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Pebble Project: Baseline Environmental Team – Agency Review Meetings

Instream Flow Study

November 29, 2007

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MSOffice2

HDR

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Slide 1

MSOffice1 NDM sent a new logo and template for use in the presentations (email from Loretta Ford Nov 15 2006) -- I believe we are supposed to use at least the new logo in our presentation, if not the same powerpoint (although that appears to be up to us)
, 20-Nov-06

MSOffice2 eliminate Ecofish logo – looks out of place on HDR footer – will identify myself as Ecofish at start of presentation
, 20-Nov-06

Instream Flow Study Objectives

- Characterize instream habitat
- Define relationship between fish habitat and stream flow

Instream Flow Study Components

1. Flow-habitat
2. Off-channel habitat
3. Spawning gravel habitat
4. Surface water temperature
5. Geomorphology

In addition, there is interaction with other studies, including: hydrology, groundwater, fish biology, macroinvertebrates, stream and riparian ecology

Baseline studies have identified potentially flow sensitive habitats

- Small and large gravel deposits: egg incubation; intragravel DO and temperature
- Riffles: juvenile rearing, insect production
- Channel margins: juvenile rearing, insect production
- Off-channel habitats: juvenile rearing, insect production, DO and temperature
- Riparian zone: channel structure, insect production

Riffles

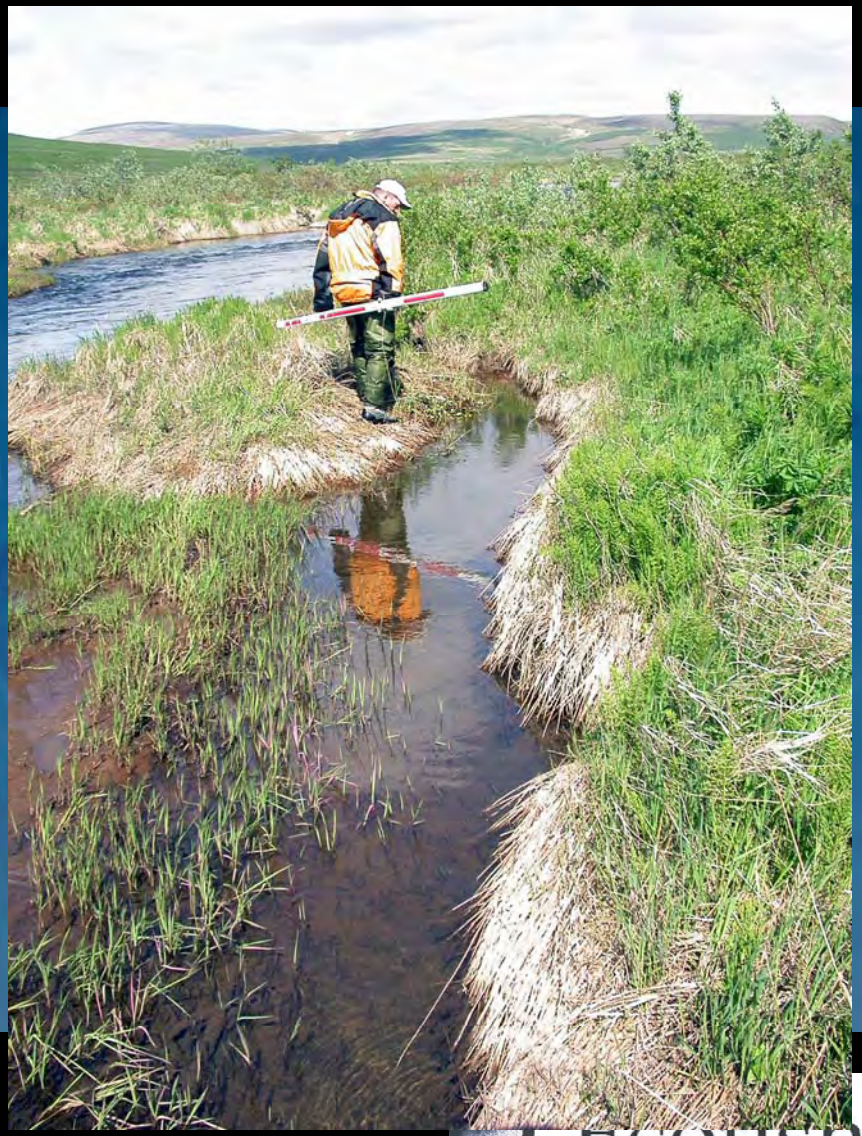
- Shallow, fast habitats
- High sensitivity to flow change
- High food production value
- Spawning habitat for some species in some reaches

Egg Incubation Gravels

- Located in flow sensitive and flow insensitive habitats
- Value is species-specific
- Intragravel flow mediates quality

Channel Margin Habitat

- Shallow, slow habitats
- High cover and food production value
- Moderately flow sensitive
- Inhabited by young-of-years (coho fry and juveniles of other species)



Riparian Zone

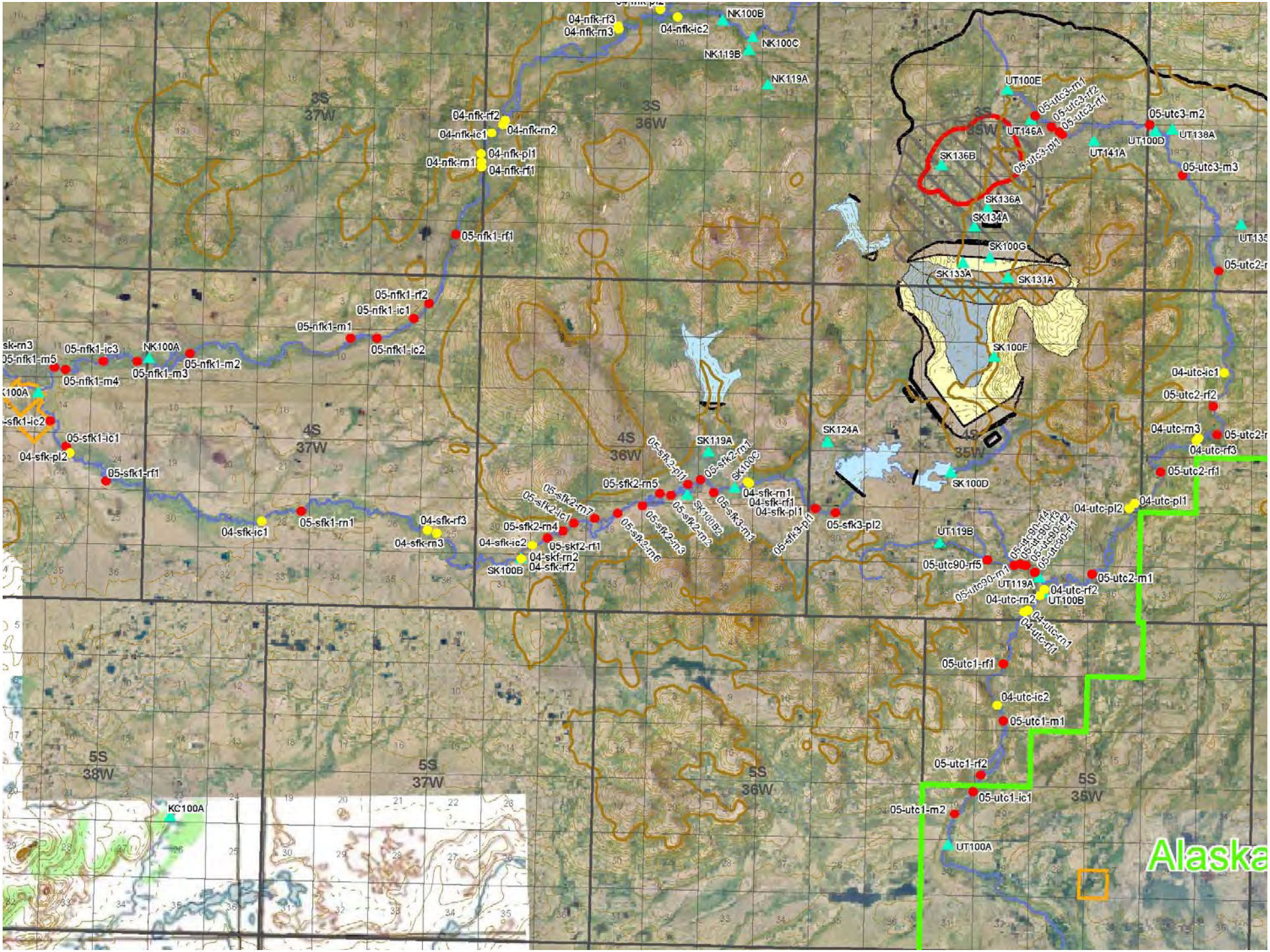
- Edge of riverbank to ≥ 15 m out from channel edge
- Indirect fish habitat
- Channel structure (limit erosion)
- Insect production
- Other values: wildlife, wetlands

