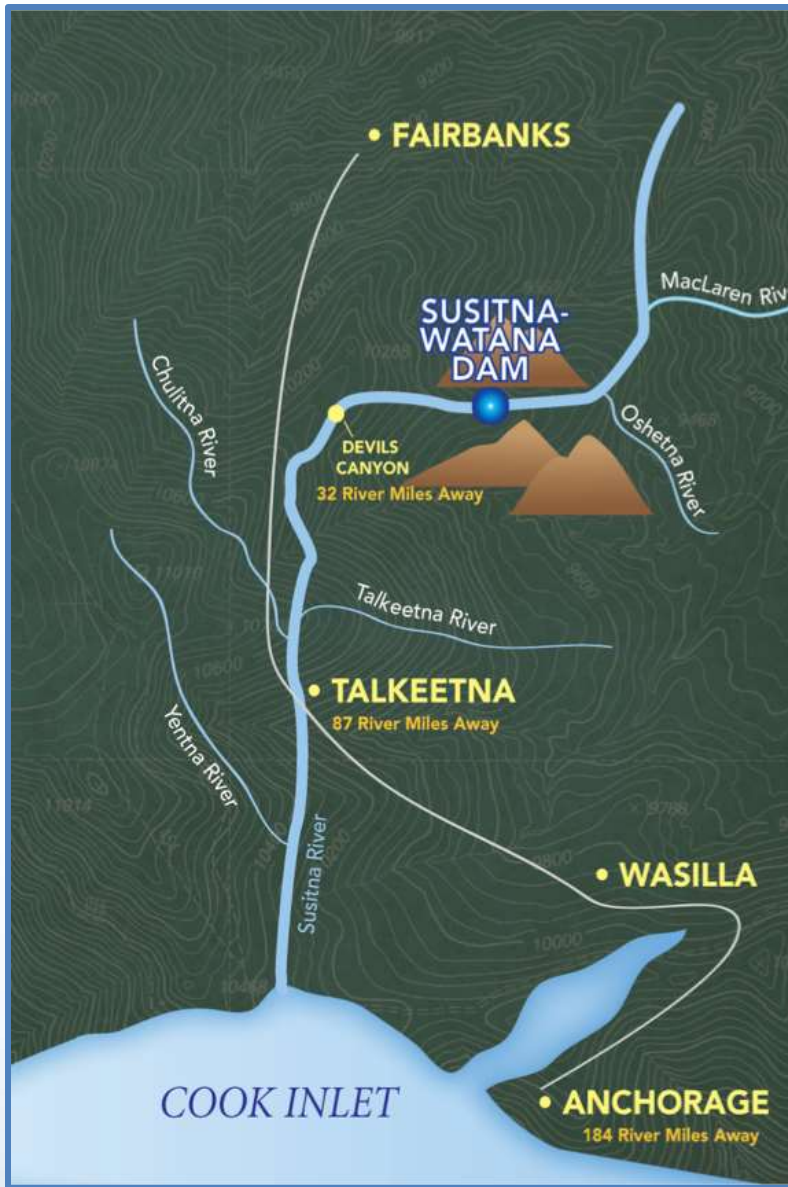Technical WorkGroup Meeting

Fish and Aquatics Instream Flow

Update on Habitat Suitability Criteria Development

27 March 2013

Prepared by R2 Resource Consultants
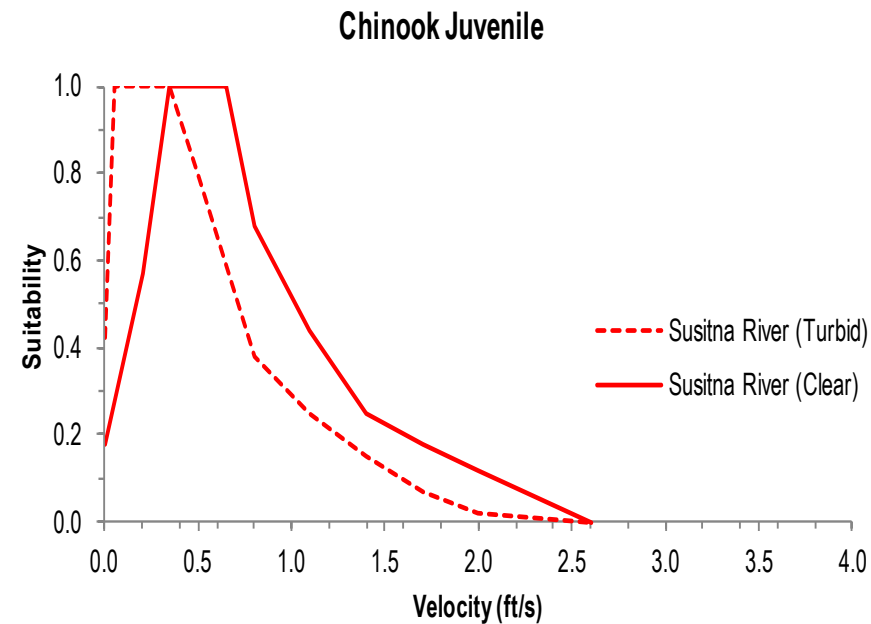
Topics of Discussion

- Development of Habitat Suitability Criteria (HSC) Curves
  - What are HSC Curves?
  - Review of 1980's Project data (RSP 8.5.2.6)
    - Selection of target species and life stages
    - Species and life stage periodicity
    - Development of 1980's HSC curves
  - Collection of site-specific HSC data (2012 Pilot Study) (2012 IFS Compendium of Technical Memoranda, Section 6)
    - Data collection methods
    - Review HSC utilization frequency plots
  - Proposed 2013 HSC data collection (RSP 8.5.4.5)
  - Next Steps: **Schedule HSC Technical Meeting**
- Development of HSI Curves (RSP 8.5.4.5)
  - Benthic macroinvertebrates & algal habitats
  - Stranding and trapping criteria (bed slope, minimum depth, inundation rate/timing)
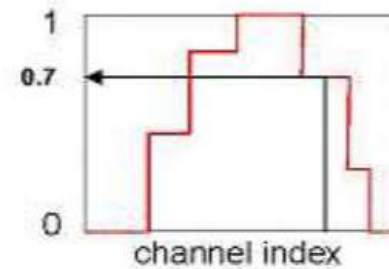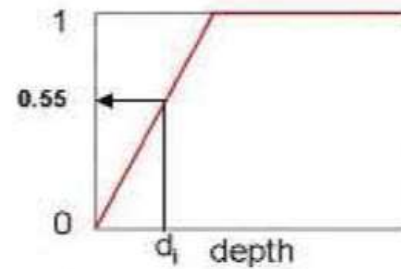 - Fish passage/connectivity (side channels and sloughs)

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HSC Curve Development

Habitat Suitability Criteria (HSC)

- HSC curves represent the functional relationship between independent variables such as depth, velocity, substrate, cover, etc., and the response of a species life stage to a gradient of the independent variable (suitability).

- HSC curves for different variables are combined in a multiplicative fashion to rate the suitability of discrete areas of a stream for use by a species and life stage of interest.

- Designed for use in Instream Flow Incremental Methodology to quantity changes in habitat variables related to various flow regimes.

Chinook Juvenile

Legend:
- - - - Susitna River (Turbid)
——— Susitna River (Clear)

Y-axis: Suitability (0.0 to 1.0)
X-axis: Velocity (ft/s) (0.0 to 4.0)

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Composite Suitability for cell I =
HSCv * HSCd *HSCci = 0.9 * 0.55 * 0.7
= 0.3465
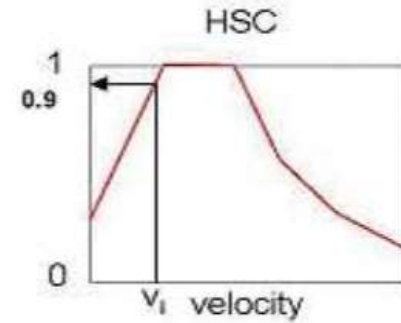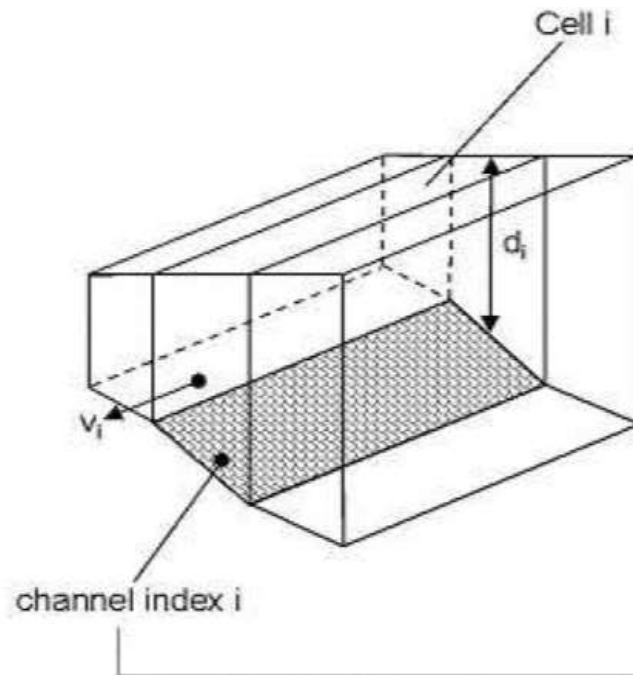
HSC Curve Development

