Long-Term Monitoring to Determine Status and Trends of Native Fish in the Colorado River through Grand Canyon

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COOPERATORS

SWCA – Mainstem native Fish Monitoring (TK, HB, SN)

AGFD – Mainstem trout monitoring (EF)

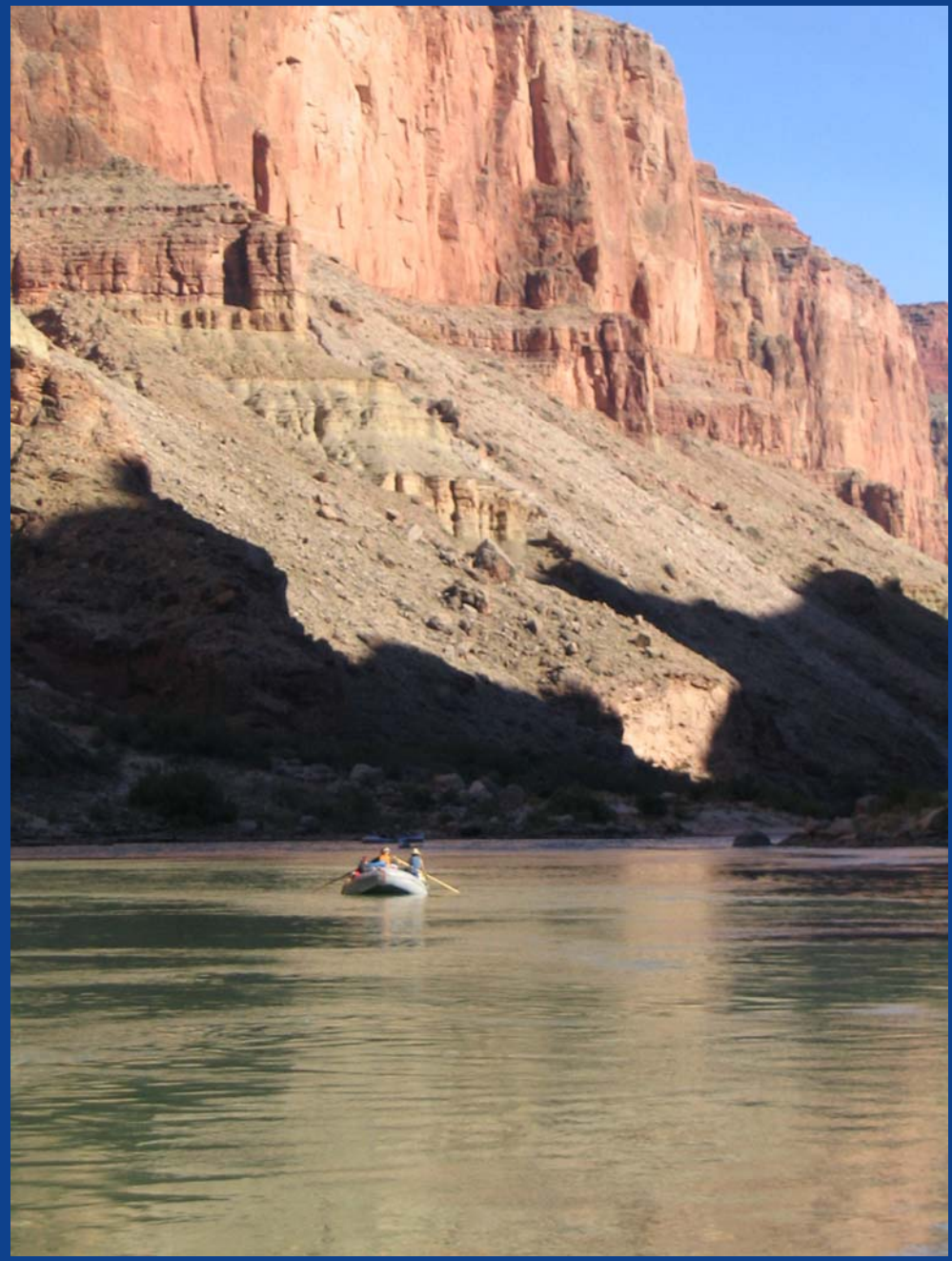
FWS - LCR HBC population est.

