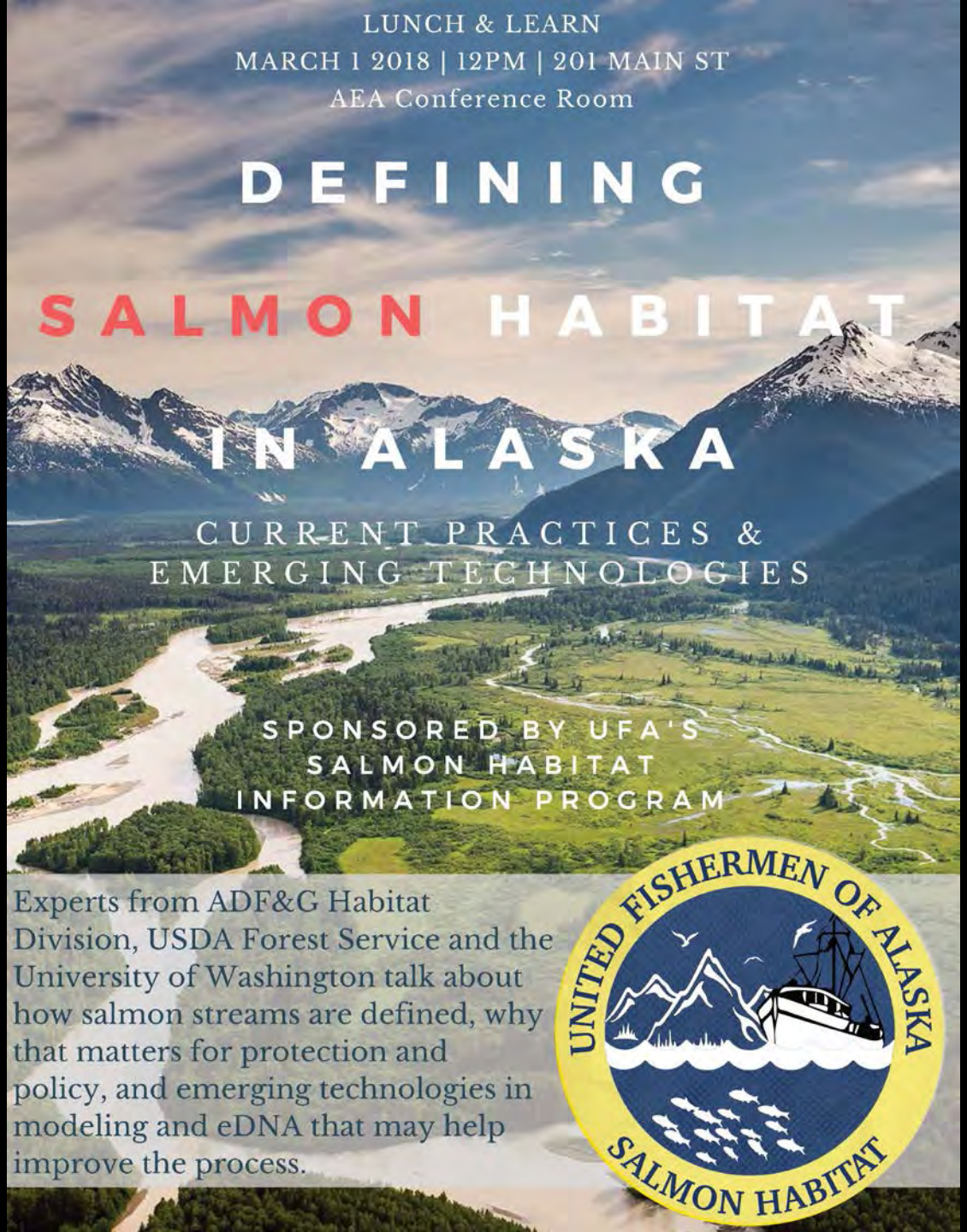

LUNCH & LEARN
MARCH 1 2018 | 12PM | 201 MAIN ST
AEA Conference Room
DEFINING
SALMON HABITAT
IN ALASKA
CURRENT PRACTICES &
EMERGING TECHNOLOGIES
SPONSORED BY UFA'S
SALMON HABITAT
INFORMATION PROGRAM
Experts from ADF&G Habitat Division, USDA Forest Service and the University of Washington talk about how salmon streams are defined, why that matters for protection and policy, and emerging technologies in modeling and eDNA that may help improve the process.
UNITED FISHERMEN OF ALASKA
SALMON HABITAT

ADF&G Statutory Authority and The Anadromous Waters Catalogue

UFA Board Meeting
March 1, 2018
Juneau, AK

Ron Benkert
Fish & Game Coordinator
ADF&G Division of Habitat
Central Region

Discussion Objectives

- Provide an overview of ADF&G Statutory Authority for fish and wildlife habitat protection
- Identify jurisdictional boundaries of our statutes
- Overview of how we conduct fish/habitat inventories
- Provide a detailed overview of the Anadromous Waters Catalogue

ADF&G Statutory Authority
Fish Protection

- THE FISHWAY ACT
  - AS 16.05.841
- ANADROMOUS FISH ACT
  - AS 16.05.871
- SPECIAL AREA PERMITTING
  - 5 AAC 95.700
- FISH RESOURCE PERMIT
  - Required for handling or transporting fish

Fishway Act

requires that any obstruction built across fish-bearing waters will provide for fish passage

Jurisdiction

- Applies to all fish bearing streams (resident and anadromous) and all fish species.
- Requires long-term commitment to operation & maintenance
- Applies to fish passage only

Activities not covered by .841

- Projects that don't have the potential to block passage
  - Docks, streambank protection, motorized stream crossings, etc.

Anadromous Fish Act

AS 16.05.871

- (a) ADF&G must specify those waters that are important for the spawning, rearing, or migration of anadromous fish (AWC)
- (b-c) notification and plans required before conducting work in a specified waterbody (permit application)
- (d) ADF&G will approve or deny the proposed work

Anadromous Fish Act (.871)

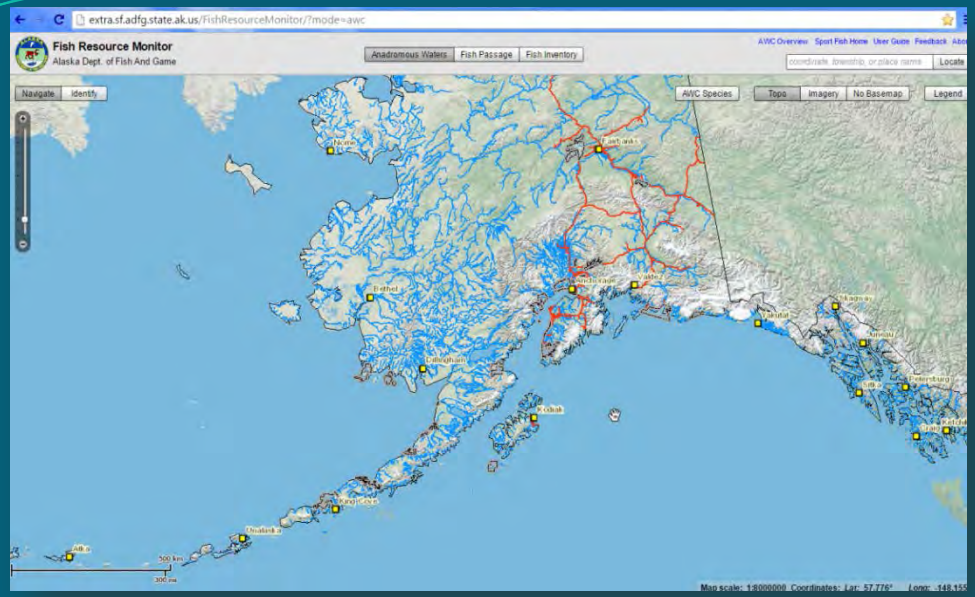
Jurisdiction

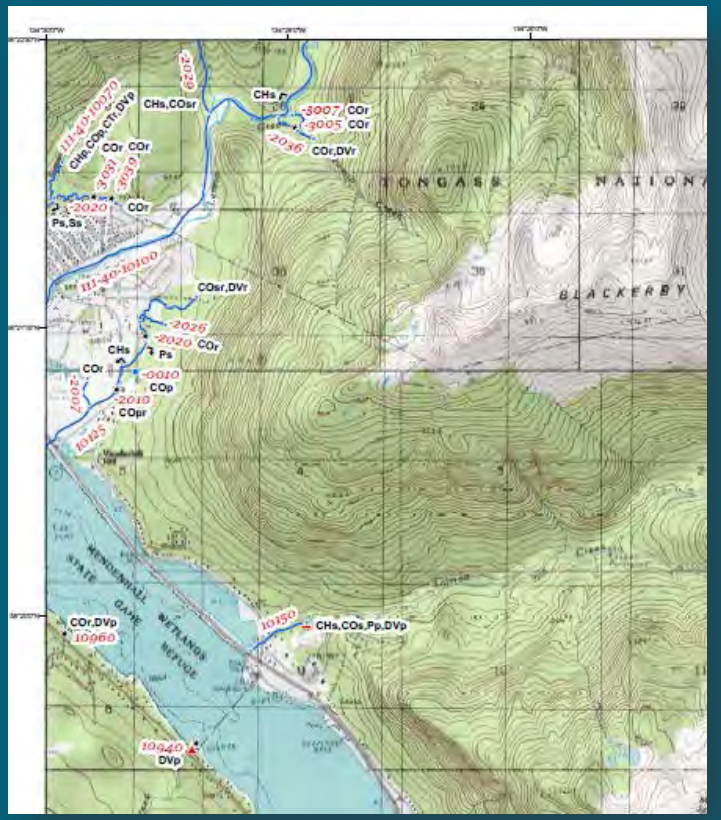
- Applies to any activity
- Applies to any life stage

Application of .871

- Activity occurring below OHW with some exceptions
- Waterbody must be in AWC
- Freshwater only down to the mean low OHW in the marine environment

AWC Data





- Fish Resource Monitor
- GIS Data
- Google Earth (KMZ) Downloads
- Atlas Map Downloads (PDF)
- Updated annually

Alaska Freshwater Fish Inventory (AFFI)

- AFFI Goal: To complete a statewide baseline inventory of fish communities and associated aquatic and riparian habitats using standardized methods
- Annual Objectives:
  - To spatially increase mapped anadromous fish habitat documented in the AWC
  - To record aquatic and riparian habitat characteristics at each sampling location
  - Provide this information to Habitat Biologists to assist in making informed permitting decisions

Annual Study Design

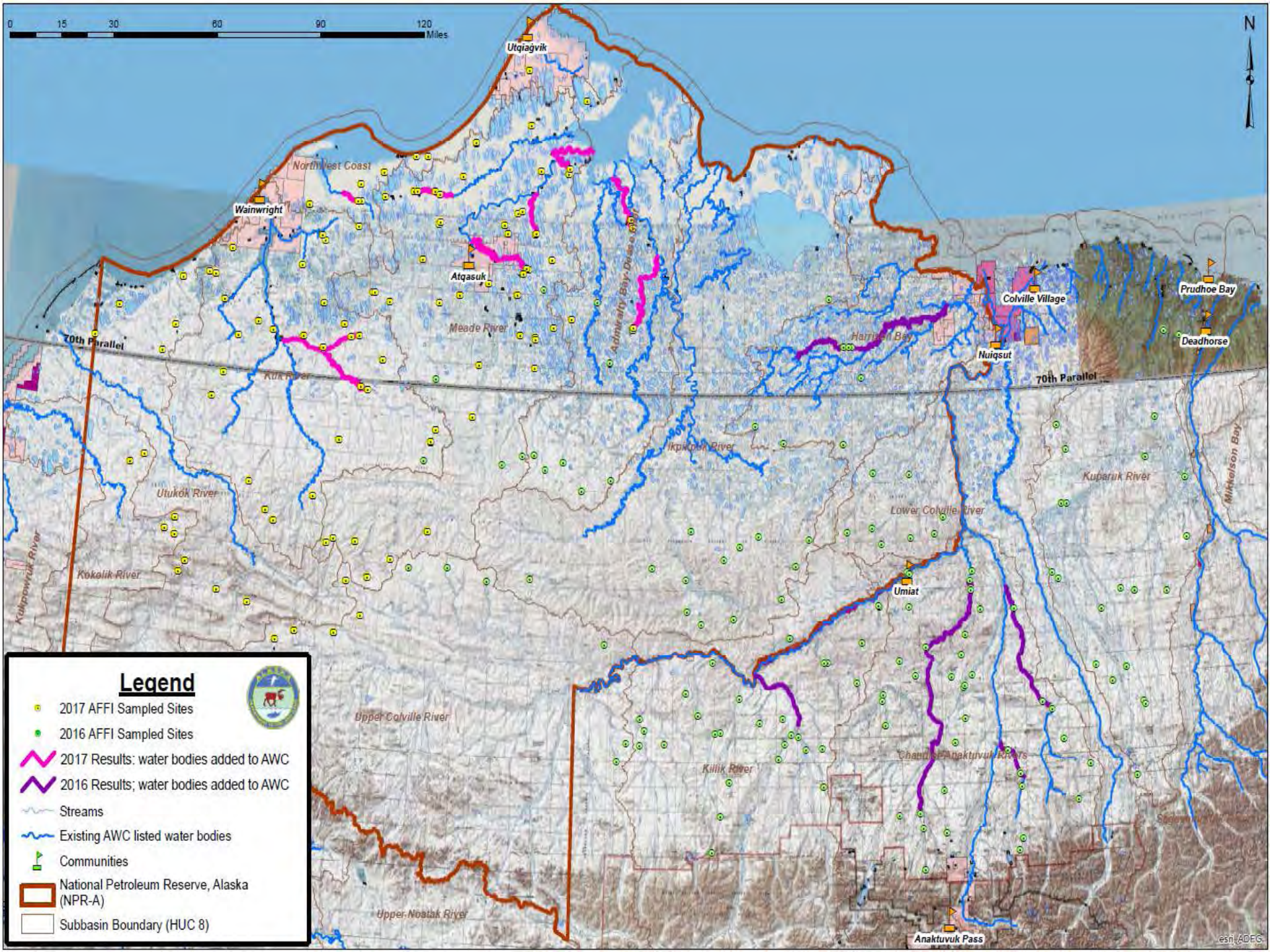
- Study Area Selection
  - Watershed based
  - Extent of prior surveys
  - Human activity
  - Funding
- Target site considerations
  - All lakes and streams within study area
  - Split into 50-, 200-, and 1,500-sq. km units
- Target site determination
  - Filtering
    - Remove current AWC streams
    - Remove previously surveyed lakes and streams
    - Remove sites above barriers

AFFI Program Efforts and Results

- Over the last 15 years the program has prioritized and surveyed 61 of Alaska's 139 subbasins, about 40,000 sq.km/year.
- Since program inception about 1,493 nominations have successfully added at least 7,000 km of anadromous stream habitat to the AWC.
- From 2010 to 2017, the AFFI program sampled 917 target sites and generated 433 AWC nominations for 445 different waterbodies.
- This effort resulted in 294 new streams and 40 new lakes added to the AWC.
- This added approximately 3,310 km stream distance into the AWC, increasing the extent of our Title 16 authority

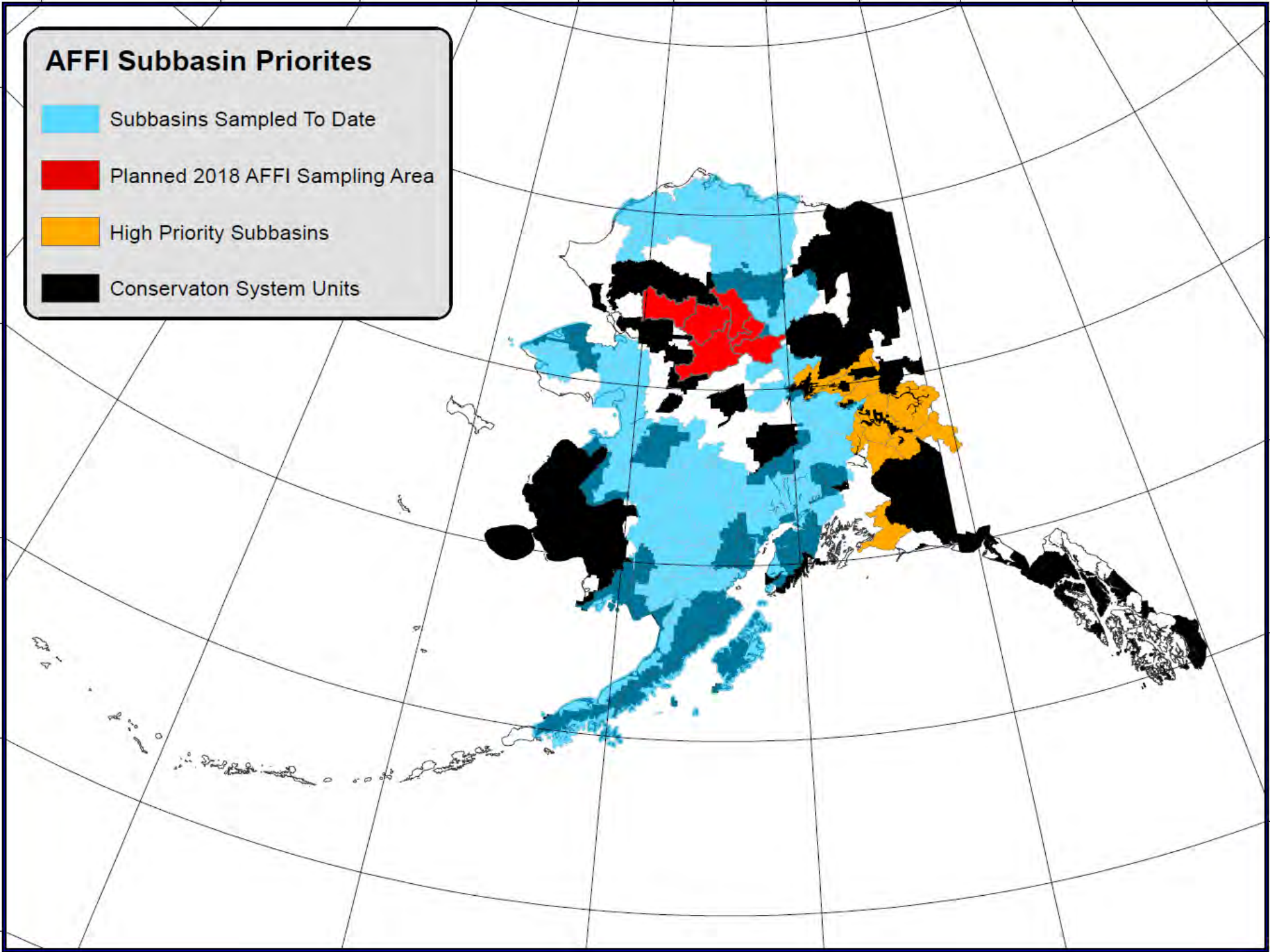
Recent AFFI Efforts and AWC Additions

- 2014 – Sampling efforts focused in the Nushagak, Wood, and Kvichak river systems.
  - 170 site visited resulting in 84 new or extended streams and 6 previously undocumented anadromous lakes.
- 2015 – Sampling efforts focused along the length of the Alaska Peninsula
  - 182 sites visited resulting in 115 new or extended streams and 34 previously undocumented lakes
- 2016 - Sampling efforts focused on the Colville River in NPR-A.
  - 123 sites visited resulting in 9 new or extended streams
- 2017 – Sampling was conducted on drainages to the Chukchi Sea within the NPR-A boundary
  - 229 sites visited resulting in 9 new or extended streams