– **The USGS classifies HSC curves into three categories (Categories 1, 2, and 3) based on the types of data used (Bovee 1986).**

Chinook Salmon Juvenile

Category 1 curves – derived from personal experience and professional opinion, from literature based curve sets, or from negotiated definitions.
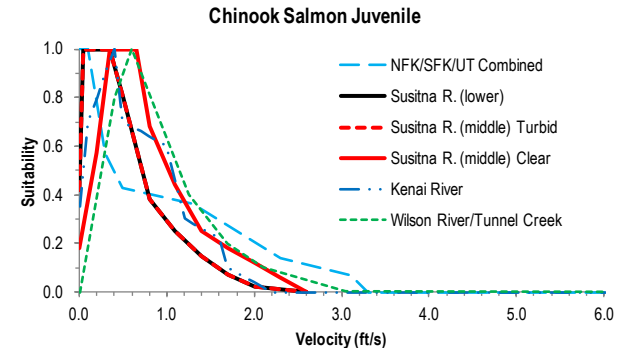
Category 2 curves – developed from site-specific data that reflect microhabitat attributes measured at locations used by the target fish species.

Category 3 curves - rely on site-specific data and are designed to factor in the availability of certain habitat attributes into the curves thereby reducing bias.

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Review of 1980's HSC Data

Species Presence

- Historically, the Susitna River supported at least 20 fish species including both resident and anadromous species
  - Chinook, sockeye, chum, coho, pink salmon
  - Rainbow, Arctic grayling, Dolly Varden, round whitefish, humpback whitefish
  - Burbot, longnose sucker, Bering cisco, eulachon, sculpin, stickleback, Arctic lamprey, pike, lake trout
- Species richness is generally highest in the Lower River Segment and lowest in the Upper River Segment

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Common Name	Susitna River Segment		
	Lower	Middle	Upper
Arctic grayling	X	X	X
Dolly Varden	X	X	X
Humpback whitefish	X	X	X
Round whitefish	X	X	X
Burbot	X	X	X
Longnose sucker	X	X	X
Sculpin	X	X	X
Eulachon	X		
Bering cisco	X		
Threespine stickleback	X	X	
Ninespine stickleback	X		
Arctic lamprey	X	X	
Chinook salmon	X	X	X
Coho salmon	X	X	
Chum salmon	X	X	
Pink salmon	X	X	
Sockeye salmon	X	X	
Rainbow trout	X	X	
Northern pike	X		
Lake trout	X		

Fish Species Distribution and Relative Distribution

(Jennings 1985, Delaney et al. 1981

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Species Periodicity

- Fish periodicity describes the temporal and spatial utilization of main channel, off-channel, and tributary habitats in the Susitna River by individual fish species and life stages

- Periodicity information/tables developed for 14 species and up to 9 different life stages per species

- Information based on studies conducted in the 1980s and 2000s. (Barrett et al. 1983, Jennings 1985, Thompson et al. 1986, Yanusz et al. 2007 & 2011, and Merizon et al. 2010)

- Adult migration timing based on; fishwheel; radio telemetry and capture-mark-recapture studies.

- Spawning timing determined from visual observation during foot, boat and aerial surveys.

- Juvenile outmigration based on capture at stationary migrant traps.

- Periodicity of egg incubation based on adult spawn timing, egg development time from fertilization to emergence, and observations of fry emergence.

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Species and Life Stage Periodicity (Pink Salmon)

Life Stage	Habitat Type						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Main Channel	Side Channel	Tributary Mouth	Side Slough	Upland Slough	Tributary												
Middle Susitna River																		
Adult Migration																		
Spawning																		
Incubation																		
Fry Emergence																		
Age 0+ Migration																		
Lower Susitna River																		
Adult Migration																		
Spawning																		
Incubation																		
Fry Emergence																		
Age 0+ Migration																		

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Chinook Salmon Life Stage	Habitat Type																
	Main Channel	Side Channel	Tributary Mouth	Side Slough	Upland Slough	Tributary	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Middle Susitna River																	
Adult Migration																	
Spawning																	
Incubation																	
Fry Emergence																	
Age 0+ Rearing																	
Age 0+ Migration																	
Age 1+ Rearing																	
Age 1+ Migration																	
Lower Susitna River																	
Adult Migration																	
Spawning																	
Incubation																	
Fry Emergence																	
Age 0+ Rearing																	
Age 0+ Migration																	
Age 1+ Rearing																	
Age 1+ Migration																	

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1980's HSC Data Collection

- 4-years of data collection (1981-1984) (Estes and Vincent-Lang 1984)

- Middle River Segment - focused on tributary, slough, and side channel habitats between Devils Canyon and Three Rivers

- Lower River Segment – focused slough, side channel, and tributary mouths between Three Rivers and Yentna River

- 35 separate sampling sites (Estes and Vincent-Lang 1984)

- Sampled twice a month from May-October

- Separate sampling efforts for resident species, rearing juvenile salmon, and spawning salmon

- Developed HSC curves for chum, sockeye, Chinook, coho, and pink salmon, rainbow trout, Arctic grayling, round whitefish, and longnose sucker

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1980's HSC Data Collection

- **Resident Fish Species**
  - Focused on tributaries, tributary mouths, and sloughs
  - Sampling methods included electrofishing, hook-and-line, and radio telemetry
- **Rearing Juvenile Salmon**
  - Focused on tributaries, upland sloughs, side sloughs, side channels, and limited main channel
  - Systematic sampling of 300 sq. ft. cells (50 ft. x 6 ft.) selected for representativeness and homogeneous
  - Utilized electrofishing and seining
- **Spawning Salmon**
  - Focused on tributaries, tributary mouths, sloughs and side channels
  - Proximity to hydraulic modeling sites (evaluation of preference)
  - Visual observations from streambank

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1980's Resident Adult HSC Curve Observations

Species	Boat Electrofishing	Hook and Line
Rainbow trout	44	99
Arctic grayling	138	2
Round whitefish	384	
Longnose sucker	157	
Burbot	18	
Humpback whitefish	15	
Dolly Varden	2	
Total	**758**	**101**

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Species	Boat Electrofishing	Hook and Line
Rainbow trout	44	99
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Longnose sucker	157	
Burbot	18	
Humpback whitefish	15	
Dolly Varden	2	
Total	**758**	**101**

>88%

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1980's Juvenile HSC Curve Observations

Species	Electrofishing		Beach Seining		Total	
	Effort	Catch	Effort	Catch	Effort	Catch
Chinook	871	3,066	389	1,329	1,260	4,395
Coho	871	1,907	389	113	1,260	2,020
Sockeye	658	814	355	192	1,013	1,006
Chum	408	1,152	106	5	514	1,157
Total	**2,808**	**6,939**	**1,239**	**1,639**	**4,047**	**8,578**

Effort=number of cells (50 ft. x 6 ft.) sampled; catch=total catch per cell
Suchanek et al. 1984a

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1980's Juvenile HSC Curve Observations

Species	Electrofishing		Beach Seining		Total	
	Effort	Catch	Effort	Catch	Effort	Catch
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Suchanek et al. 1984a

>80%

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1980's Spawning HSC Curve Observations

Species	Macroabitat Type					Total
	Main Channel	Side Channel	Slough	Tributary	Tributary Delta	
Chum	0	4	298	0	31	**333**
Sockeye	0	0	81	0	0	**81**
Chinook	0	0	0	265	0	**265**
Pink[1]	No HSC Data Collected					
Coho[1]	No HSC Data Collected					
Total	**0**	**4**	**379**	**265**	**31**	**679**

[1]Utilized Spawning HSC curves develop for Terror Lake Project

1980's Spawning HSC Curve Observations

Species	Macroabitat Type					Total
	Main Channel	Side Channel	Slough	Tributary	Tributary Delta	
Chum	0	4	298	0	31	**333**
Sockeye	0	0	81	0	0	**81**
Chinook	0	0	0	265	0	**265**
Pink[1]	No HSC Data Collected					
Coho[1]	No HSC Data Collected					
Total	**0**	**4**	**379**	**265**	**31**	**679**

[1]Utilized Spawning HSC curves develop for Terror Lake Project

55.8%   **39%**

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1980's HSC Curves Developed

Species	Life Stage	Depth	Velocity	Substrate	Cover
Chum Salmon	Spawning	M	M	M	
	Juvenile	M,L	M,L		M,L
Sockeye Salmon	Spawning	M	M	M	
	Juvenile	M,L	M,L		M,L
Chinook Salmon	Spawning	M	M	M	
	Juvenile	M,L	M,L		M,L
Coho Salmon	Spawning	M	M	M	
	Juvenile	M,L	M,L		M,L
Pink Salmon	Spawning	M	M	M	
Rainbow Trout	Adult	M	M		M
Arctic Grayling	Adult	M	M		M
Round Whitefish	Adult	M	M		M
	Juvenile	M	M		M
Longnose Sucker	Adult	M	M		M

