

Pebble Project Fish Resource Baseline Studies Update 2007



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HDR



Baseline Study Objectives

Document the distribution and abundance of fish resources within the project area

Acquire pre-development baseline data for post development monitoring

Guide Project Design

Provide information for environmental permitting.



2007 Mine Site Baseline Studies

Rainbow Trout Telemetry Study & Spring Spawning Surveys

Overwinter Sampling

Salmon Escapement Estimates

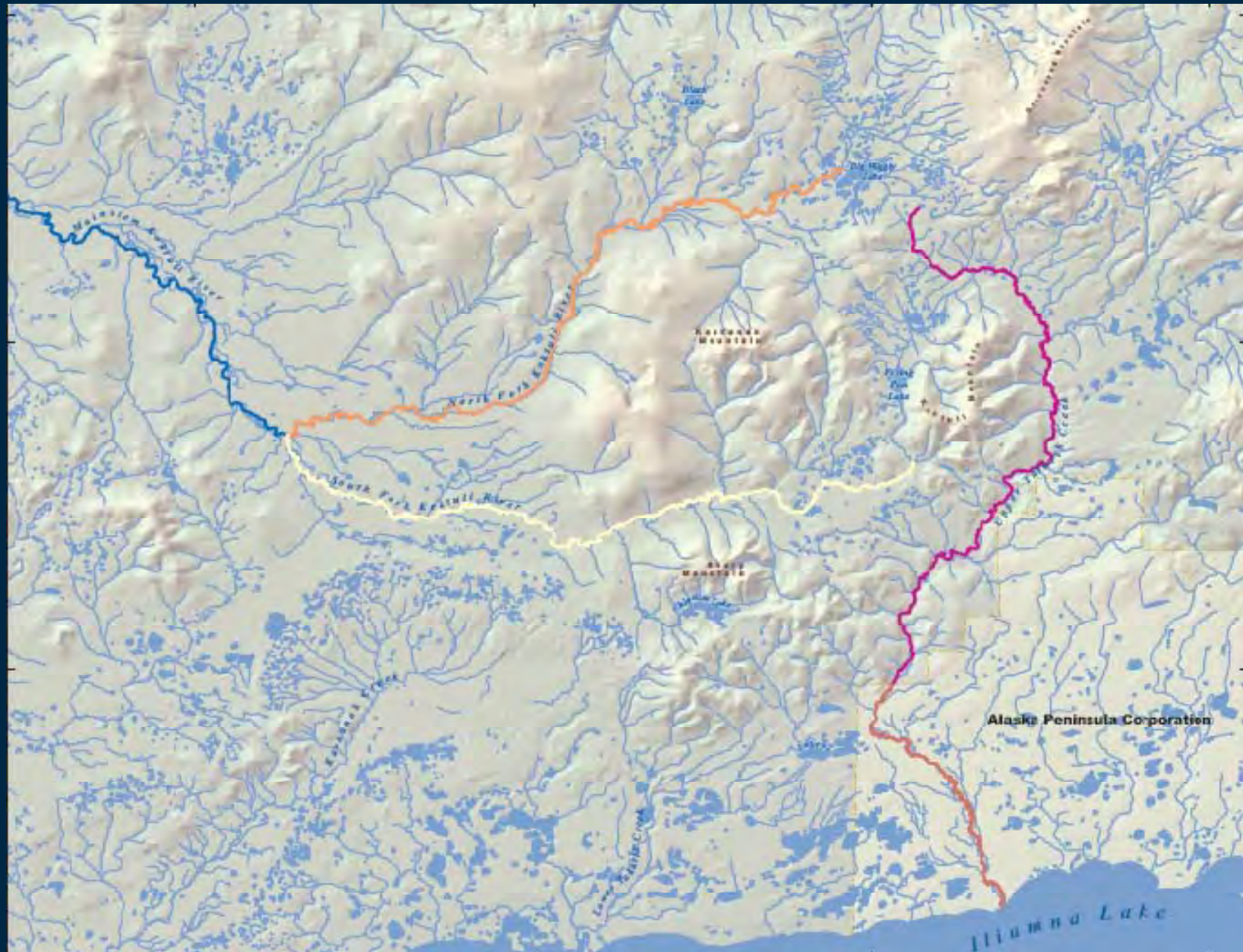
UT Fish Abundance

Juvenile Anadromous Fish Distribution

Fish Tissue Sampling

Habitat Surveys UT Reach 3 Tributaries

Mine Site Study Area



Upper Talarik Rainbow Trout Radio Telemetry

Study Objectives



- Document life history patterns
 - Migrations patterns related to
 - spawning, feeding, overwintering
 - Geographic extent
- Examine relationships between fish that utilize the UT and how may also use other streams in the region.

Rainbow Trout Radio Telemetry Tagging Methods

- 38 tags surgically implanted
- Aqui-S isoeugenol anesthetic
- Summerfelt and Smith (1990) technique
- Mobile sterile surgery station





A Little More About Tagging

- Tags – Lotek SRM11-35 coded tags with mortality indication
- Tag life ~ 2 years
- Tagging occurred from 8/24 – 9/18 resulting in 9 discrete tag events
- 21 fish sub sampled to establish length / weight relationship

And Even More Yet

- Tag weight = 10 g in air and 5.6 g in water
- Minimum tag length (FL)= 440 mm (861g)
- Average tag length = 543 mm (1,800g)
- Maximum = 648 mm (3,100 g)
- Tag in air = 1.2 % of the smallest fish body weight
- Floy tags were deployed with each radio tagged fish

Rainbow Trout Radio Telemetry Tracking Methods

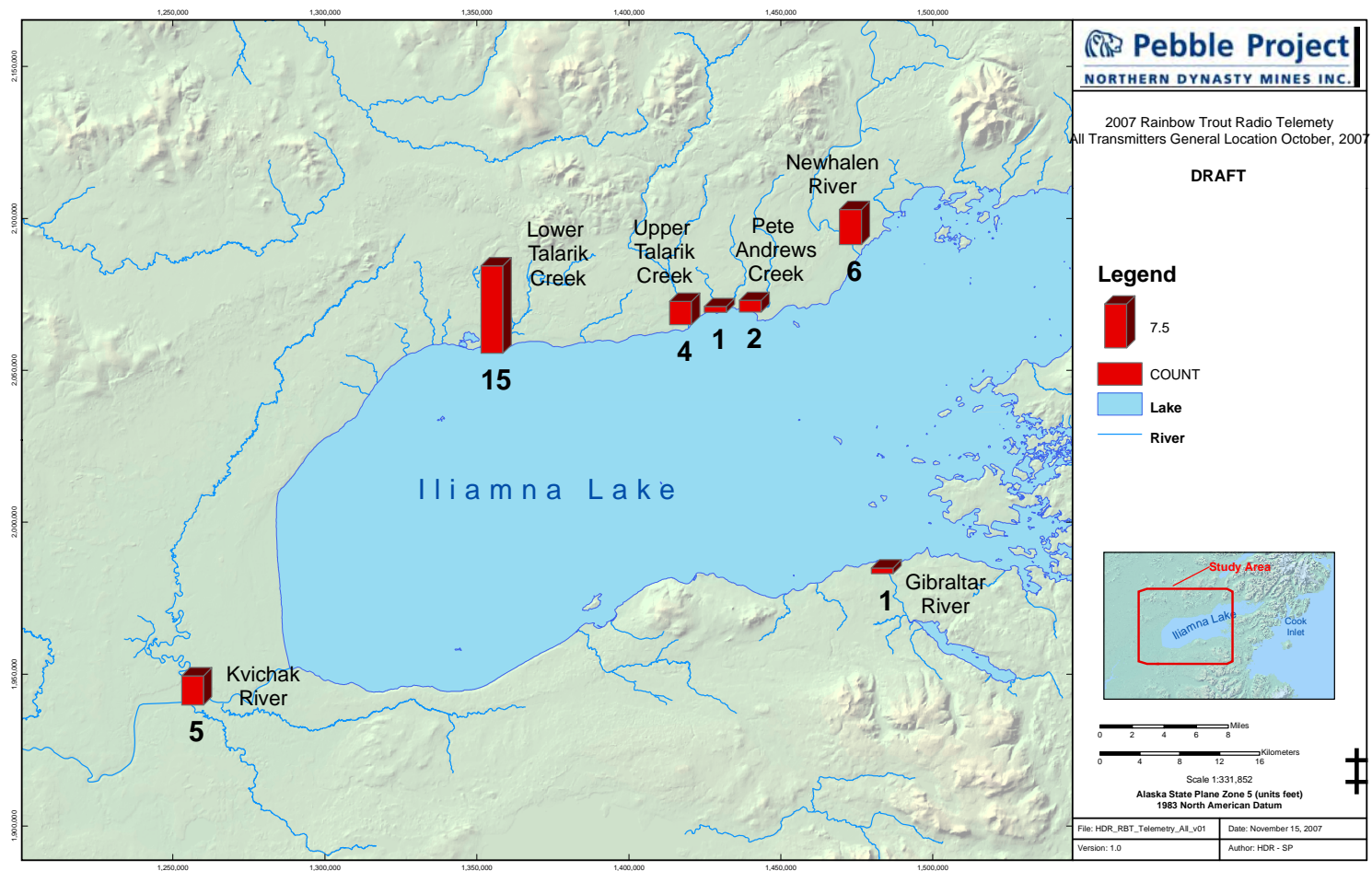
Monitor movement with mobile and stationary tracking methods

- Fixed stations
 - $\frac{3}{4}$ mile U/S from the mouth of the UT
 - At the mouth of the Lower Talarik adjacent to lagoon



Rainbow Trout Radio Telemetry Results

Distribution of transmitters as of last survey in October of 2007



Rainbow Trout Radio Telemetry Tracking Results

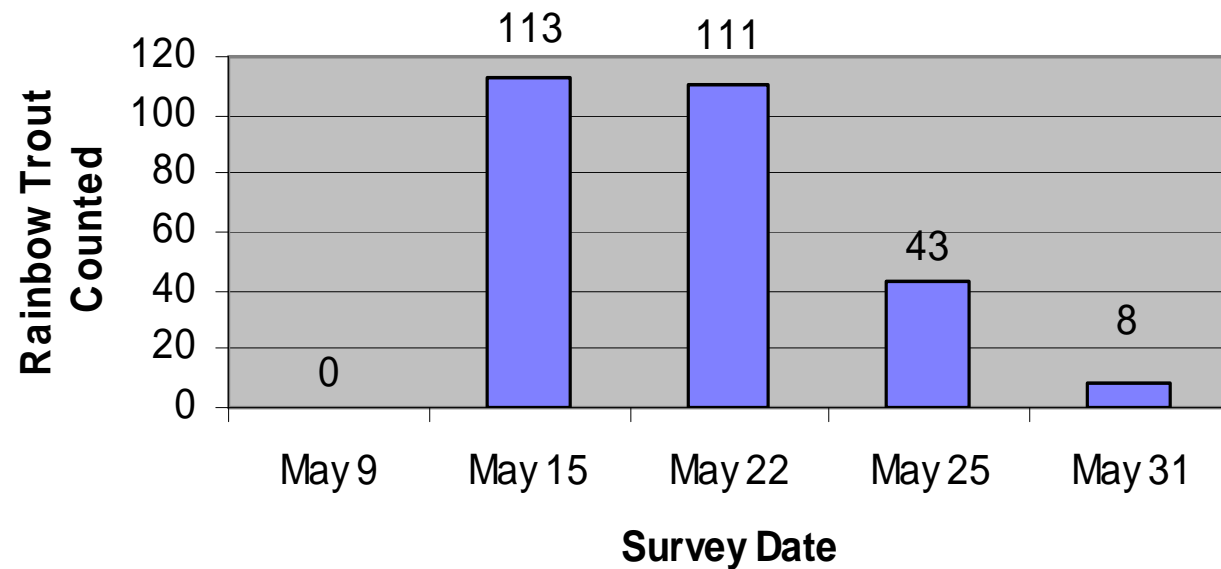
- 34 of 38 tagged fish have contributed data
- Average aerial survey produces 24 unique locations
- 5 mortalities based on tag sensor
- 4 survived >30 days and traveled to other rivers