0 15 30 60 90 120 Miles
N
Utqiaġvik
Wainwright
Atqasuk
Meade River
Colville Village
Nuiqsut
Prudhoe Bay
Deadhorse
70th Parallel
Kuk River
Utukok River
Kokolik River
Umiat
Lower Colville River
Kuparuk River
Upper Colville River
Killik River
Upper Nostak River
Anaktuvuk Pass
Legend
2017 AFFI Sampled Sites
2016 AFFI Sampled Sites
2017 Results: water bodies added to AWC
2016 Results; water bodies added to AWC
Streams
Existing AWC listed water bodies
Communities
National Petroleum Reserve, Alaska (NPR-A)
Subbasin Boundary (HUC 8)
esri ADEC

Future AFFI Efforts

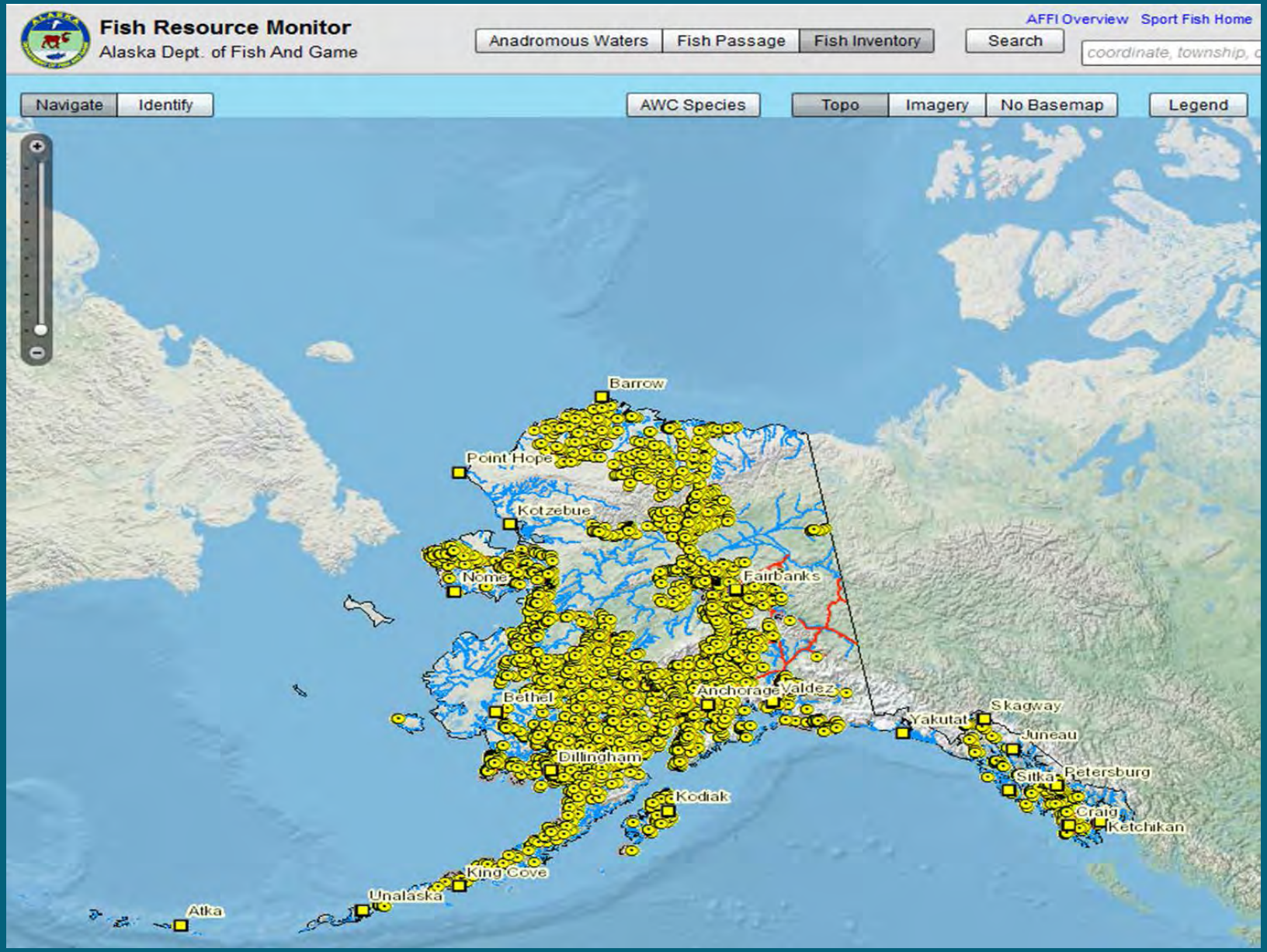
- 2018 – Kobuk and Koyukuk river systems
- 2019/2020 – Upper Yukon River including Black, Grass, and Fortymile river systems
- 2021 and beyond - . Program plans to re-prioritized based on information collected over last 15+ years to continue to sample/re-sample areas that; remain high priority, have pending development, proved promise for nomination in past survey but could not capture 2 individuals, etc.

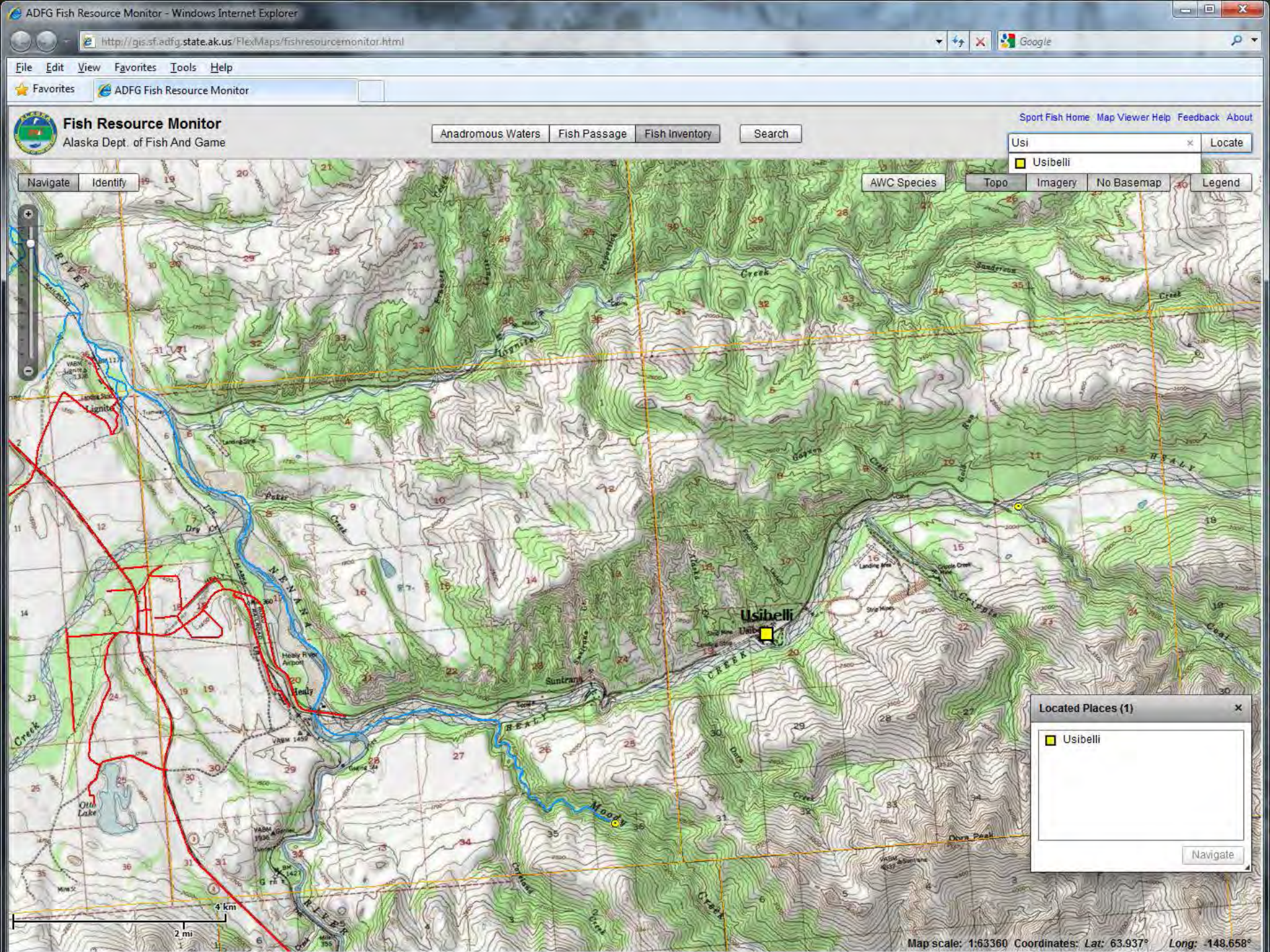

AFFI Subbasin Priorites
Subbasins Sampled To Date
Planned 2018 AFFI Sampling Area
High Priority Subbasins
Conservaton System Units

AFFI Information Collected

- Site location information: upstream, downstream, and habitat site coordinates
- Water quality information:
  - Temperature
  - dissolved oxygen
  - turbidity
  - pH
  - Conductivity
  - water color
- Hydrology: stream width, depth, gradient, and velocity
- Dominant and subdominant substrate classes
- Characterization of riparian vegetation communities

Fish Resource Monitor Tour




ADFG Fish Resource Monitor - Windows Internet Explorer
http://gis.sf.adfg.state.ak.us/FlexMaps/fishresourcemonitor.html
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ADFG Fish Resource Monitor
Fish Resource Monitor
Alaska Dept. of Fish And Game
Anadromous Waters
Fish Passage
Fish Inventory
Search
Sport Fish Home
Map Viewer Help
Feedback
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Moody
Suntrana
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Poker Creek
Dry Cr
Otto Lake
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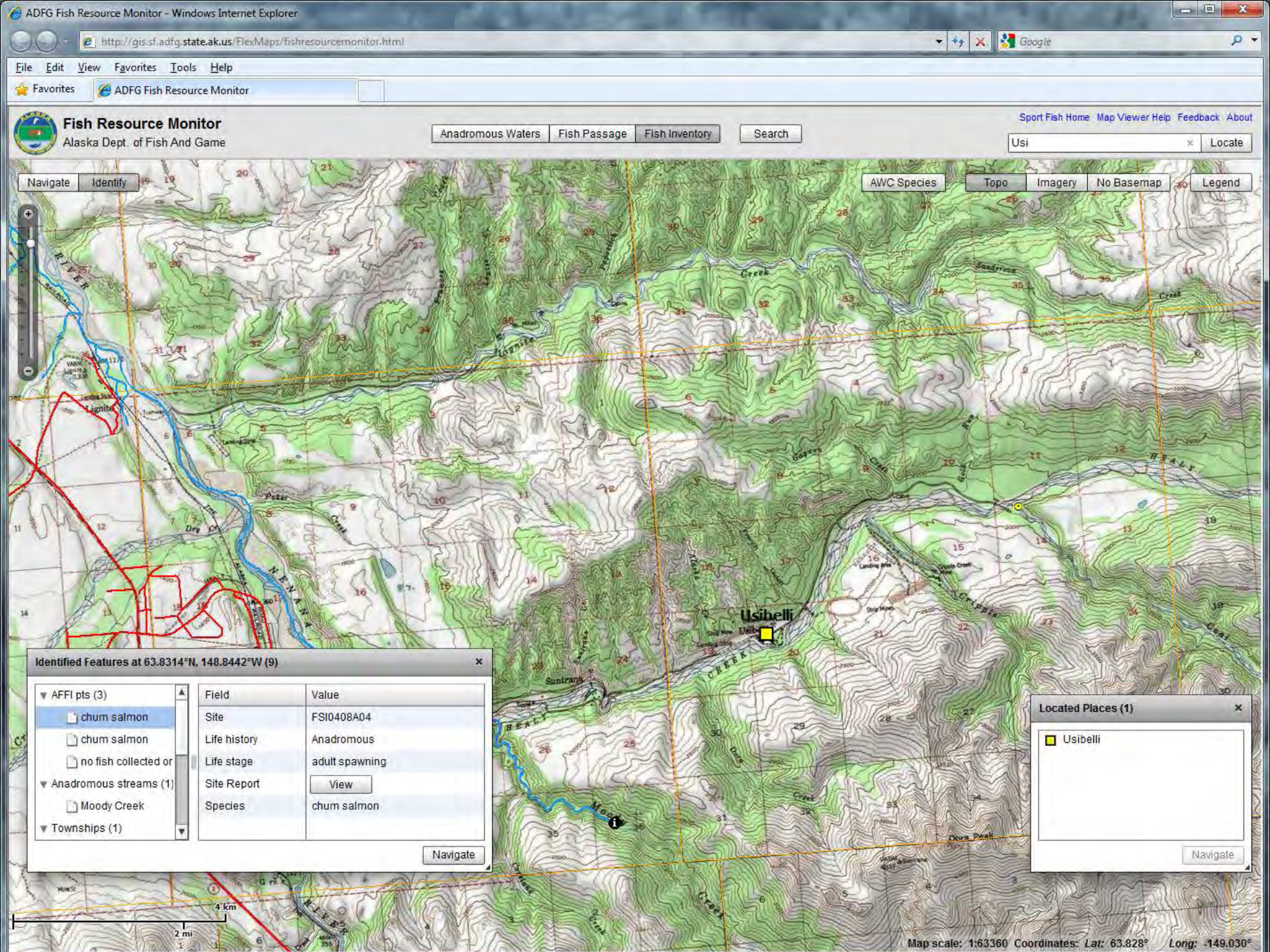
4 km
2 mi
Map scale: 1:63360 Coordinates: Lat: 63.937° Long: -148.658°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AWC Species
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Usibelli
Identified Features at 63.8314°N, 148.8442°W (9)
AFFI pts (3)
chum salmon
chum salmon
no fish collected or
Anadromous streams (1)
Moody Creek
Townships (1)
Field
Value
Site
FSI0408A04
Life history
Anadromous
Life stage
adult spawning
Site Report
View
Species
chum salmon
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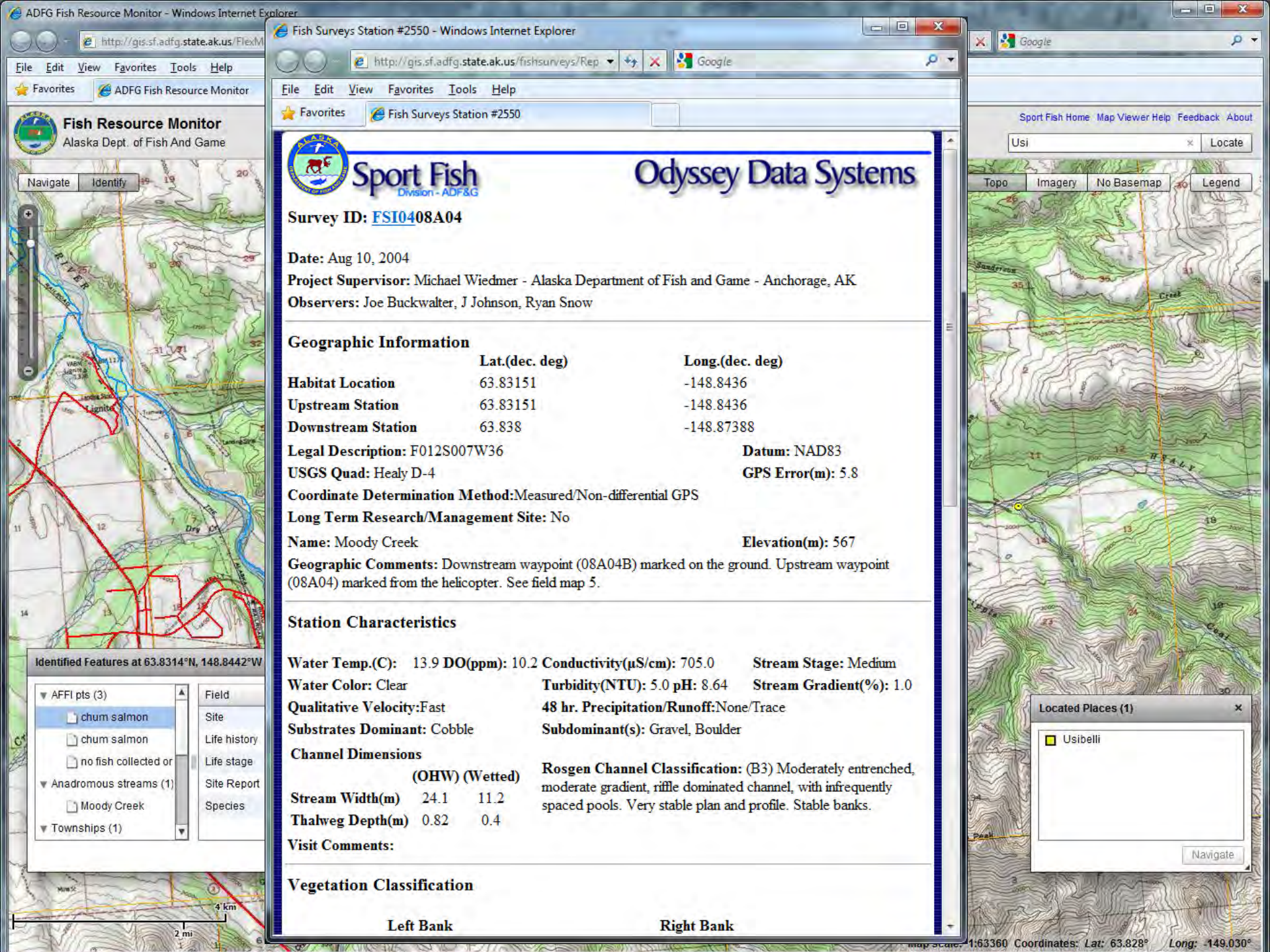
ADFG Fish Resource Monitor - Windows Internet Explorer
Fish Surveys Station #2550 - Windows Internet Explorer
Fish Resource Monitor
Alaska Dept. of Fish And Game
Navigate
Identify
Identified Features at 63.8314°N, 148.8442°W
AFFI pts (3)
chum salmon
chum salmon
no fish collected or
Anadromous streams (1)
Moody Creek
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Field
Site
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Life stage
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Sport Fish Home
Map Viewer Help
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About
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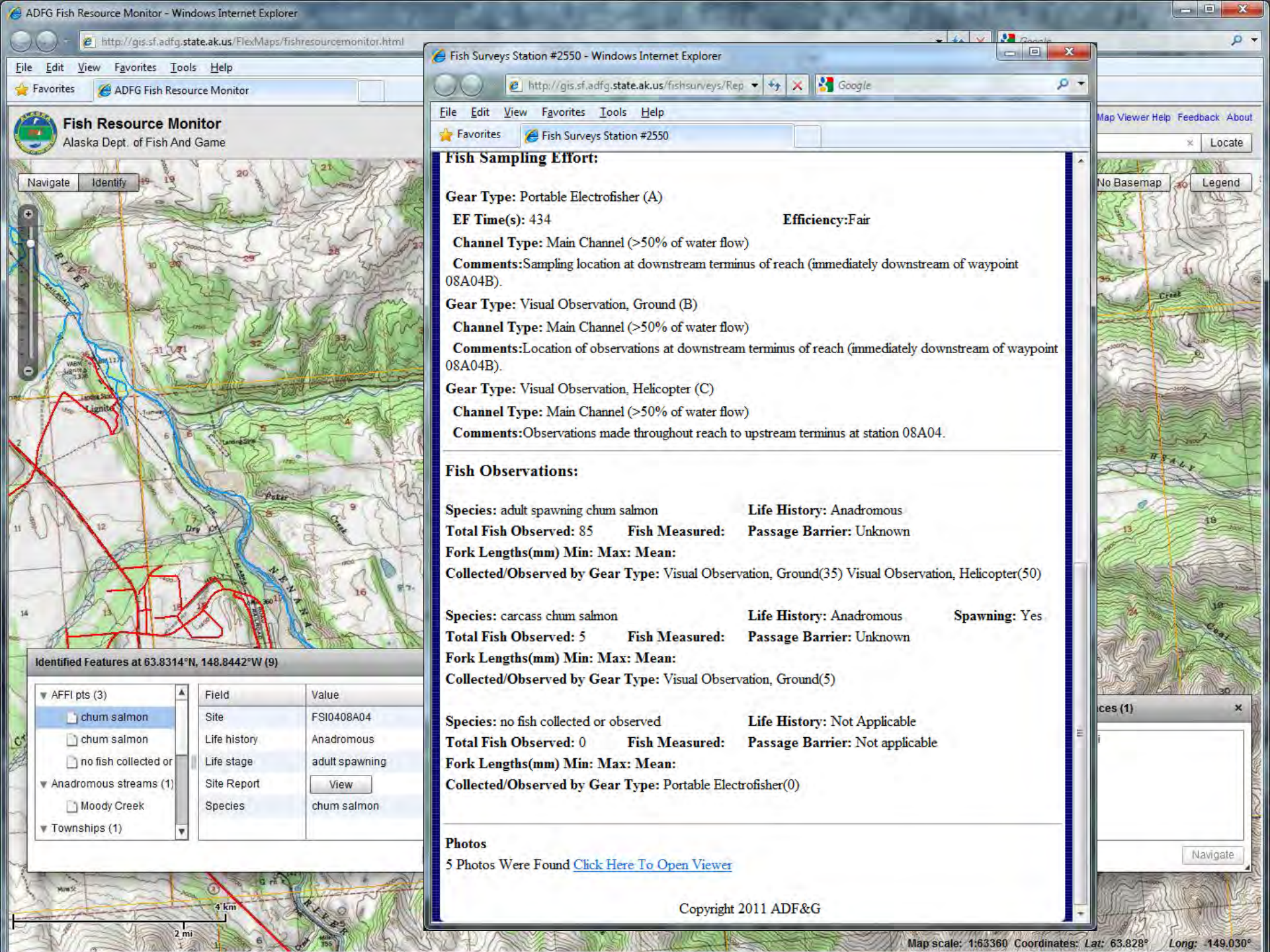
Topo
Imagery
No Basemap
Legend
Located Places (1)
Usibelli
Navigate
Sport Fish
Division - ADF&G
Odyssey Data Systems
Survey ID: FSI0408A04
Date: Aug 10, 2004
Project Supervisor: Michael Wiedmer - Alaska Department of Fish and Game - Anchorage, AK
Observers: Joe Buckwalter, J Johnson, Ryan Snow
Geographic Information
Lat.(dec. deg)
Long.(dec. deg)
Habitat Location 63.83151 -148.8436
Upstream Station 63.83151 -148.8436
Downstream Station 63.838 -148.87388
Legal Description: F012S007W36
Datum: NAD83
USGS Quad: Healy D-4
GPS Error(m): 5.8
Coordinate Determination Method:Measured/Non-differential GPS
Long Term Research/Management Site: No
Name: Moody Creek
Elevation(m): 567
Geographic Comments: Downstream waypoint (08A04B) marked on the ground. Upstream waypoint (08A04) marked from the helicopter. See field map 5.
Station Characteristics
Water Temp.(C): 13.9 DO(ppm): 10.2 Conductivity(µS/cm): 705.0 Stream Stage: Medium
Water Color: Clear
Turbidity(NTU): 5.0 pH: 8.64 Stream Gradient(%): 1.0
Qualitative Velocity:Fast
48 hr. Precipitation/Runoff:None/Trace
Substrates Dominant: Cobble
Subdominant(s): Gravel, Boulder
Channel Dimensions
(OHW) (Wetted)
Stream Width(m) 24.1 11.2
Thalweg Depth(m) 0.82 0.4
Rosgen Channel Classification: (B3) Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.
Visit Comments:
Vegetation Classification
Left Bank
Right Bank
4 km
2 mi
Coordinates: Lat: 63.828° Long: -149.030°