M=middle river; L=lower river
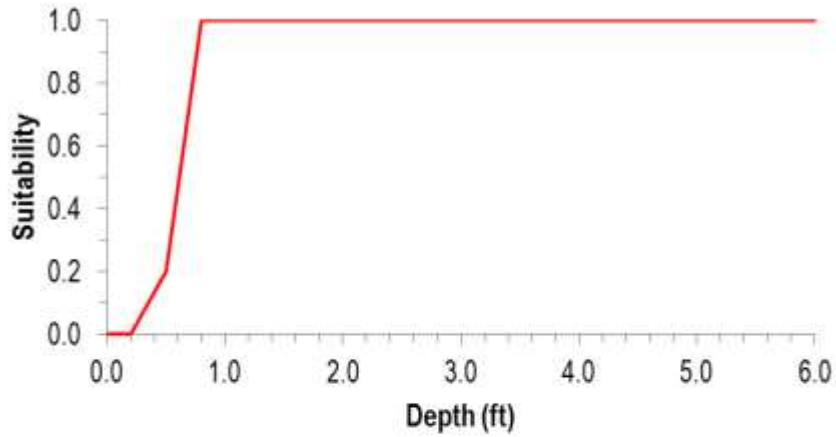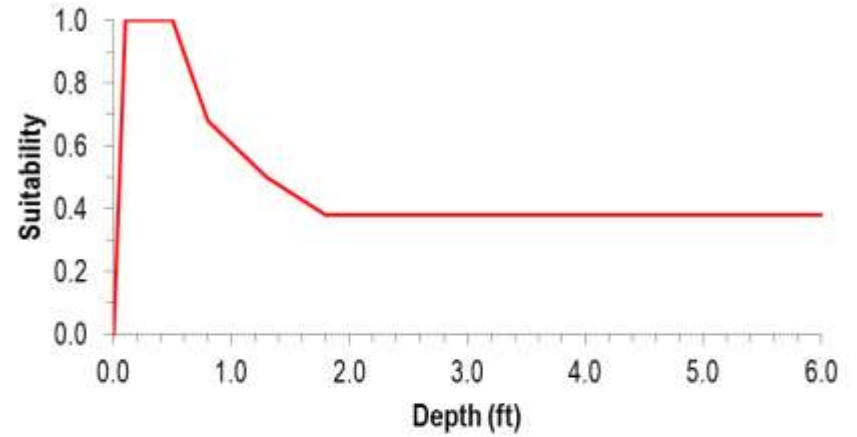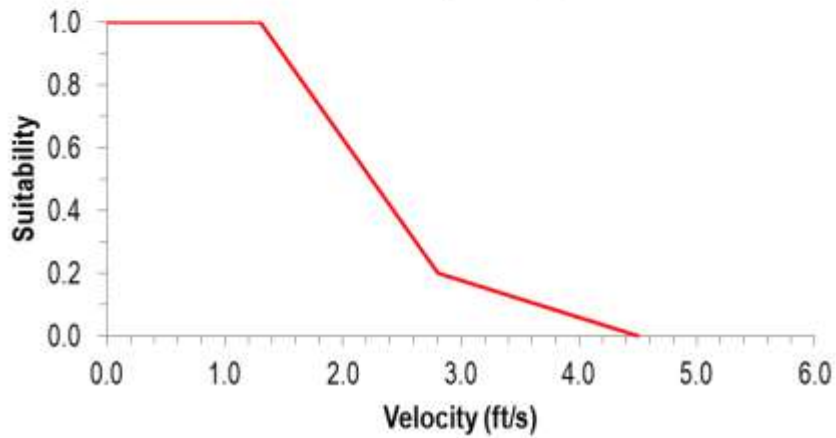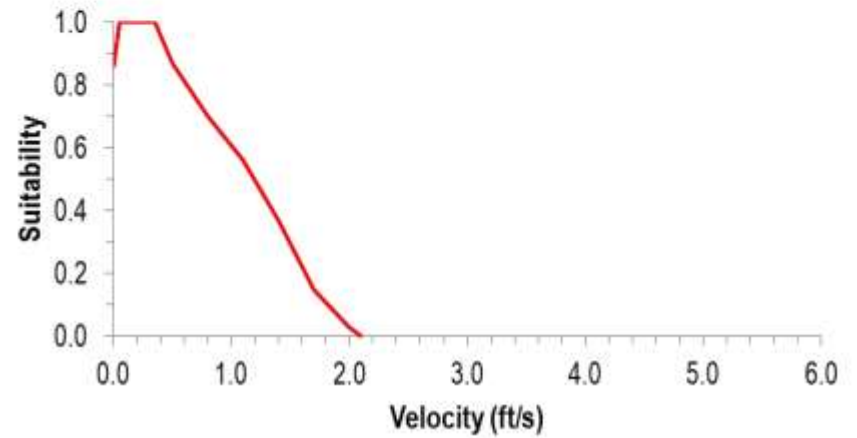
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Chum SCH Spawning — Suitability vs Depth (ft)

Chum SCH Juvenile — Suitability vs Depth (ft)

Chum SCH Spawning — Suitability vs Velocity (ft/s)

Chum SCH Juvenile — Suitability vs Velocity (ft/s)

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SUSITNA-WATANA HYDRO   *Clean, reliable energy for the next 100 years.*
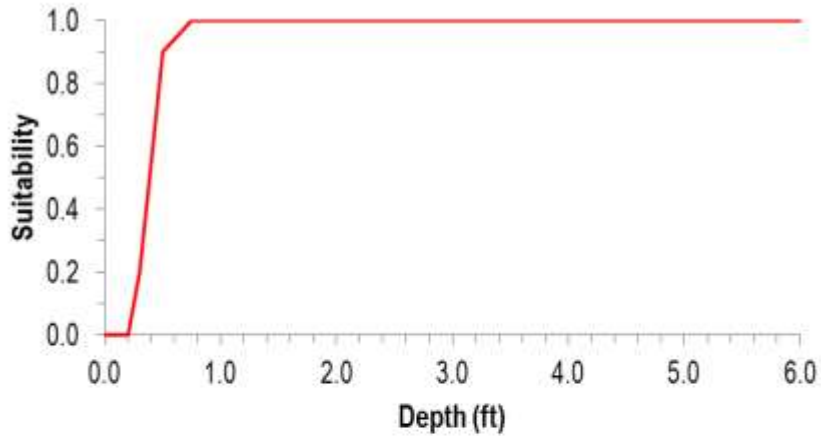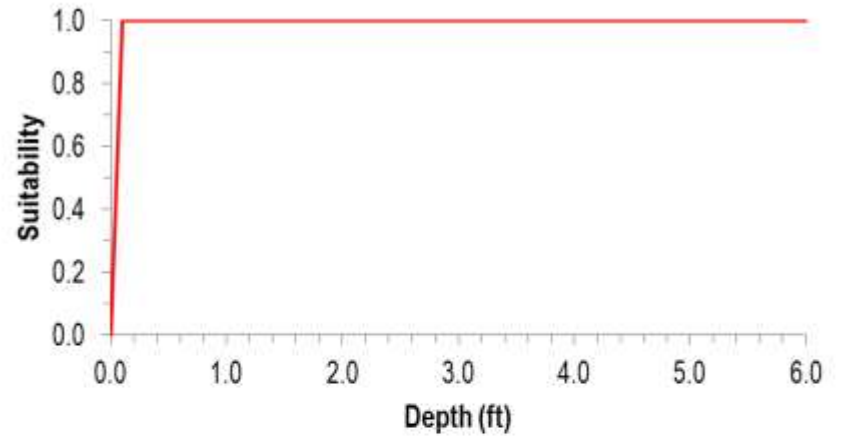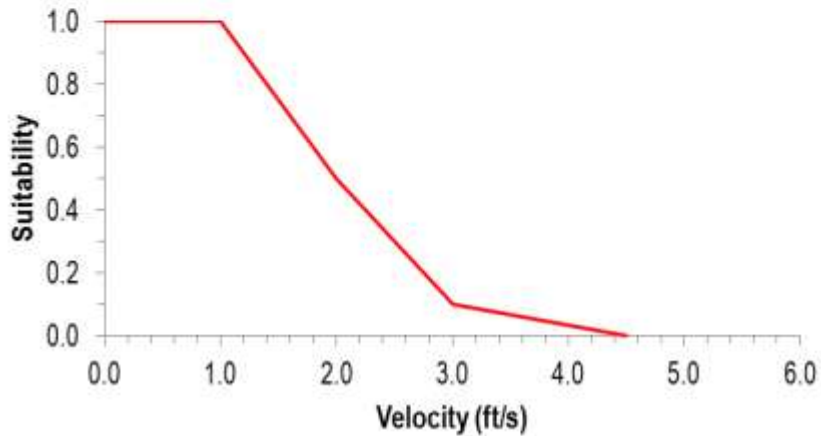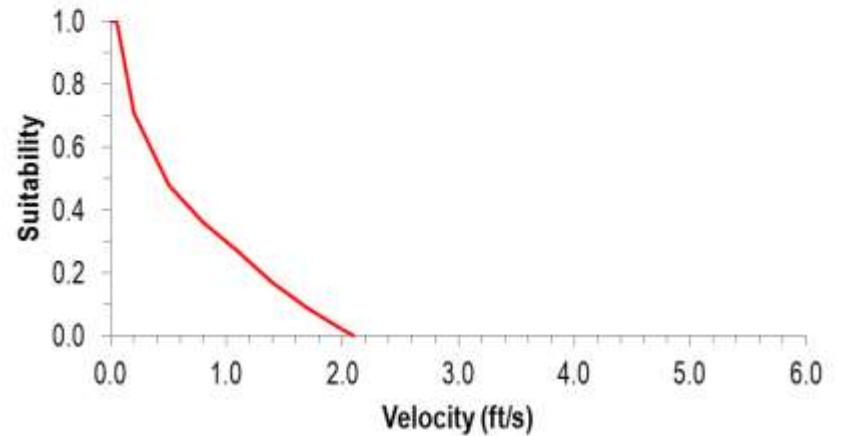
2012 HSC Data Collection Summary