Tracking Status	Number of Transmitters	Percent of Sample (<i>n</i> =38)
Consistently Tracked	26	68.4%
Intermittently Tracked	8	21.1%
Limited or No Data	4	10.5%

Upper Talarik Creek Rainbow Trout Surveys

Five aerial surveys were flown during May 2007

**2007 Upper Talarik Creek Rainbow Trout
Aerial Counts**





Salmon Escapement

Study Objectives: Obtain estimates of run timing and escapement of salmon by species to UT, SFK and NFK by means of aerial survey counts

Aerial surveys were conducted every 5 days from July 6 – October 9, 2007

- SFK - 18 Aerial Surveys
- NFK - 18 Aerial Surveys
- UT - 18 Aerial Surveys

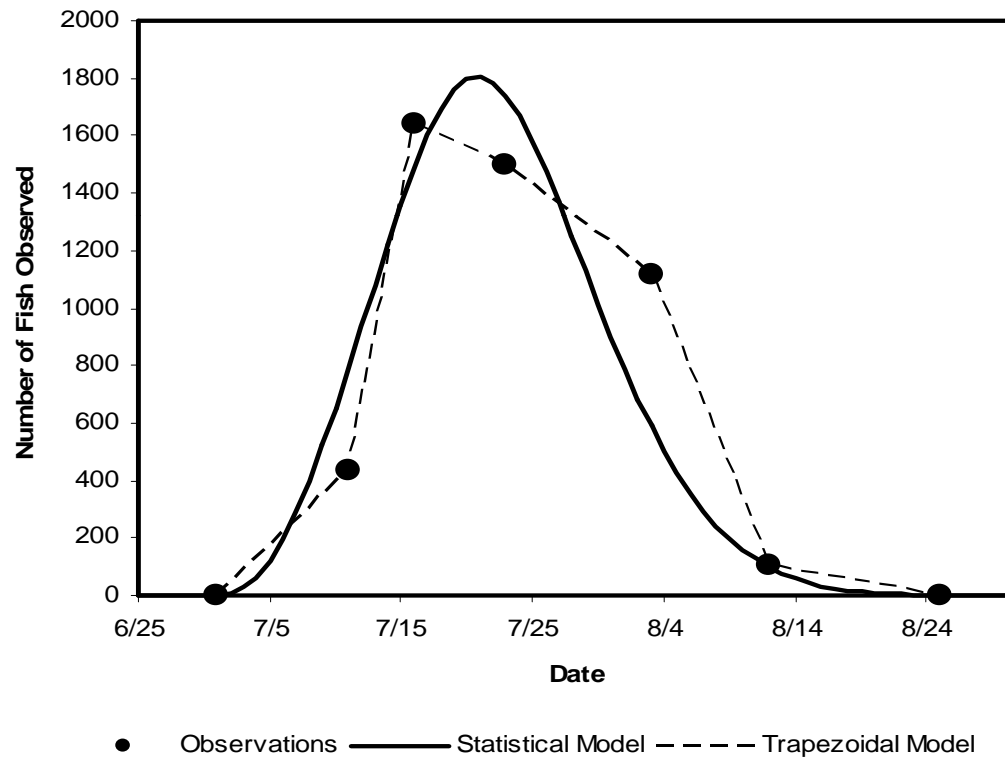
Escapement Estimates

Two methods are used to estimate escapement

(1) A trapezoidal model where the number of fish present in the study area by day is estimated using linear interpolation for the days not surveyed; and

(2) A statistical model where maximum likelihood methodology (MLE) is used to estimate a fish abundance curve by fitting actual observations to modeled abundances. Specifics of the statistical model can be found in Hilborn et al (1999).

Trapezoidal and Statistical model to aerial observations for estimation of area-under-the-curve.



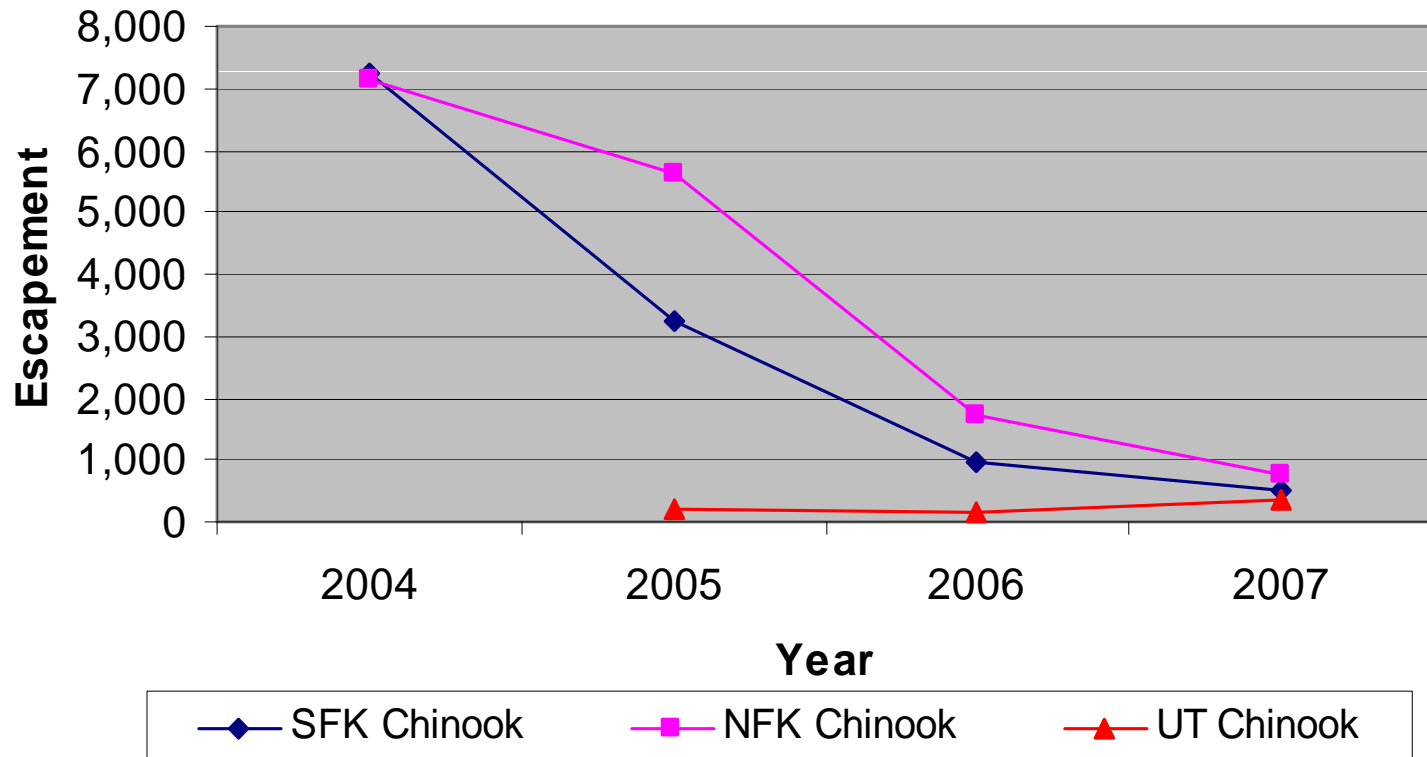
Observations for Chinook salmon from the South Fork of the Kaktuli River were used for this illustration.