Off-Channel Habitat

- Up to 2 m deep
- Low to zero velocity
- Silt substrate
- Extensive cover
- Used by juvenile coho, other species

Flow-Habitat Study

- Began in 2004
- Expanded with additional transects in 2005
- Data collected summer 2004 through 2006
- New in 2007: 6 sites on UT, new riffle sites on NK, SK
- Includes NK, SK, MK, UT, and UT trib 190
- Professional judgment and stratified-random placement of transects throughout project reaches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Flow-Habitat Field Study

- Establish vertical control (once on first trip, but validate each subsequent trip)
- Cross section geometry (once on first trip)
- Depth & velocity (2-3 times)
- Water surface elevation (all trips)
- Hydraulic slope (all trips)
- Substrate and cover (once)

Slide 12

MSOffice4 I thought we mesaured velocity twice in some reaches in 2006. Note that we have checked on changes in cross section geometry.
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Transects – 92 total

- South Fork Koktuli River: 3 reaches
  - 28 transects
- North Fork Koktuli River: 3 reaches
  - 21 transects
- Mainstem Koktuli River: 1 reach
  - 5 transects
- Upper Talarik Creek: 3 reaches
  - 32 transects
- Upper Talarik Tributary UT190: 1 reach
  - 6 transects

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Transects by mesohabitat

Reach	Length	Run	Riffle	Pool	Island Complex	TOTAL SITES
UT-1	9.43	4	4	0	2	**10**
UT-2	17.19	9	4	2	1	**16**
UT-3	8.65	3	2	1	0	**6**
UT-Trib 190		1	5	0	0	**6**
Total		17	15	3	3	**38**
SK-1	20.46	3	4	1	3	**11**
SK-2	6.42	8	1	1	1	**11**
SK-3	12.15	2	1	3	0	**6**
Total		13	6	5	4	**28**
NK-1	16.9	5	2	0	4	**11**
NK-2	14.27	3	3	2	2	**10**
Total		8	5	2	6	**21**
MK		2	2	0	1	**5**
Grand Total of Sites						**92**