- Focused on main channel, side channel, side slough, and tributary mouth/delta habitat areas (1980s surveys)
- Sampling was concentrated in the Middle and upper portion of the Lower River Segment with known fish use
- Hunt for Fish Sampling vs. Random or Stratified Sampling
- Sampling timing corresponded to peak of spawning activity (2012 IFS Compendium of Technical Memoranda, Section 6)
- Cooperative effort between R2 and LGL
- R2 sampling events : July 17-19, August 21-23, September 17-19
- LGL sampling: August 15-29
- Methods included snorkel, seining, radio telemetry (LGL), and pedestrian surveys
- Total of 284 HSC measurement: 117 spawning
                                                   167 adult, juvenile, fry

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Proposed HSC Curve Development Priority^{23}

Common Name	Low	Moderate	High
Arctic grayling			X
Dolly Varden		X	
Humpback whitefish		X	
Round whitefish	X		
Burbot		X	
Longnose sucker		X	
Sculpin	X		
Eulachon		X	
Bering cisco	X		
Threespine stickleback	X		
Arctic lamprey	X		
Chinook salmon			X
Coho salmon			X
Chum salmon			X
Pink salmon			X
Sockeye salmon			X
Rainbow trout			X
Northern pike	X		
Lake trout	X		

2012 HSC Sampling Sites

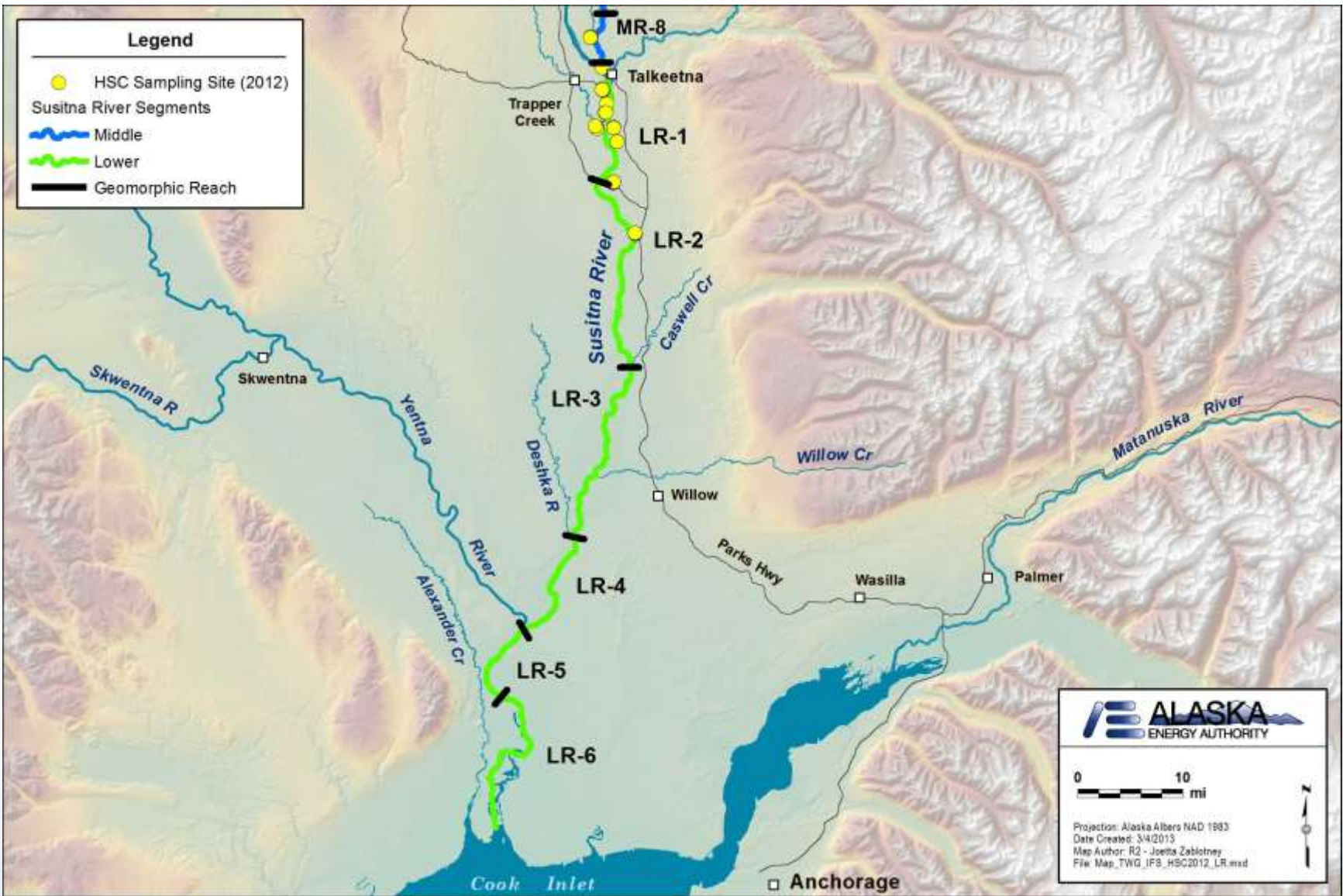| Species	Life Stage	River Segment	Macrohabitat Areas	Sample Sites	Possible Sampling Technique	Sample Timing
Chinook	Juvenile	Middle	Slough, side channel, tributary mouths	Slough 21, 8A, and 6A	Snorkel, electrofishing, seining	June, July, August, September
	Spawning	Middle	Tributary, mainstem	Indian R., 4th of July Cr., Lane Cr.	Pedestrian survey, side scan sonar, Didson	July, August
Sockeye	Juvenile	Middle	Slough, side channel, tributary mouths	Slough 20, 9, 8, 6A	Snorkel, electrofishing, seining	June, July, August, September
	Spawning	Middle	Slough, and side channels	Slough 11, 8A,	Pedestrian survey, side scan sonar, Didson	August, September, October
Coho	Juvenile	Middle Lower	Slough, side channel, tributary mouths	Slough 6A, Lane Cr., Birch & Sunshine Cr.	Snorkel, electrofishing, seining	June, July, August, September
	Spawning	Middle	Tributary mouths	Indian R., 4th of July Cr., Slough 8A	Pedestrian survey	August, September
Chum	Juvenile	Middle	Slough, side channel, tributary mouths	Slough 21, 9, and 6A	Snorkel, electrofishing, seining	June, July, August,
	Spawning	Middle Lower	Slough, side channel, mainstem, trib. delta	Slough 21, 11, and 8A Montana Cr.	Pedestrian survey, side scan sonar, Didson	August, September
Pink	Juvenile	Middle	Slough, side channel, tributary mouths	None specified	Snorkel, electrofishing, seining	June, July
	Spawning	Middle Lower	Slough, side channel, tributary delta	Slough 21, 15, and 11	Pedestrian survey	July, August

