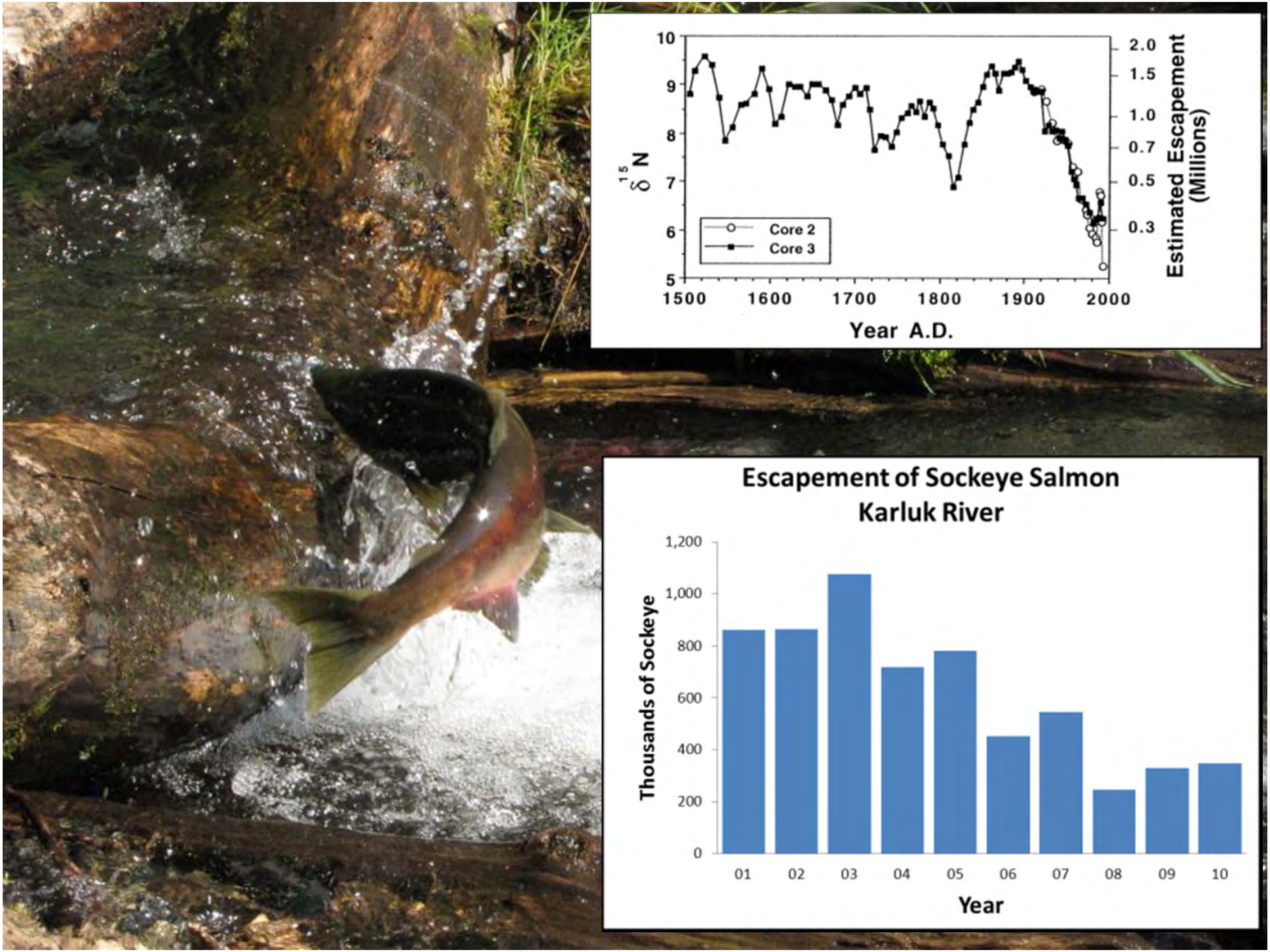
The relative proportion of salmon in the assimilated diet of Kodiak brown bears (Robbins et al 2011)

Salmon make up:

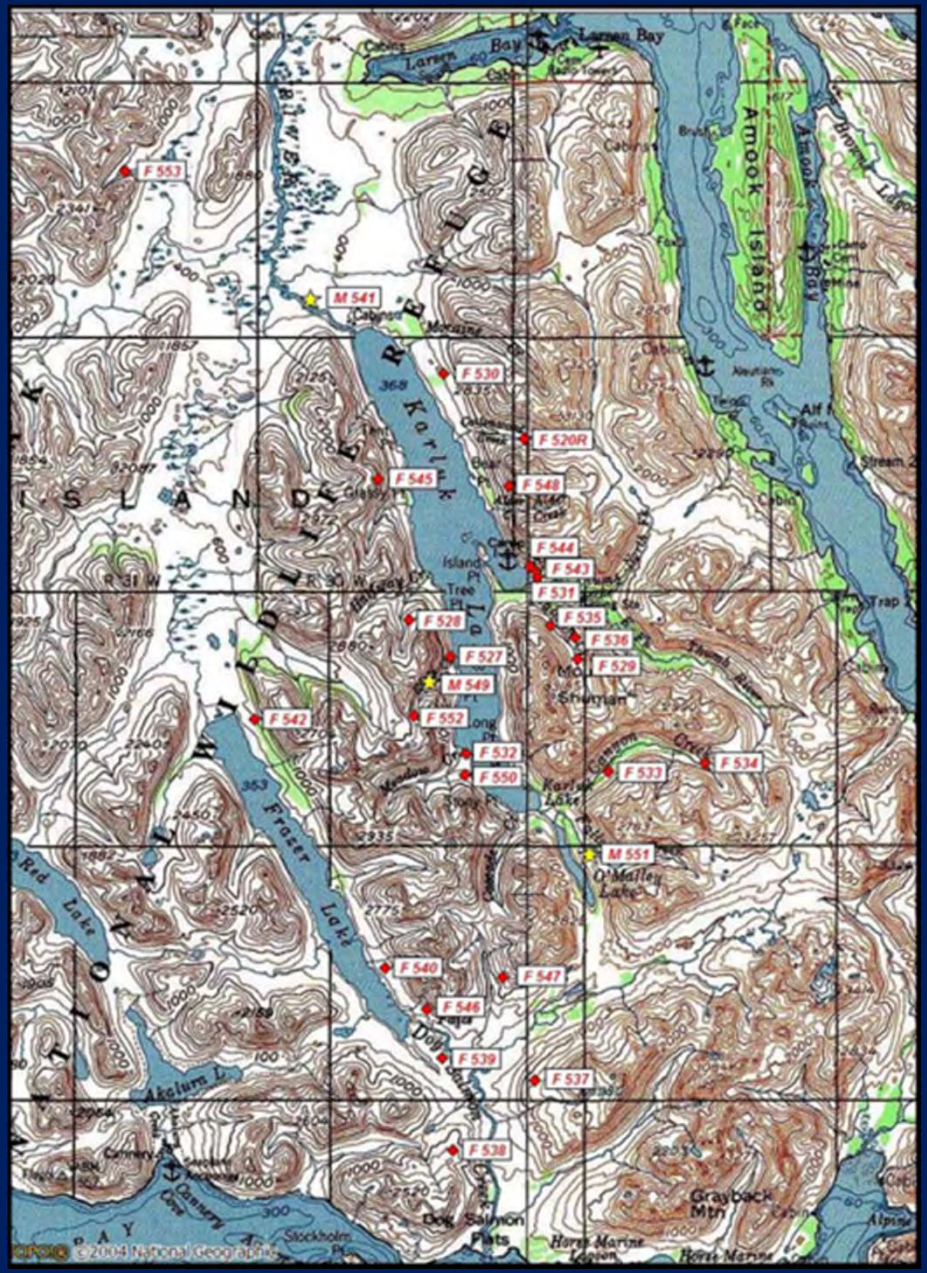
- 68% assimilated diet in boars
- 48% for sows
- 43% for subadults
- 21% for dep. Offspring

Annual est. consumption:

- Boars – 3016 ± 1239 kg
- Sows – 1521 ± 724 kg


10
9
8
7
6
5
$\delta^{15}N$
2.0
1.5
1.0
0.7
0.5
0.3
Estimated Escapement (Millions)
Core 2
Core 3
1500
1600
1700
1800
1900
2000
Year A.D.
Escapement of Sockeye Salmon
Karluk River
1,200
1,000
800
600
400
200
0
Thousands of Sockeye
01
02
03
04
05
06
07
08
09
10
Year