Slide 14

MSOffice3 Has this slide been updated? Please do so with notes regarding transects eliminated from the study. Can you copy this onto here without a white background? That would look much better.
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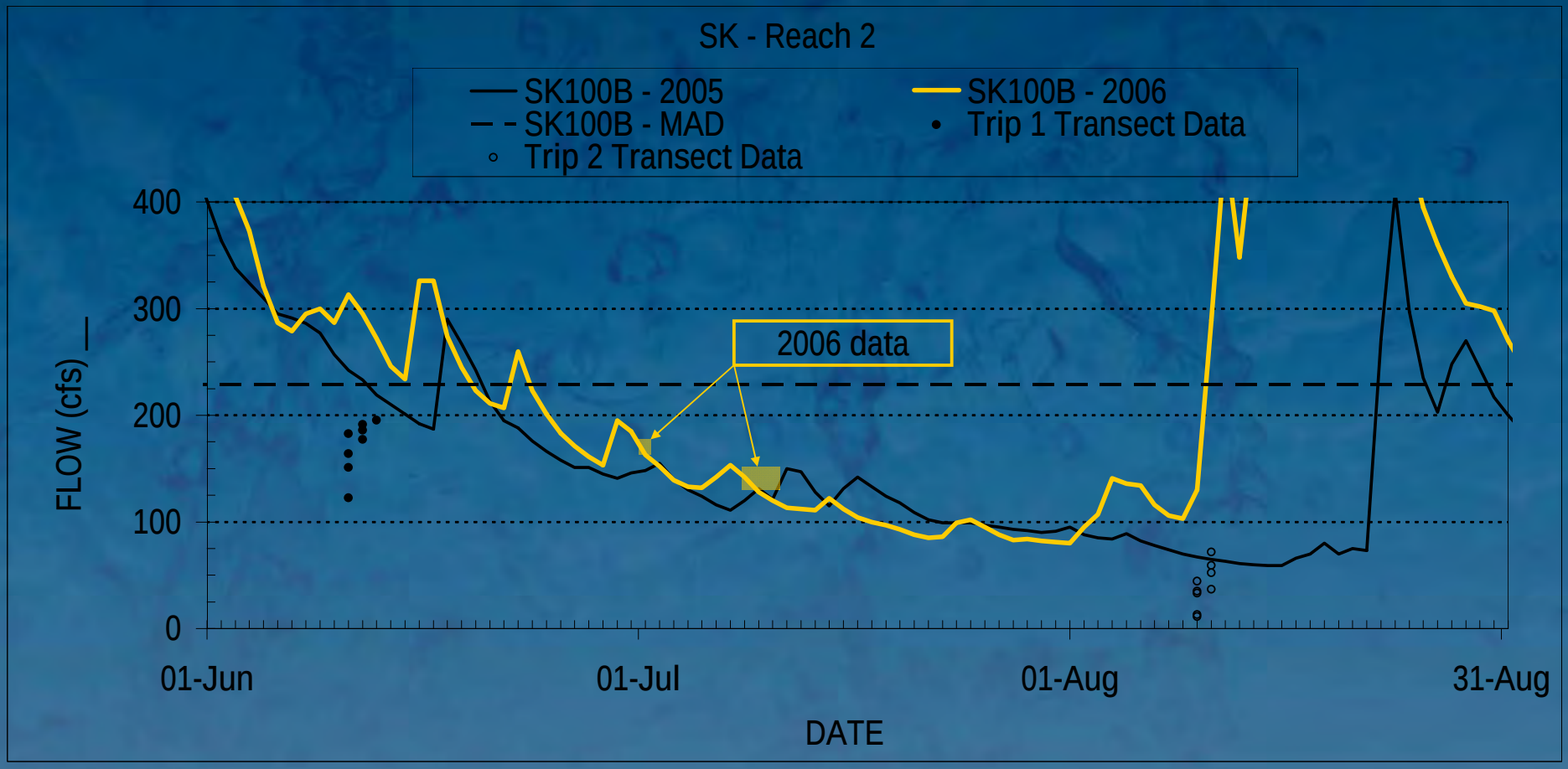
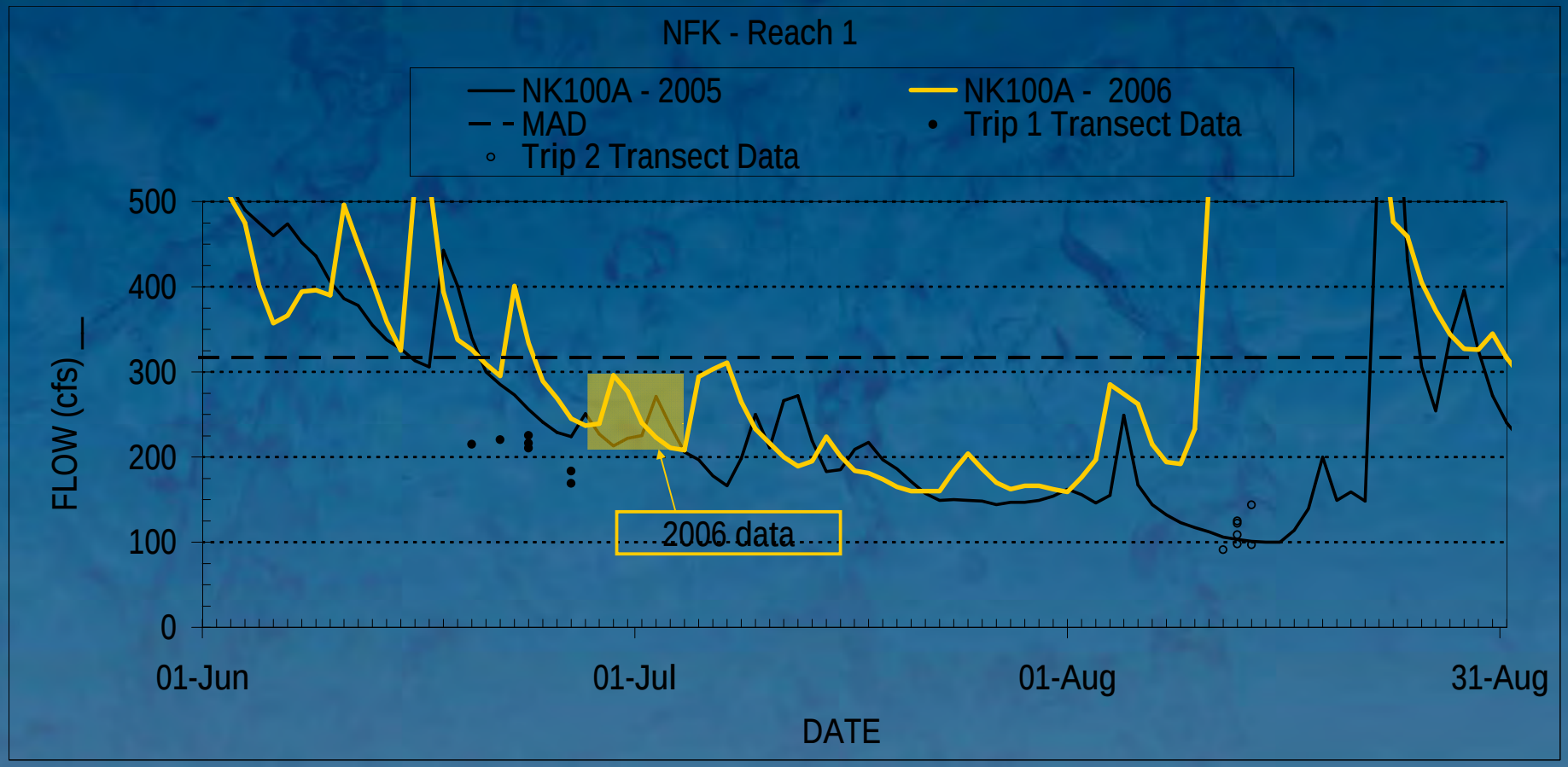
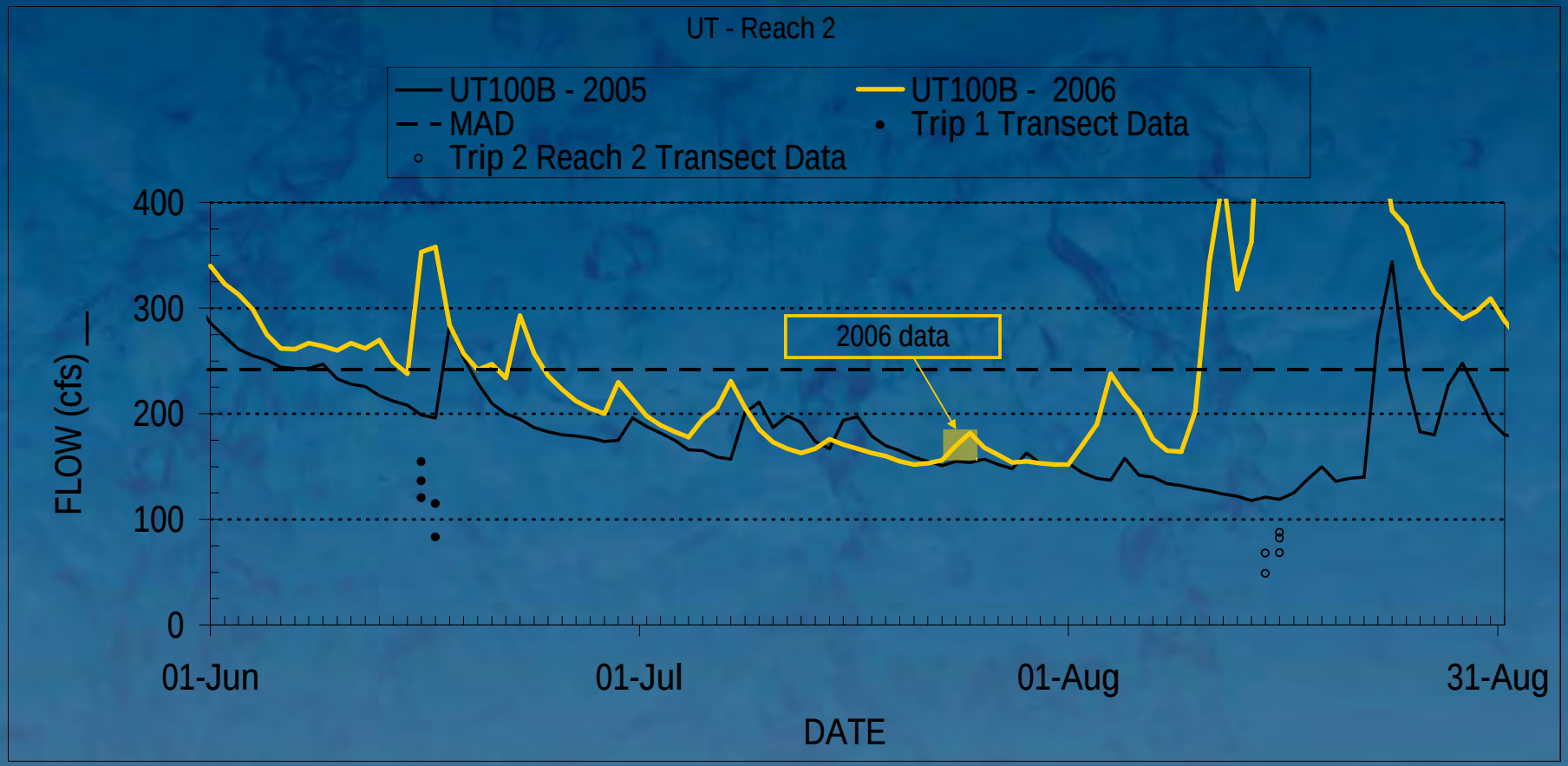
Flow-Habitat Field Study Results