Chinook Escapement

Trapezoidal Results

Stream Life = 15d, Observer Efficiency = 0.8 SFK / NFK & 0.6 UT

Chinook Escapement

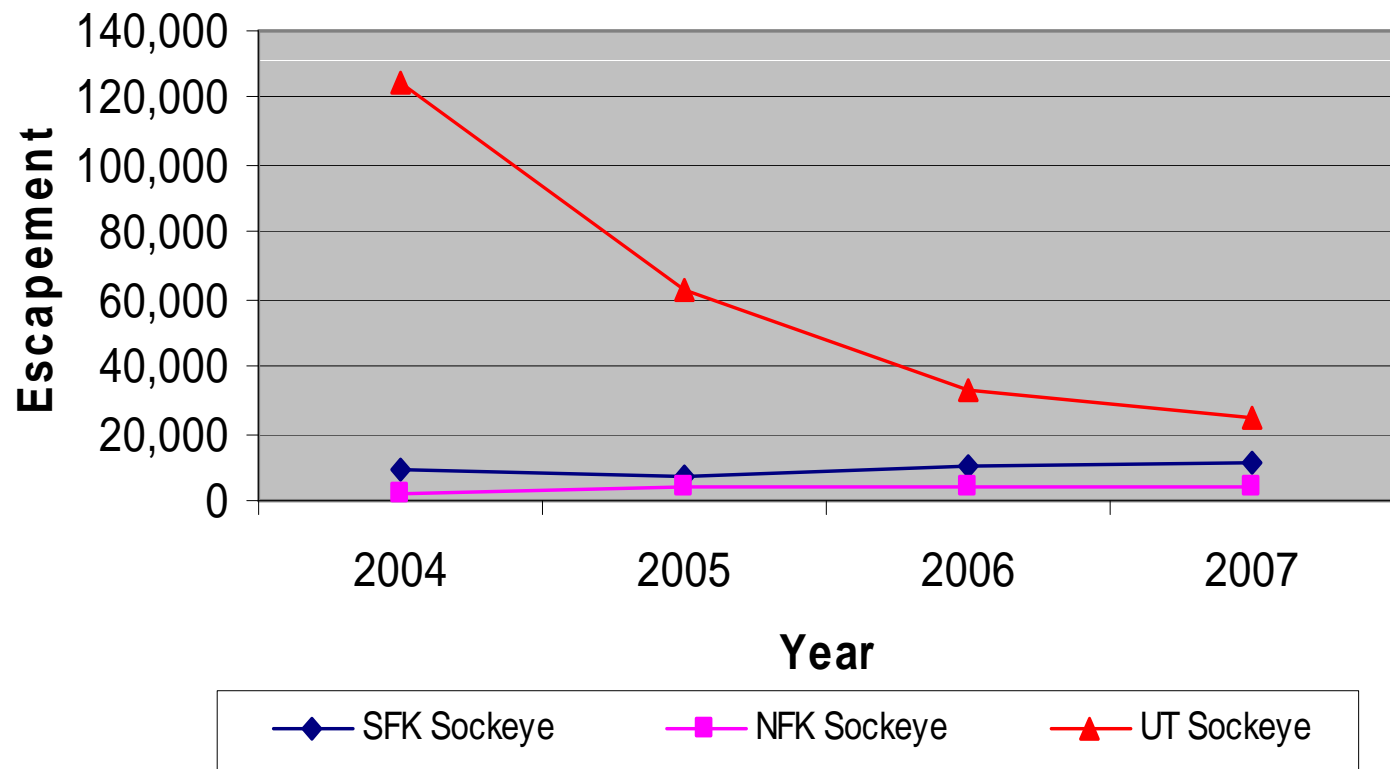


Sockeye Escapement

Trapezoidal Results

Stream Life = 10d, Observer Efficiency = 0.8 SFK / NFK & 0.7 UT

Sockeye Escapement

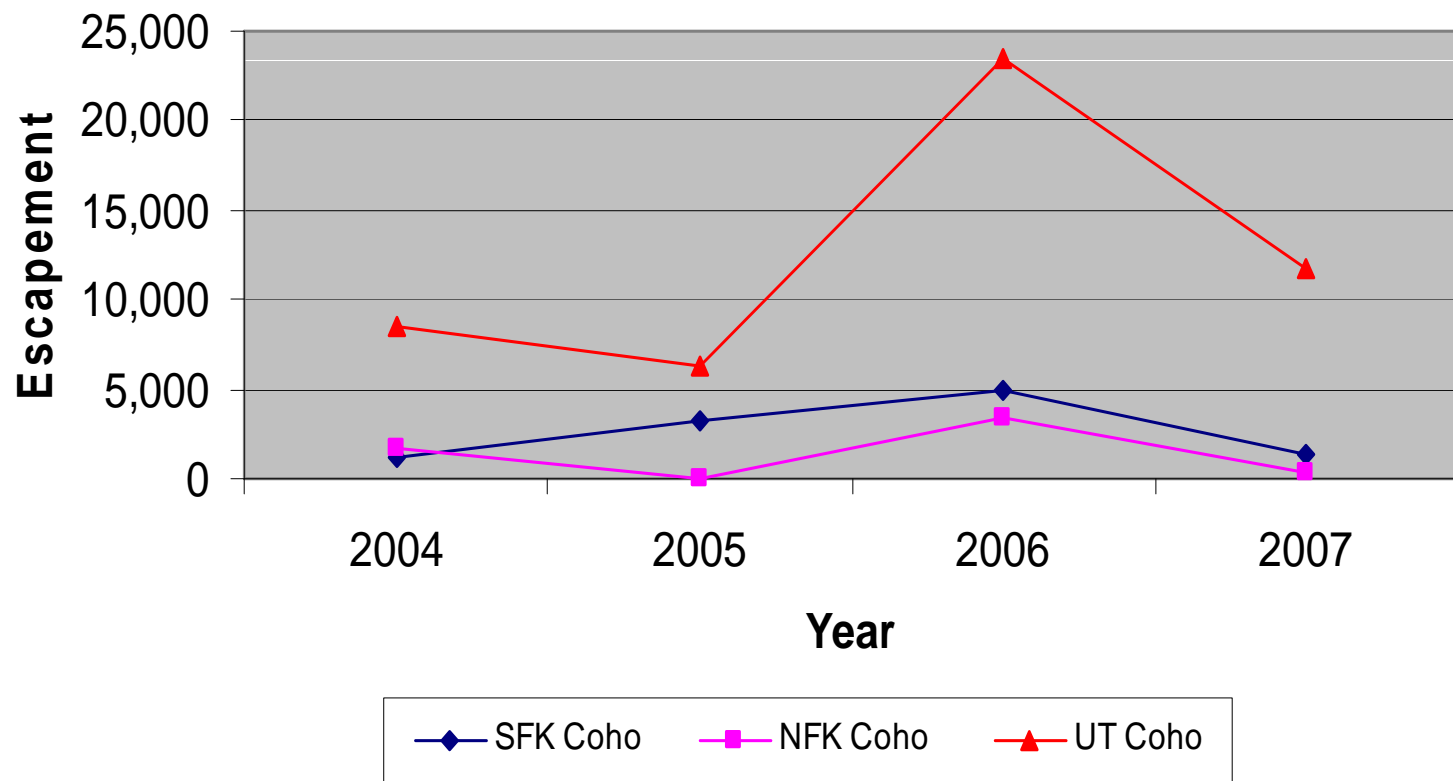


Coho Escapement Est.

Trapezoidal Results

Stream Life = 12d, Observer Efficiency = 0.6 SFK, NFK & UT

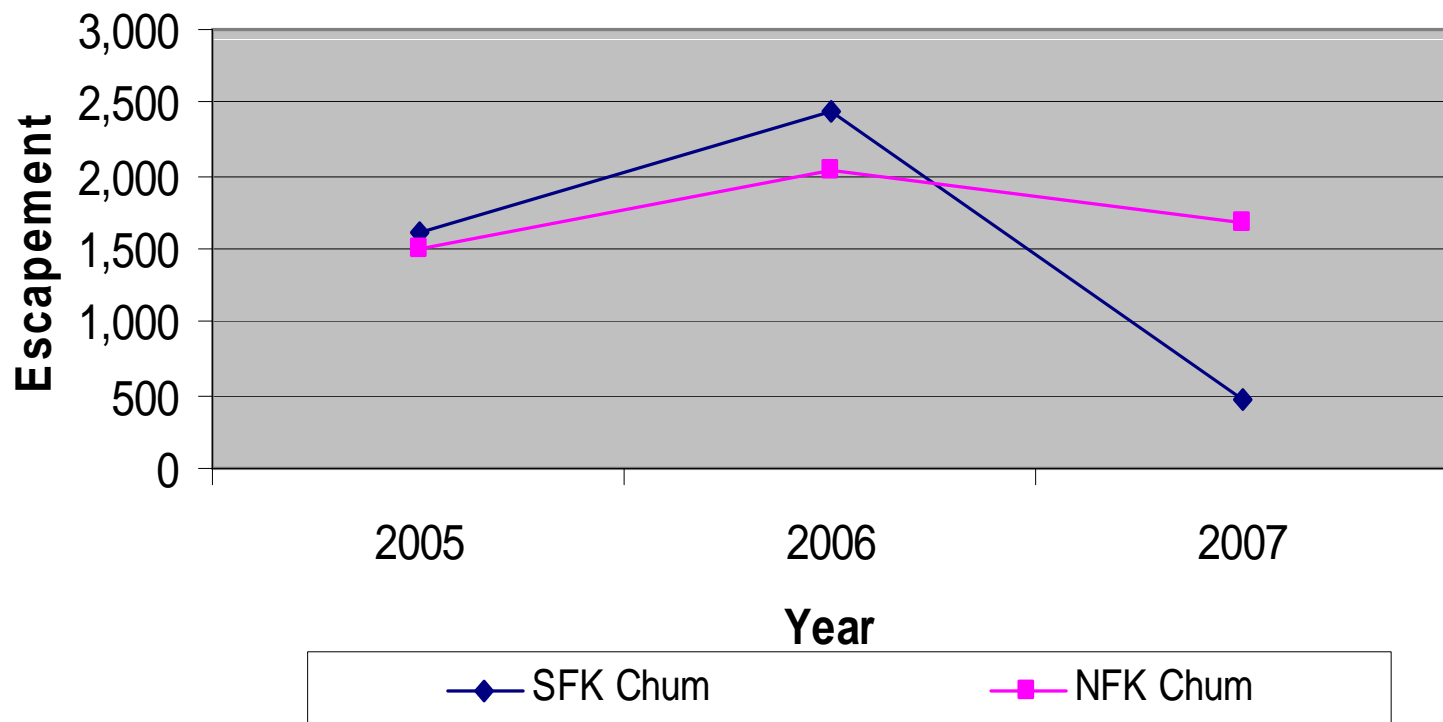
Coho Escapement



Chum Escapement Est.

Trapezoidal Results –
Stream Life = 12 d, Observer Efficiency = 0.6 NFK & SFK

Chum Escapement

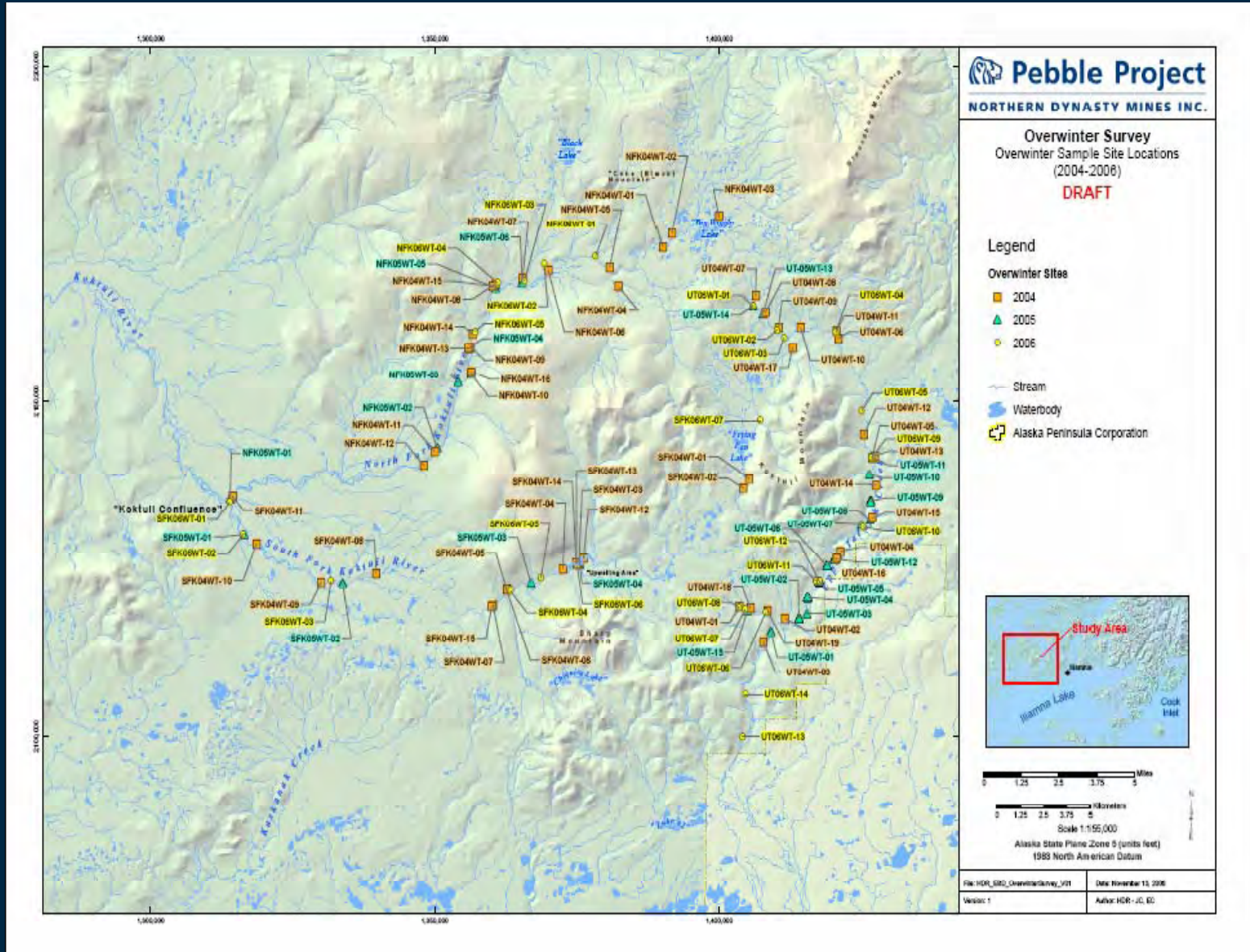


Overwinter Sampling

- Objective - Document spatial distribution and relative abundance of juvenile fish and identify overwintering habitats