Fish Sampling Effort:

Gear Type: Portable Electrofisher (A)

EF Time(s): 434 **Efficiency:**Fair

Channel Type: Main Channel (>50% of water flow)

Comments: Sampling location at downstream terminus of reach (immediately downstream of waypoint 08A04B).

Gear Type: Visual Observation, Ground (B)

Channel Type: Main Channel (>50% of water flow)

Comments: Location of observations at downstream terminus of reach (immediately downstream of waypoint 08A04B).

Gear Type: Visual Observation, Helicopter (C)

Channel Type: Main Channel (>50% of water flow)

Comments: Observations made throughout reach to upstream terminus at station 08A04.

Fish Observations:

Species: adult spawning chum salmon **Life History:** Anadromous
Total Fish Observed: 85 **Fish Measured:** **Passage Barrier:** Unknown
Fork Lengths(mm) Min: Max: Mean:
Collected/Observed by Gear Type: Visual Observation, Ground(35) Visual Observation, Helicopter(50)

Species: carcass chum salmon **Life History:** Anadromous **Spawning:** Yes
Total Fish Observed: 5 **Fish Measured:** **Passage Barrier:** Unknown
Fork Lengths(mm) Min: Max: Mean:
Collected/Observed by Gear Type: Visual Observation, Ground(5)

Species: no fish collected or observed **Life History:** Not Applicable
Total Fish Observed: 0 **Fish Measured:** **Passage Barrier:** Not applicable
Fork Lengths(mm) Min: Max: Mean:
Collected/Observed by Gear Type: Portable Electrofisher(0)

Photos

5 Photos Were Found Click Here To Open Viewer

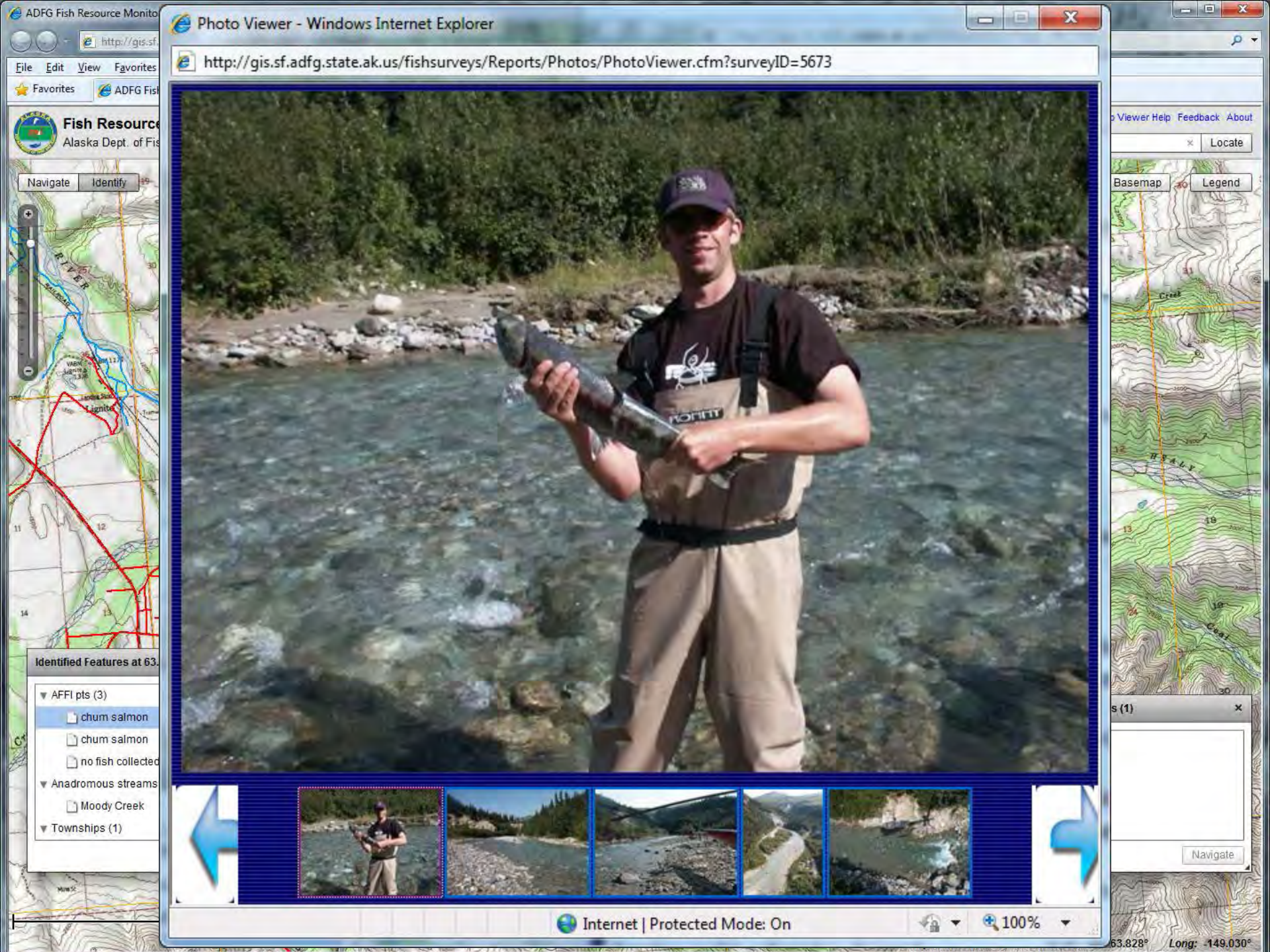


Photo Viewer - Windows Internet Explorer
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Internet | Protected Mode: On
100%
Fish Resource
Alaska Dept. of Fis
Navigate
Identify
Identified Features at 63.
AFFI pts (3)
chum salmon
chum salmon
no fish collected
Anadromous streams
Moody Creek
Townships (1)
Basemap
Legend
Locate
Navigate

Questions?

Ron Benkert
ADF&G Habitat
Central Area Office

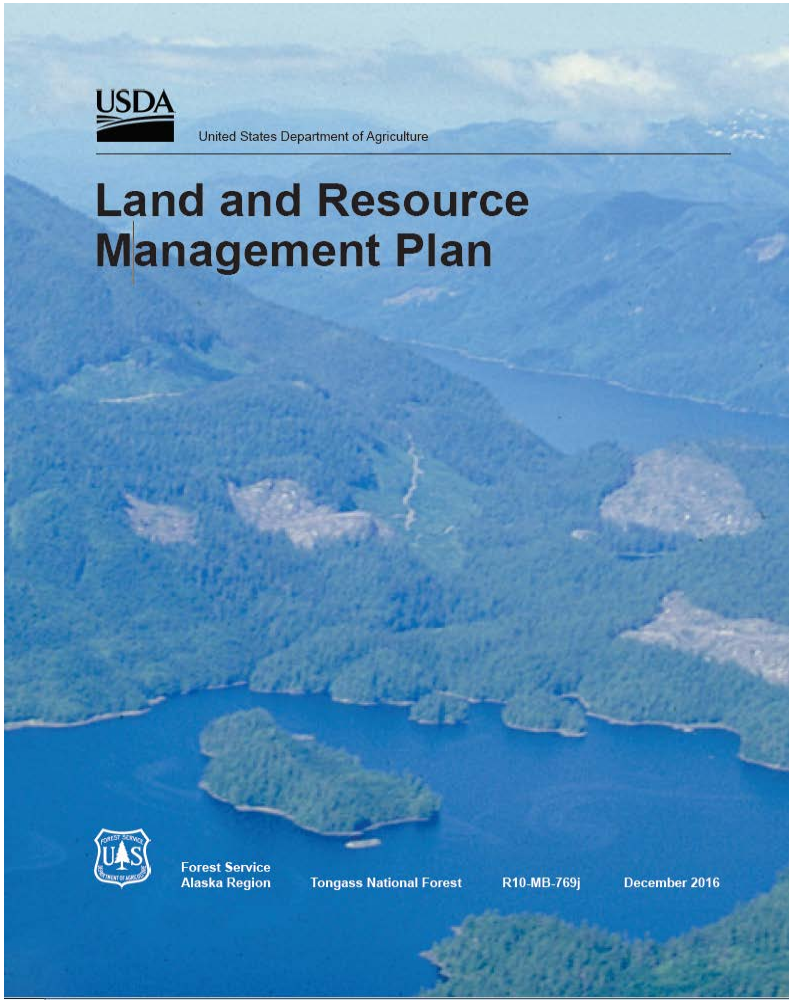
(907) 267-2172
ronald.benkert@alaska.gov

Fish-Stream Identification, Classification and Protection Measures on the Tongass National Forest

Sheila Jacobson, Fish Program Manager
Alaska Region, Tongass National Forest

Tongass Riparian Areas

Embodies the provisions of the laws, implementing regulations, and other guiding documents



How is salmon habitat identified on NFS lands?

Original modeling based on physical habitat and Anadromous Waters Catalog sampling using Innovative GIS

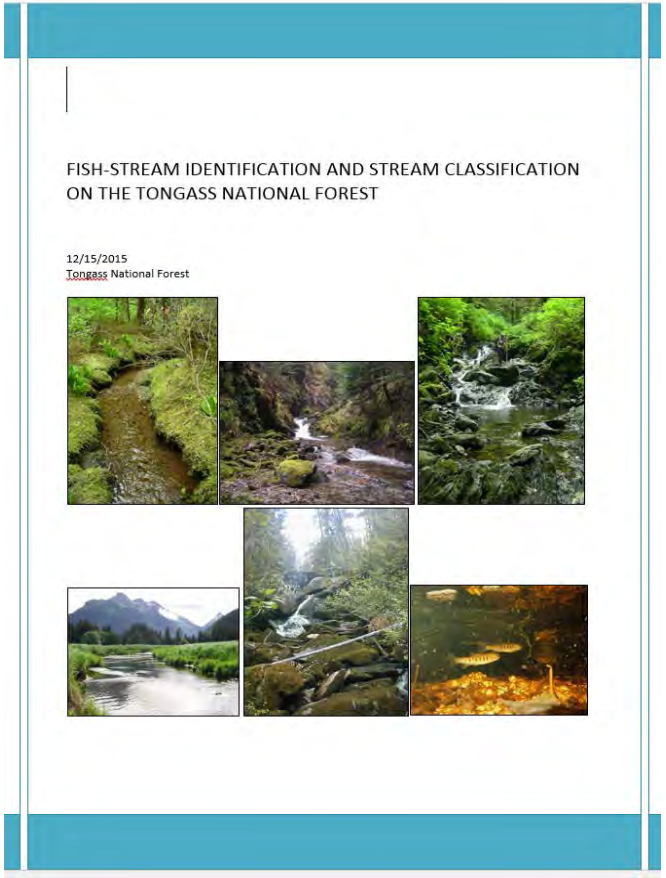
Solidified knowledge of core Floodplain habitat

Since then, we've been adding streams from field surveys in:

- Floodplain side channels (important floodplain connectivity)
- Small tributaries that are difficult to map remotely (no photo signature)
- Upper limits of habitat (steelhead trout/coho salmon)

Every project we do – we map new salmon habitat

Fish Stream Identification



- **Field protocol in place**
  - **Forest Service Handbook directives**
  - **Stream Classification Guidance**
- **Start with existing data (ADFG, WaterXings data, known barriers, etc)**
- **Emphasis on fish sampling: are fish present?**

Tongass National Forest Stream Classification Field Guide

Stream Classes – **Definitions, Tongass Forest Plan:**

Class I. Streams and lakes with anadromous or adfluvial fish or fish habitat; or high quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

Class II. Streams and lakes with resident fish or fish habitat – generally steep channels 6 to 25 percent or higher gradient – where no anadromous fish occur, and otherwise do not meet Class I criteria.