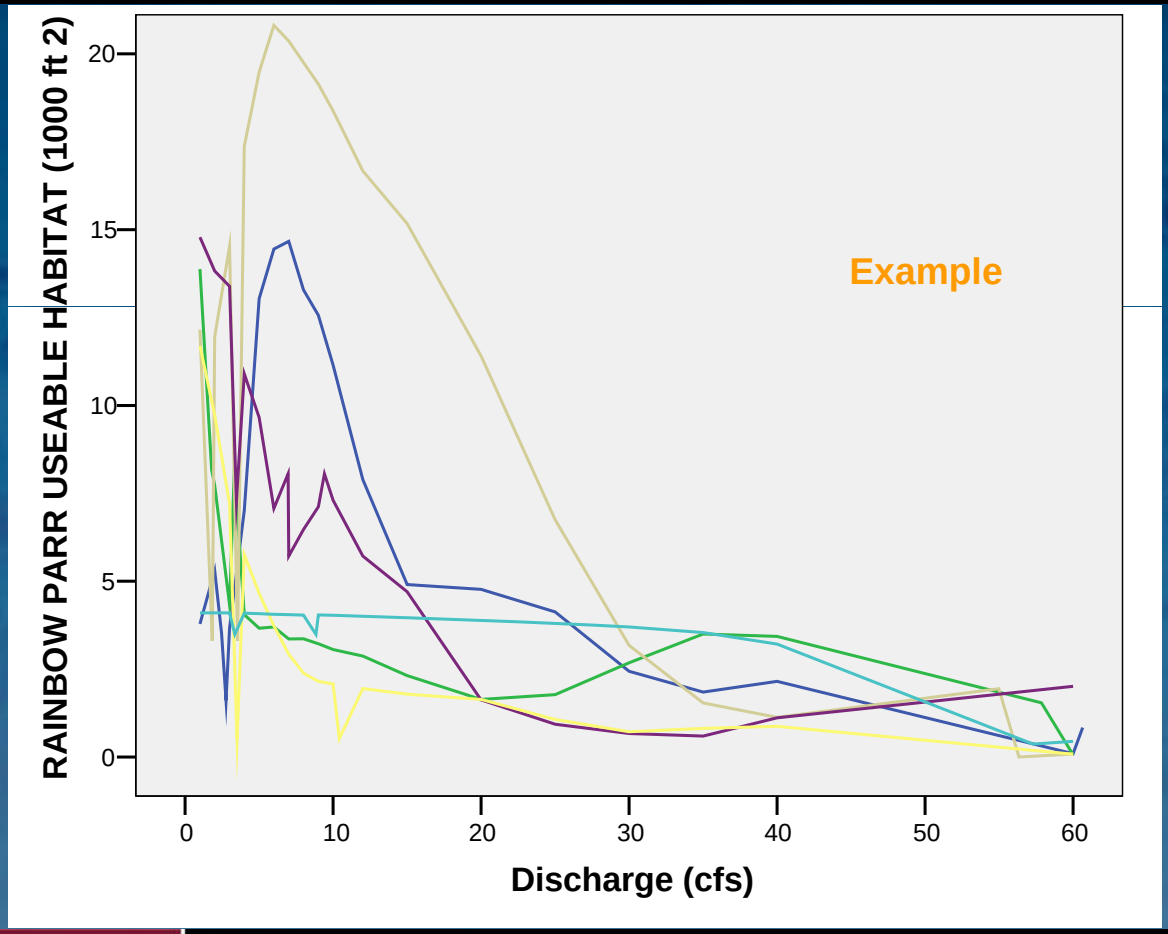
Flow-Habitat Field Study Results



Flow-Habitat Field Study Results



Flow-Habitat Relationship



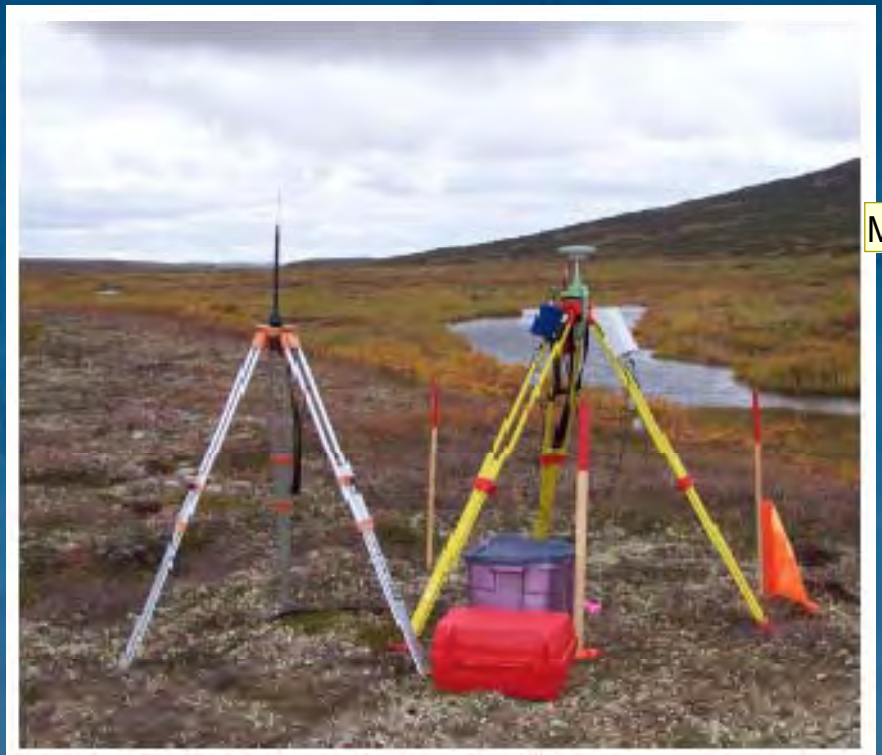
Off-Channel Habitat Study

- Extends instream flow study by quantifying spatial and seasonal habitat quality and use in flow-habitat cross sections
- Performed in South Fork Koktuli River Reach 2
- New in 2007: Upper Talarik Creek Reach 2
- Quantified off-channel habitat with physical measurements laterally and vertically connected using DGPS
- Fish sampling effort followed off-channel measurements

Off-Channel Habitat Study

Parameters Collected

- Cross section geometry
- Waterbody width and depth, substrate, cover
- Water surface elevation
- Water quality – temperature, conductivity, DO
- Fish species/lifestage presence
- Connectivity (proposed in 2008)



LEICA DGPS BASE UNIT AND RX-FM BASE TRANSMITTER

Slide 20

MSOffice5 Please review changes i have made to this to ensure accuracy.
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Off-Channel Habitat Study