Overwinter Sample Site Locations

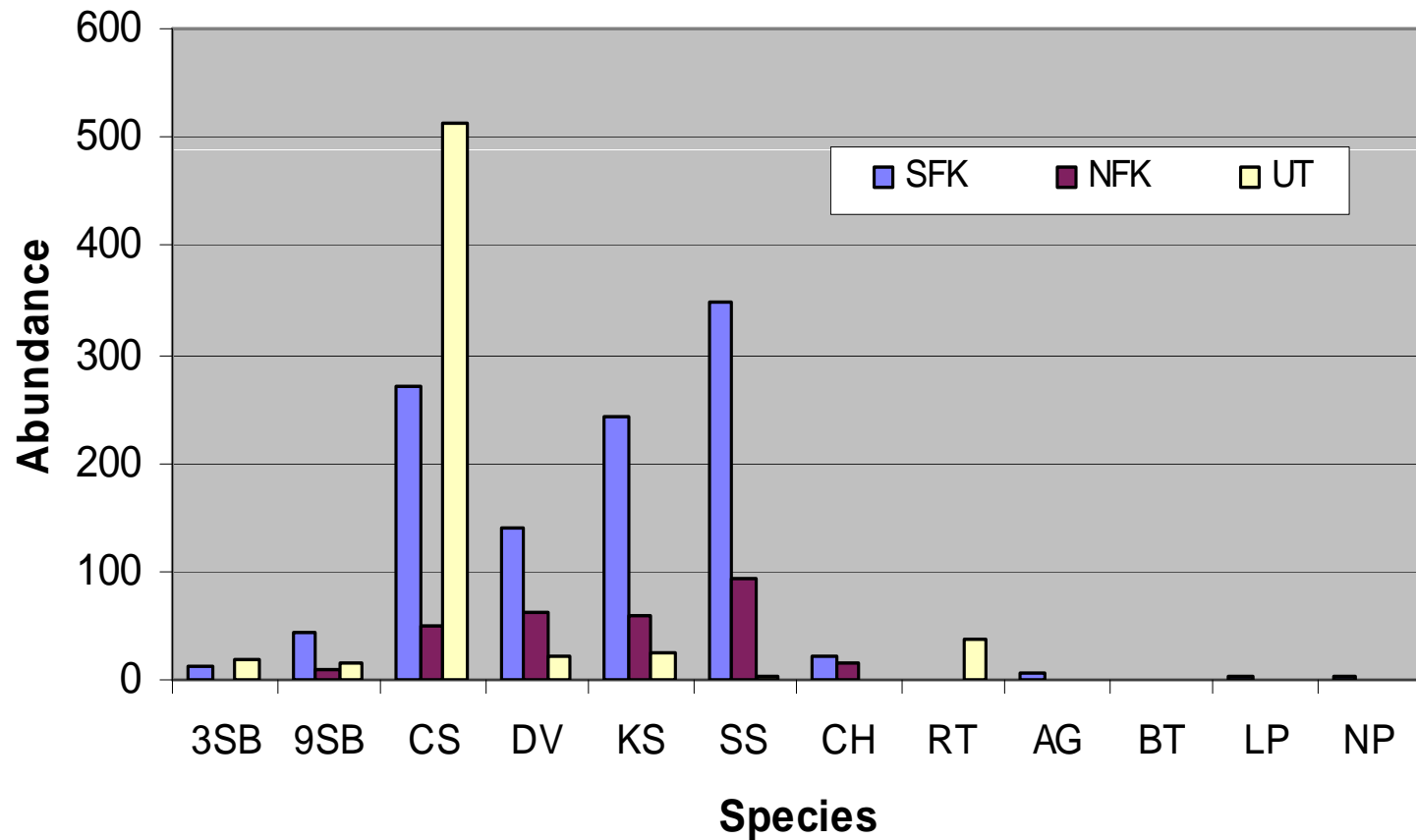




- 2004-2006 catch rates were low
- 2007 catch rates increased as a result of putting greater effort in to sampling off channel habitats (OCH)

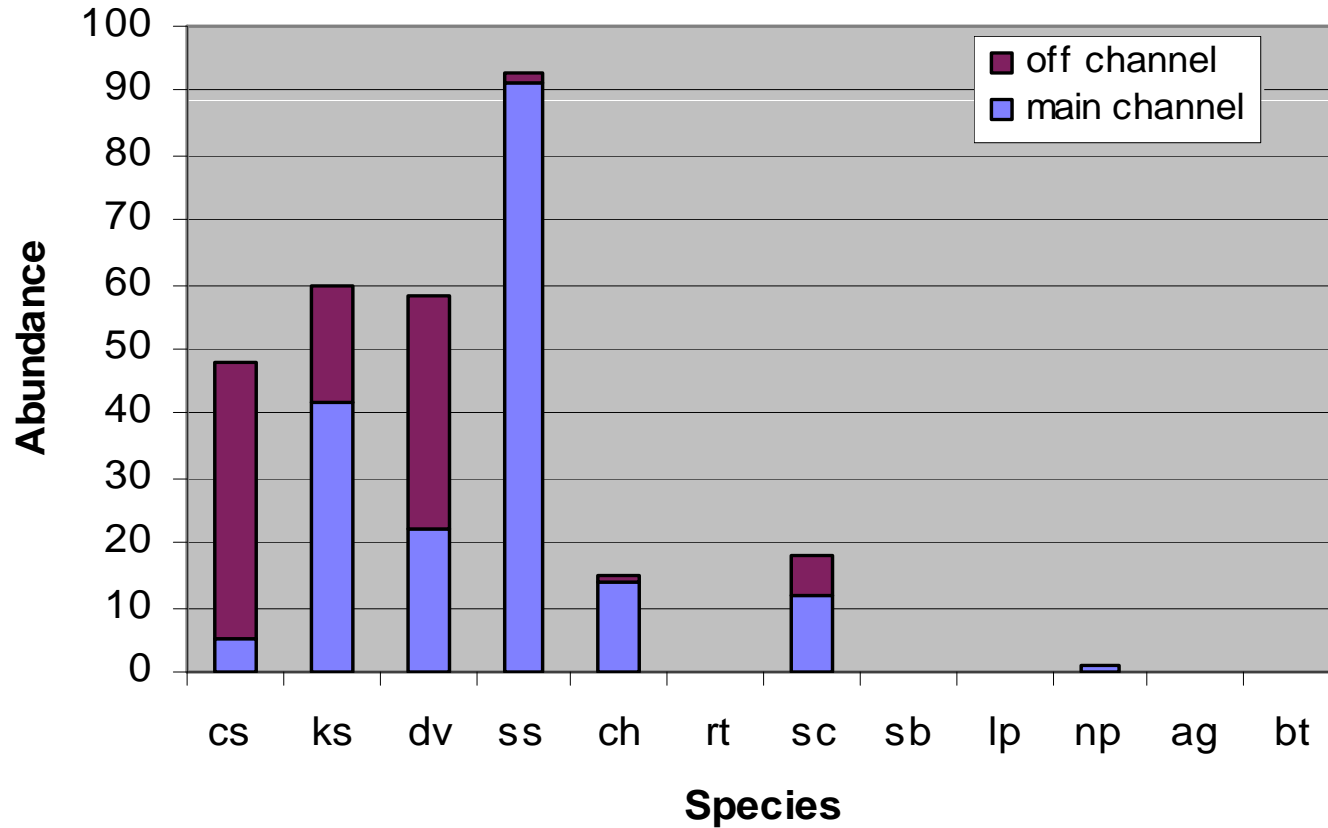
Overwinter Sample Results Total Relative Abundance 04-07

Winter Sample Results 2004 - 2007



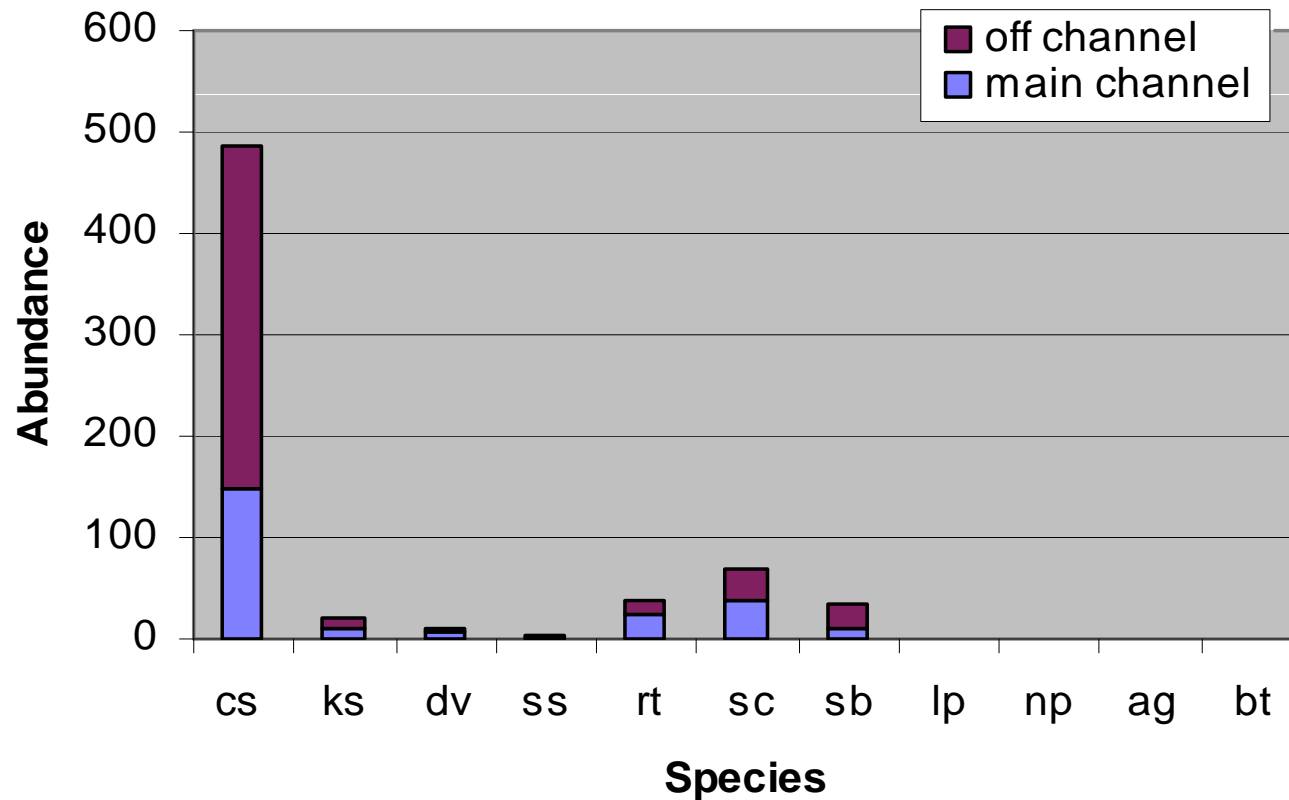
Species Distribution Between Main and Off Channel Habitats