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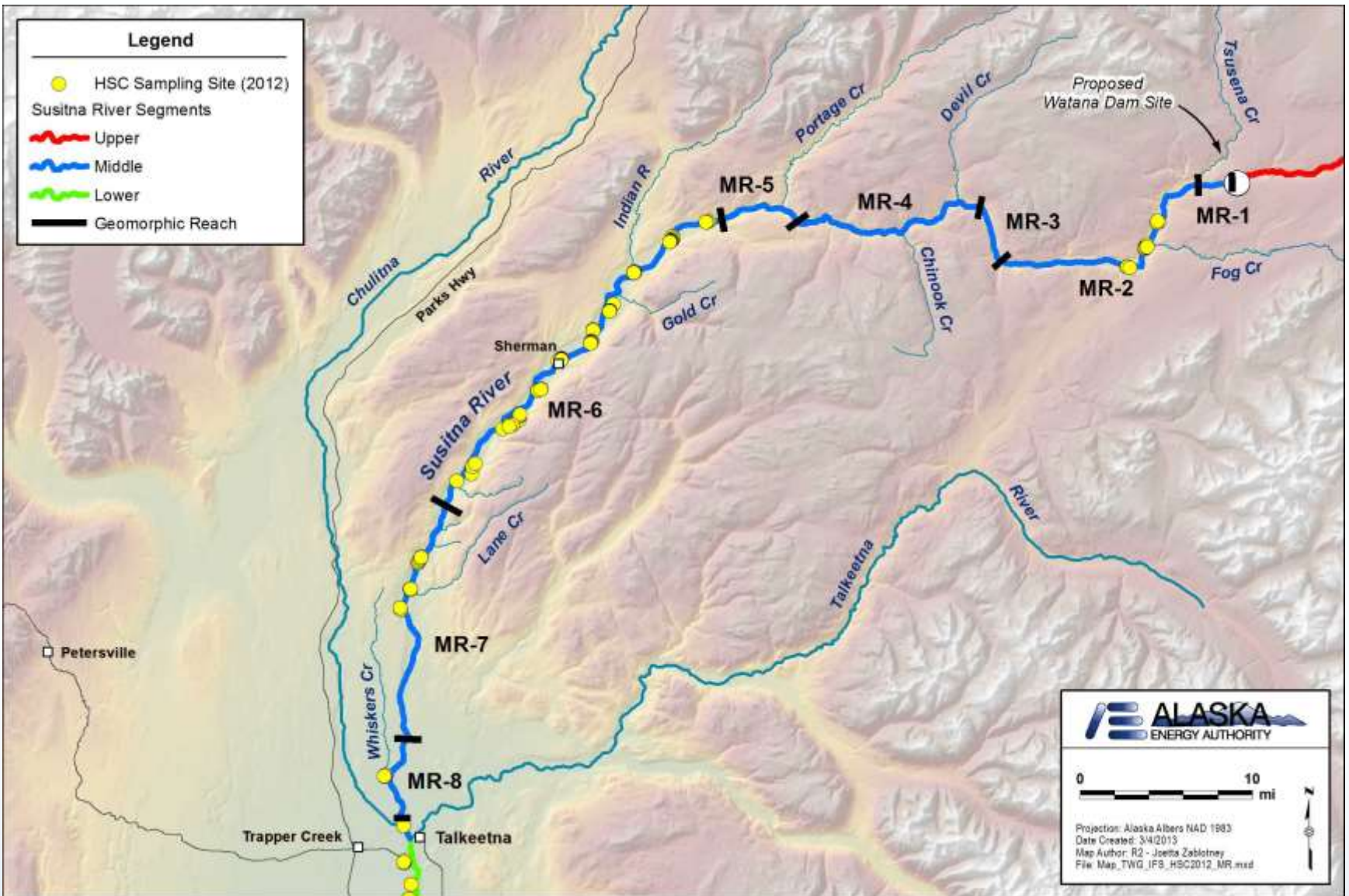
2012 HSC Data Collection – Adult & Juvenile Rearing

- Site specific data collection included:
  - Geomorphic reach
  - Macrohabitat type
  - Species identification
  - Fish length and age class (fry, juvenile, adult)
  - Relative position in the water column (distance from bottom)
  - Proximity to cover (woody debris, boulder, vegetation, etc.)
  - Water depth – measured to nearest 0.1 ft using topset rod
  - Mean water velocity – measured to nearest 0.01 ft/sec
  - Nose velocity – measured at fish location in water column
  - Substrate composition (dominant, subdominant, % dominant)
  - Water temperature
  - Secchi disk transparency
  - location coordinates (GPS)

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2012 HSC Data Collection – Spawning

- Site specific data collection included:
    - Geomorphic reach
    - Macrohabitat type
    - Species identification
    - Water depth at u/s of redd – measured to nearest 0.1 ft
    - Mean water velocity – measured to nearest 0.01 ft/sec
    - Substrate composition (dominant, subdominant, % dominant)
    - Redd dimensions (length and width)
    - Presence of groundwater upwelling
    - Water temperature
    - Turbidity (NTU)
    - Location coordinates (GPS)

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2012 HSC Spawning Observations

Macrohabitat Type	River Segment	Salmon Species				
		Chinook	Sockeye	Pink	Chum	Coho
Sloughs						
Slough 21	Middle	0	0	0	7	0
Slough 11	Middle	0	4	0	4	0
4th of July Slough	Middle	0	0	0	11	0
Slough 10	Middle	0	0	0	0	0
Slough 9A	Middle	0	4	0	19	0
Slough 9	Middle	0	14	0	1	0
Slough 8a	Middle	0	21	0	1	0
Whiskers Slough	Middle	0	0	3	0	0
Tributary Delta						
Indian River	Middle	0	0	0	3	0
4th of July Cr.	Middle	0	0	7	1	0
Montana Cr.	Lower	0	0	7		0
Side Channel						
Montana Cr.	Lower	0	0	0	10	0
Total		**0**	**43**	**17**	**57**	**0**

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2012 HSC Spawning Observations

Macrohabitat Type	River Segment	Salmon Species				
		Chinook	Sockeye	Pink	Chum	Coho
Sloughs						
Slough 21	Middle	0	0	0	7	0
Slough 11	Middle	0	4	0	4	0
4th of July Slough	Middle	0	0	0	11	0
Slough 10	Middle	0	0	0	0	0
Slough 9A	Middle	0	4	0	19	0
Slough 9	Middle	0	14	0	1	0
Slough 8a	Middle	0	21	0	1	0
Whiskers Slough	Middle	0	0	3	0	0
Tributary Delta						
Indian River	Middle	0	0	0	3	0
4th of July Cr.	Middle	0	0	7	1	0
Montana Cr.	Lower	0	0	7	0	0
Side Channel						
Montana Cr.	Lower	0	0	0	10	0
Total		**0**	**43**	**17**	**57**	**0**

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2012 HSC Spawning Observations

Macrohabitat	Spawning Observations by Species					Percent of
	Chinook	Sockeye	Pink	Chum	Coho	Total
Main Channel	0	0	0	0	0	0%
Side Channel	0	0	0	10	0	8.5%
Side Slough	0	43	3	43	0	76.1%
Trib. Delta	0	0	14	4	0	15.4%
Total	**0**	**43**	**17**	**57**	**0**	**117/100%**

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2012 HSC Spawning Observations

Macrohabitat	Spawning Observations by Species					Percent of
	Chinook	Sockeye	Pink	Chum	Coho	Total
Main Channel	0	0	0	0	0	0%
Side Channel	0	0	0	10	0	8.5%
Side Slough	0	43	3	43	0	76.1%
Trib. Delta	0	0	14	4	0	15.4%
Total	**0**	**43**	**17**	**57**	**0**	**117/100%**

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2012 HSC Observations

Number of observation by species and life stage
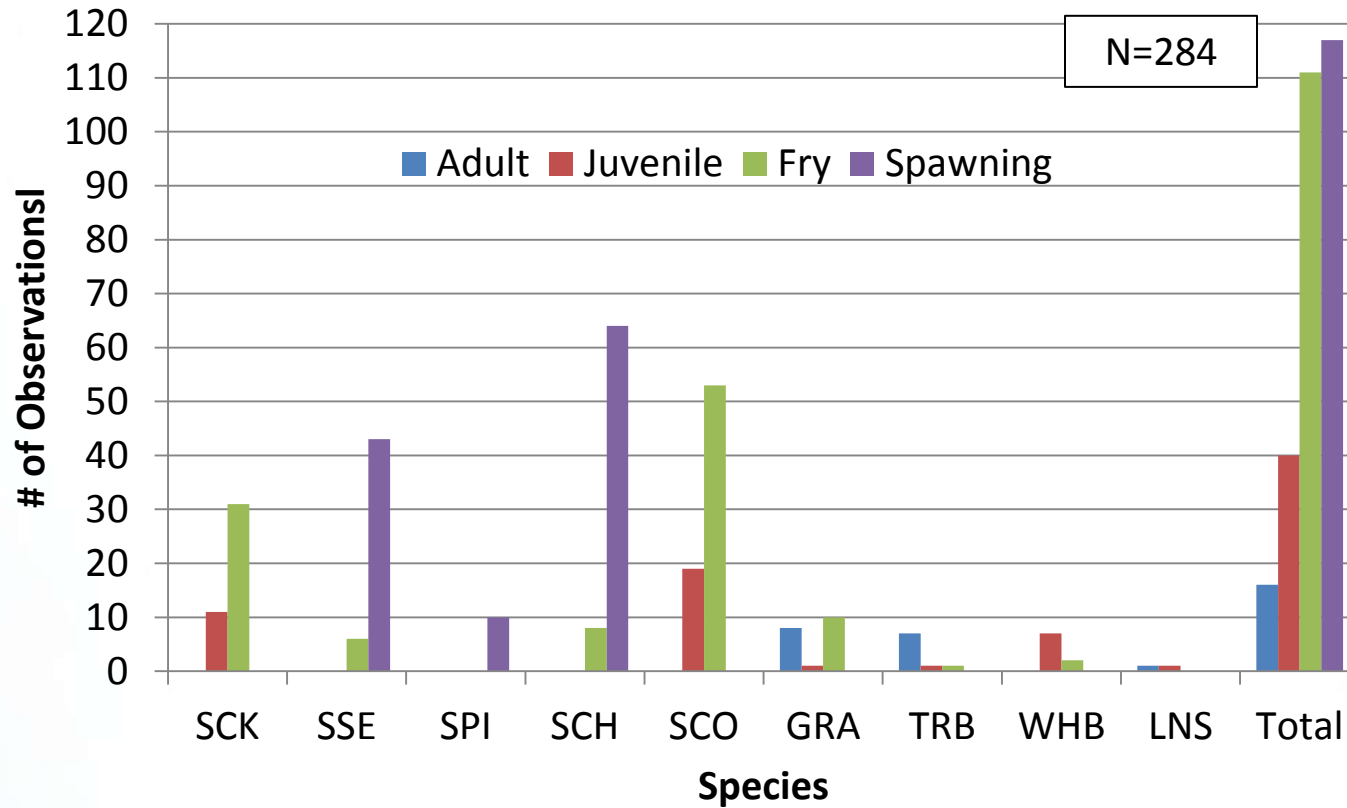
SCK=Chinook, SSE=sockeye, SPI=pink, SCH=chum, SCO=coho, GRA=artic grayling, WHB=humpback whitefish, LNS=longnose sucker