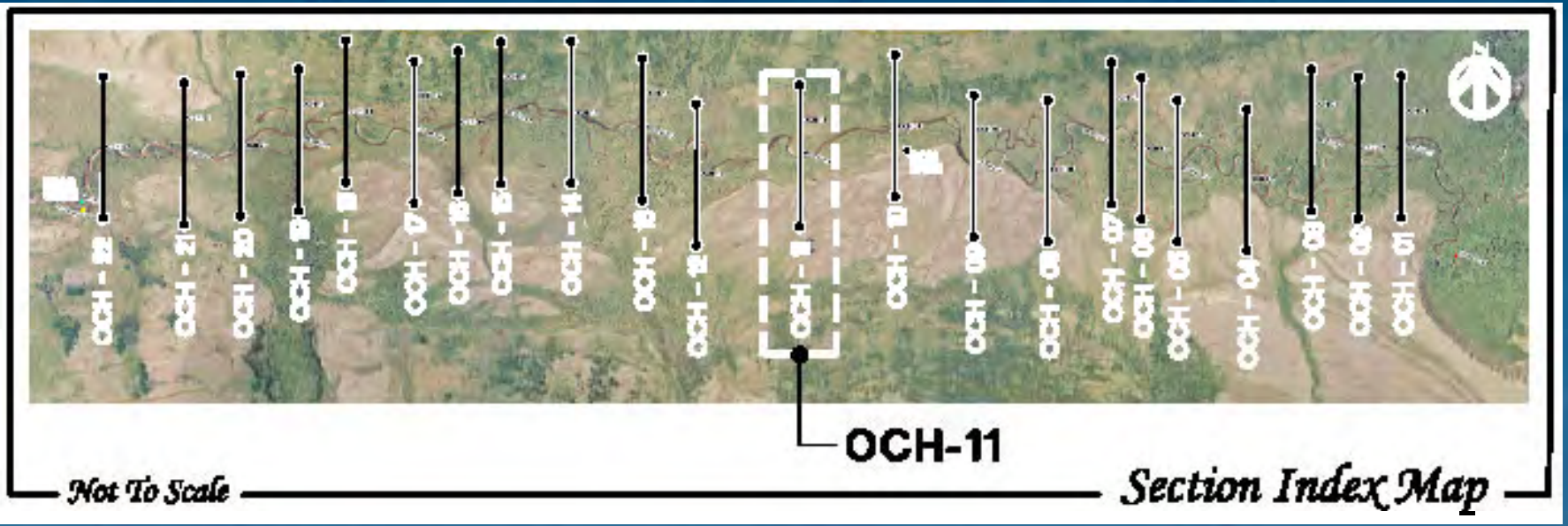
South Fork Koktuli Reach 2

- 2 Data Collection Field Trips
  - September 2005 (high flow)
  - July-August 2006 (low flow)
- 15 transects

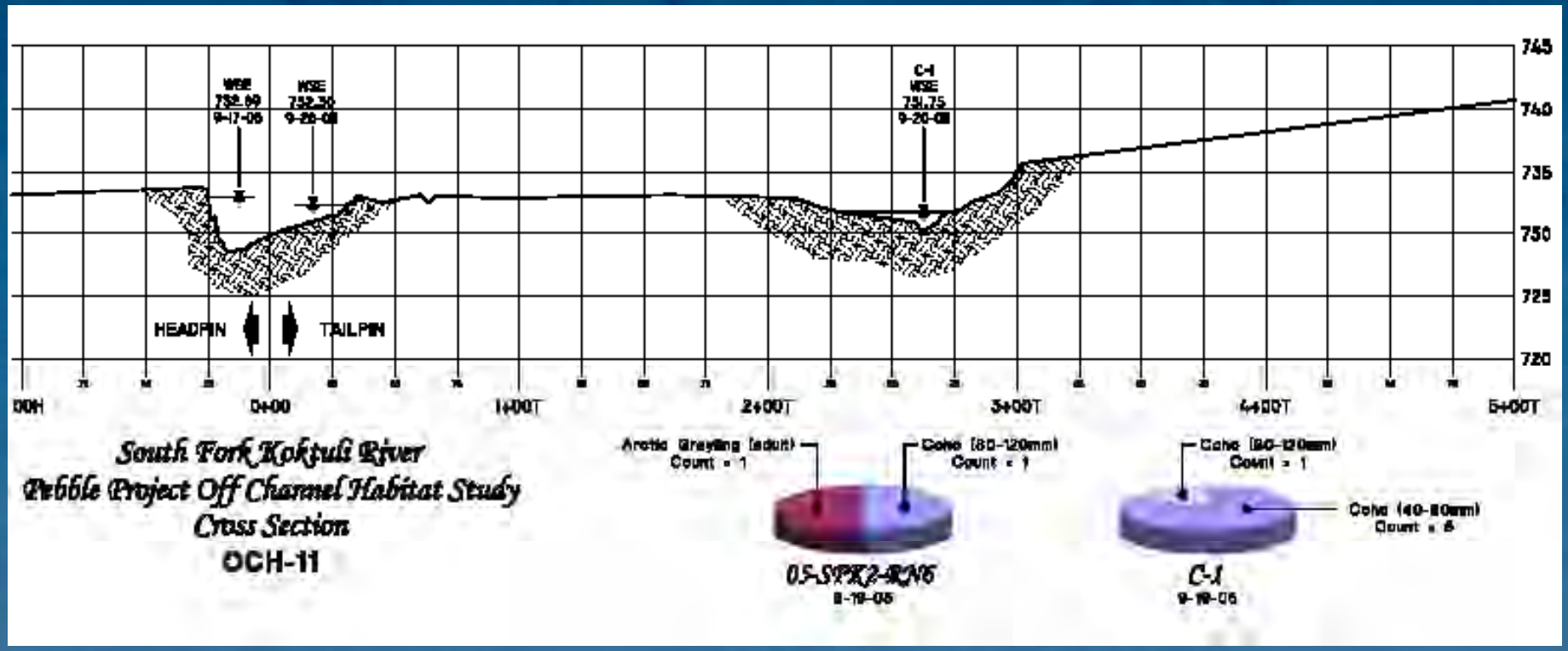
Upper Talarik Creek Reach 2

- 2 Data Collection Field Trips
  - June 2007 (low flow)
  - September 2007 (high flow)
- 16 transects

Off-Channel Habitat Study



Off-Channel Habitat Results



Surface Water Temperature Study

- Thermistors located throughout SK, NK, UT
- 40 Continuous surface water temperature stations
- 8 Continuous air temperature stations
- Groundwater data available
- SNTEMP model selected
- Current and MDC scenarios will be modeled

Surface Water Temperature Study

- Input parameters include:
  - Hydrology:
    - Main channel flow and water temperature
    - Tributary flow and water temperature
    - Groundwater flow and temperature
  - Meteorology:
    - Air temperature
    - Relative humidity
    - Wind speed
    - % Possible sun (cloud cover)
    - Solar radiation (optional)
  - Geometry:
    - Elevation and latitude
    - Topography
    - Main channel width, length, and heading
    - Riparian vegetation

Fisheries Field Study - component of instream flow study

- Snorkel flow-habitat and off-channel sites
- Describe fish use of habitat
- Collect depth-velocity data to validate/create habitat suitability criteria (HSC)
- Enumerate fish by species/life stage at transect sites to validate habitat modelling

Fisheries Field Study

Flow-Habitat sites:

- 2 trips to all sites –
  - July 2005
  - July 2006
- SFK Reach 2 – coincidental with Off-Channel sites

SK Off-Channel Habitat:

- 3 trips to all sites –
  - September 2005
  - June 2006
  - August/September 2006

UT Off-Channel Habitat:

- 2 trips to all sites –
  - July 2007
  - October 2007

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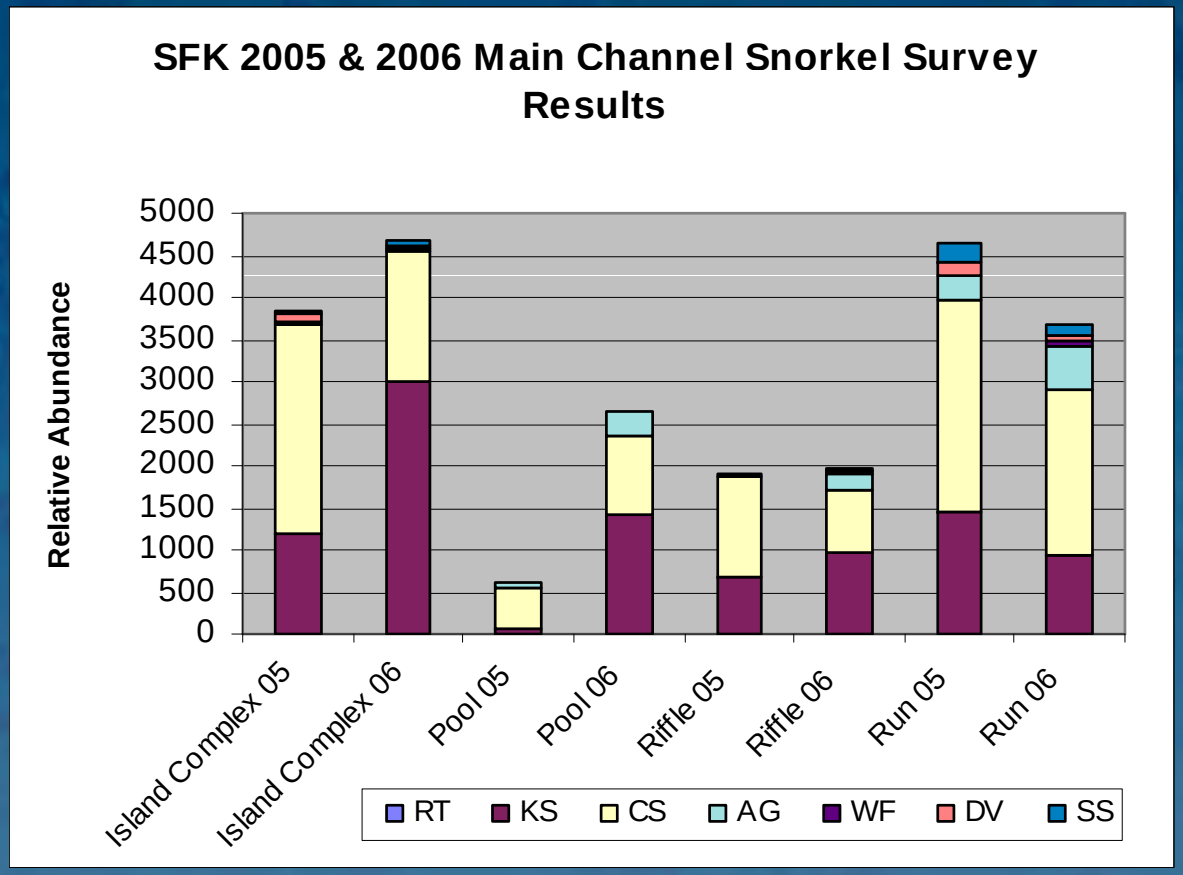
Snorkeling Results



Slide 28

MSOffice7 Can we color these plots so that the fish species have the same colors in each -- this is especiallly important for coho, chinook, grayling, and rainbow

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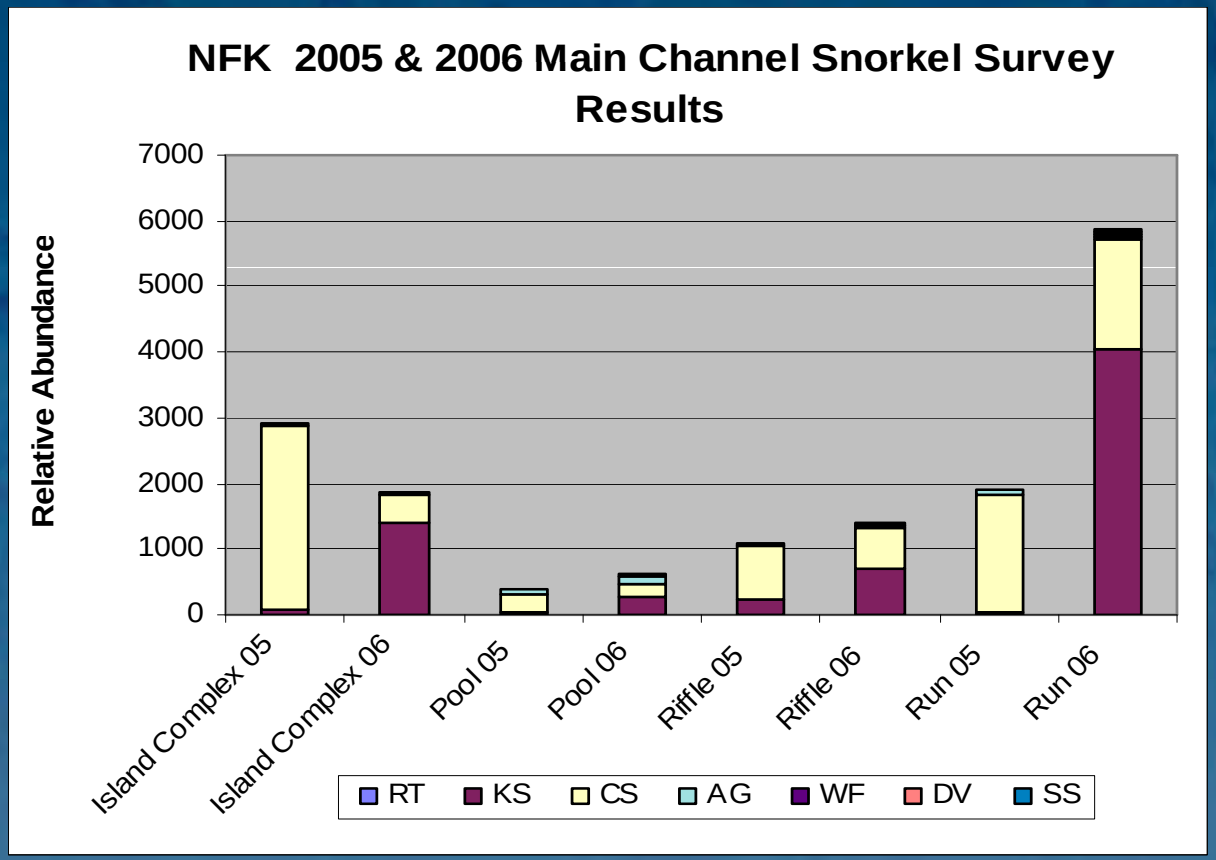
Snorkeling Results



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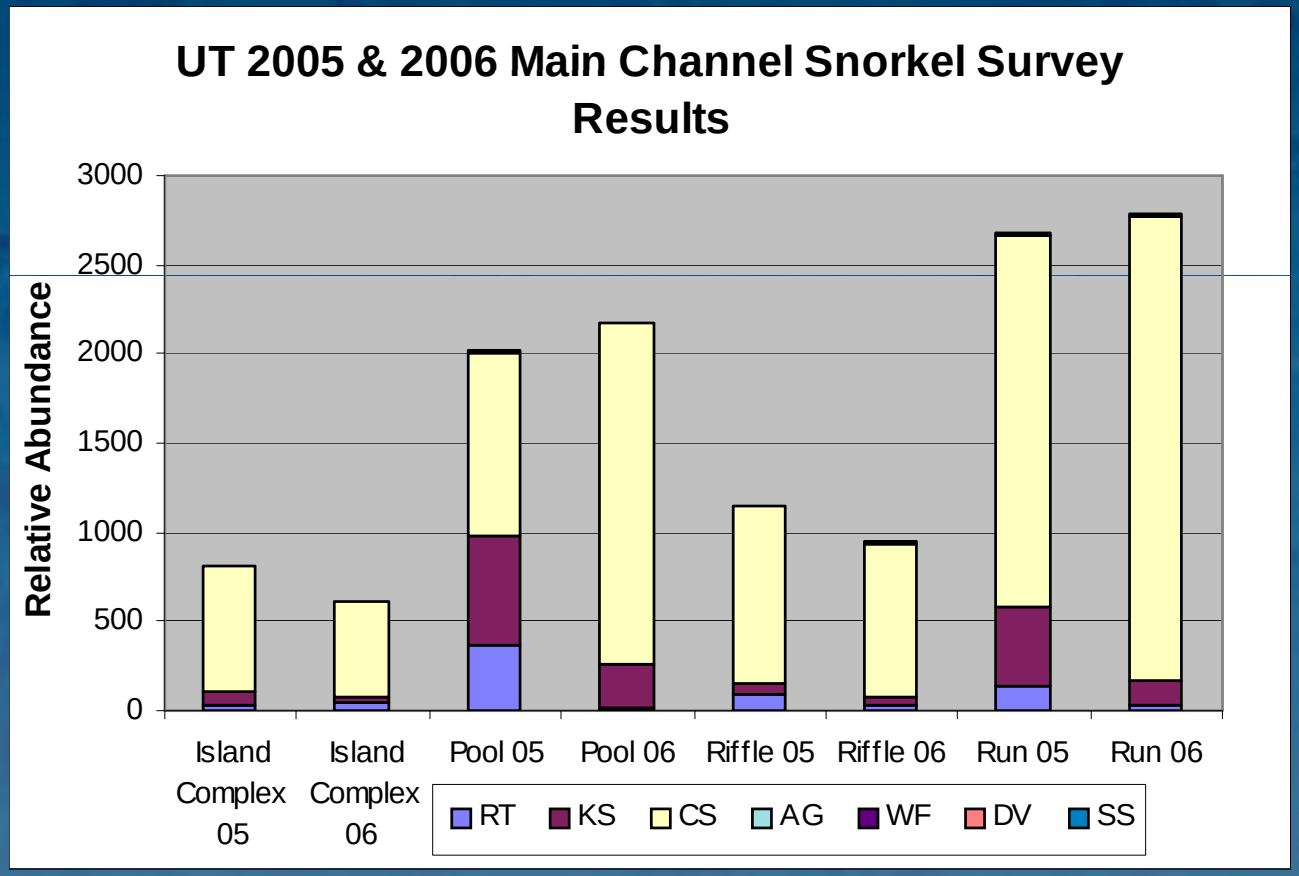
Snorkeling Results