Capture Operations 2010 & 2011

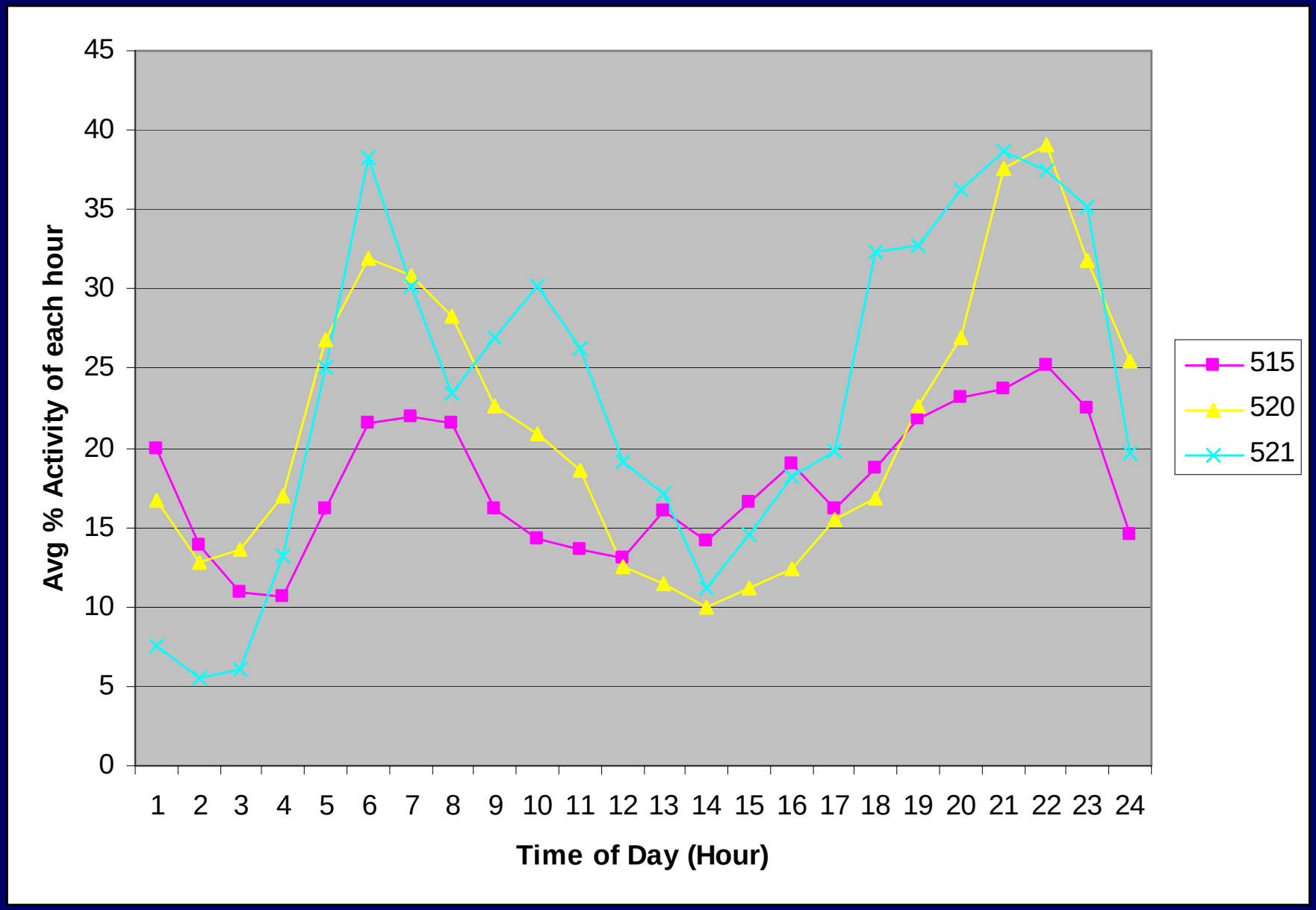


Captured Bears 2010-2011

- **37 females & 3 males**
- **Ave. Age = 11.1 yrs**
- **Ave. Body Condition = 2.8** (scale 1-5)
- **Ave. time to Immobilization = 7 min**
- **Ave. Est. Wgt. = 415 lbs.**
- **34 ♀ fitted with GPS collars**
- **1 ♀ & 1 ♂ fitted with VHF collars**
- **2 ♀ & 2 ♂ not fitted with collars**