NFK Winter Sampling 2004-2007



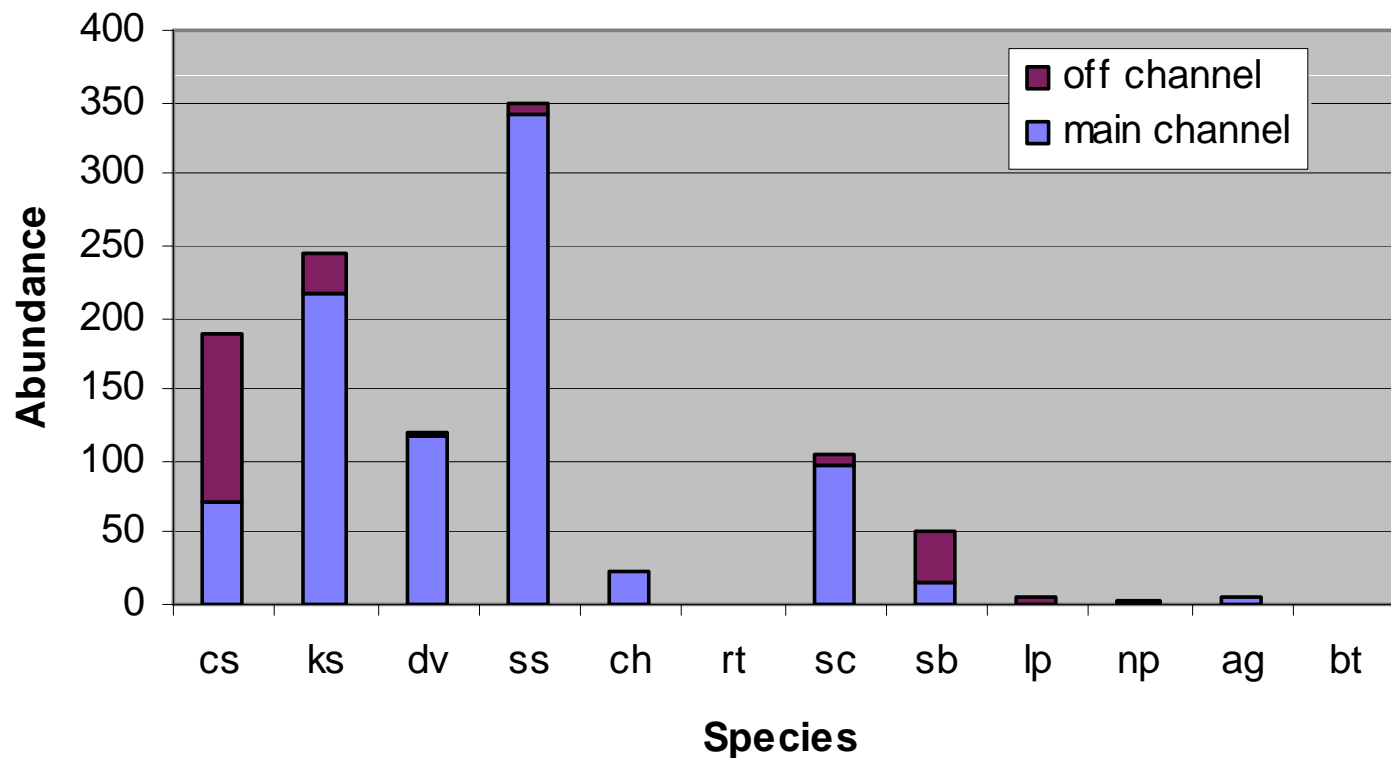
Species Distribution Between Main and Off Channel Habitats

Upper Talarik Winter Sampling 2004-2007



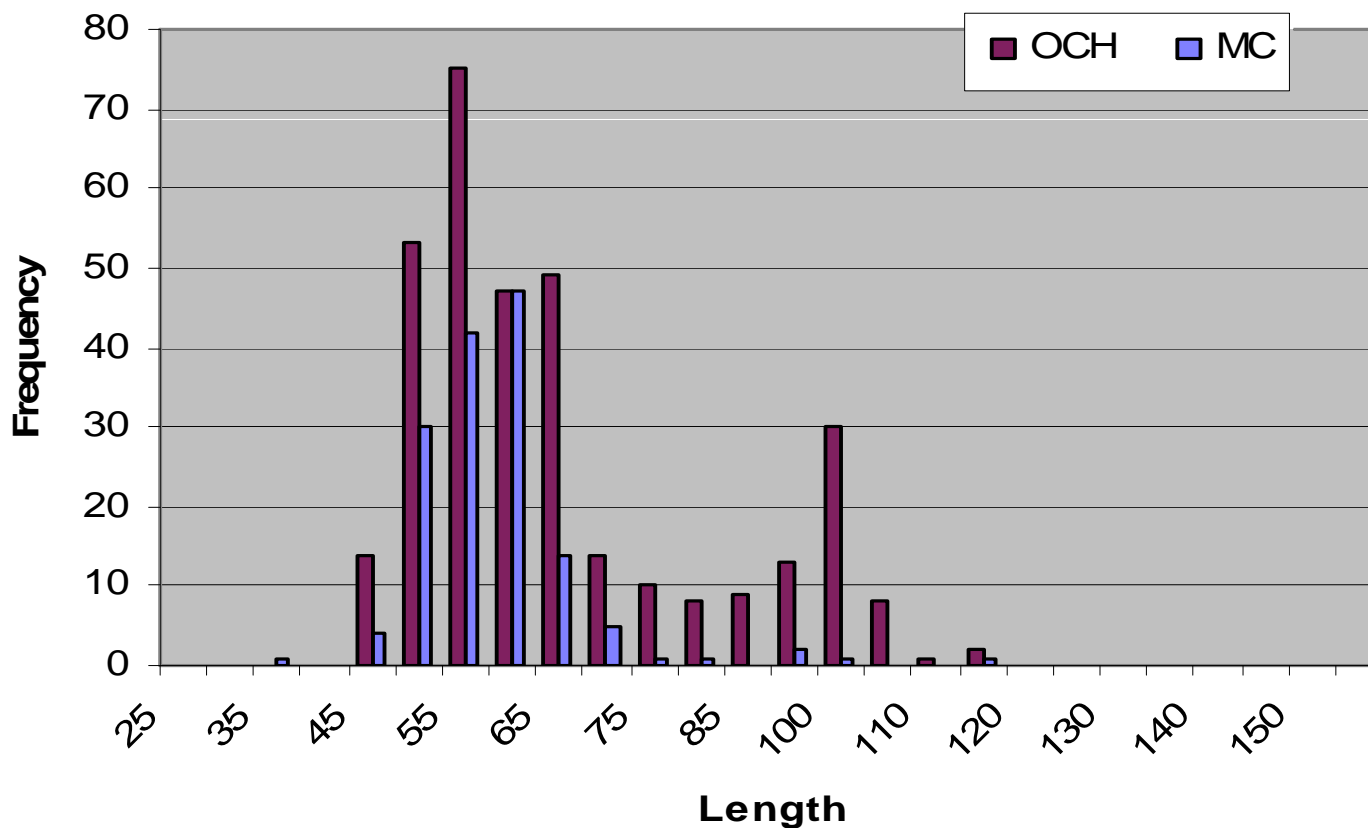
Species Distribution Between Main and Off Channel Habitats

SFK Winter Sampling 2004-2007



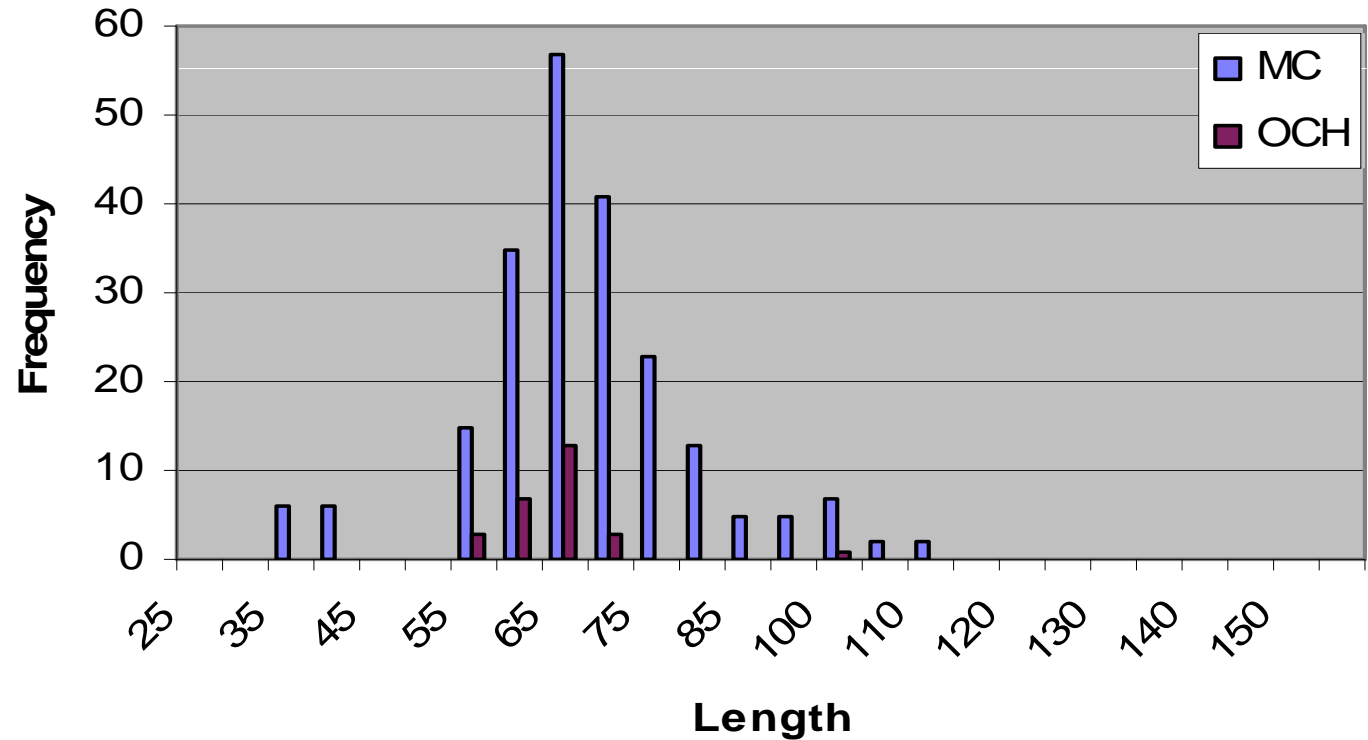
UT – Coho Size Class Distribution Between Main and Off Channel Habitats