Slide 30

MSOffice6 Can we recolor this plot so that the colors match the species in the previous two figures?
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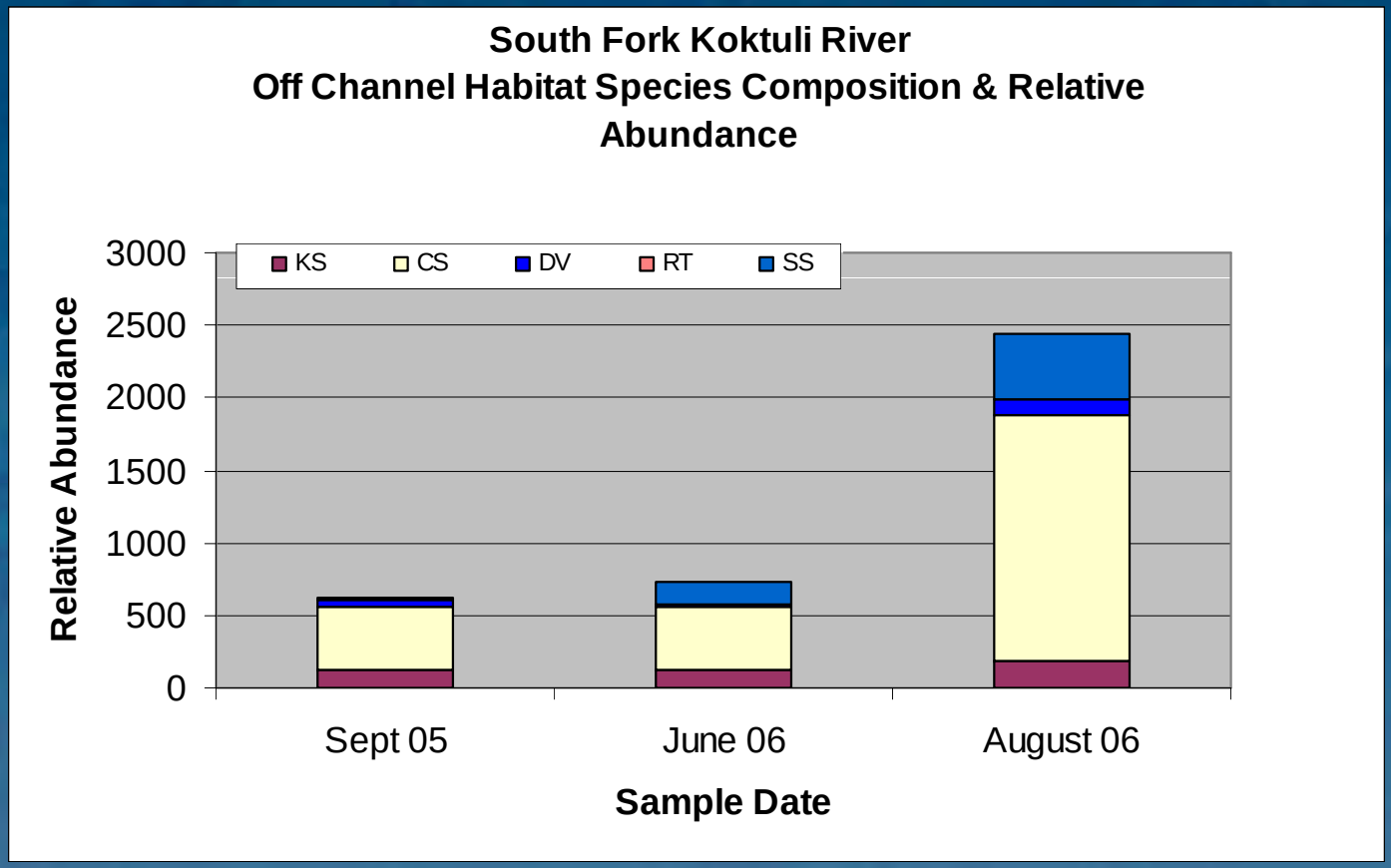
Snorkeling Results