GCMRC -Trout removal, data synthesis,logistics

HSS – Boatman support

GCNP – Permits

VOLUNTEERS – Field help



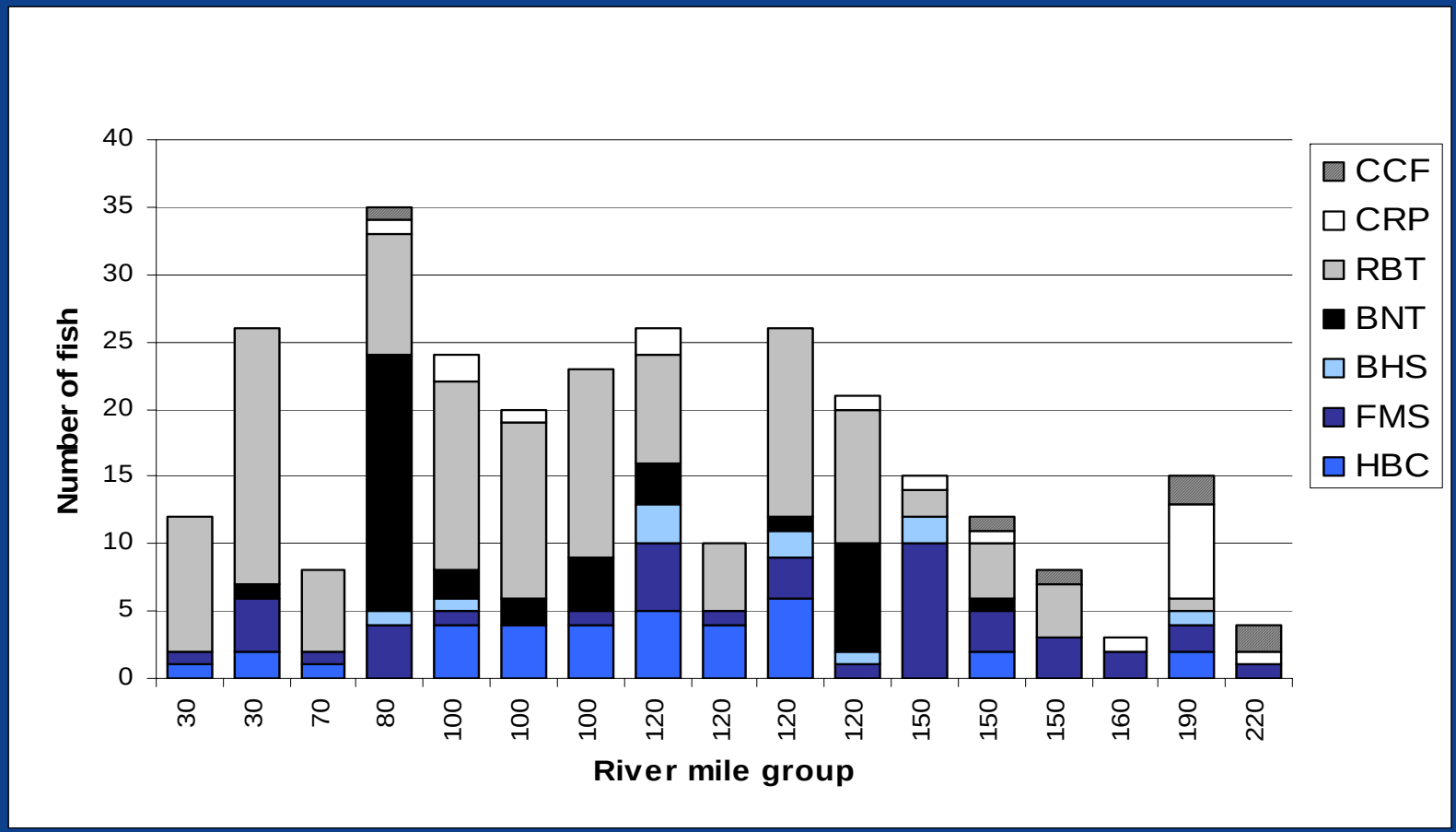
Goals and Objectives

1. Develop and implement a long-term native fish monitoring program to track status and trends in:
    a. Distribution
    b. Range
    c. Relative abundance