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2012 HSC Observations by Species and life stage

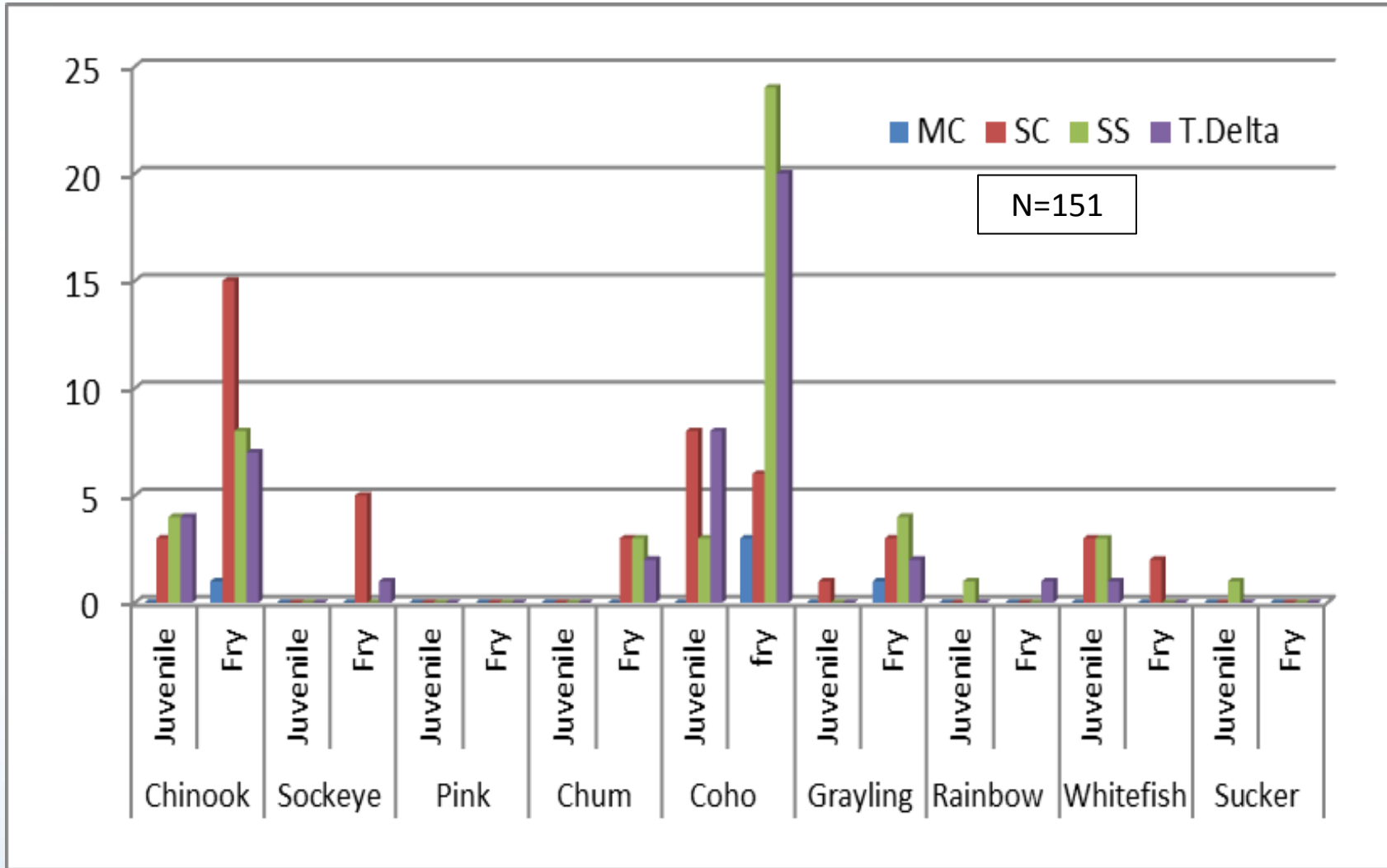| Life Stage	Total # Obs.	Fish Species								
		SCK	SSE	SPI	SCH	SCO	GRA	TRB	WHB	LNS
Adult	16	0	0	0	0	0	8	7	0	1
Juvenile	40	11	0	0	0	19	1	1	7	1
Fry	111	31	6	0	8	53	10	1	2	0
Spawning	117	0	43	10	64	0	0	0	0	0
Total	**284**	**42**	**49**	**10**	**72**	**72**	**19**	**9**	**9**	**2**

SCK=Chinook, SSE=sockeye, SPI=pink, SCH=chum, SCO=coho, GRA=artic grayling, TRB=rainbow trout, WHB=humpback whitefish

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2012 HSC Observations by Species and life stage

Life Stage	Total # Obs.	Fish Species								
		SCK	SSE	SPI	SCH	SCO	GRA	TRB	WHB	LNS
Adult	16	0	0	0	0	0	8	7	0	1
Juvenile	40	11	0	0	0	19	1	1	7	1
Fry	111	31	6	0	8	53	10	1	2	0
Spawning	117	0	43	10	64	0	0	0	0	0
Total	**284**	**42**	**49**	**10**	**72**	**72**	**19**	**9**	**9**	**2**

SCK=Chinook, SSE=sockeye, SPI=pink, SCH=chum, SCO=coho, GRA=artic grayling, TRB=rainbow trout, WHB=humpback whitefish

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MC=main channel, SC=side channel, SS=side slough, T. Delta= trib. delta

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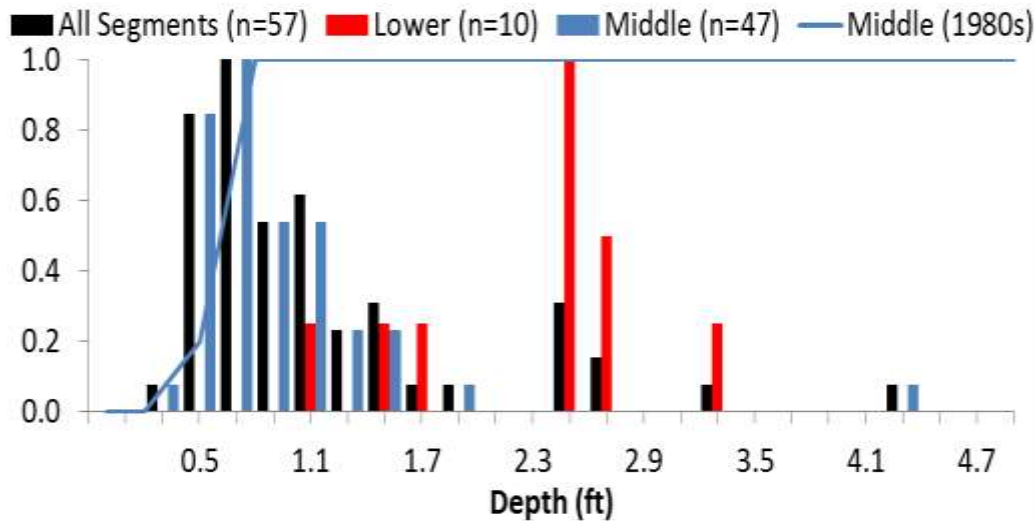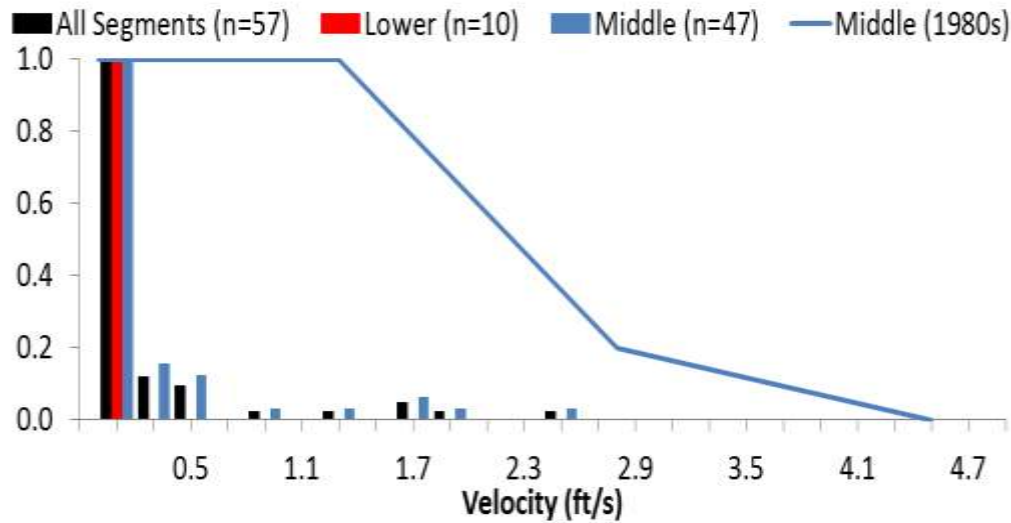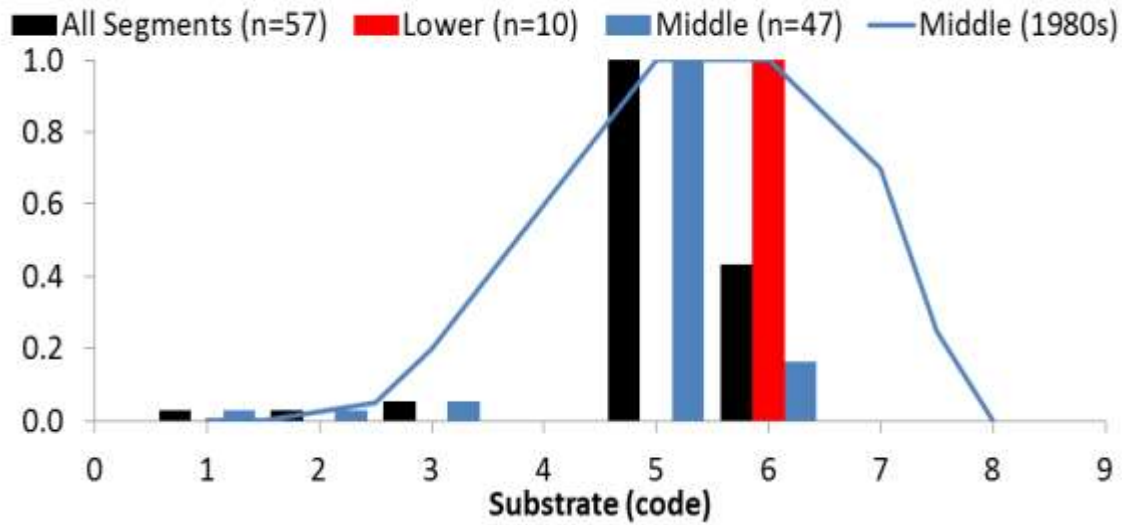
2012 HSC Sampling methods:
Snorkel
Beach Seining
Pedestrian