Slide 31

MSOffice10 Can we recolor this plot so that the colors match the species in the previous two figures?
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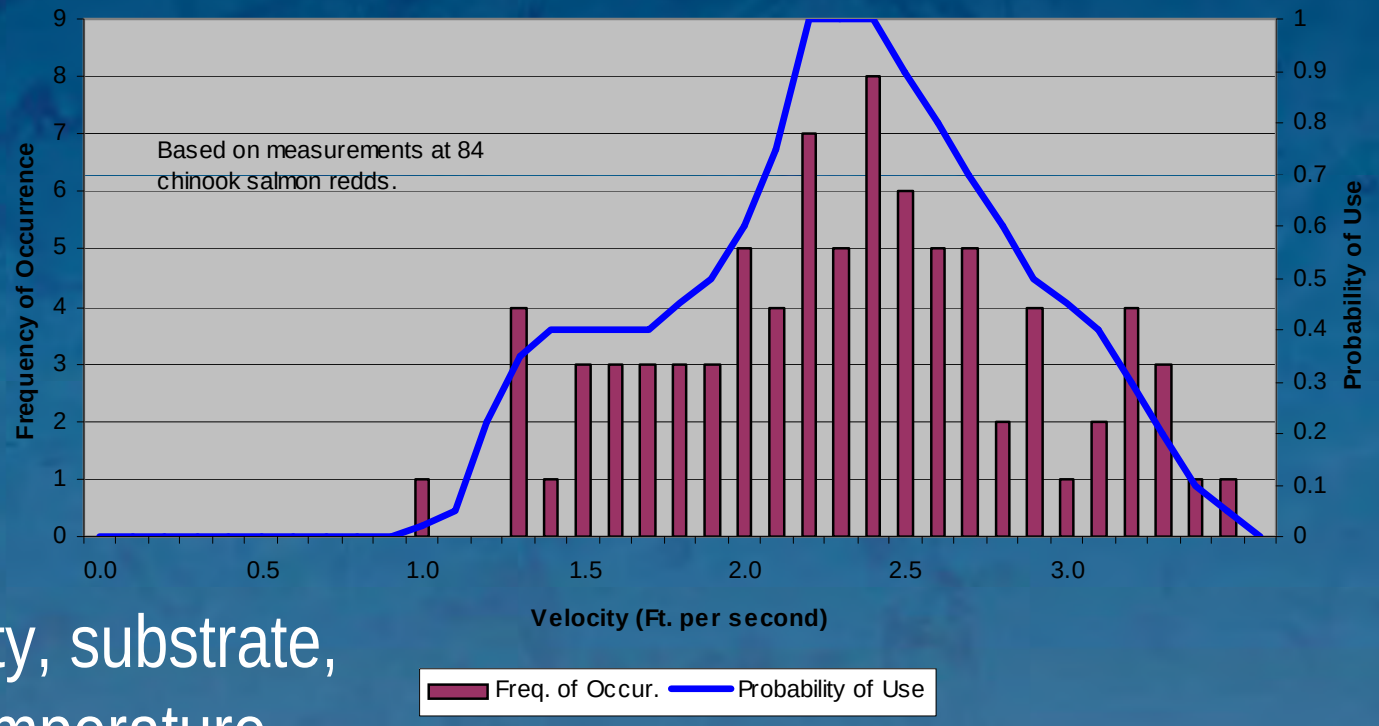
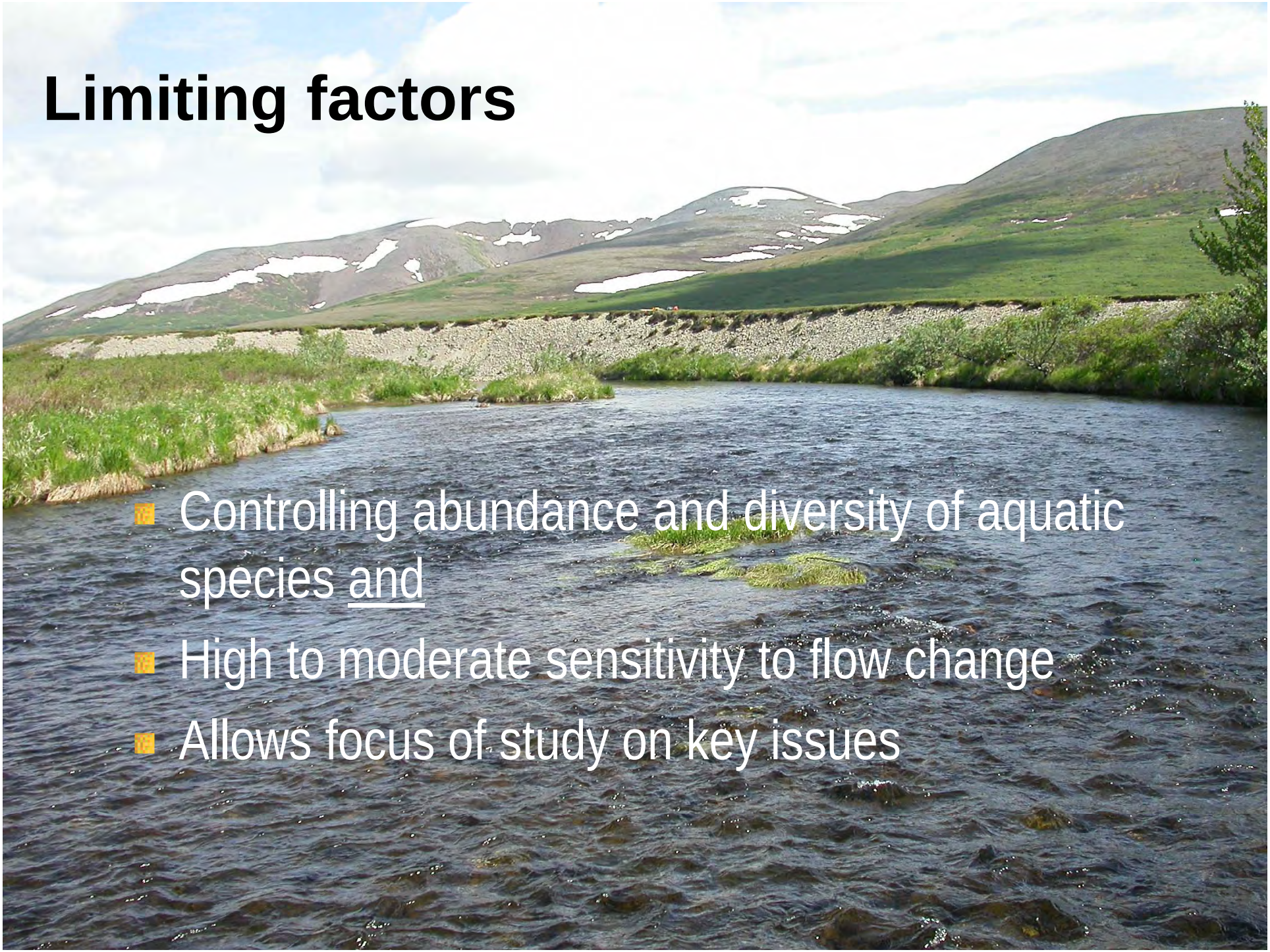
Habitat Suitability Criteria Development

- All species
- Collected 2004-2006
- Additional 2007
- Depth, velocity, substrate, cover, and temperature

Figure 5. Velocities at chinook salmon spawning locations - data combined for the North and South Forks of the Koktuli River, 2005 and 2006.



Limiting factors



- Controlling abundance and diversity of aquatic species and
- High to moderate sensitivity to flow change
- Allows focus of study on key issues

Potential limiting factors

Limiting factor	Description/Rationale	Flow sensitive habitats	Ecosystem components affected	Physical habitat variable	Other variables
Spawning habitat for salmon	Adult salmon require sufficient depth and velocity to construct redds and bury their eggs. Larger bodied salmon, such as chinook, require greater depths and higher velocities than other species and therefore may be affected more severely by flow reduction.	Small and large gravel deposits in riffles in larger streams; pools in smaller streams, and runs in medium streams.	Egg incubation	Weighted useable area: width, depth, velocity, substrate.	Temperature and dissolved oxygen
Rearing habitat for rearing adult and sub-adult salmonids	Resident salmonid species such as rainbow trout, and anadromous species such as chinook salmon, are territorial and require sufficient space for successful rearing, which may be limited at higher population densities, particularly during low flow periods.	Riffles and runs. Pools show little change in wetted area with flow.	Adult spawning, juvenile rearing, insect production	Weighted useable area: width, depth, velocity, and cover.	Growing season temperature, food production
Rearing habitat for young-of-year salmonids	Young-of-year salmonids require lower water velocities and higher proximity to cover than their older, larger-bodied stages. They are sensitive to predation and displacement from high flows.	Channel margins, including semi-isolated shallows and undercut banks.	Juvenile rearing, insect production	Weighted useable area: width, depth, velocity, and cover.	Growing season temperature
Off-channel and overwintering habitat for juvenile salmonids	For species that prefer low water velocities, such as coho salmon, off channel habitats provide critical rearing habitat during the growing season, but also potentially overwinter.	Off-channel habitats.	Juvenile rearing, insect production	Weighted useable area: width, depth, velocity, and cover.	Channel connectivity, temperature and dissolved oxygen (overwinter).
Channel maintenance	Flow is the master variable that controls habitat quality and distribution in rivers. Flow regime magnitude, timing, and duration influence sediment transport and channel shape, in turn determining riverine habitat quality.	Riparian zone, active sediment deposits in channel or in the stream banks, aquatic vegetation.	Channel structure, sediment transport, macrophyte density	Flow magnitude and duration thresholds (indicators of hydraulic alteration).	Macrophyte habitat

Ongoing Activities