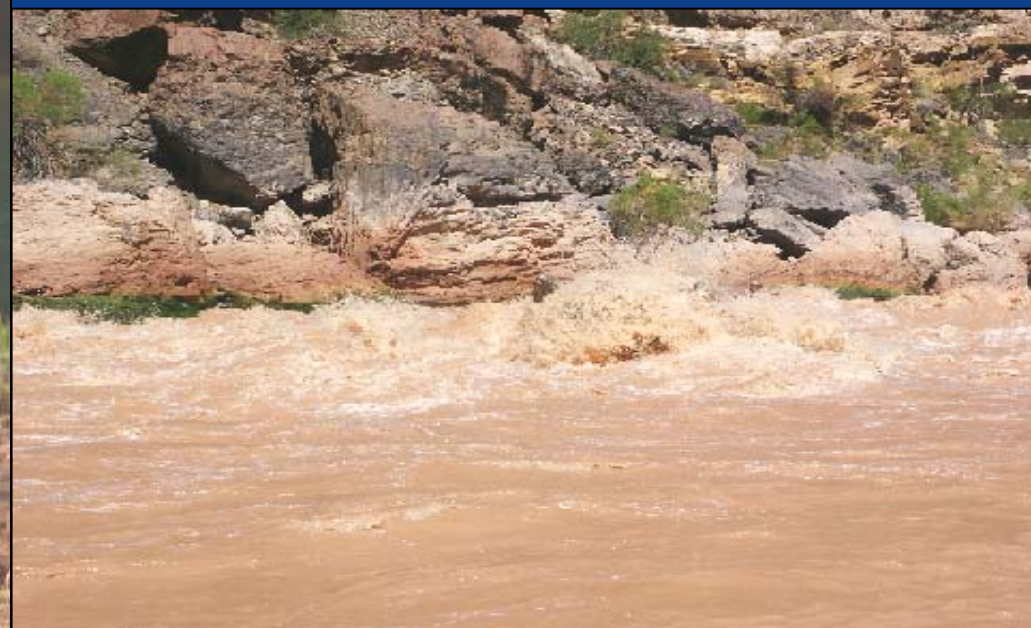
2. Trial period of 5 years is necessary to determine trends
    a. Target Coefficient of Variation (CV) is 0.10.
    b. This CV would be sufficient to detect a 20% change in relative abundance.

Why?

So we have a baseline



- TCD
- TROUT REMOVAL
- EXPERIMENTAL FLOWS
- AMBIENT RIVER TEMP CHANGE
- RELATIVE CHANGES IN POPULATION
- SEDIMENT AUGMENTATION



METHODS

Sample allocation

- Stratified-random
- Input historical data
- Sample.exe
- 11 geomorphic reaches

Sample gear

- Trammel nets (TK)
- Hoop nets (HB)
- Seine (SN)

Sample trips

- Stratified random samples
- HBC aggregations
- Seining for YOY

Methods: Analysis

- **Stratified random sampling (Sampling.exe)**
- **Relative abundance Trend analysis using CPE index**
  - 20% change per year over 5 years
- **Distribution**
  - Descriptive
- **Length Distribution**
- **Will not allow true abundance estimates**

Methods: Estimating Sample Size and Allocation Using Sampling.exe (C. Walters unpublished)

- **Input file – historic data: catch per mile by gear type and species**
- **Monte Carlo resampling of data to estimate number of samples needed to minimize CV (target of 0.1)**
- **Allocated to 11 Geomorphic reaches based on historic distribution of captures**
- **Limitations – historic data collection was not random so allocation is clumped at frequently sampled sites**
- **Correction – increase sample sizes at less frequently sampled sites**

Sampling.exe Output

TRAMMEL NETS

Number of Samples per year

Reach	BHS	FMS	HBC	No/year Output	No/year Expected	No/year Actual
1	8	4	4	30	60	30
2	47	15	6	47	30	60
3	152	60	38	152	150	90
4	46	6	4	46	60	60
5	26	10	2	30	120	150
6	6	0	1	30	90	90
7	2	0	0	30	90	89
8	20	6	0	30	60	60
9	78	16	1	78	30	50
10	11	4	1	30	60	90
11	11	1	0	30	30	49
	407	**122**	**57**	**533**	**780**	**818**