UT Coho OCH vs. MC



SFK – Chinook Size Class Distribution Between Main and Off Channel Habitats

SFK Chinook MC vs OCH



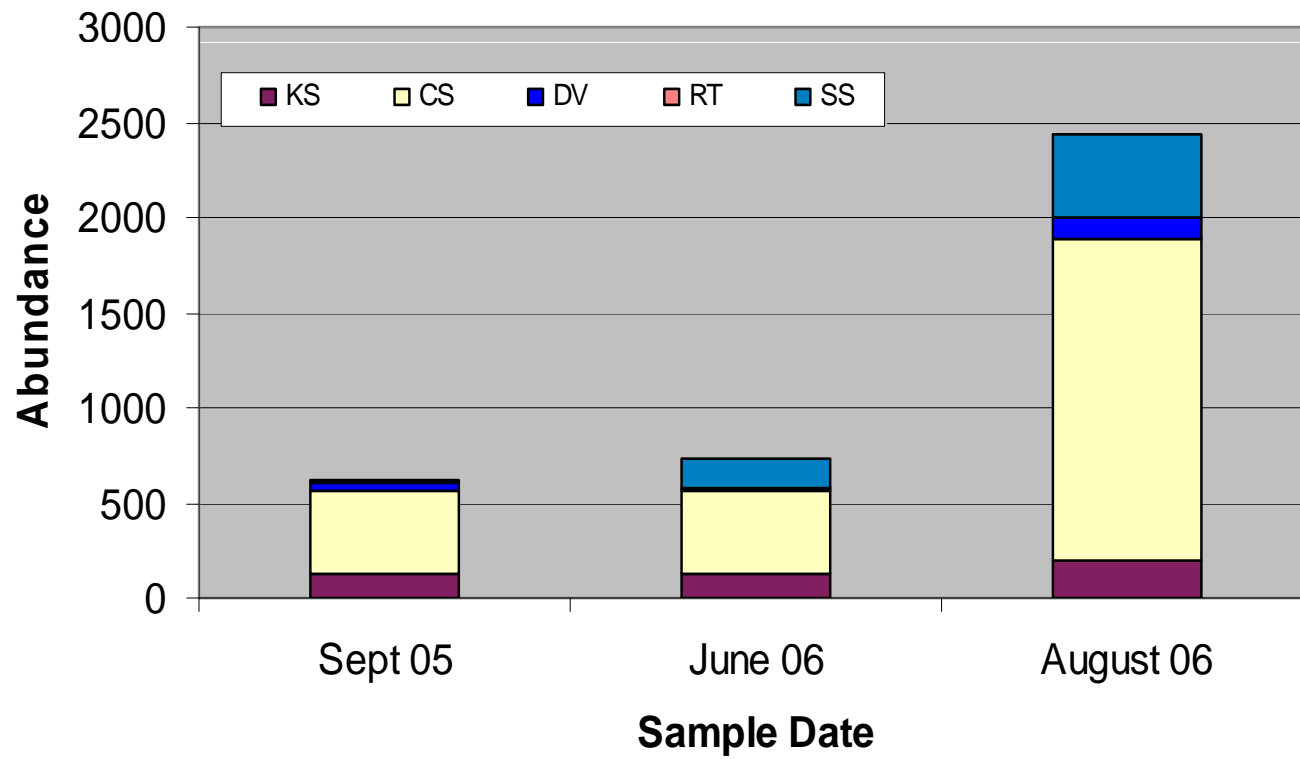
SFK OCH Study Area

22 transects – 1000 ft long

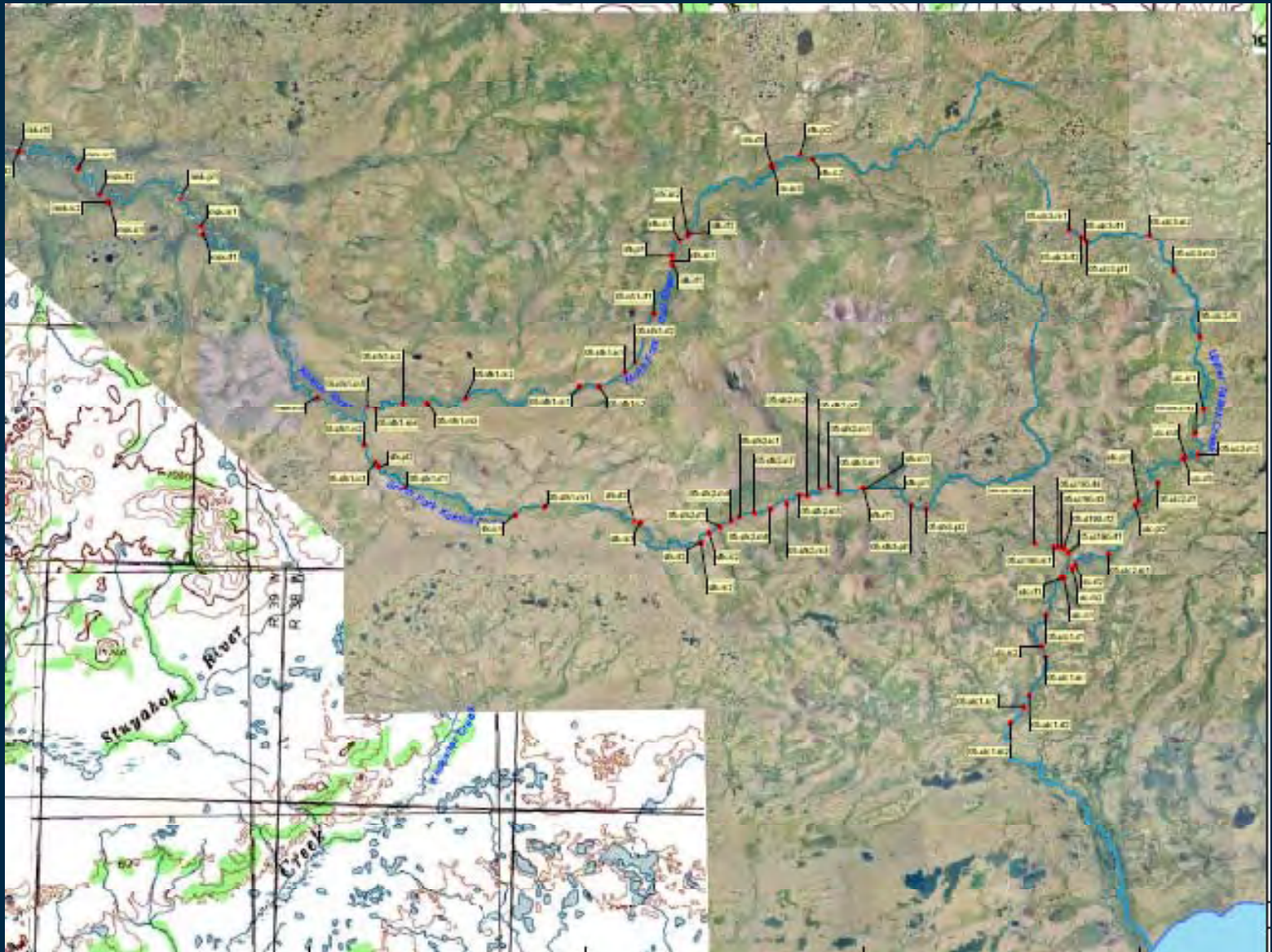


SFK Off Channel Habitat Sample Results

Off Channel Habitat Species Composition & Relative Abundance



89 Snorkel Sites - All Drainages





Upper Talarik Creek Snorkel / Depletion Estimates

- **Study Goal:** Develop fish abundance estimates and habitat associations for juvenile salmonids in the lower two-thirds of Upper Talarik Creek under summer conditions.
- Uses a more quantitative and more focused method (removal sampling) to calibrate a more variable but wider-ranging method (snorkel surveys)

Upper Talarik Creek Snorkel / Depletion Estimates

Blocking Nets Set Prior to Snorkel Survey



Two Snorkel Surveyors Per Site, All Fish Counted



Multi-Pass Removal Depletion Sampling (Zippin 1956) Conducted After Snorkel Surveys

Three to five passes with the electrofisher in a given area.