Class III. Perennial and intermittent streams with no fish populations but which have sufficient flow, or transport sufficient sediment and debris, to have an immediate influence on downstream water quality or fish habitat capability. For streams less than 30 percent gradient, special care is needed to determine if resident fish are present.

Class IV. Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to directly influence downstream water quality or fish habitat capability. Class IV streams do not meet the criteria used to define Class I, II or III streams.

Class I Reaches Must Have:

- anadromous or adfluvial fish presence or habitat presence;

OR

- high quality resident fish presence or habitat presence;

[As a guideline, enhancement involving an engineered structure should have a minimum of 500 meters of usable upstream habitat.]

Class II Reaches Must Have:

- resident fish populations or resident habitat presence;

No anadromous fish populations

Class III Reaches Must Have:

- NO fish populations;
- **> 1.5 m (5 ft) bankfull width; > 5 m (15 ft) incision depth***
- sufficient flow or ability to transport sufficient sediment/debris to have an immediate influence on downstream water quality OR fish habitat capability

*Streams that do not meet the width and incision criteria may be classified as Stream Class III based on other parameters listed on page 4

Class IV Reaches Must Have:

- NO fish populations;
- insufficient flow or sediment/debris transport ability to directly influence downstream water quality OR fish habitat capability;
- > 0.3 m (1 ft) bankfull width

Otherwise, does not meet Class I, II, or III criteria

Tongass National Forest Stream Classification Field Guide

Stream Classification System – Characteristics

Class I – ***The PRESENCE of anadromous species most clearly identifies Stream Class I waters.***

- GENERALLY low-moderate gradient (< 6% but up to around 9% depending on situation) stream channels;
- ALWAYS downstream of complete fish passage barriers, UNLESS a reasonable enhancement opportunity could provide access to > 500 m of connected habitat

Class II – ***The confirmed and consistent ABSENCE of anadromous fish species along with resident fish species PRESENCE most clearly identifies Stream Class II waters.***

- Generally moderate to steep gradient channels (6 to 25% or higher);
- May be associated with step-pool habitat

Tongass National Forest Stream Classification Field Guide

Stream Classification System – Stream gradient, slope, and barrier considerations:

STREAM GRADIENT: 0 - 6%:

- **Very high probability of containing anadromous and/or resident salmonids** depending on landscape position and presence of significant stream barriers downstream

  - Very likely be confirmed as fish streams **(Stream Class = I or II)**
    - Generally, no exact habitat features other than barriers as defined in the **Adult Salmonid Migration Blockage Table** can be used to distinguish between Stream Class I and II reaches – **it must be identified by the presence of anadromous species OR the presence of a "high-value" (i.e., fishable population) of resident species .**

STREAM GRADIENT: 6 - 12%:

- **Moderate-to-high probability** of containing anadromous or resident salmonids depending on landscape position and downstream barrier presence

  - Probability of occupancy in the 6-12% gradient range increases when the longitudinal profile of the reach consists of a sequence of stepped pools accessible to fish.
    - Resident trout and char species can frequently occupy this type of habitat at gradients greater than those inhabited in situations of a less-stepped profile.
    - Coho salmon sometimes spawn and rear in these stepped-pool reaches.

Tongass National Forest Stream Classification Field Guide

Adult Salmonid Migration Blockage Table

FISH SPECIES						
Criterion	Coho	Steelhead	Sockeye	Chinook	Pink/Chum	Dolly Varden
Max. Fall height A blockage may be presumed if fall height exceeds:	11 feet (3.35m)	13 feet (3.96m)	10 feet (3.05 m)	11 feet (3.35 m)	a) 4 feet (1.22 m) with deep plunge pools not flooded at high tide. b) 3 feet (0.91m) without pools.	6 feet (1.83m)
Pool depth A blockage may be presumed if pool depth is less than the following, and the pool is unobstructed by boulders or be bedrock:	1.25 x jump height, except that there is no minimum pool depth for falls: (a) <4 feet (1.2 m) in the case of **coho and steelhead**; and (b)<2 feet (0.6m) in the case of other anadromous fish species.					
Steep channel A blockage may be presumed if channel steepness is greater than the following without resting places for fish:	>225 feet (68.6m) @ 12% gradient >100 feet (30.5m) @ 16% gradient >50 feet (15.2m) @ 20% gradient				>100 feet (30.5m) @ 9% gradient	>50 feet (15.2m) @ 30% gradient

To determine waterfall height (Max. Fall height, as above), measure the additive height of falls only if there is no resting pool.

Fish Sampling

Tongass National Forest Stream Classification Field Guide

Generalized Stream Class and Fish Productivity by Process Group

Process Group	Gradient	Landscape Position	Stream Class	Fish Habitat Production Capability
High Gradient Contained (HC)	>6%	Steep mountain slope	1,2,3,4	Small resident populations
Alluvial Fan (AF)	Variable	Depositional footslopes	1,2,3,4	Low productivity due to dynamic channels and interrupted surface flow
Moderate Gradient Contained (MC)	2-6%	Footslopes. Lowlands, valley bottom	1,2	Resident and anadromous habitats with variable productivity
Moderate gradient Mixed Control (MM)	2-6%	Valley bottom, footslope	1,2	Moderate to highly productive anadromous and resident fish habitat
Low Gradient Contained (LC)	0-2%	Lowlands and valley bottoms	1,2	Moderately productive resident and anadromous fish habitats
Flood Plain (FP)	0-2%	Valley bottom, floodplain	1,2	Diverse and productive anadromous spawning and rearing habitat
Palustrine (PA)	<1%	Peatland-bog, wetlands, valley bottom	1,2	High juvenile rearing potential
Estuarine (ES)	0-3%	Estuary, tidal deltas	1	Highly productive anadromous spawning habitat
Glacial Outwash (GO)	Variable	Glacial valleys	1,2,3	Fish habitat concentrated in channel margins and side channels

Estuarine Process Group (ES)

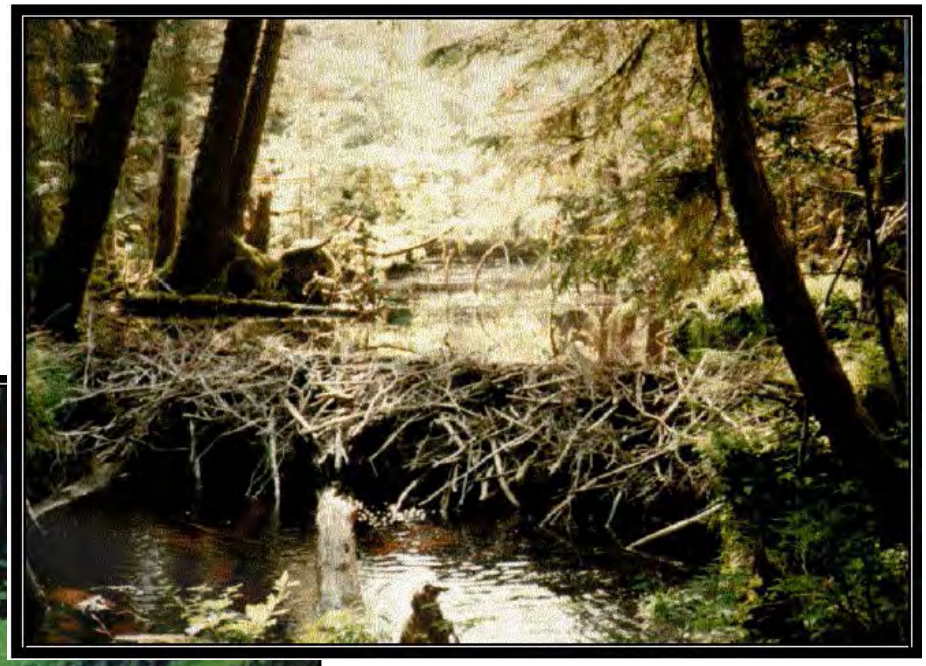
- **Directly influenced by tidal inundation**
- **High fisheries value**
- **Sediment storage**

Floodplain Process Group (FP)

- **High stream flows are not contained within banks; flood plain development is evident**
- **Stream banks composed of easily eroded alluvial material**
- **Large wood recruited from riparian forest creates complex habitat**
- **Prime fish habitat**
- **Sediment storage**

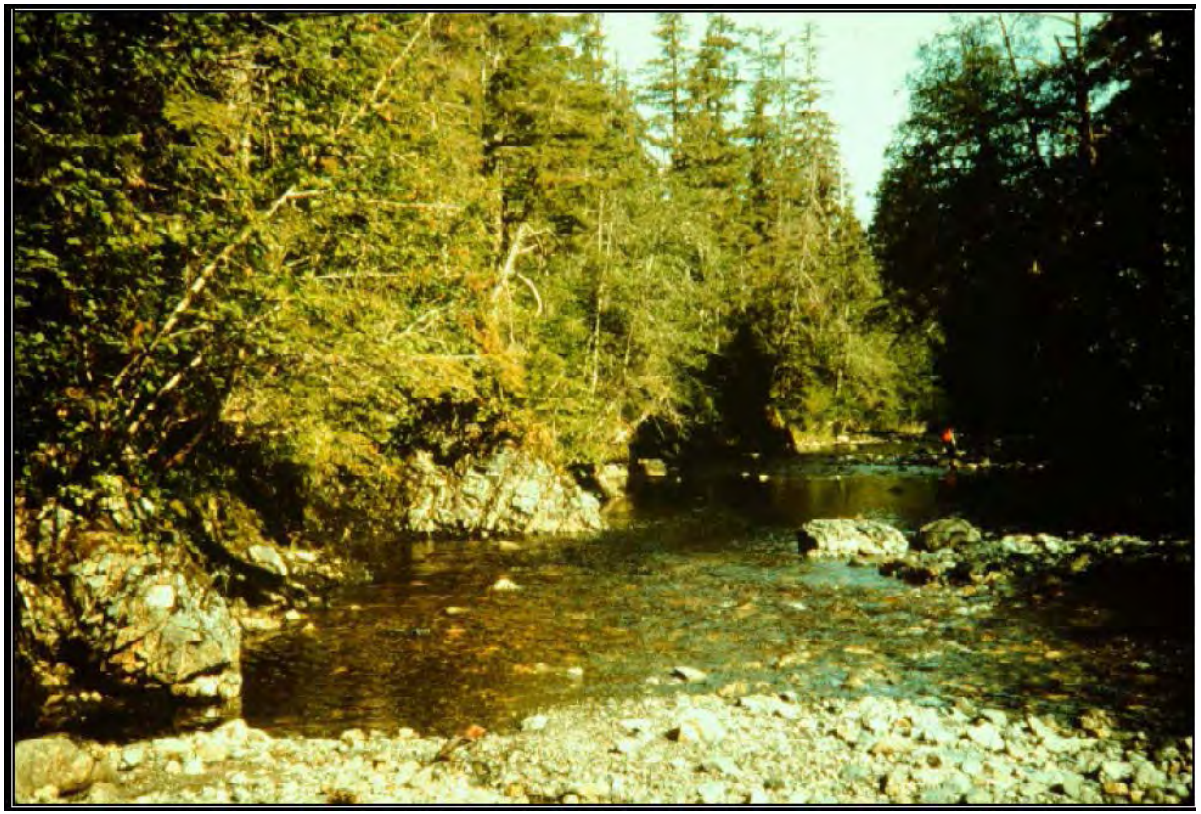
Palustrine Process Group (PA)

- **Placid flow wetland streams**
- **Also, beaver ponds**
- **High fisheries value**
- **Sediment storage**



Low Gradient Contained (LC)
Moderate Gradient Contained (MC)

- **Bedrock in stream bed and banks**
- **Low to moderate aquatic habitat value (barriers)**
- **Sediment transport**



Moderate Gradient Mixed Control (MM)

- **Mixture of bedrock and alluvium in stream bed and banks, limited floodplain development**
- **Moderate to high fish habitat value**
- **Sediment transport**

Alluvial Fan (AF)

- **Transition between steep mountain slopes and valley floor**
- **Bank erosion, multiple channels, intermittent surface flow**
- **Large wood triggers avulsions, but also creates stability**
- **Moderate fish habitat value – groundwater upwelling**
- **Sediment transport & deposition**

Pro's and Con's of Tongass Stream Identification Methodology

- Provides information on fluvial processes, which determine how streams function in life histories of salmon
- Ground truthing occurs at project level

- Allows physical habitat call (w/o sampling)
  - Harder to prove absence than presence
  - Physical model over-predicts
- Does not account for stream barriers that limit the actual distribution of salmon (enhancement opps)
- Mapping is more intensive in areas where projects have occurred
- Generally, side channels tend to be underrepresented
- No species specific endpoints as in the Anadromous Waters Catalog

Staney Creek Comparison

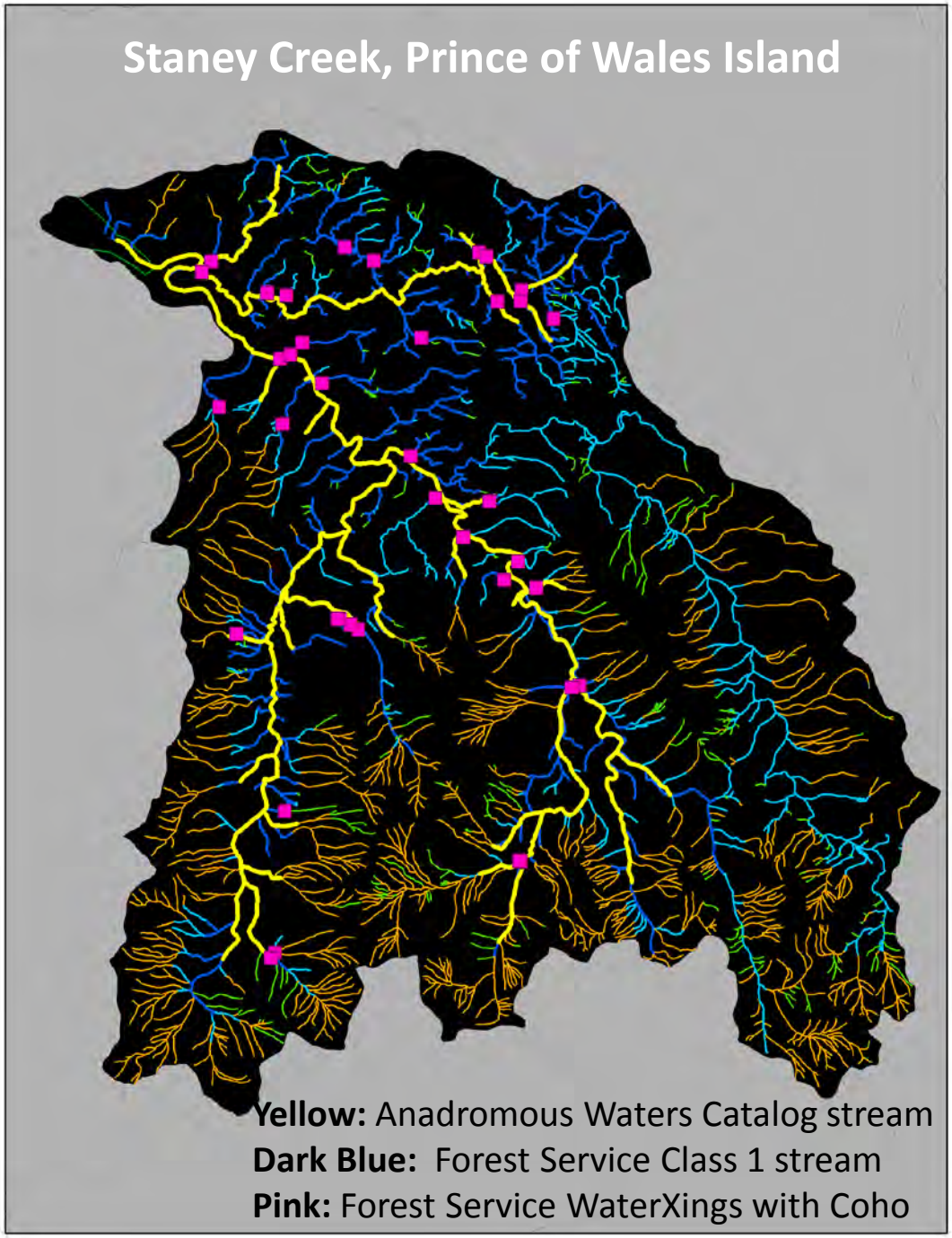
Anadromous Waters Catalog = 43 miles
Forest Service Class I = 105 miles

