Why are we sampling where we are and what will CHaMP data be used for?
What is CHaMP’s objective?

• Describe fish habitat in the Columbia River basin.
  • The CRB is actually sort of big.
  • Need to refine the question a bit.

• Describe fish habitat in some of the salmon population watersheds in the CRB.
CHaMP Watersheds

Not a random sample, but is it a biased set?
Salmon Population Watersheds in Columbia River basin

• Watersheds
  • Vary by eco-region
  • Vary in degree and type of human impact
  • Vary in extent of impacts of hatchery production

• We can compare CHaMP-watersheds to all watersheds in the CRB
Natural landscape classes within CHaMP domain
CHaMP HUC6 within steelhead domain

- Hot, dry, low erodibility: 7
- Very warm, dry, erodible: 4
- Cool, high: 4
- Warm, low slope, mixed erodibility: 1
- Warm, low erodibility: 2
- Warm, low, steep: 47
- Dry, mid-elev, mod slope: 3
- Cool, wet, mid-elev, erodible: 7
- Wet, cool, high, moderate erodibility: 24
- Cascades: 1

**Legend:**
- **CHaMP**
- **Not in CHaMP**
What is CHaMP’s objective?

• Describe fish habitat in the Columbia River basin.
  • The CRB is actually sort of big.
  • Need to refine the question a bit.

• Describe fish habitat in some of the salmon population watersheds in the CRB.
  • These watersheds are actually sort of big.
  • Need to further refine the question.

• Describe fish habitat in a set of reaches in a set of salmon population watersheds in the CRB.
Methow River ~4000 km of streams

We’re going to visit 25 each year – which ones?

GRTS (Generalized Random Tessellation Stratified) Master Sample
- Spatially balanced
- Randomized

How to represent a population of 4000 with a sample of 25?

First define the population of interest
Target frame
- Wadeable
- Accessible
- Perennial

~350 km

Rotating panel design
15 annual sites
10 “rotating” sites
How and Why are sites within the target frame chosen?

- Strata or features of interest
- Experimental designs
- Spatial pattern of natural variability

- Why does this matter?
Ordination By Watershed

Normalise
Resemblance: D1 Euclidean distance

watershed

2D Stress: 0.18

- Nason/Tumwater
- White River
- Icicle/Chumstick
- Chiwawa River
- Upper Wenatchee River
- Lower Wenatchee River
Ordination By Ownership

Normalise
Resemblance: D1 Euclidean distance

Ownership
▲ Private
▼ Federal

2D Stress: 0.18
So What?
Difference between naïve vs. informed analyses

Median particle size $D_{50}$ (mm)

**Disturbance level**
- Low
- High

**Reach type**
- Mountain
- Floodplain + Constrained

**Naive**

**Informed by classification**

**Disturbance**
- Low
- High

Difference between naïve vs. informed analyses
Leveraging CHaMP/ISEMP Habitat-Fish Models Across Watersheds

- CHaMP Habitat Metrics can be modeled from a small set of geomorphic attributes
  - Surface Gradient, Valley Class, Disturbed Class Name, Primary Bedform Class, Elevation, Strahler Order, Discharge
- Watershed-watershed differences are largely explained by these attributes.

- Watersheds are unique
  - They're made from a different combinations of geomorphic attributes

- Watersheds are not Special
  - Within geomorphic attributes, things are pretty much the same this holds for a wide range of habitat metrics
Network Models

• Provide means to scale up data to watershed or sub-watershed scale
  • Uses coarse level data to fill in blanks
  • Spatially explicit predictions

• Use network models to extrapolate site level parameter estimates for watershed scale products

• Provide means to extend identified relationships to data poor or un-sampled areas
Network Model: carrying capacity

Carrying Capacity

8.0 fish / m

0.5 fish / m
Watershed capacity:
41,091 redds
Steelhead juvenile capacity

Watershed parr (60 – 99 mm) capacity:  
3.7 parr/m

Watershed pre-smolt (≥100 mm) capacity:  
2.7 pre-smolt/m
Estimated rearing capacity – juvenile O. mykiss
Intensively Monitored Watersheds, Life Cycle Models

Map Produced by Carol Volk, SFR
CHaMP / PIBO monitoring locations relative to Steelhead Populations and MPGs
Spatial overlap in some areas, not as much in others.
Spatial overlap in some areas, not as much in others.
Why CHaMP Camp?
2009: Within Site Variability

- In 2009, sites were surveyed multiple times (mostly 3 times) to get at observation error

Variability Explained:
- $V(\text{Site}) = 86\%$
- $V(\text{Res}) = 14\%$

Normalise
Resemblance: D1 Euclidean distance

2D Stress: 0.13