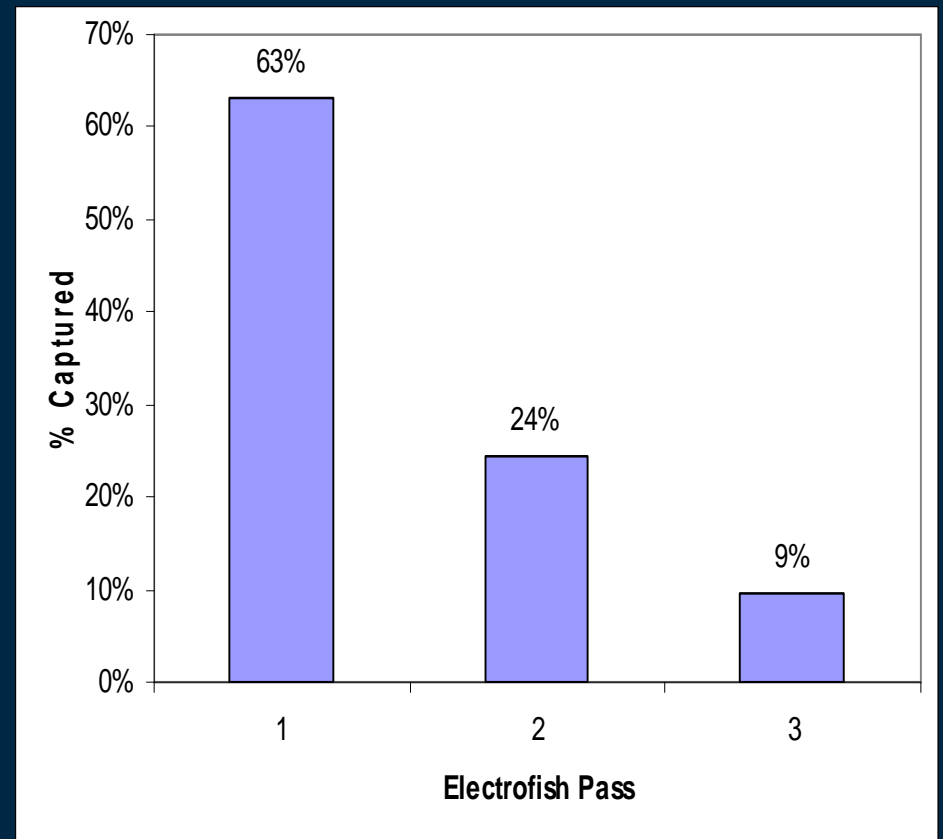


Depletion Regression Across All Sites

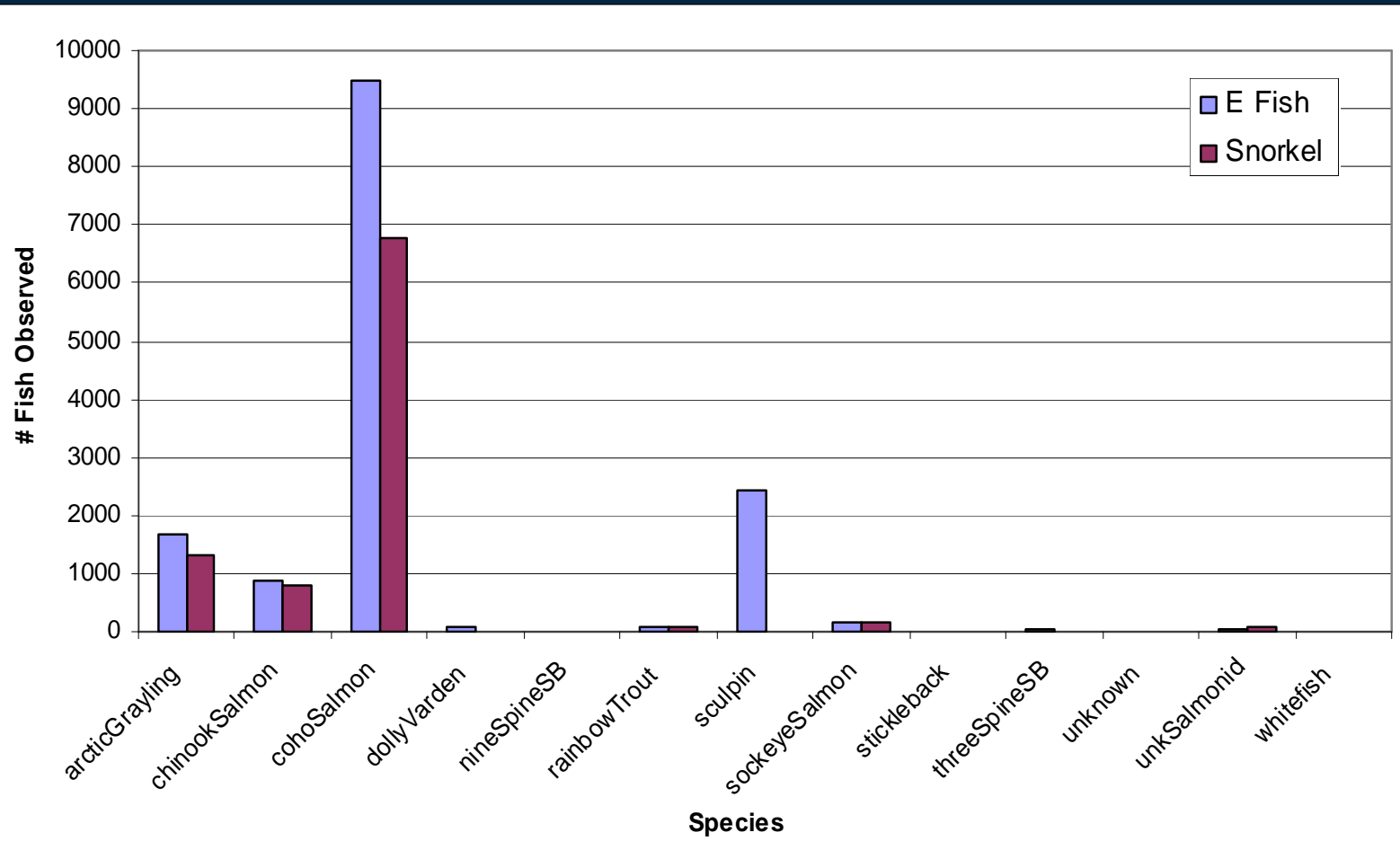
Key Assumptions:

1. Depletion occurs with each successive pass
2. No fish enter or leave the sample site

Habitat Type	No. Sampled
Run	6
Riffle	5
Island Complex	3
Pool	1

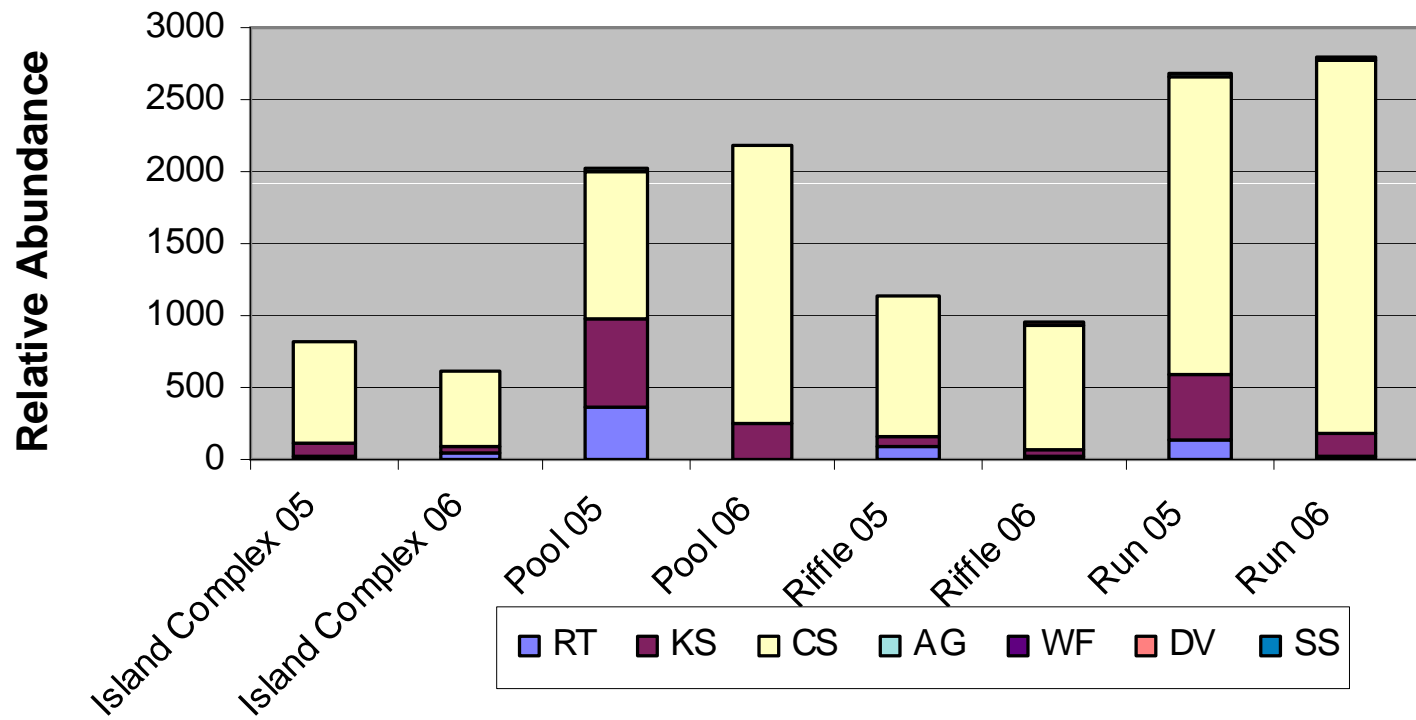


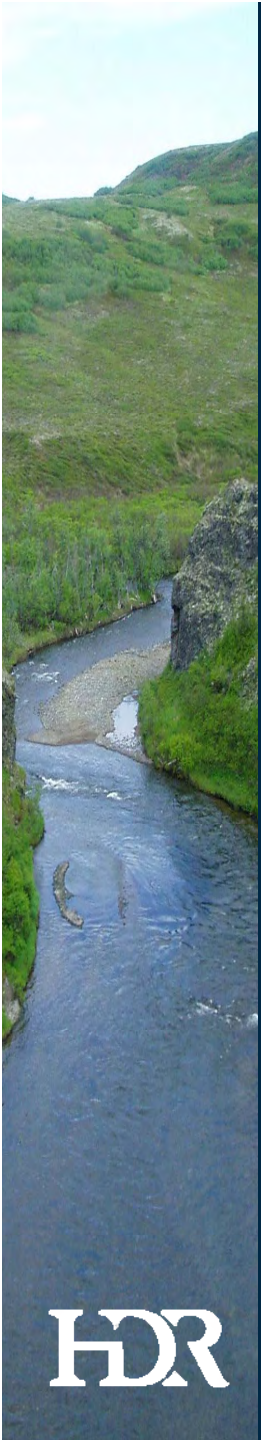
Comparison Between Upper Talarik Depletion Estimates and Snorkel Counts