2012 Example Sampling Areas:
Sloughs
Clear water plumes
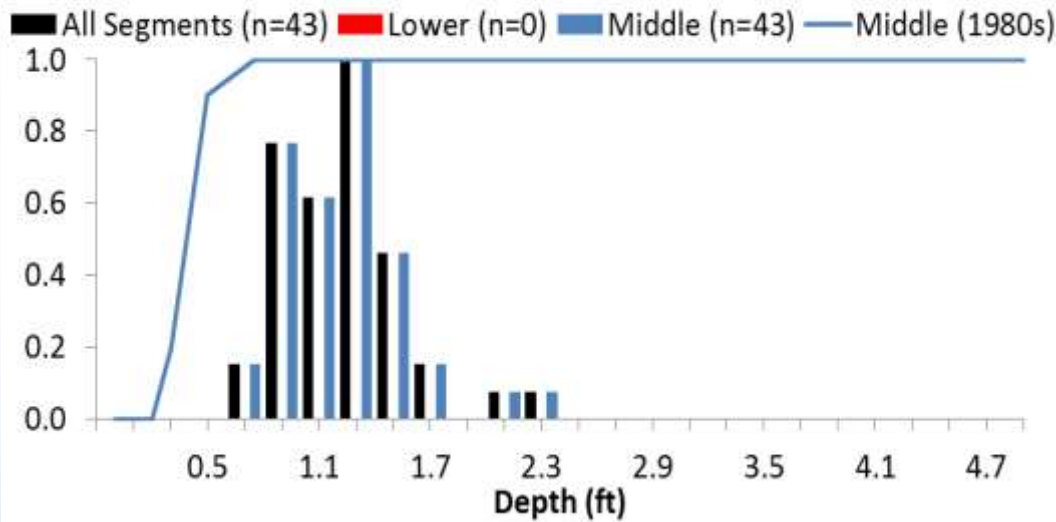Side channels

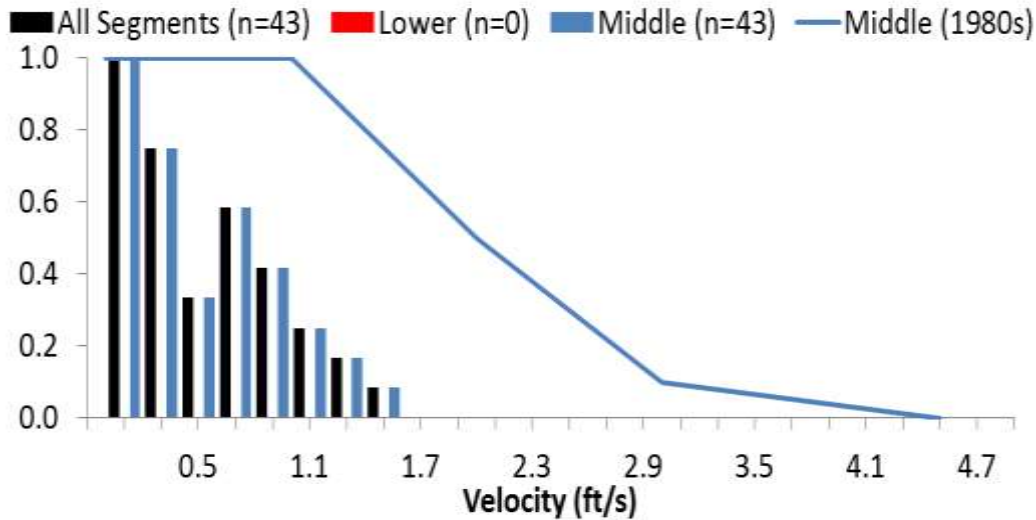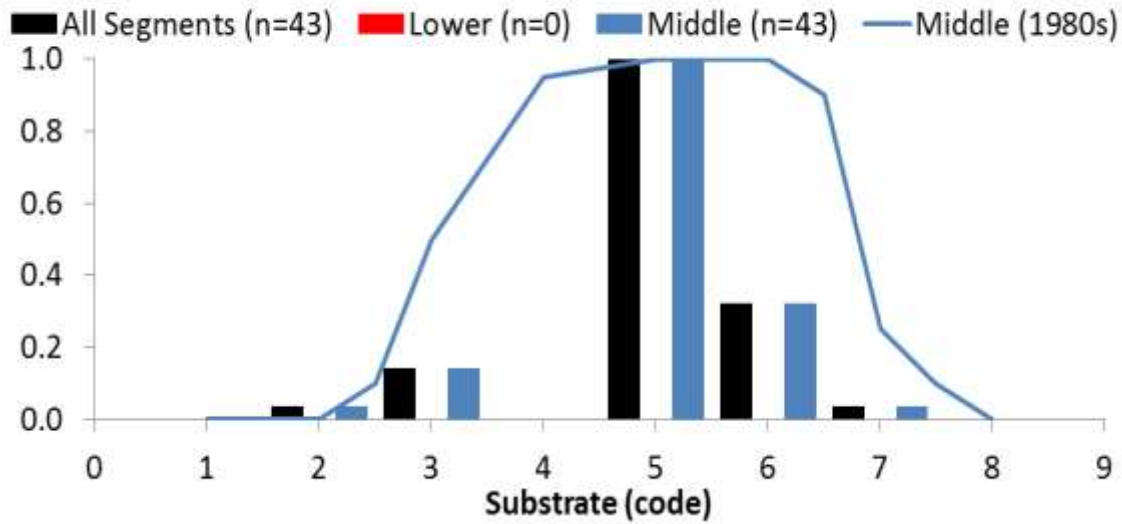**Chum Salmon Spawning**

Chum Salmon Spawning

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Sockeye Salmon Spawning

Sockeye Salmon Spawning

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2013 HSC Sampling

- Focus on priority species and life stage, but collect HSC data on all fish observed/captured

- Goal of >100 measurement per life stage

- Sample Timing: May – September
  - 8-10 samplings (approx. 2 x per month) by two field crews
  - Winter Sampling (March, April, & December)

- Methods:
  - snorkel, seining, video, pedestrian
  - Hook and line, electrofishing
  - DIDSON/Side Sonar
  - Price AA velocity meters

- Coordinate Field Activities
  - Fish distribution and abundance
  - Salmon escapement (LGL)
  - Cross train field crews (LGL, HDR, R2)