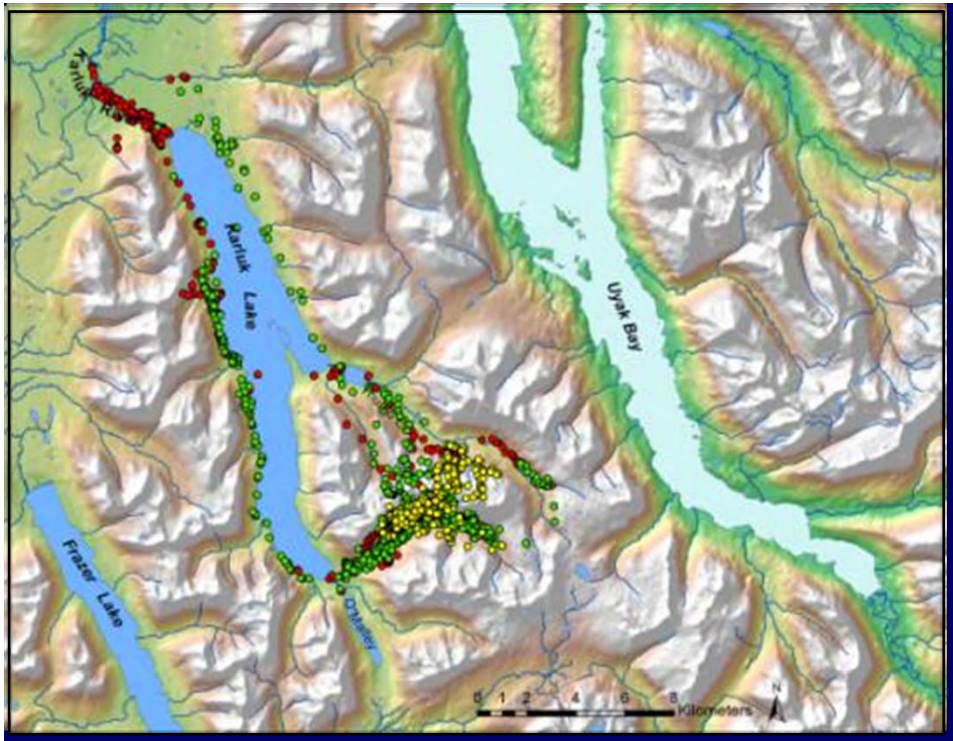
Radio-Telemetry

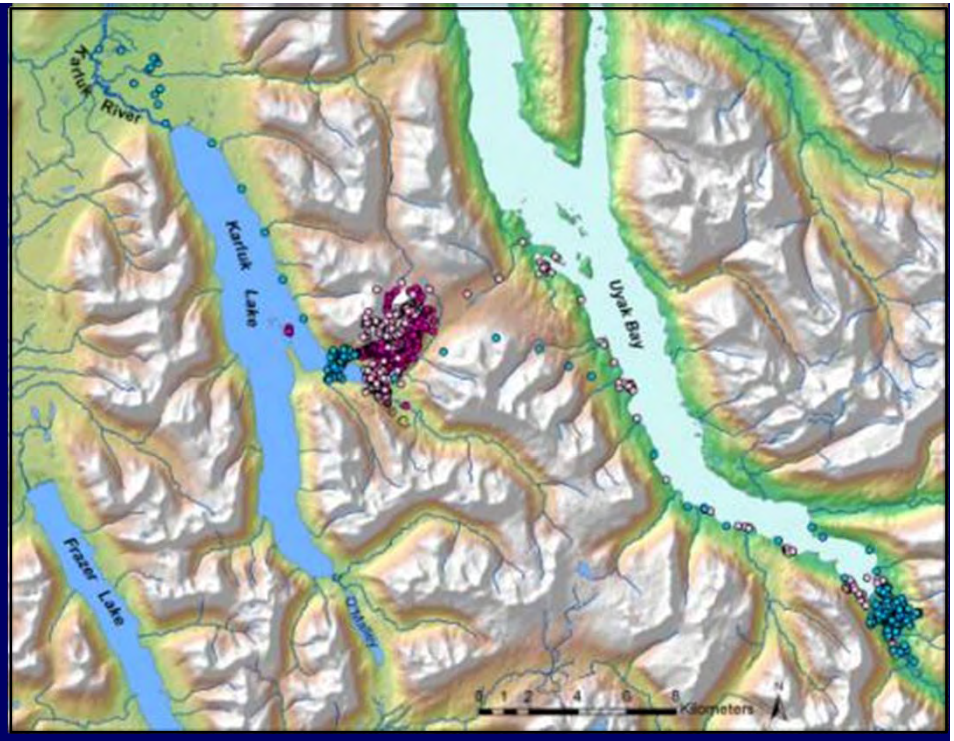
Daily Activity Levels



Data Collection at Bear Locations

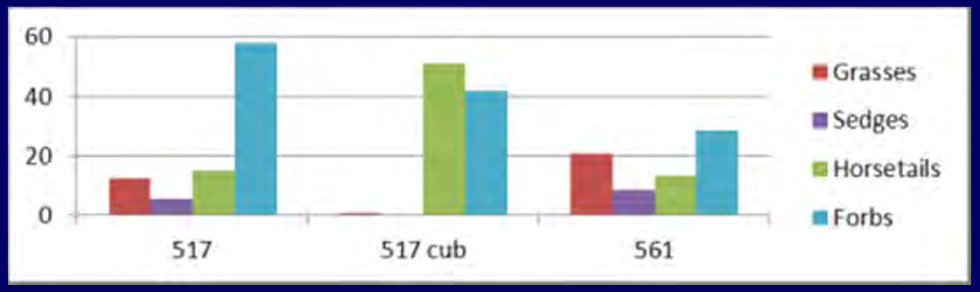
61


Karluk River
Karluk Lake
Uyak Bay
Frazer Lake
Karluk River
0 1 2 4 6 8 Kilometers
N

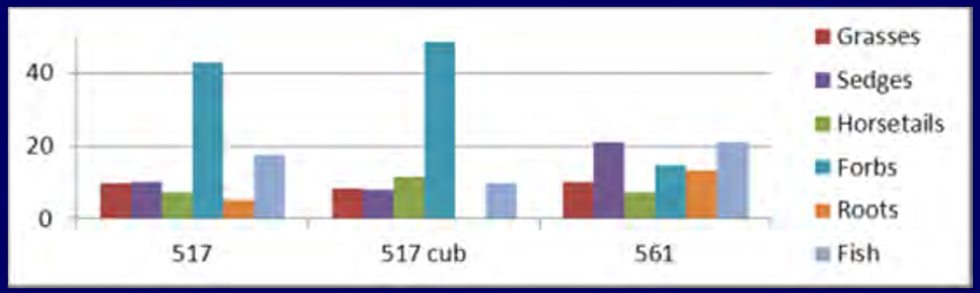

Karluk River
Karluk Lake
Uyak Bay
Frazer Lake
0 1 2 4 6 8 Kilometers
N

Simplified Bedding Site Characteristics

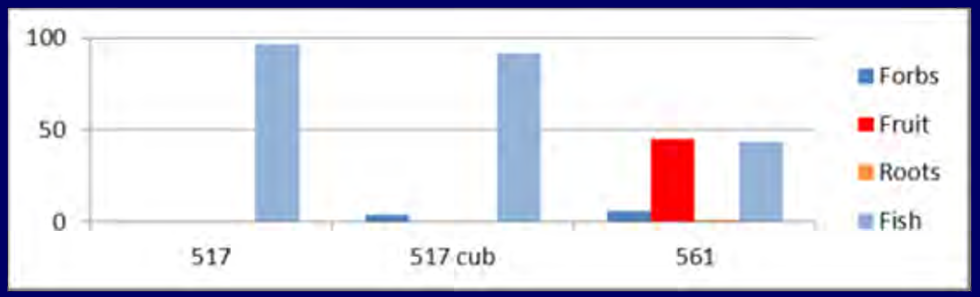
BEAR	CANOPY	STEMS	ELEVATION RANGE	PREDOMINANT LANDCOVER	MICROTOPOGRAPHY
SUBSEASON 1 : June 9 - July 14					
517	12.50%	10	419-560 m	alpine forb meadows and heath	outcrops
561	47.80%	33	202-339 m	alder thickets & berry patches	no difference
SUBSEASON 2 : June 15 - Aug 14					
517	56.80%	13	27-166 m	shrub thickets of alder or birch	no difference
517	0%	0	654-845 m	alpine tundra	outcrops
561	50.90%	15	108-235 m	thickets of alder, birch, & willow	no difference
SUBSEASON 3 : Aug 15 - Sep 24					% Beds Excavated
517	61.70%	11	0-34 m	birch thickets in cottonwood stands	61.54
561	55.10%	15	75-330 m	berry patches	30.77
SUBSEASON 4 : Sep 25 - Oct 11					
517	19	7	112-154 m	birch thickets in cottonwood stands	benches
561	8	4	462-488 m	high elevation berry patches	no difference



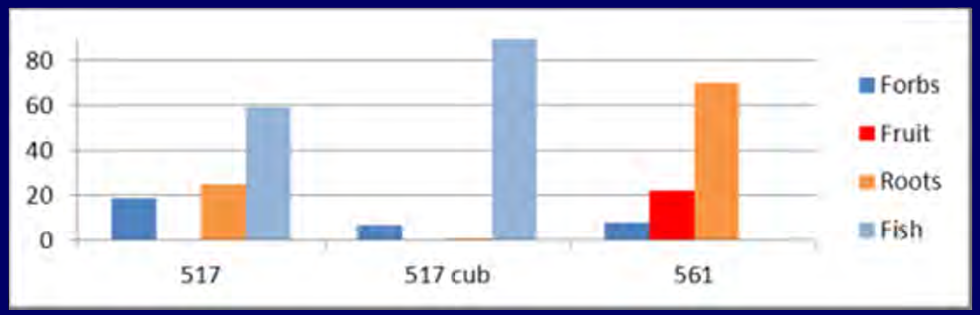
Season I: Bear 517 ate twice as many forbs and half as many graminoids as 561



Season II: Bear 517 ate half as many sedges, 3 times as many forbs, and one third as many roots as 561