41% representation in AWC

Tongass-wide Comparison

Anadromous Waters Catalog=5,259 miles
Forest Service Class I = 14,873 miles

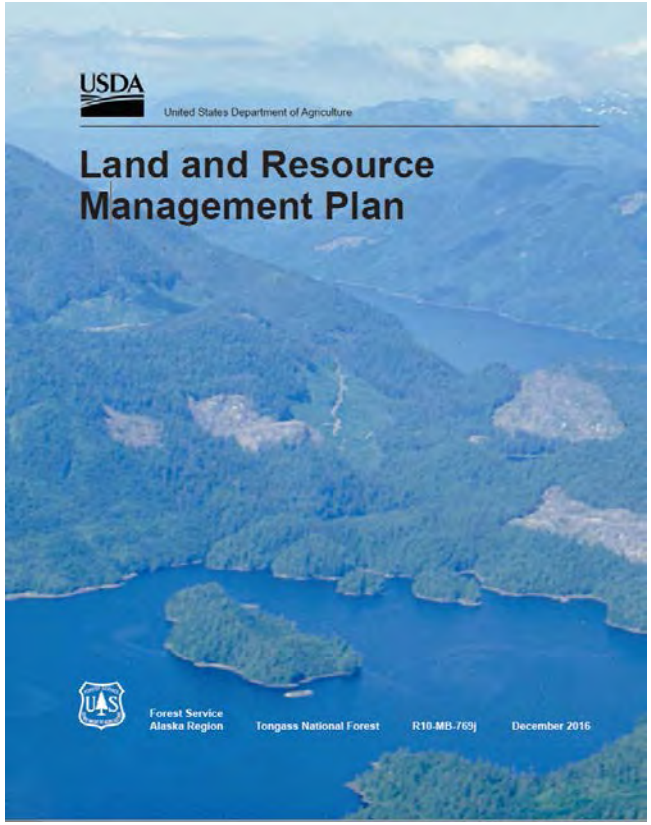
35% representation in AWC



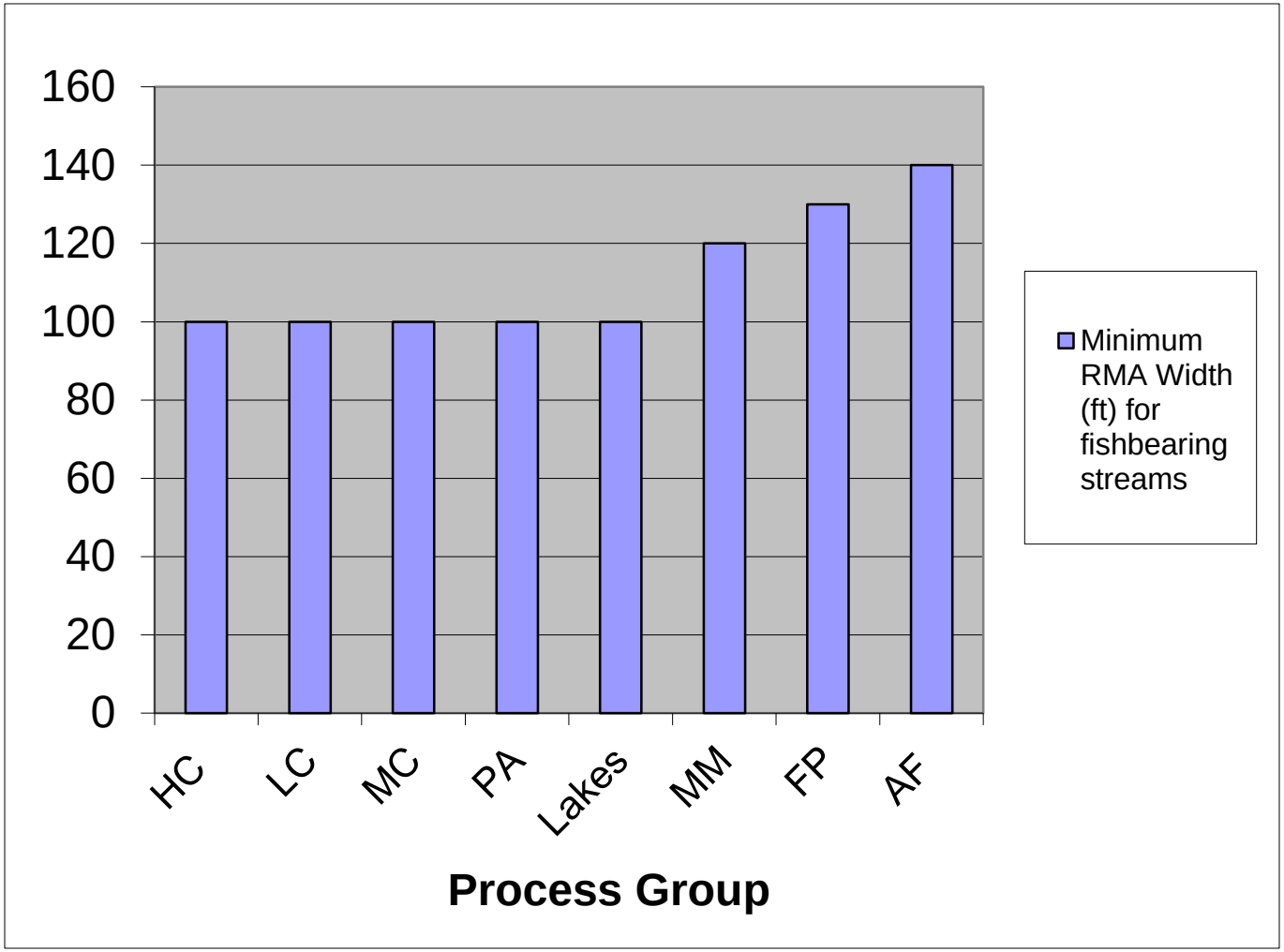
Protections Applied to Fish Bearing Streams

-Guides all natural resource management activities

- Establishes management standards and guidelines

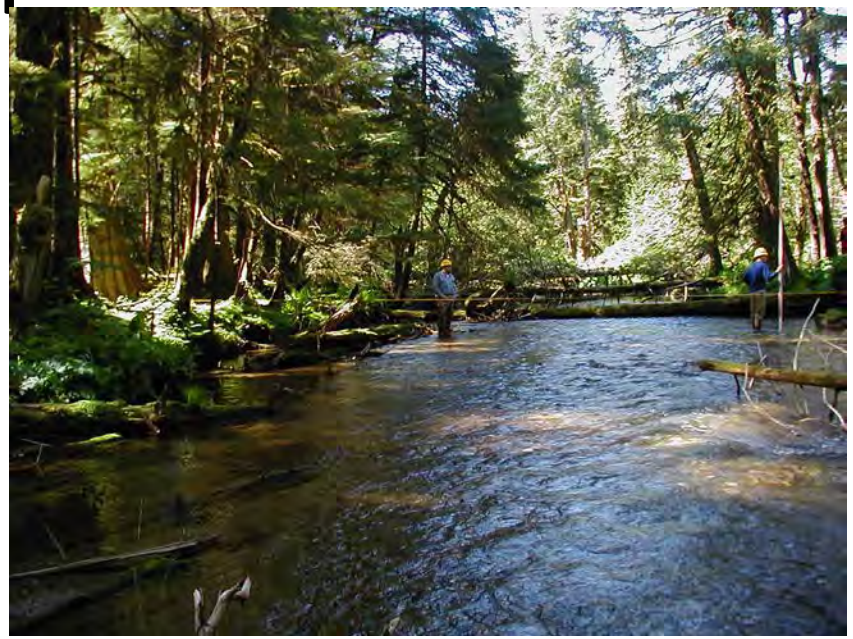


Riparian Management Area Widths by Stream Process Group for Fish Streams

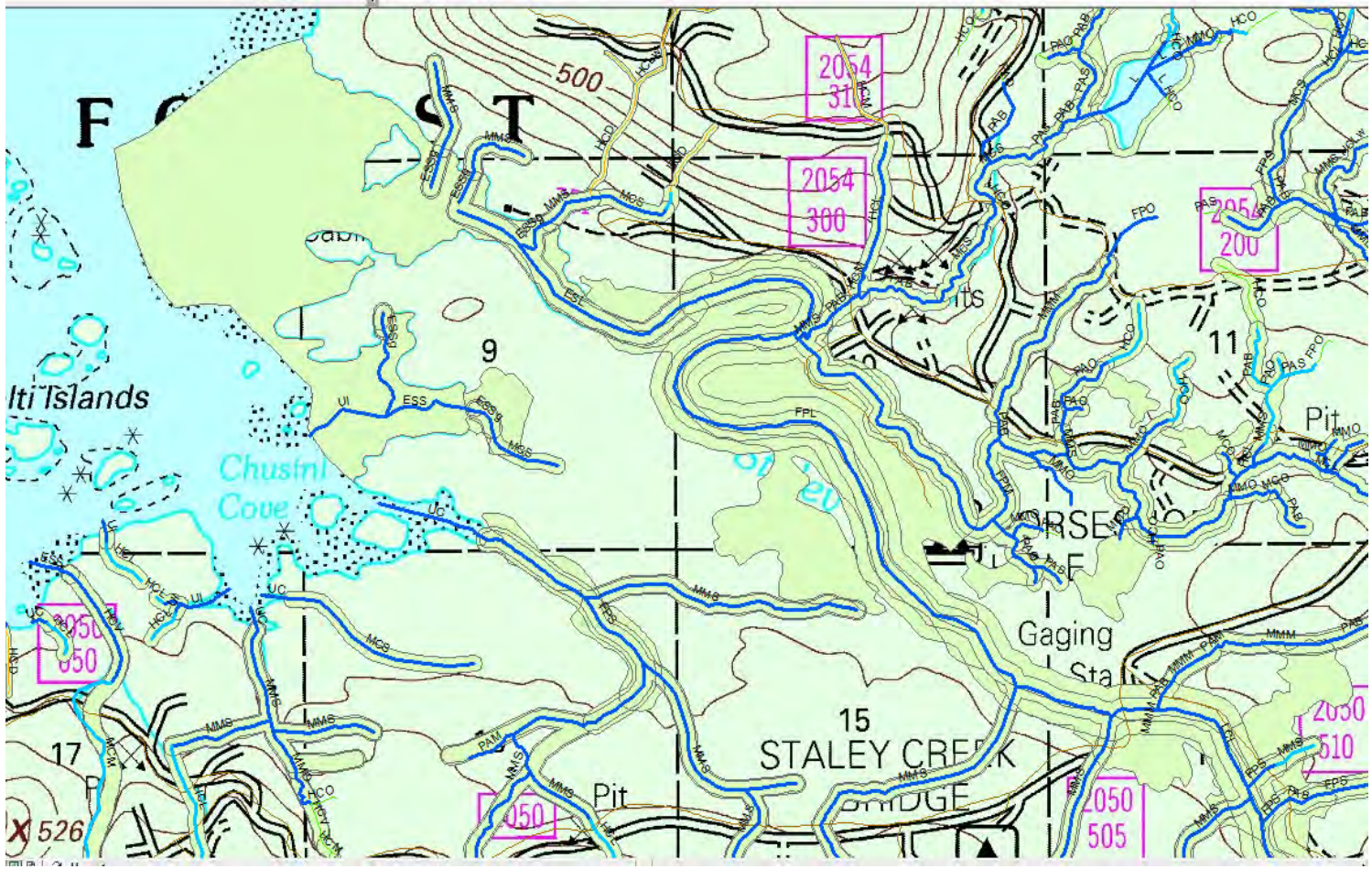


Flood Plain Riparian Rx

- No timber harvest within a minimum of 100 ft of fish bearing streams (TTRA).
- No harvest within RMA (greatest of flood-prone /wetland extent or 130 ft)
- Manage adjacent stands to maintain the integrity of RMA buffers (wind firm buffers).

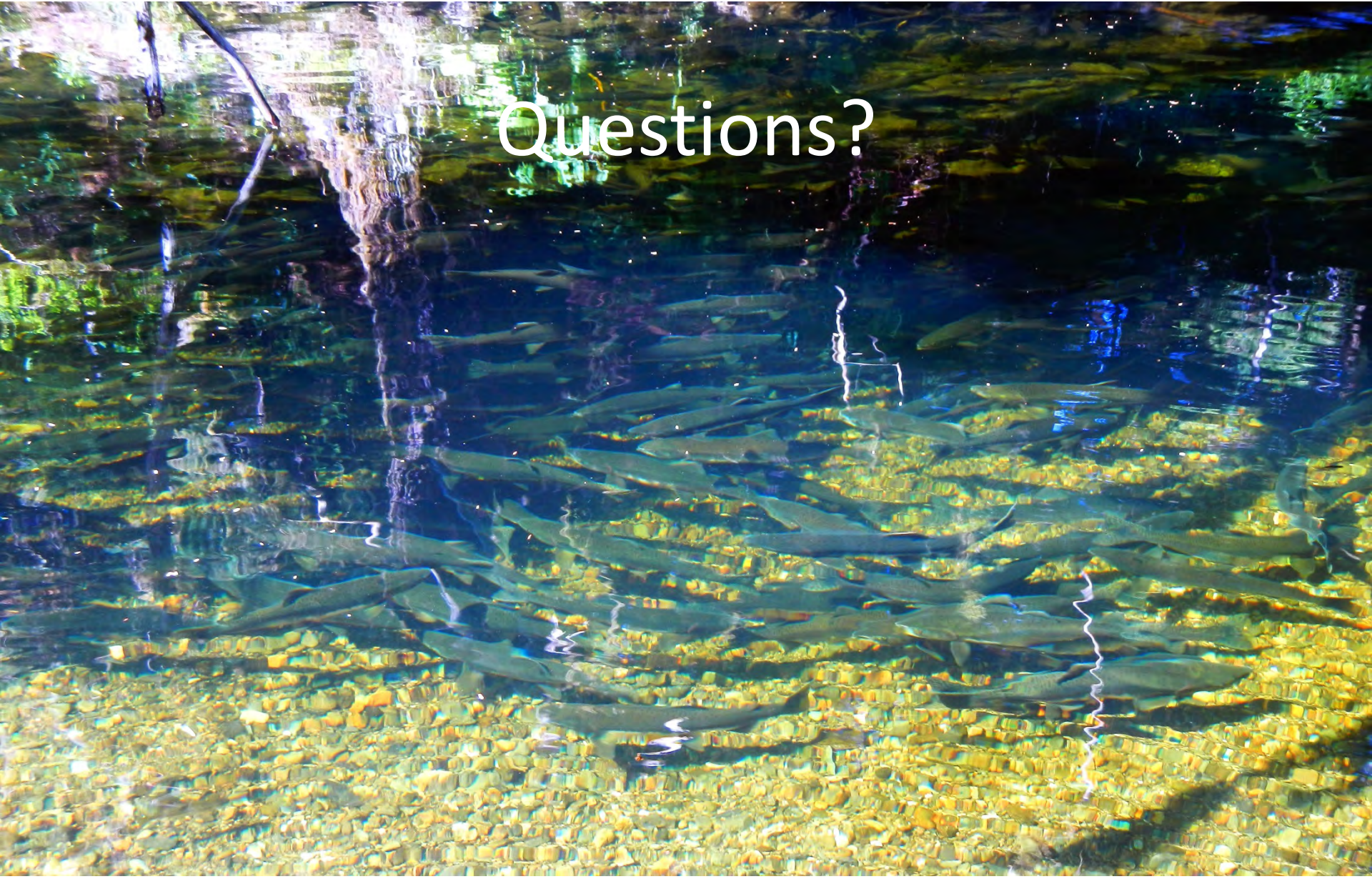


Riparian Management Area Stream Buffer Delineations



Monitoring and Evaluation

- Quality control process for Plan implementation
- Provides information to facilitate adaptive management


Questions?

Authority

- Multiple-Use, Sustained-Yield Act of 1960
- National Environmental Policy Act (NEPA)
- National Forest Management Act (NFMA) 1976
- 36 Code of Federal Regulations, Section 219 1982
- Clean Water Act (CWA) 1972
- Tongass Timber Reform Act (TTRA) 1990
- Alaska National Interest Lands Conservation Act (ANILCA) 1980
- Recreational Fisheries Executive Order 1995

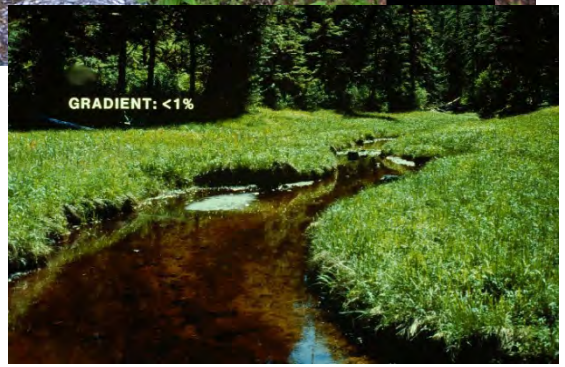
Policy

- National Riparian Policy (FSM 2526.03) 5/2004
- Regional Riparian Policy (FSM 2526 R-10 Supplement) 5/2006
- National Water Quality Management Policy (FSM 2500)
  - National Best Management Practices Technical Guide 2012
- Regional Soil and Water Conservation Handbook (FSH 2509.22, Chapter 10, Best Management Practices) 2006
- National ENG Manual Direction – Fish passage
- Timber Sale Contract Clauses

External Coordination

- **FS AK Region–ADF&G MOU –Fish Protection**
- **Tongass-ADF&G MOU – Wildlife and Fisheries monitoring** (expired)
- Fish Transport Permit
- Fish Resource (sampling) Permit
- Best Management Practices MOU
- Clean Water Act
- Magnuson-Stevens Fishery Conservation & Management Act (Essential Fish Habitat)
- Endangered Species Act
- Executive Orders – Floodplain and Wetlands