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2013 HSC Sampling

- Sampling Site Selection
  - **River Segment → Geomorphic Reach → Mainstem Habitat Type → Mesohabitat Type**
- Middle River Segment
  - 6 Geomorphic Reaches (MR 1, 2, 5, 6, 7, and 8)
  - 10 Focus Areas (FA-184, 173, 171, 151, 144, 141, 138, 128, 115, 104)
  - Mainstem and mesohabitat mapping completed for entire segment (RSP Section 9.9)

Main Channel Habitats

- Main Channel
- Split Channel
- Braided Channel
- Side Channel

Off-Channel Habitats

- Side slough w/o beaver activity
- Side slough with beaver activity
- Upland slough w/o beaver activity
- Upland slough with beaver activity
- Backwater
- Tributary (up to 1.5-year return flow level)
- Tributary mouth
- Clear water plume

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Susitna River at Gold Creek (PRM 140)

Pre-Project Flood Frequency Instantaneous Peaks		Flow Duration (Percent of Time Equaled or Exceeded)	
Return Period (year)	Flow (Computed Curve), cfs	Pre-Project	Max LF OS-1
1.01	26,200	8.62	1.19
1.25	35,100	1.98	0.26
1.5	38,800	1.13	0.11
2	43,500	0.59	<0.1
5	56,200	0.16	<0.1
10	65,300	<0.1	<0.1
20	74,600	<0.1	<0.1
50	87,500	<0.1	<0.1
100	98,000	<0.1	<0.1

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50	87,500	<0.1	<0.1
100	98,000	<0.1	<0.1

Proposed 2013 HSC Sampling

- Sample Site Selection
  - Stratified Random (GRTS Random Sampling)
  - Hunt & Find (based on 1980's data and professional experience), or
  - Blend

Proposed Blended Approach
- Utilizes 2012 Habitat Mapping
- Stratifies by geomorphic reach, focus and non-focus areas, and habitat composition
- Similar to Fish Distribution and Abundance
- Provides spatial coverage and random habitat unit selection
- Incorporates 1980's data and professional experience into sample site location

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Proposed 2013 HSC Sampling

Proposed Blended Approach

Geomorphic Reach	
Outside Focus Area	**Inside Focus Area**
• **Main & off-channel habitat types** Randomly select 1 habitat unit	• **Main channel habitat types** Randomly select 2 habitat units
• Select 1, 40-meter sampling site from within each habitat unit	• **Off-channel habitat types** Randomly select 3 habitat units
	• Select 2, 40-meter sampling sites from within each habitat unit

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Focus Stratum	Habitat Stratum	Geomorphic Reach Stratum						
		MR-1	MR-2	MR-5	MR-6	MR-7	MR-8	Total
Inside Focus Areas	Main Channel	2	2	2	2	2	2	12
	Split Main Channel					2	2	4
	Braided Main Channel				2			2
	Side Channel	2	2		2	2	2	10
	Side Slough w/o Beaver		3		3		3	9
	Side Slough in Beaver Complex				3			3
	Upland Slough w/o Beaver		3		3	3	3	12
	Upland Slough in Beaver Complex				3	3		6
	Backwater				1	2		3
	Tributary		1	1	3	1	1	7
	Tributary Mouth		1	1	2			4
	Clear Water Plume			1	1			2
	Subtotal Inside Focus Areas	**4**	**12**	**5**	**25**	**15**	**13**	**74**

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Focus Stratum	Habitat Stratum	Geomorphic Reach Stratum						
		MR-1	MR-2	MR-5	MR-6	MR-7	MR-8	Total
Outside Focus Areas	Main Channel	1	1	1	1	1	1	6
	Split Main Channel		1	1	1	1	1	5
	Braided Main Channel				1		1	2
	Side Channel	1	1		1	1	1	5
	Side Slough w/o Beaver		1	1	1	1	1	5
	Side Slough in Beaver Complex					1		1
	Upland Slough w/o Beaver		1		1	1	1	4
	Upland Slough in Beaver Complex				1	1		2
	Backwater		1		1	1	1	4
	Tributary		1	1	1	1		4
	Tributary Mouth		1	1	1	1		4
	Clear Water Plume		1		1	1		3
	Subtotal Outside Focus Areas	**2**	**9**	**5**	**11**	**11**	**7**	**45**
	Subtotal Inside & Outside Focus Areas	**6**	**21**	**10**	**36**	**26**	**20**	**119**

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Proposed 2013 HSC Sampling Lower River Segment

- Lower River geomorphic mapping available
- Current mapping represents polygon units of main channel, side channels, sloughs, backwater, and tributary mouth geomorphic types (Tetra Tech 2013a)
- Two primary study areas with five tributary mouths in the lower river
- Representative/Critical Site Selection Approach
  - ✓ Identify key mainstem habitat types based on both habitat data and historic and contemporary (2012 surveys) fish utilization data
  - ✓ Proximity to IFS sampling sites
  - ✓ Focus on tributary mouths
- Select 2 sample sites within each representative habitat type located in close proximity (<2,000 ft) to the tributary mouths: Trapper Creek, Birch Creek, Sheep Creek, Caswell Creek, and Deshka River (2013 Focus Area TM).
- Coordinate with HDR eulachon spawning study

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Lower River Segment

Geomorphic Reach	Project River Mile	Tributary Mouth
LR -1	94.5	Trapper Creek
LR-1	92.5	Birch Creek
LR-2	69.5	Sheep Creek
LR-2	67.0	Caswell Creek
LR-3	45.0	Deshka River

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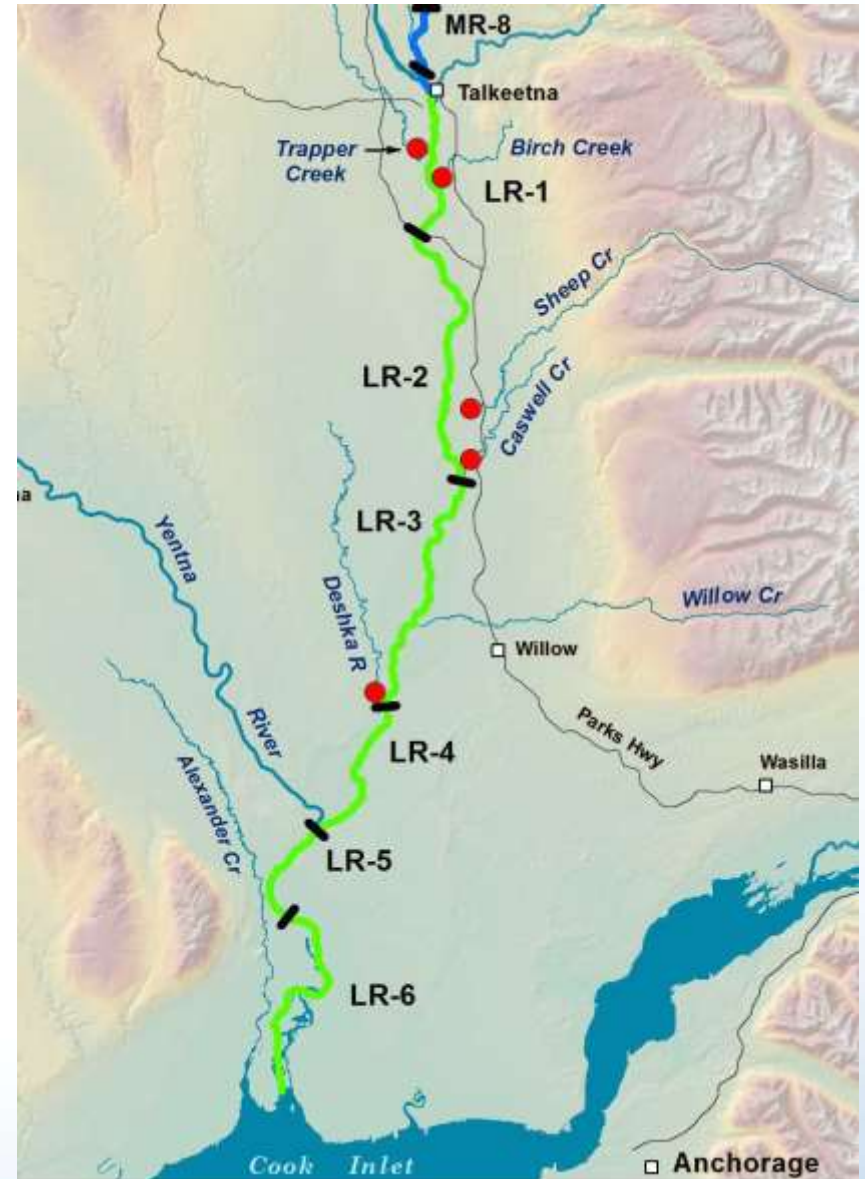
HSC Sampling – Next Steps

- Convene Technical Meeting regarding 2013 sampling methods (HSC & HSI)

- Complete 2013 HSC data collection

- Review data and information from 2013 studies

- Refine, modify or add supplemental areas in Middle and Lower River Segments for 2014 sampling

- Statistical consideration on HSC curve development

  - Potential ways to address/define uncertainty

    - Boot Strap Analysis

    - Bayesian methods (combine 1980's curves + literature curves + site specific data to develop distributions of habitat usage).

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