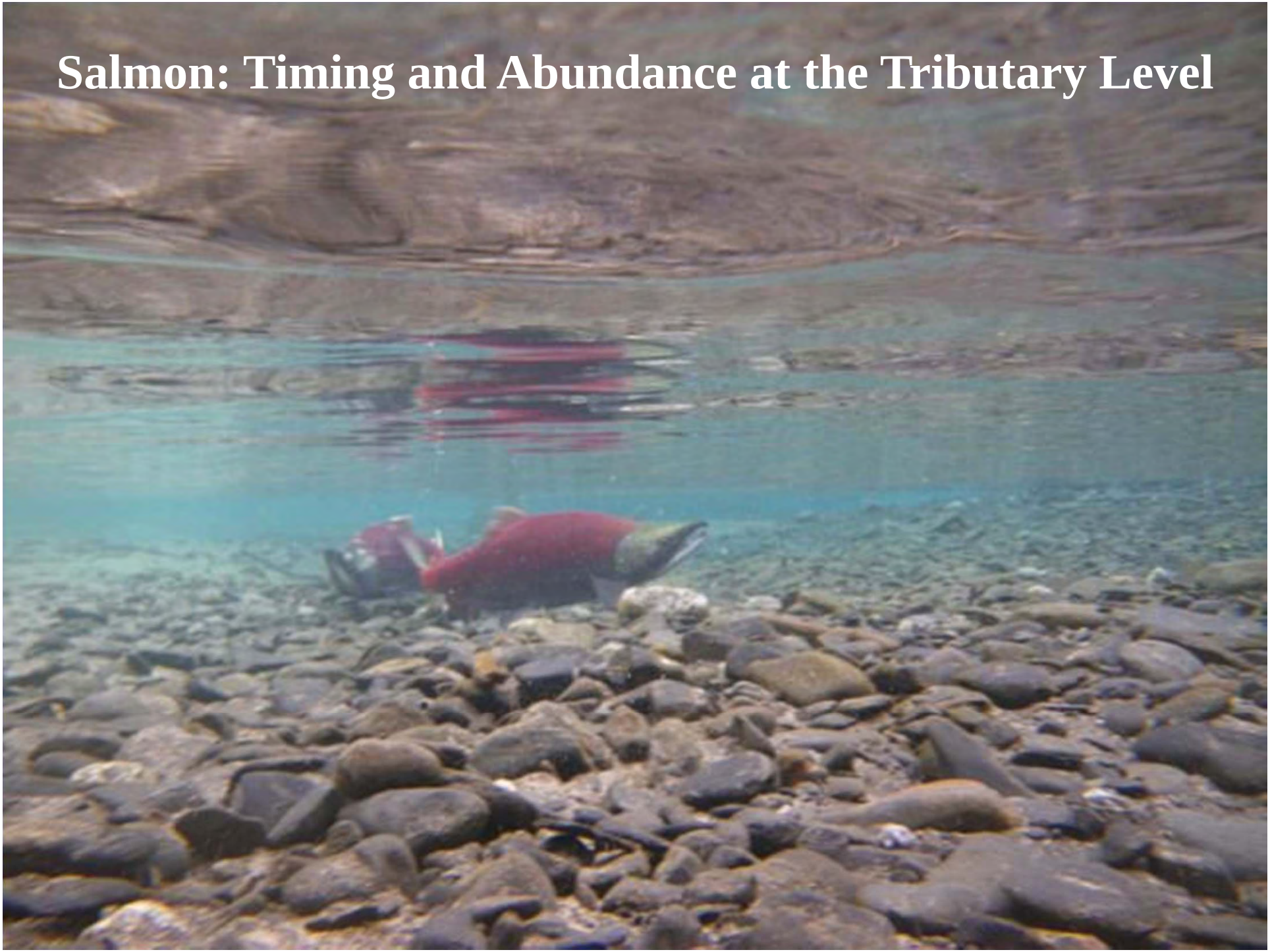


Season III: Bear 517 ate mostly fish. 561's diet was half fruit and half fish

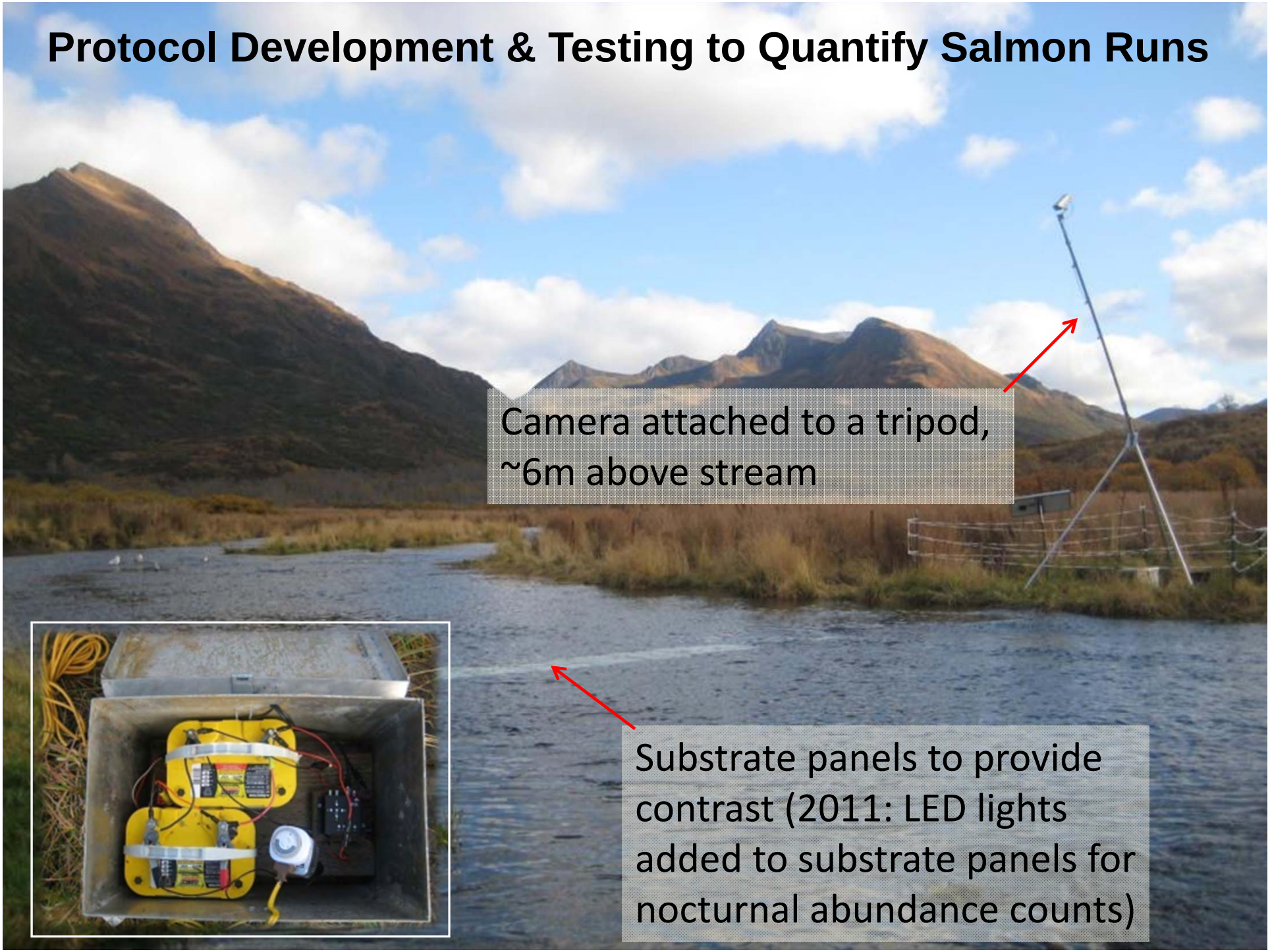