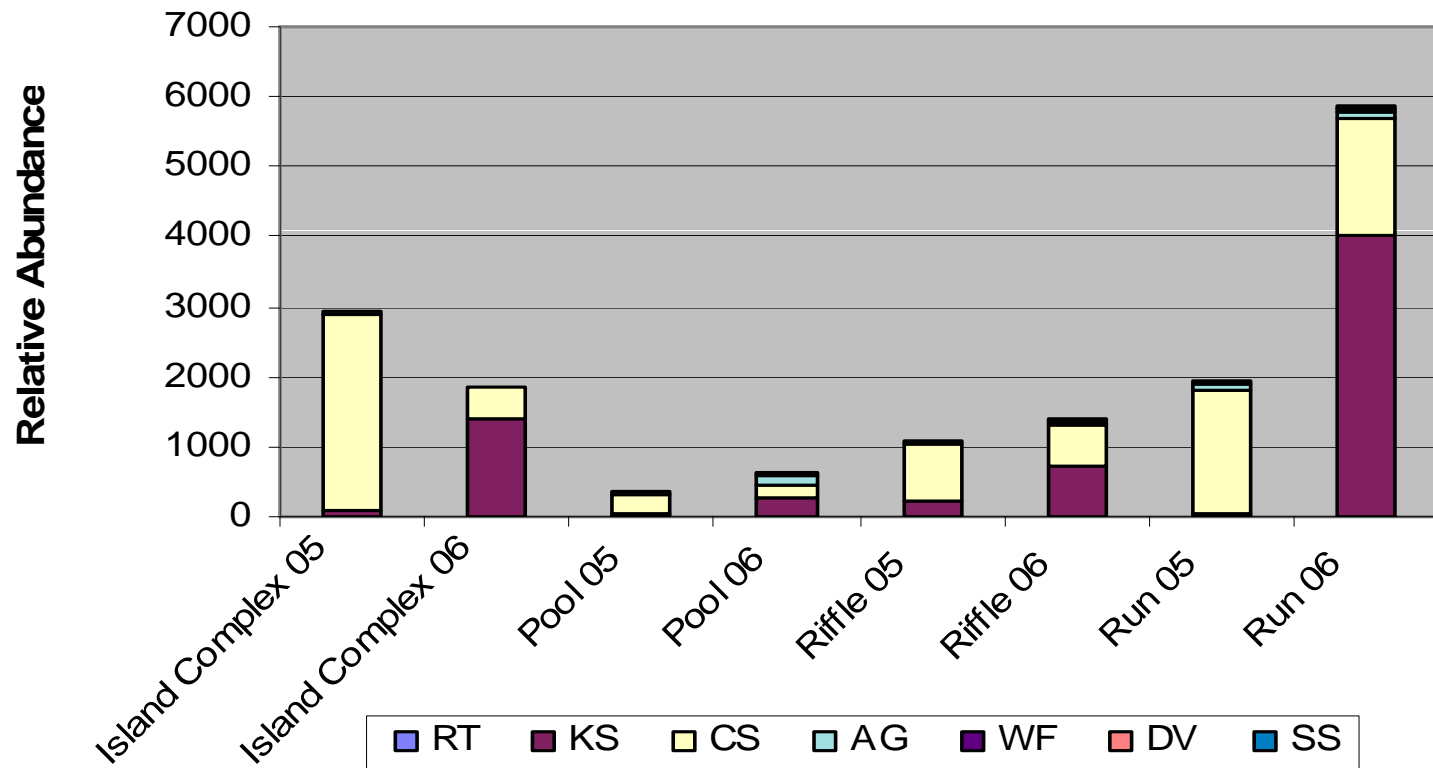


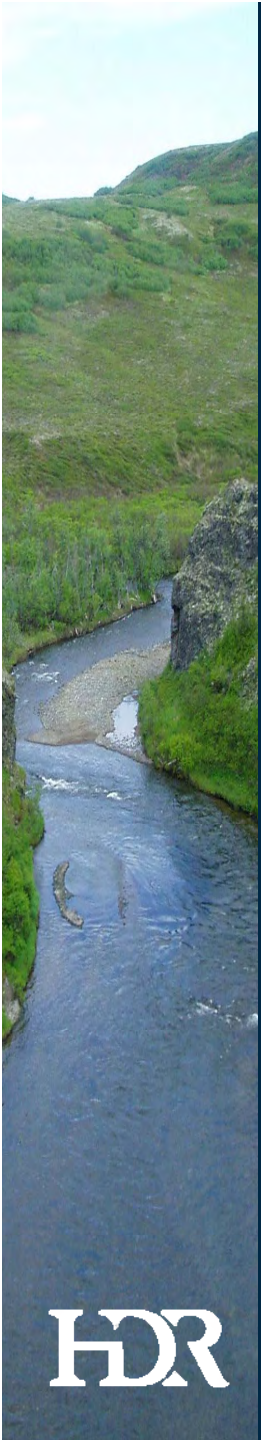
UT 2005 & 2006 Main Channel Snorkel Survey Results



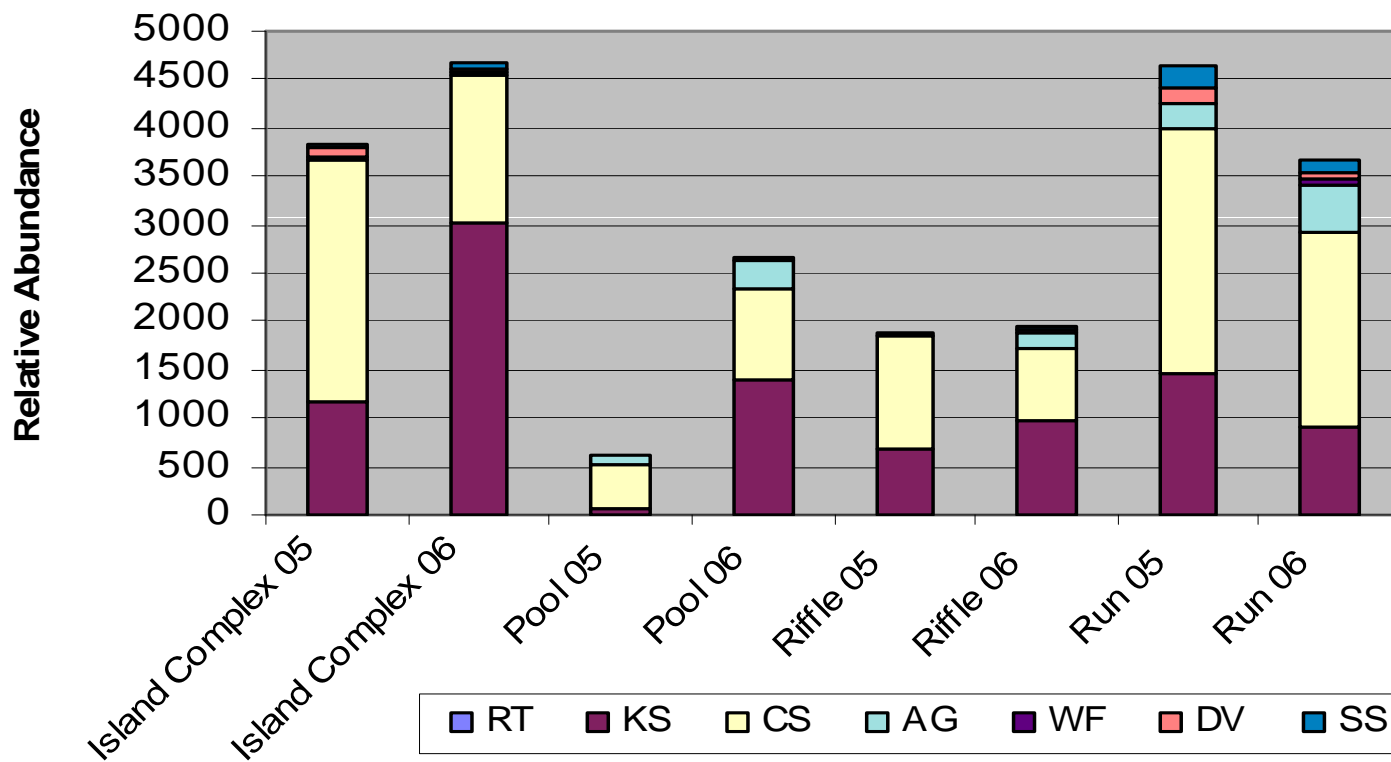


NFK 2005 & 2006 Main Channel Snorkel Surveys Results

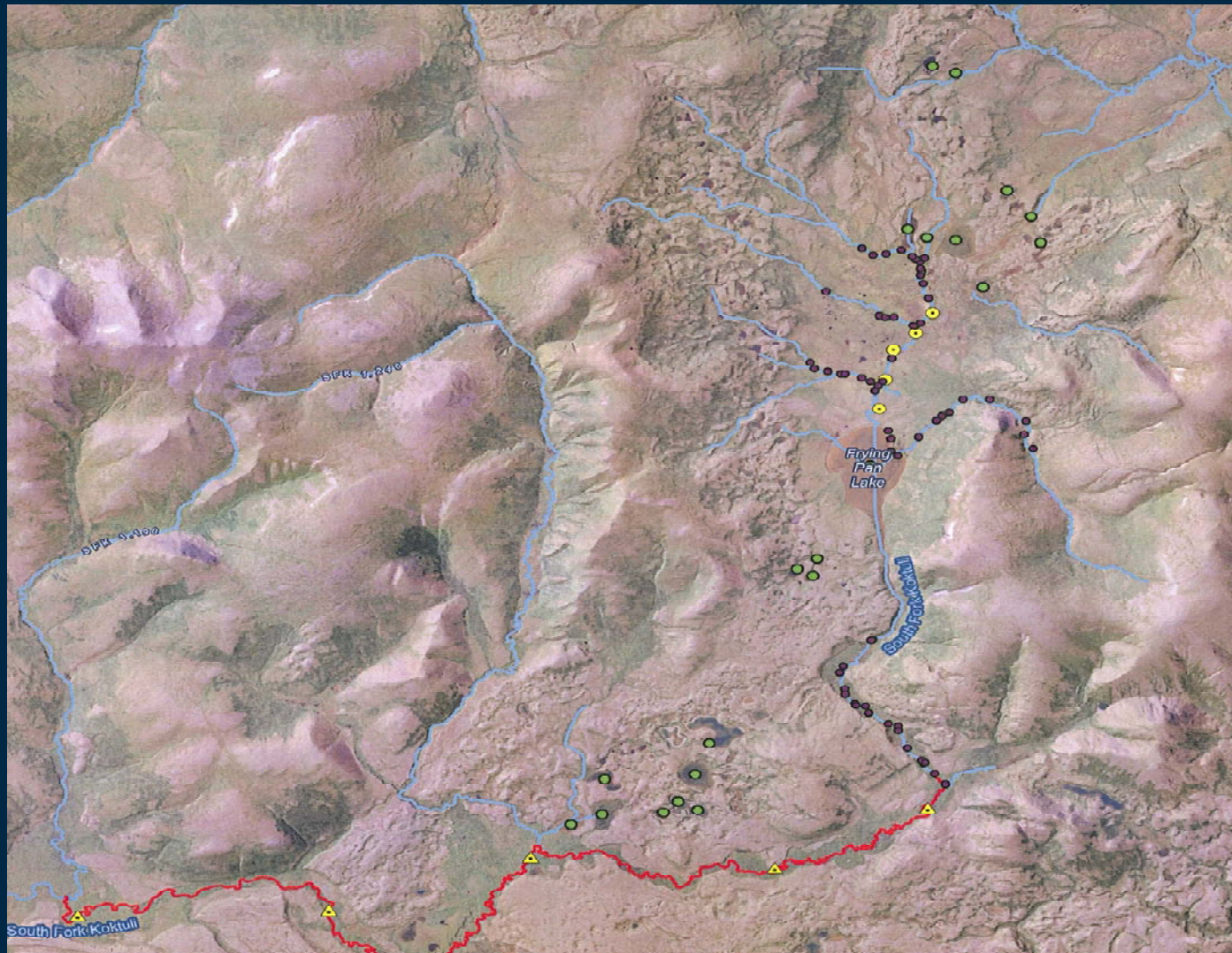




SFK 2005 & 2006 Main Channel Snorkel Survey Results



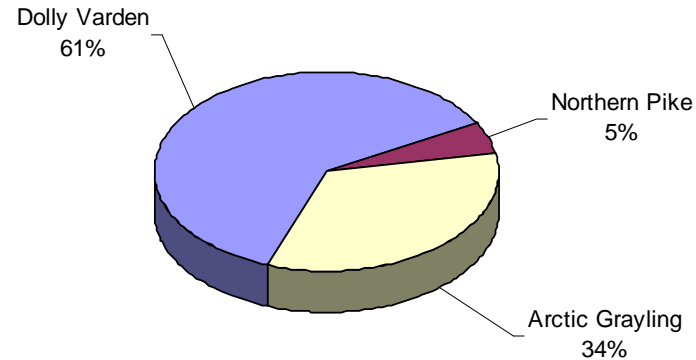
Intermittent Reach and Above FPL Sample Sites 2004-2007



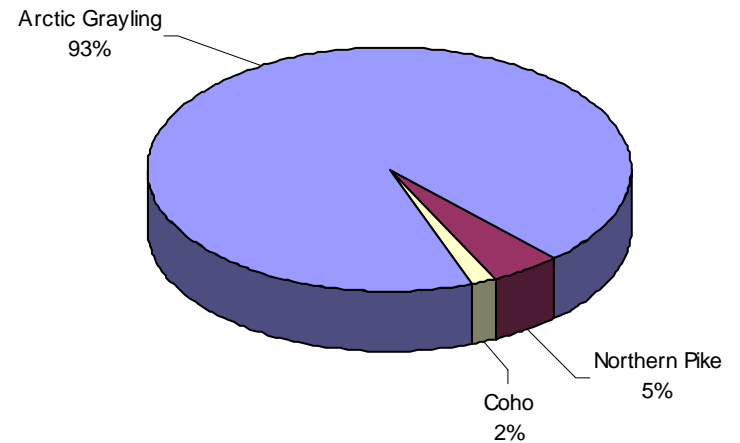
Species Composition and Relative Abundance Above Frying Pan Lake

sample size = 1,091

SFK Above FPL - Tributaries



SFK 1.0 Above FPL



The End



HDR