Typical Class I streams

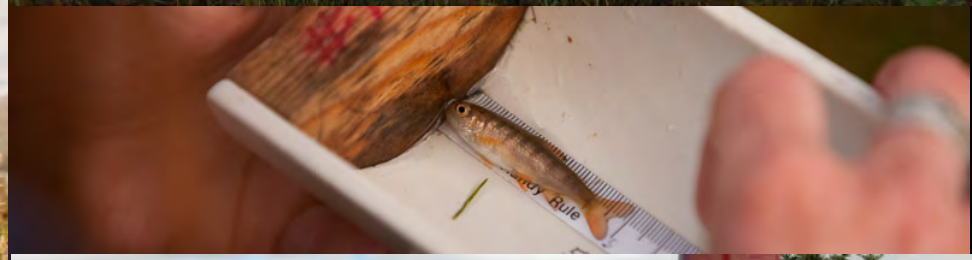


Defining fish habitat in Alaska Waters

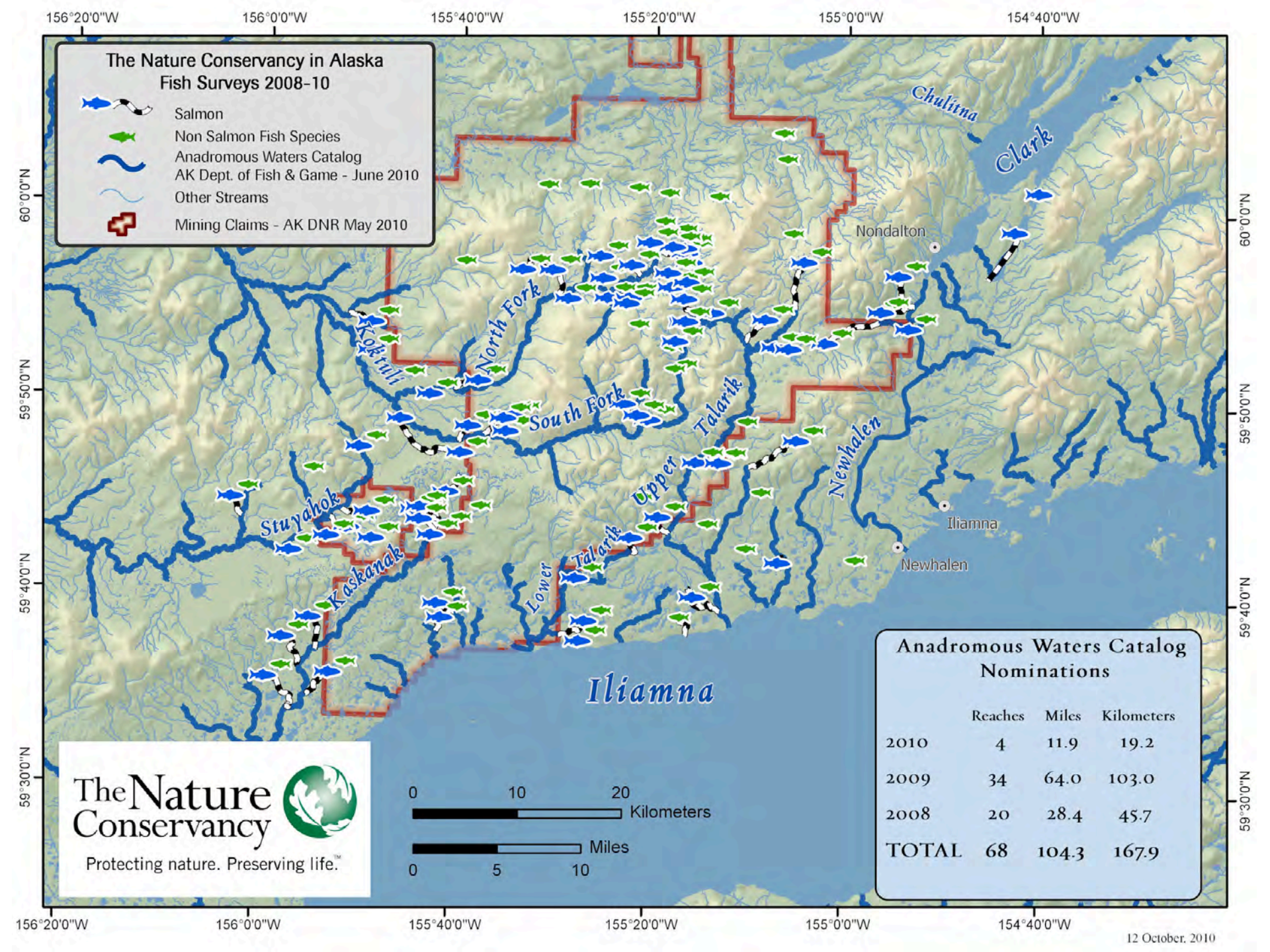
Sarah O'Neal
University of Washington
March 1, 2018

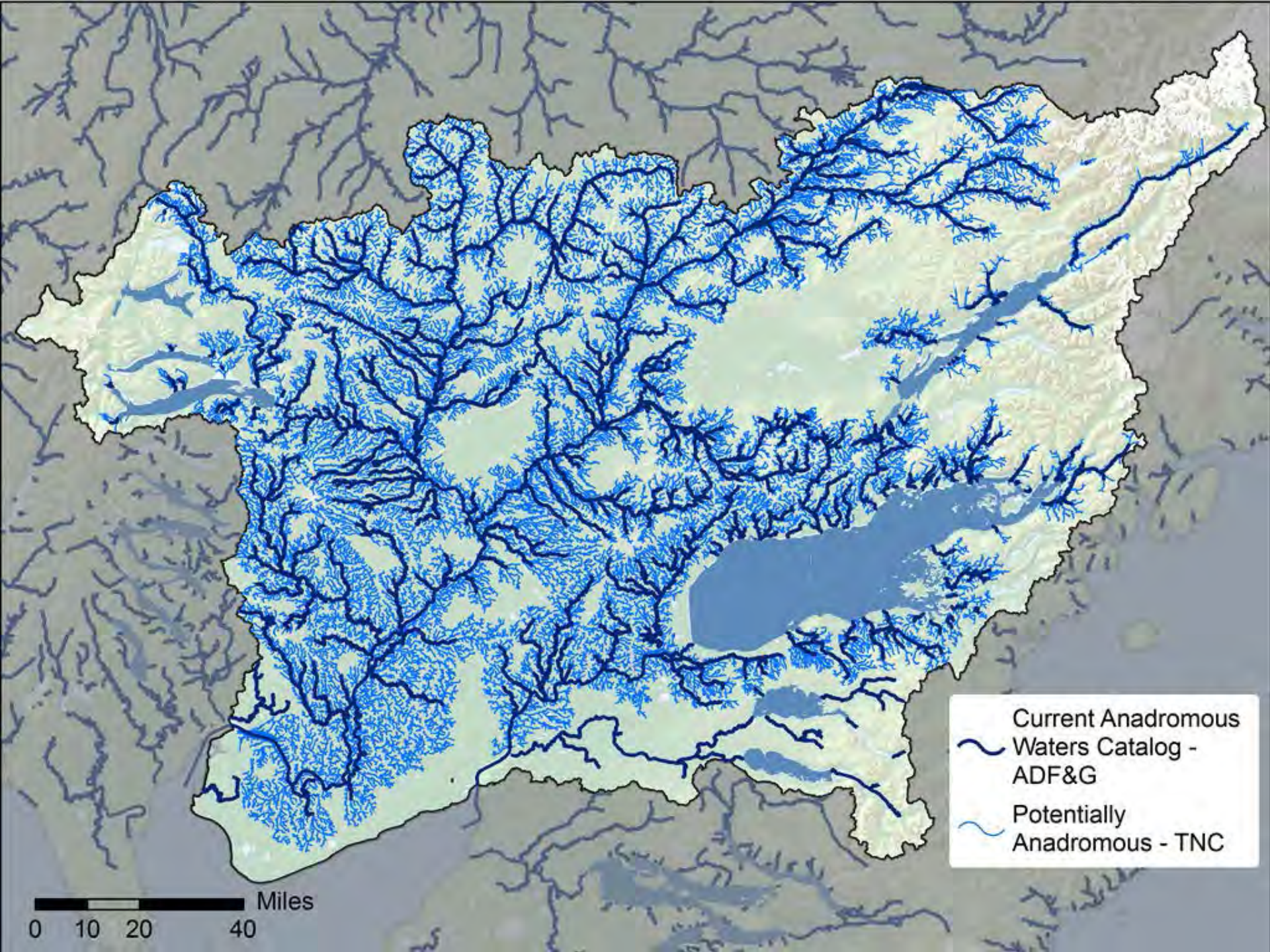
Project area


TNC

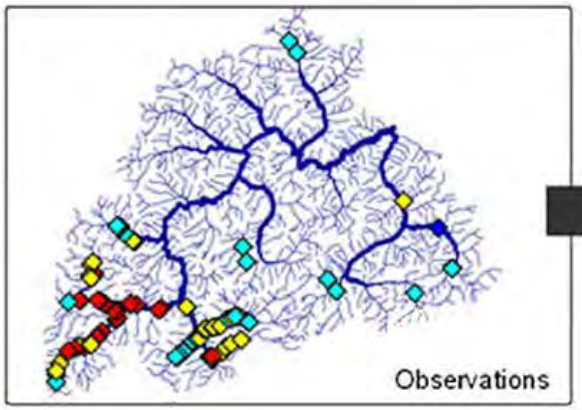


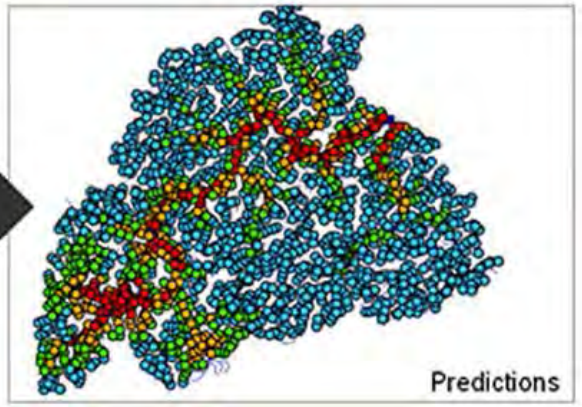

R44
Clipper II
Helipod
R44

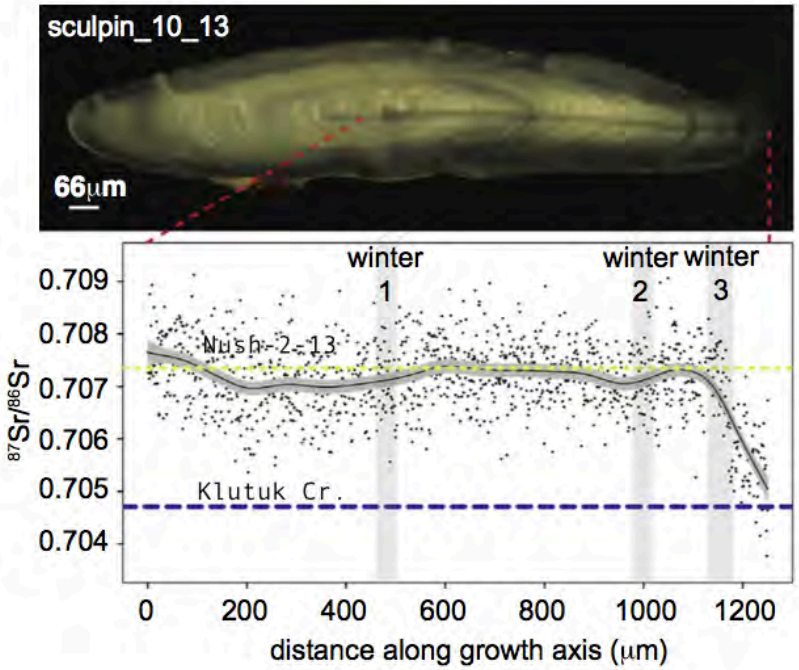

The Nature Conservancy in Alaska
Fish Surveys 2008-10
Salmon
Non Salmon Fish Species
Anadromous Waters Catalog
AK Dept. of Fish & Game - June 2010
Other Streams
Mining Claims - AK DNR May 2010
156°20'0"W
156°0'0"W
155°40'0"W
155°20'0"W
155°0'0"W
154°40'0"W
60°0'0"N
59°50'0"N
59°40'0"N
59°30'0"N
Chulitna
Clark
Nondalton
Kokhuli
North Fork
South Fork
Talarik
Upper Talarik
Lower Talarik
Newhalen
Stuyahok
Kaskanak
Iliamna
Iliamna
Newhalen
0
10
20
Kilometers
Miles
0
5
10
Anadromous Waters Catalog Nominations
Reaches
Miles
Kilometers
2010
4
11.9
19.2
2009
34
64.0
103.0
2008
20
28.4
45.7
TOTAL
68
104.3
167.9
The Nature Conservancy
Protecting nature. Preserving life.™
12 October, 2010

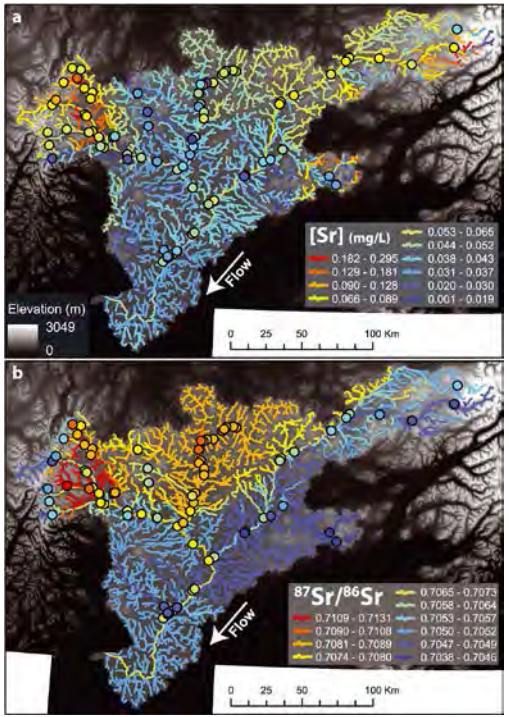

Current Anadromous Waters Catalog - ADF&G
Potentially Anadromous - TNC
Miles
0 10 20 40

Spatial Stream Network Model

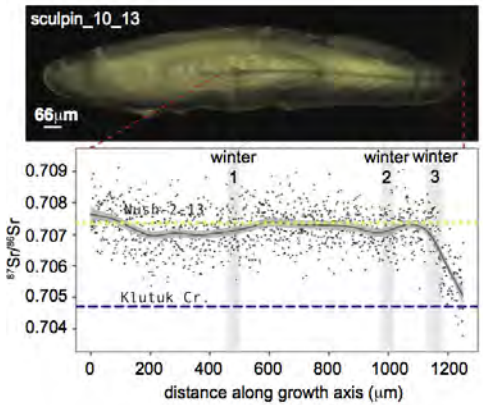




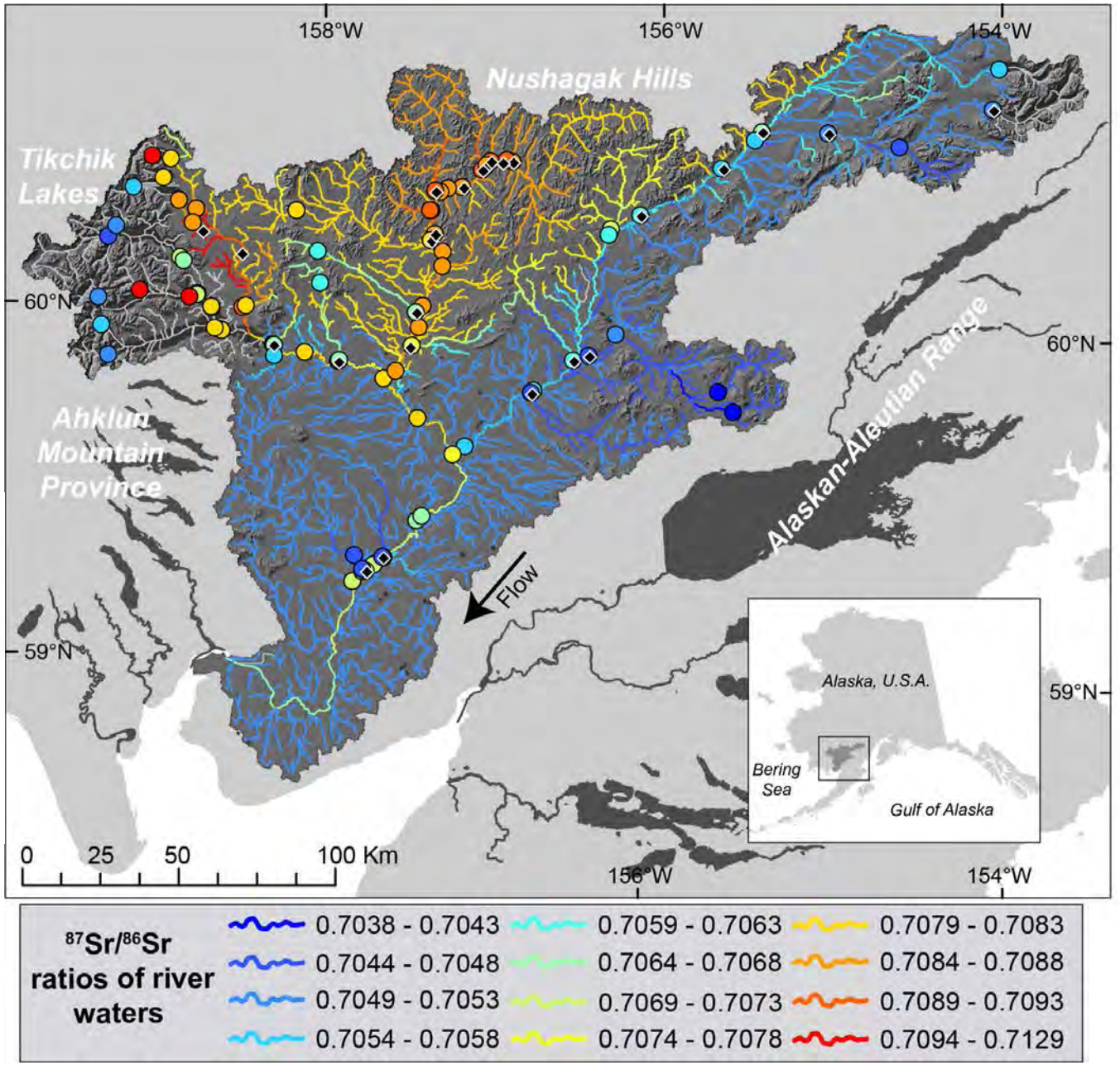




Chinook Strontium *ISOSCAPE*

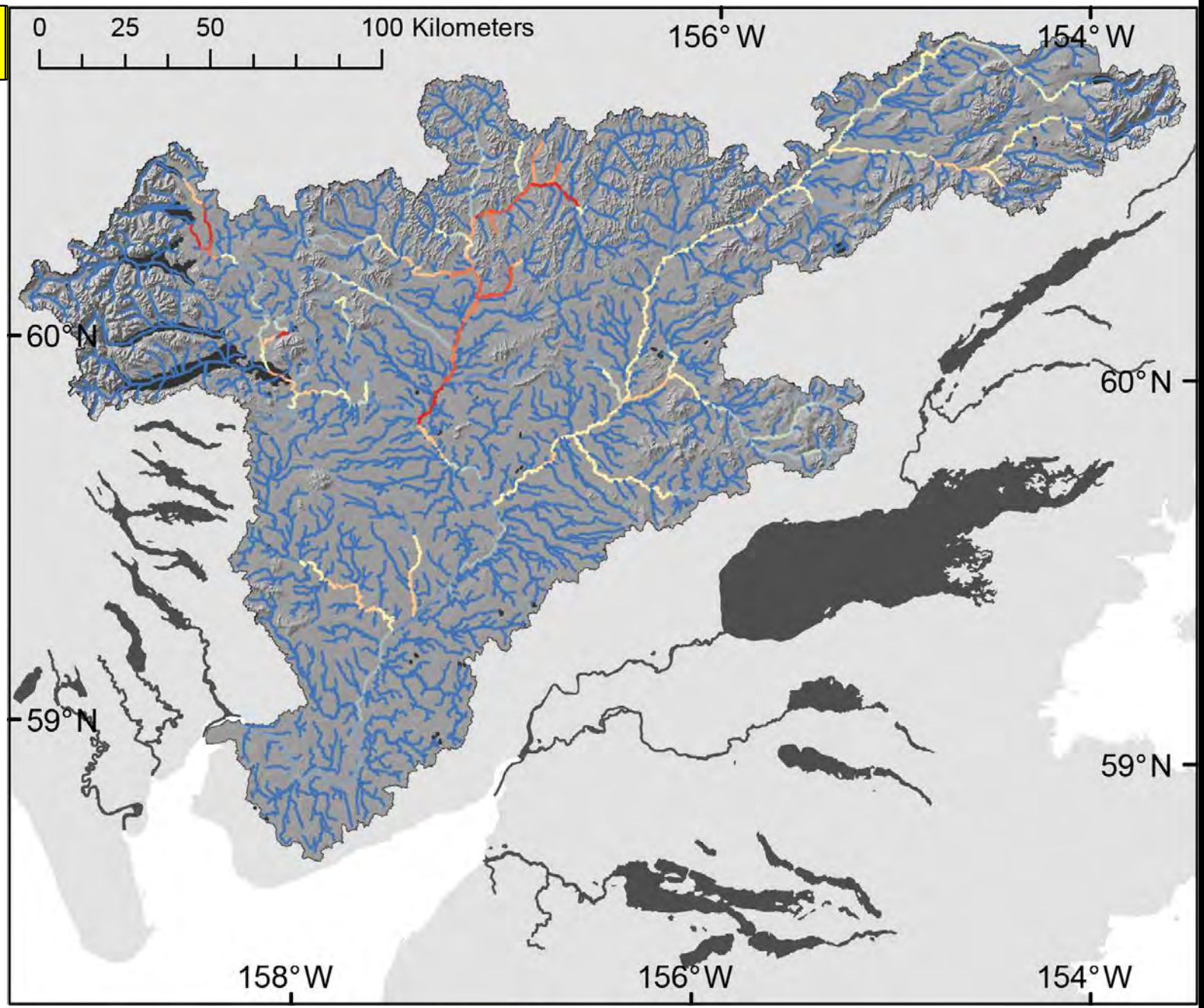


Use this to Determine Natal origins of Chinook salmon



Production patterns of Chinook salmon

2011



What is environmental DNA (eDNA)?