Season IV: Bear 561 ate 3 times as many roots and half as many forbs as 517, but no fish. 517 ate mostly fish

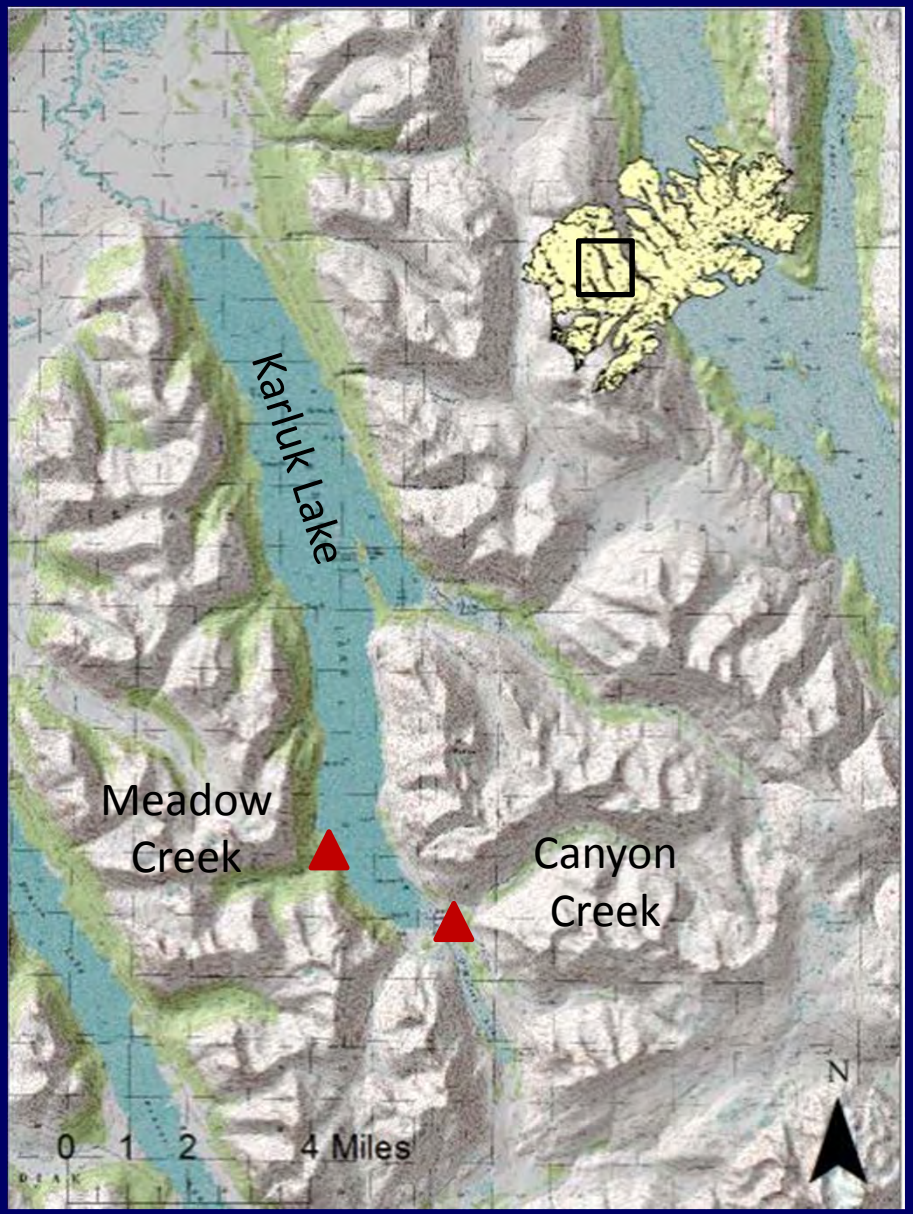
Salmon: Timing and Abundance at the Tributary Level



Protocol Development & Testing to Quantify Salmon Runs



Pilot Tributaries

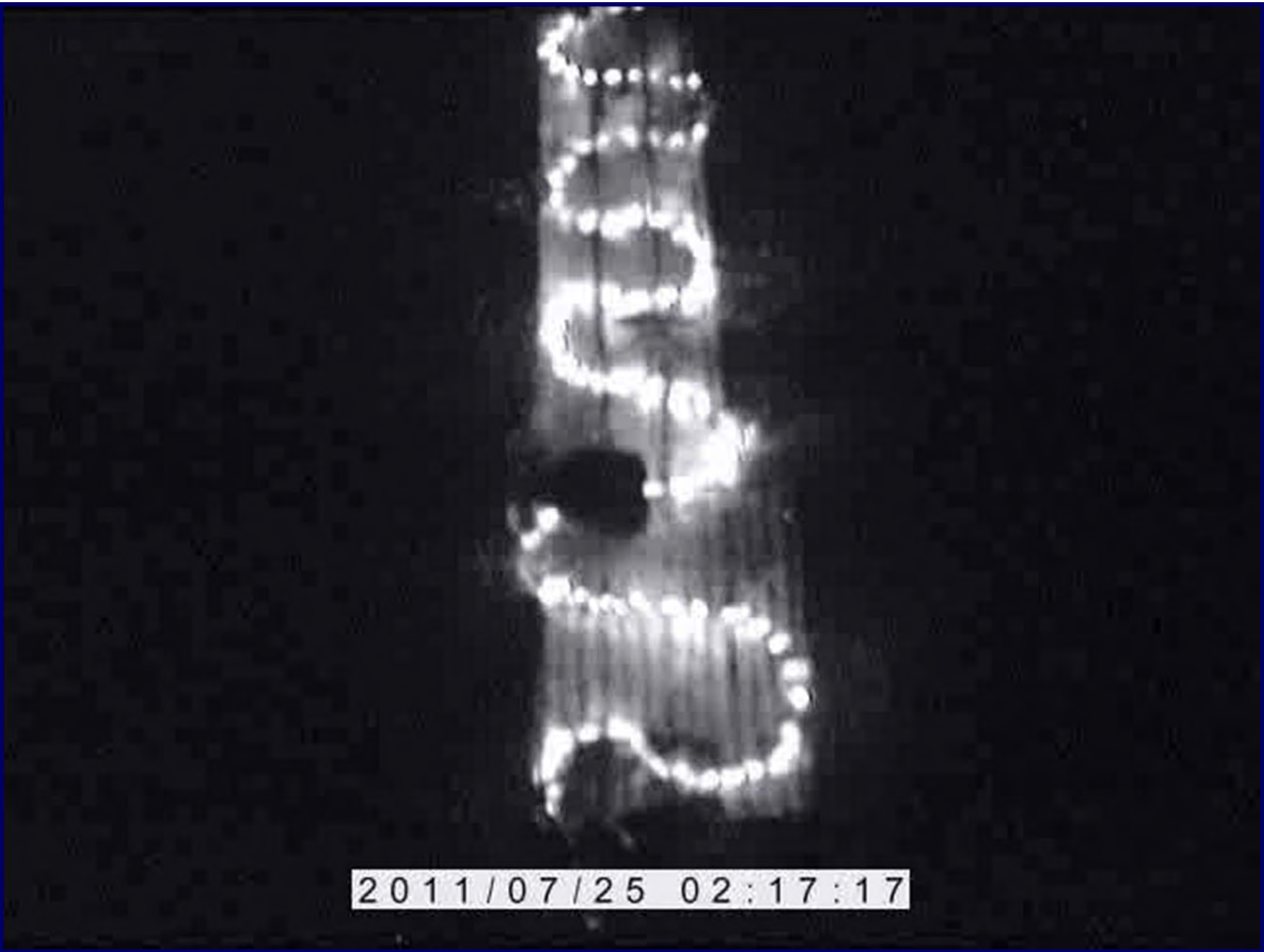


Canyon Creek
- ~18 ft wide
- ~3 ft deep
- Moderate salmon run

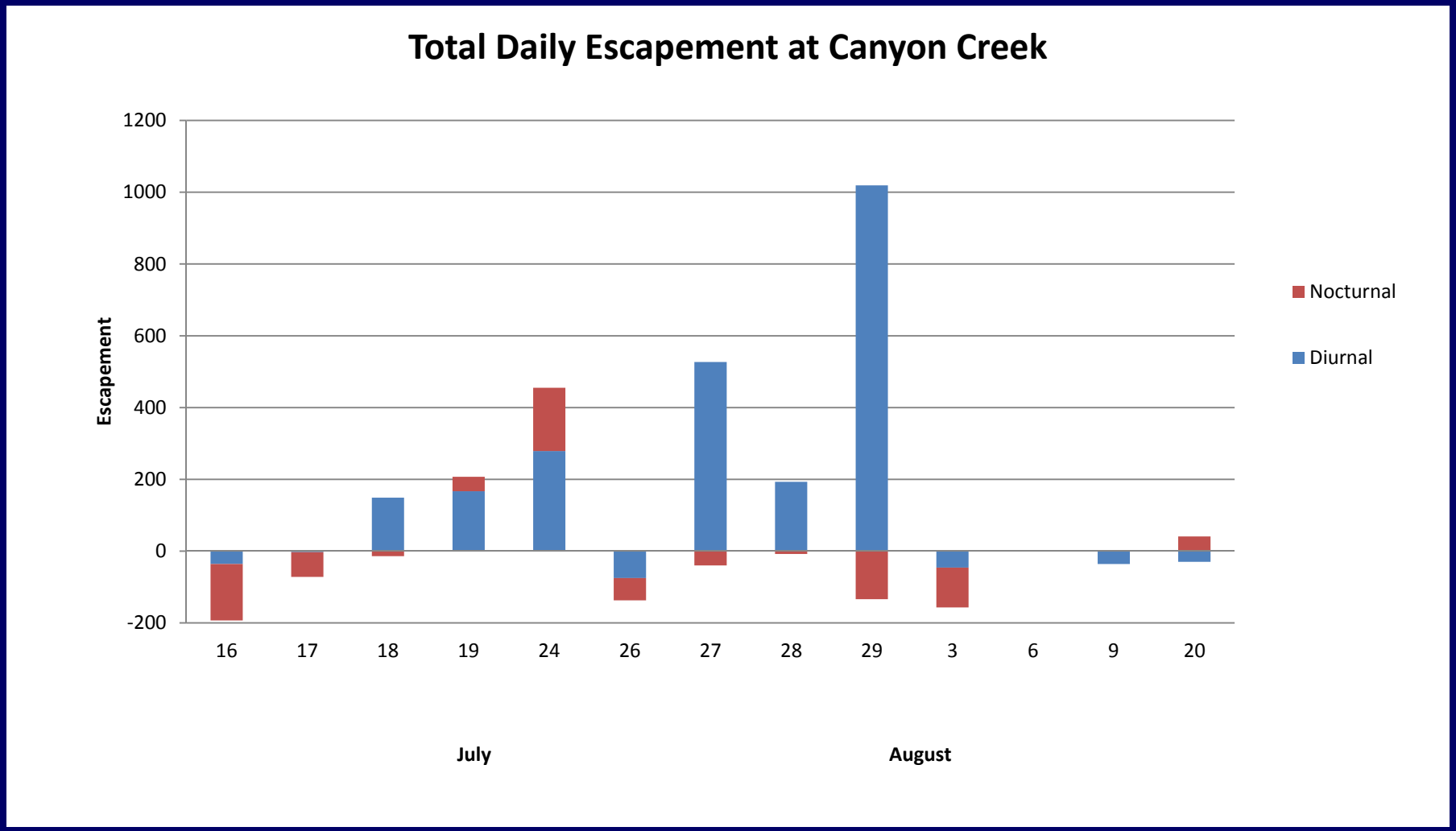
Meadow Creek
- ~15 ft wide
- <2 ft deep
- Relatively small salmon run