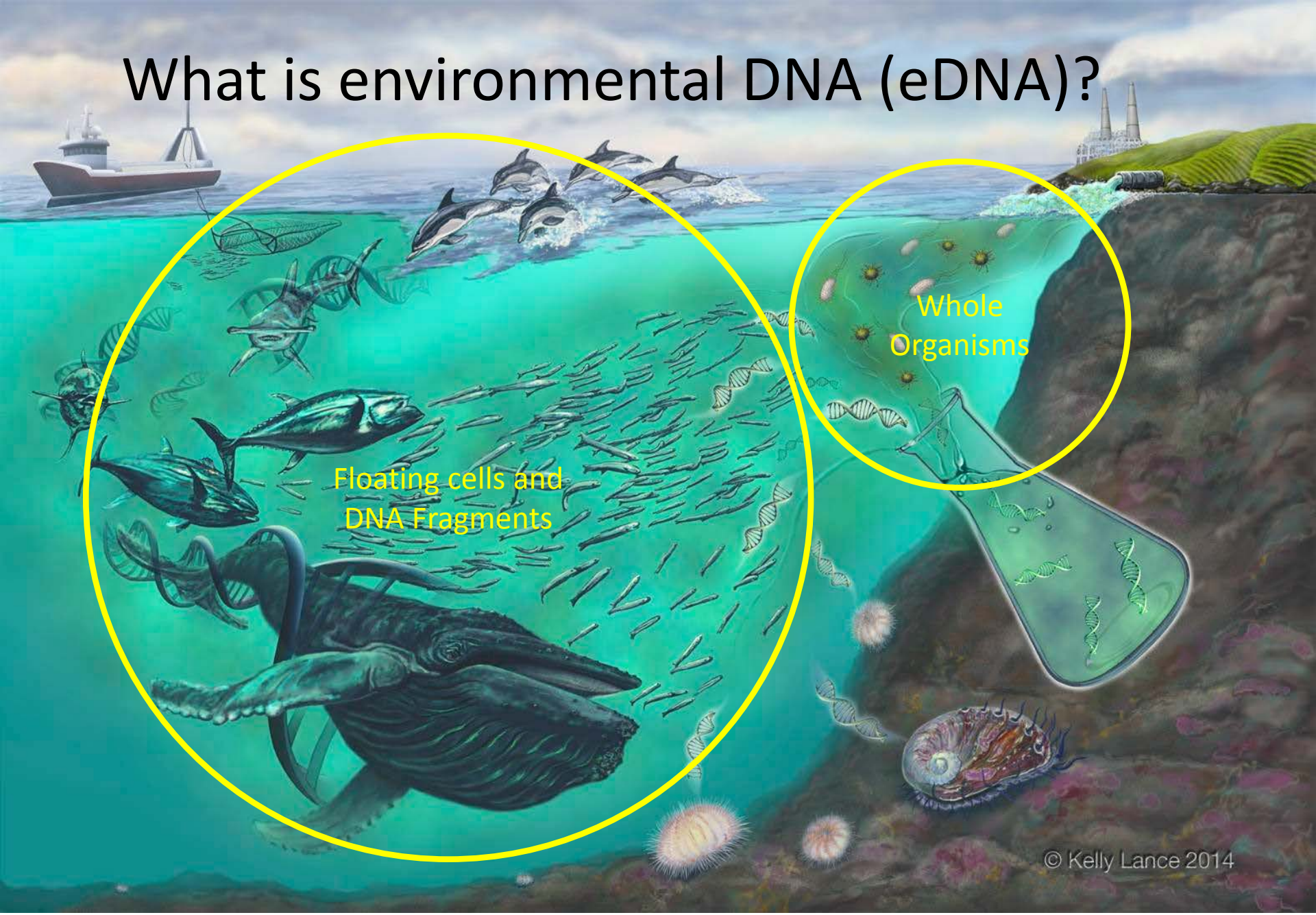
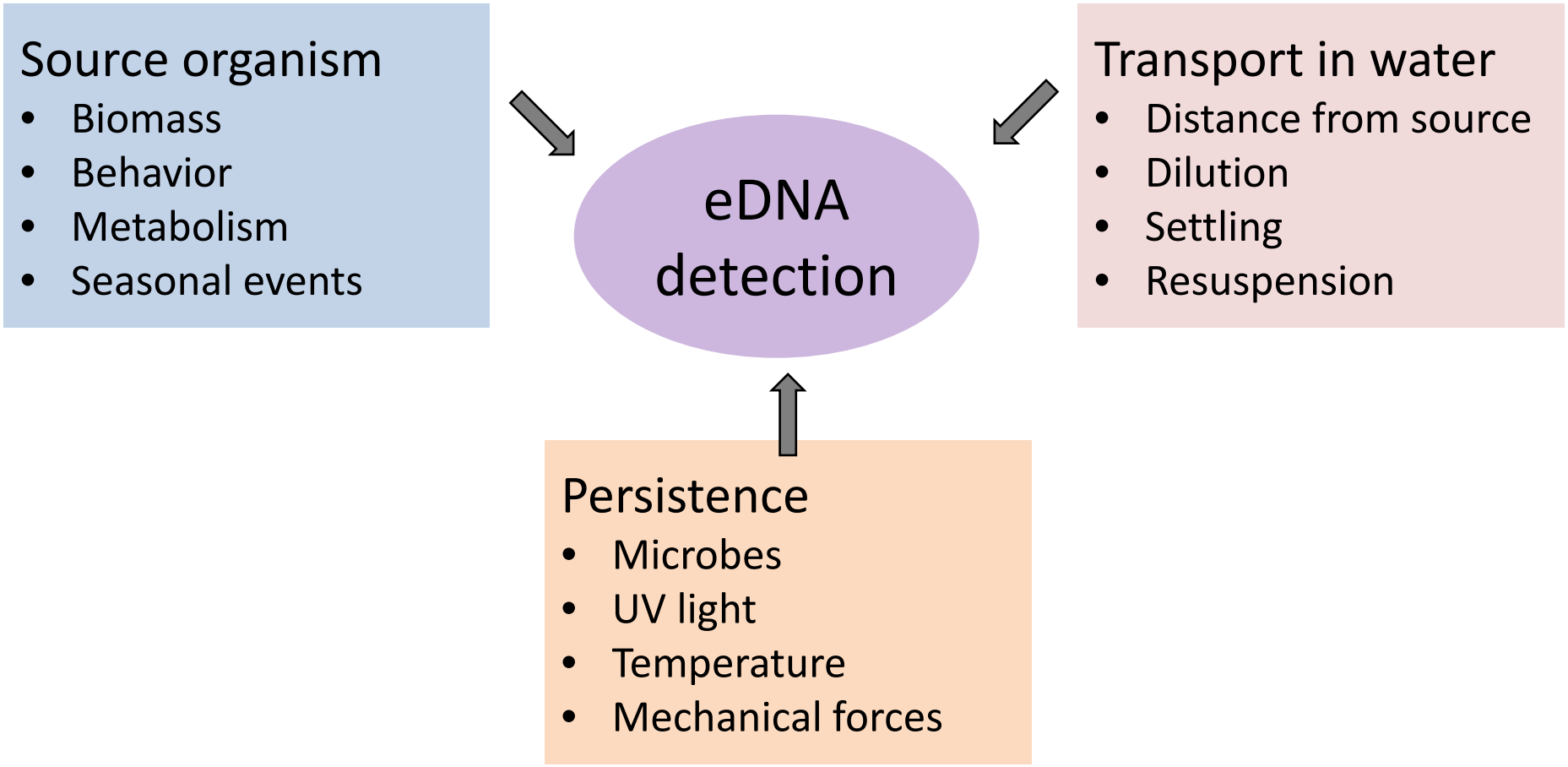


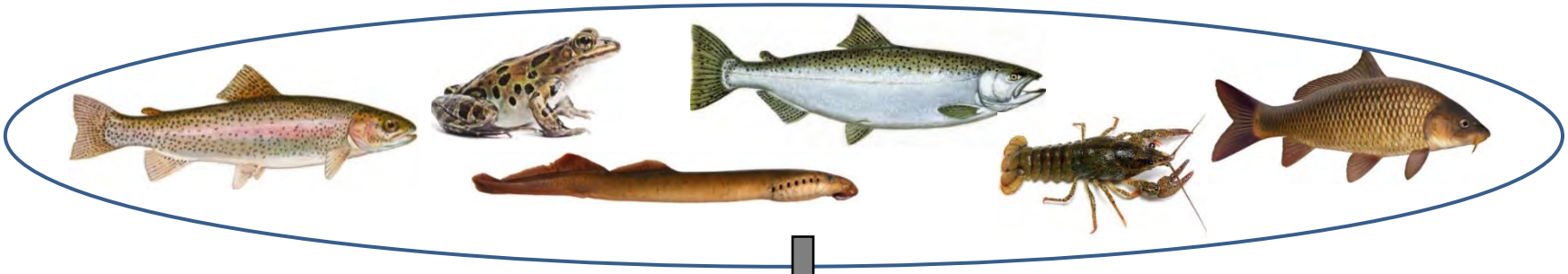
Image: Kelly Lance

Ecology of eDNA: factors that effect detection rate

- Detection is influenced by accumulation and removal of eDNA in the environment



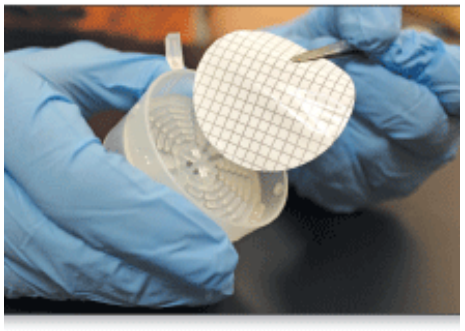
eDNA: from source to lab

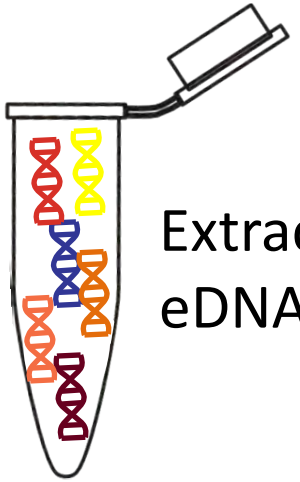


Genetic material shed into aquatic environment

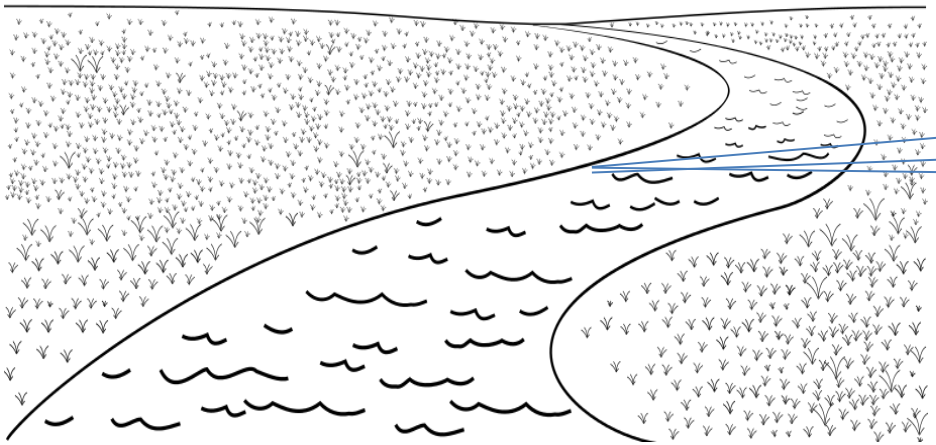
- Waste products (feces, urine)
- Mucous
- Tissues
- Cells
- Gametes