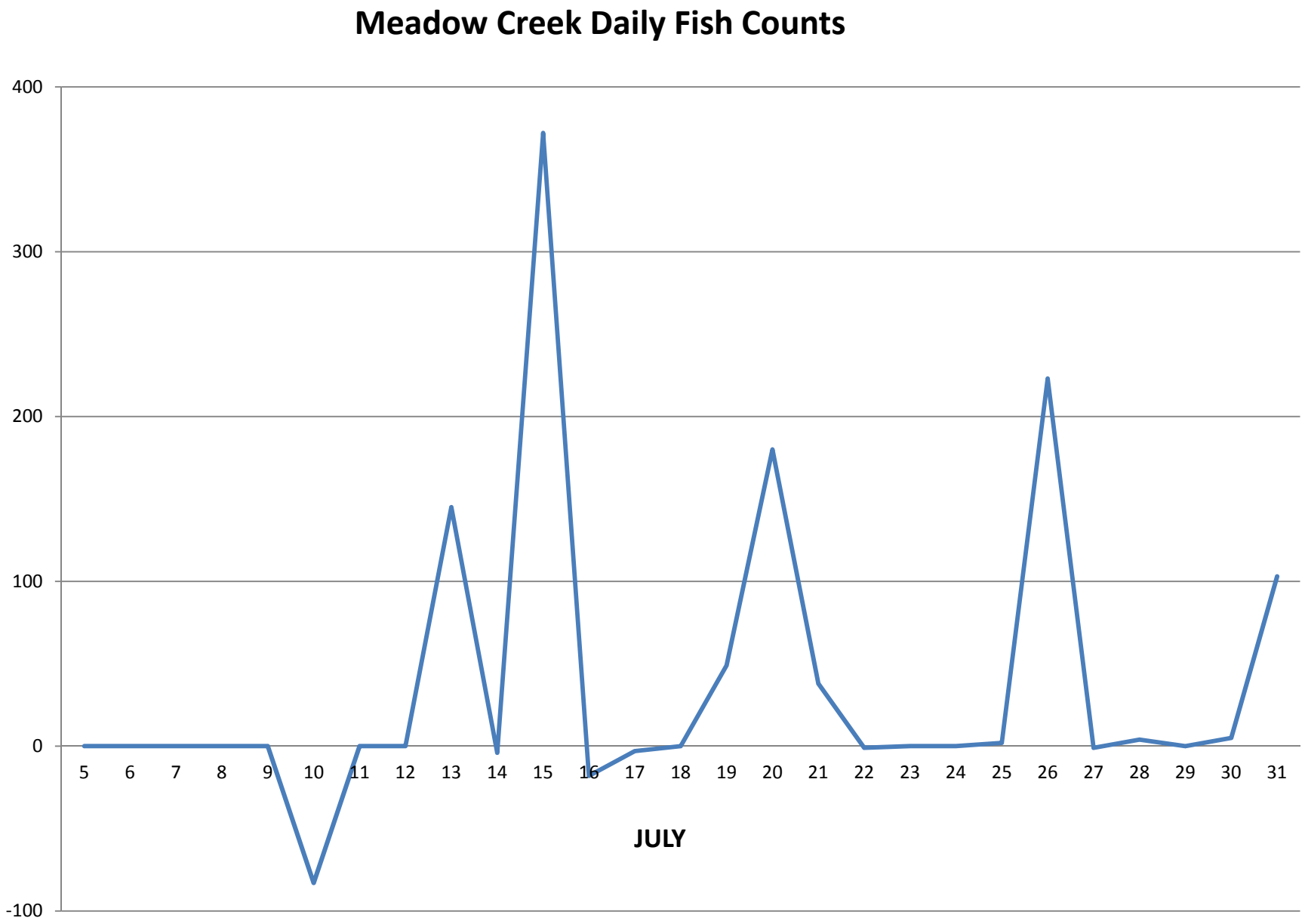
O'Malley Creek
- ~26 ft wide
- 1-3 ft deep
- Relatively large salmon run

2011/08/28 13:58:10


2011/07/25 02:17:17

Preliminary Results




Meadow Creek Daily Fish Counts
400
300
200
100
0
-100
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
JULY

Acknowledgements:

- I&M Program USFWS
- University of Idaho
- Volunteers & Biotech
- WSU
- ADF&G
- KNWR Colleagues – All the staff at the Refuge – Many Thanks
- Bears of Kodiak