eDNA

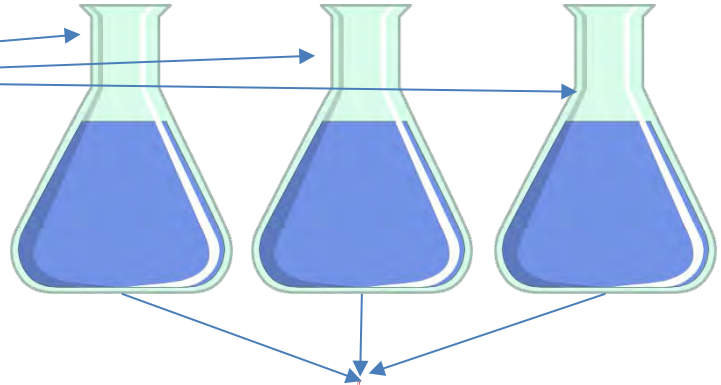


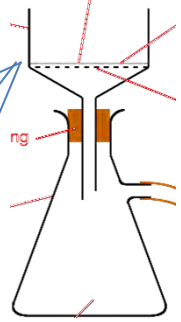


Extracted eDNA

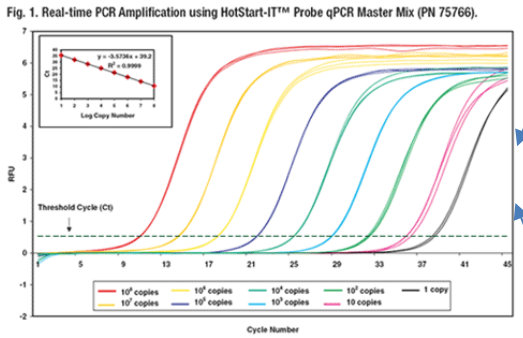


Collect 3 X 1L stream water

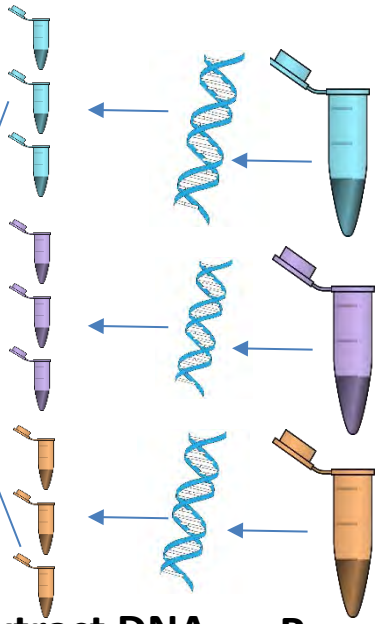




Filter on to 0.4 micron cellulose filter paper



Analyze DNA



Extract DNA

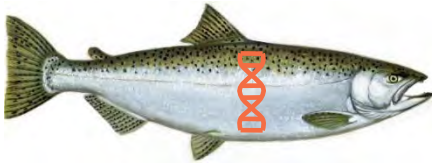
Preserve in ethanol

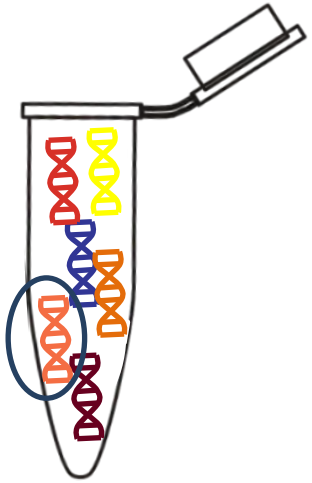
Common eDNA detection methods

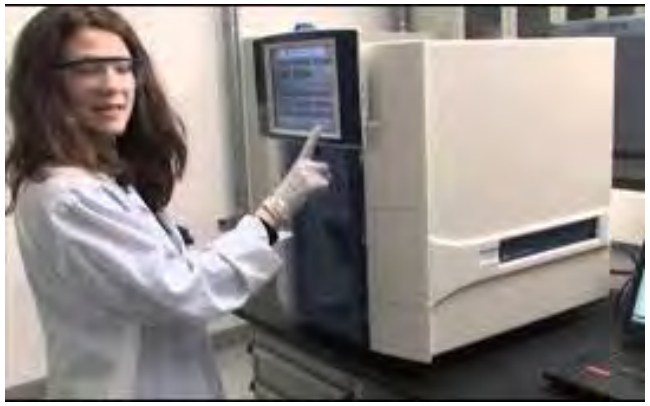
1. Single species detection

- Target single species
- Apply species-specific genetic marker

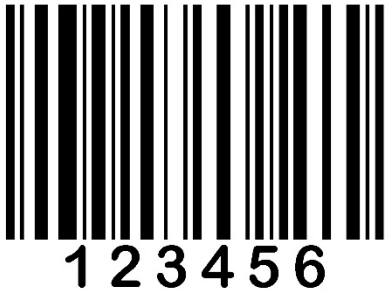
Ex: Chinook salmon





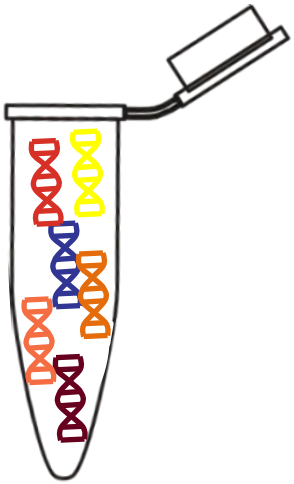


Common eDNA detection methods

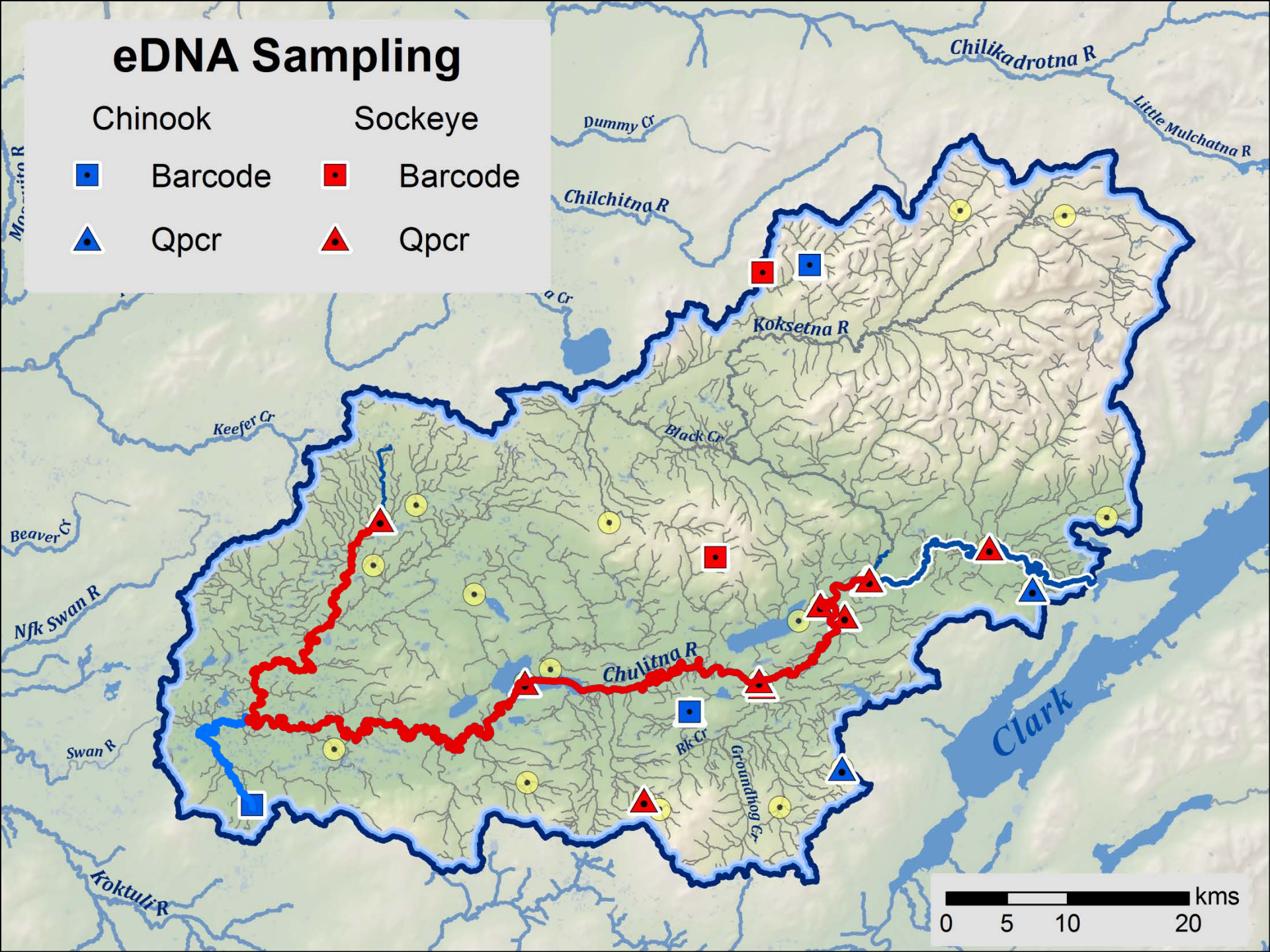


2. DNA metabarcoding

- Target multi species (biodiversity assessments)
- Involves sequencing the pool of DNA from environmental sample
  - Millions of sequence reads returned



USGS


eDNA Sampling
Chinook
Barcode
Qpcr
Sockeye
Barcode
Qpcr
Chilikadrotna R
Little Mulchatna R
Dummy Cr
Chilchitna R
Koksetna R
Keefer Cr
Black Cr
Beaver Cr
Nfk Swan R
Chulitna R
Clark
Swan R
Bk Cr
Groundhog Cr
Koktuli R
kms
0
5
10
20

eDNA-based sampling is a big change from traditional sampling methods

vs.

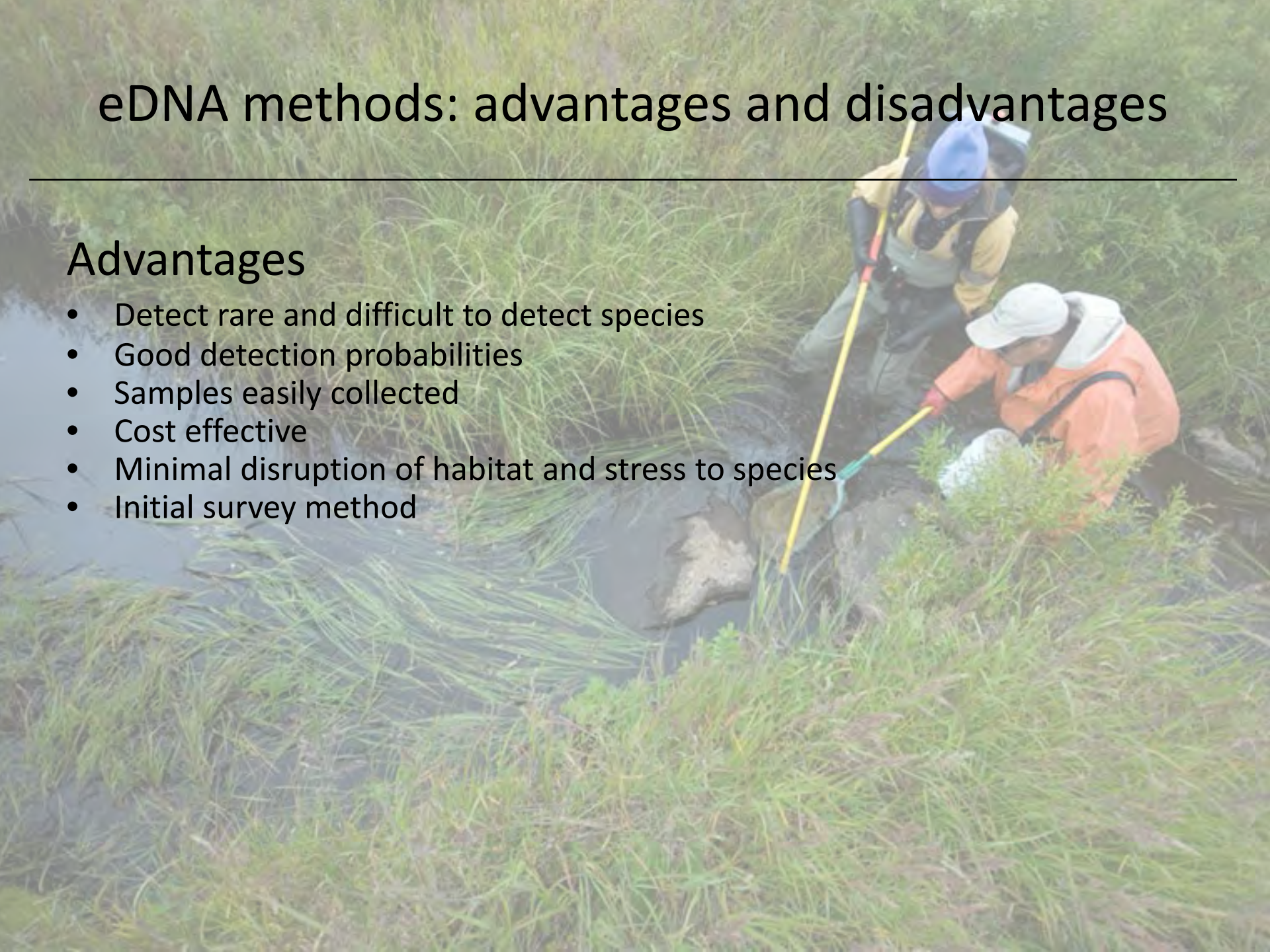
- eDNA results are comparable to electrofishing results

Photo: Tom Quinn

eDNA methods: advantages and disadvantages

Advantages

- Detect rare and difficult to detect species
- Good detection probabilities
- Samples easily collected
- Cost effective
- Minimal disruption of habitat and stress to species
- Initial survey method



eDNA methods: advantages and disadvantages

Advantages

- Detect rare and difficult to detect species
- Good detection probabilities
- Samples easily collected
- Cost effective
- Minimal disruption of habitat and stress to species
- Initial survey method

Disadvantages

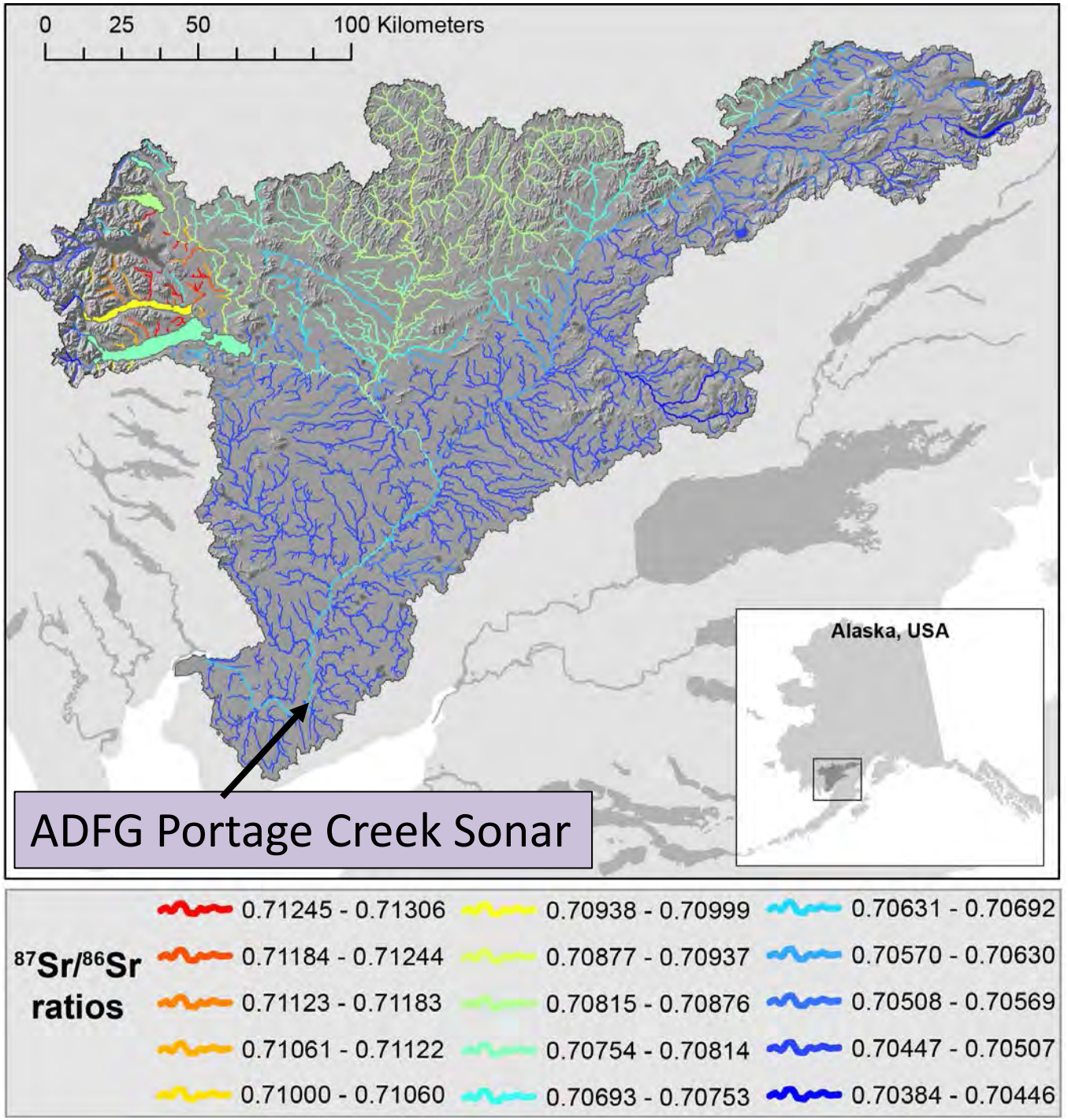
- Species presence is not verified visually
  - Presence is inferred
- False positives – detected but actually not present
- Does not differentiate live from dead
- Does not differentiate life histories

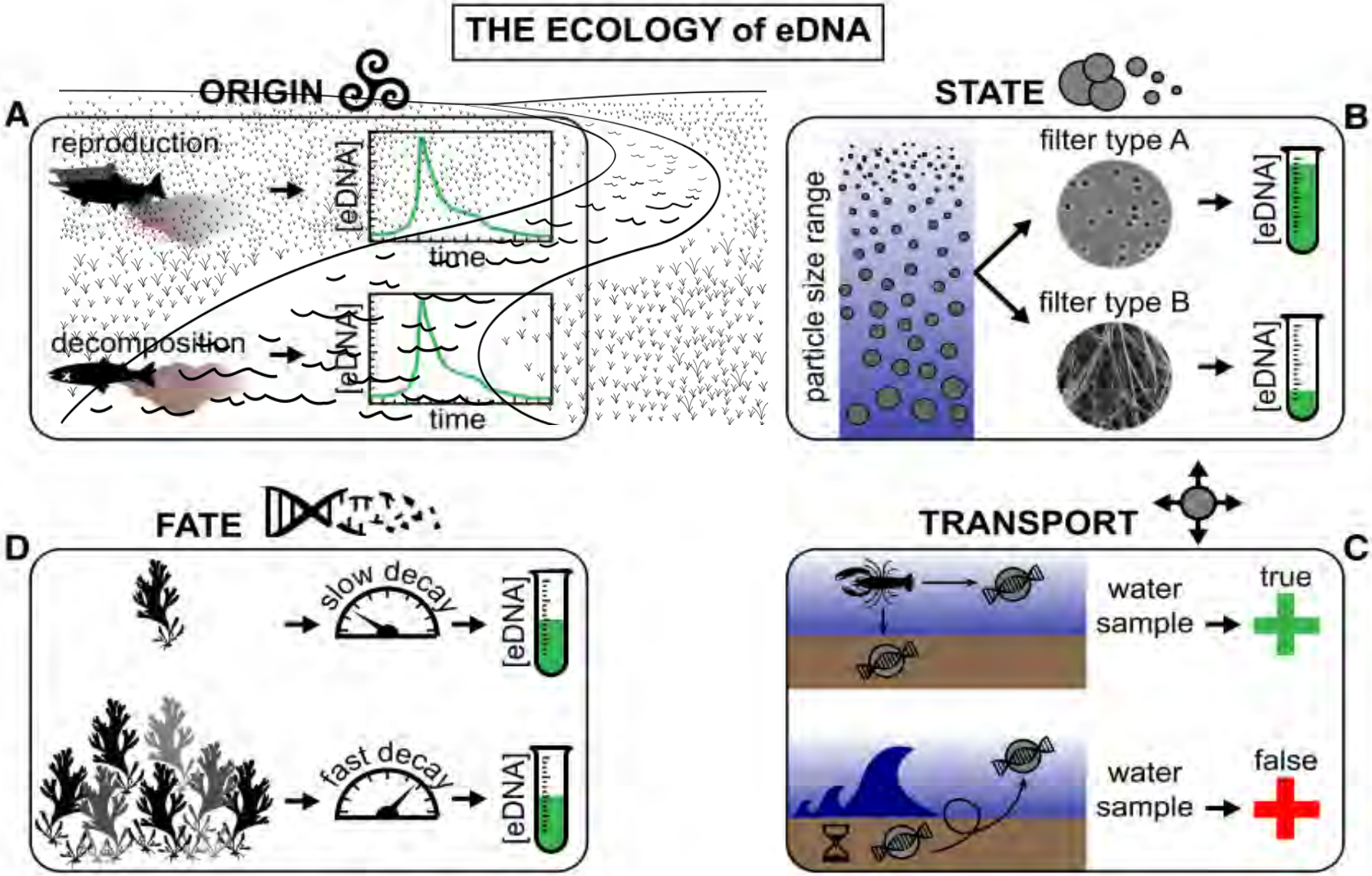
Questions?

Questions?

Sockeye Strontium *ISOSCAPE*

Use this to Determine Natal origins of Sockeye salmon





Barnes and Turner 2015

- Insert Fisheries eDNA cost comp