HOOP NETS

Number of Samples per year

Reach	BHS	FMS	HBC	No/year Output	No/year Expected	No/year Actual
1	0	120	19	36	72	36
2	0	431	0	36	36	72
3	569	227	332	332	180	72
4	0	0	0	36	72	69
5	336	43	8	36	144	180
6	39	20	22	36	108	108
7	53	13	0	36	108	144
8	0	0	0	36	72	36
9	0	143	0	36	36	72
10	0	0	0	36	72	108
11	0	0	0	36	36	0
	997	**997**	**381**	**692**	**936**	**897**

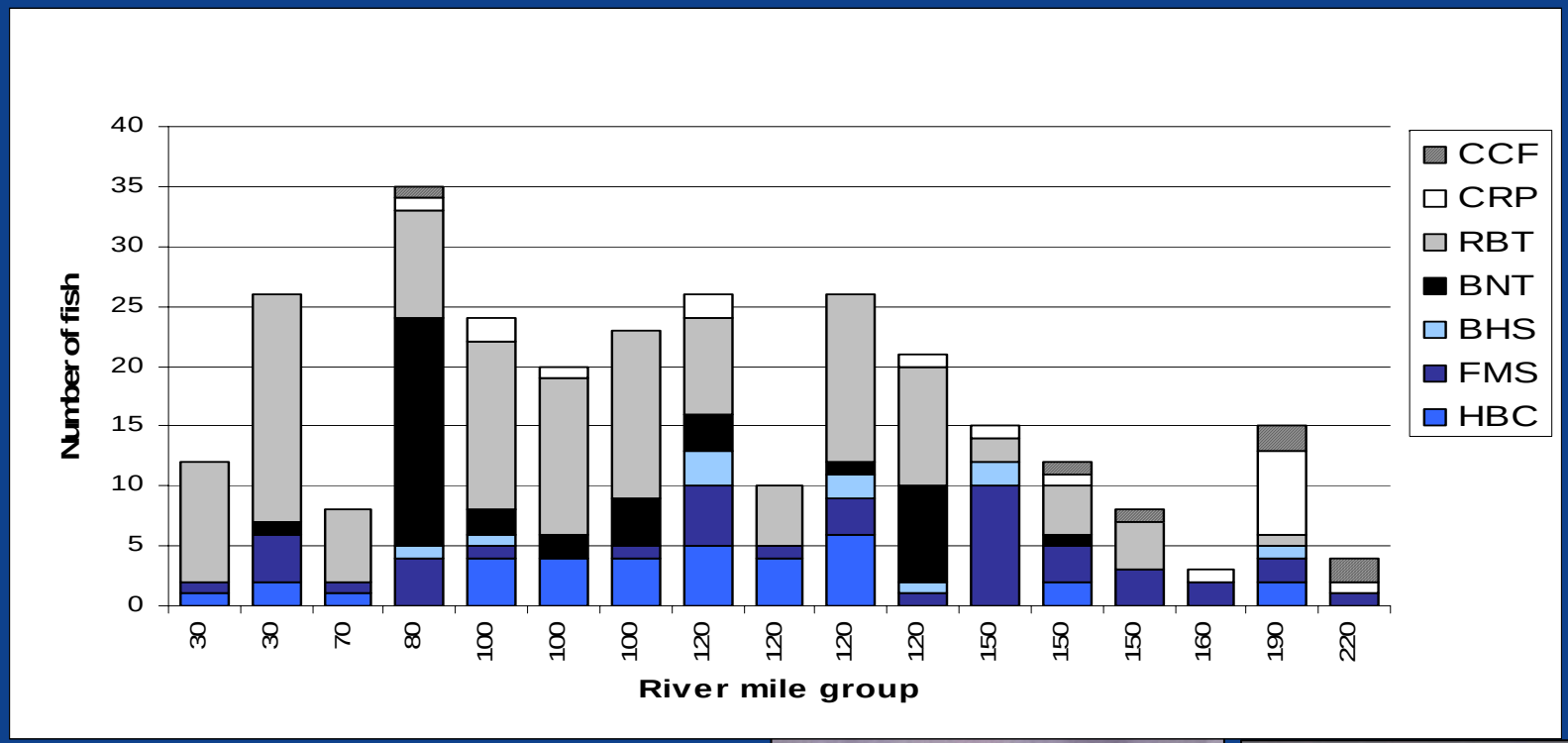
Site Selection

- **Trammel and hoop nets**
- **Start miles**
  - Number of samples per reach needed
  - Divide by number of samples possible per night

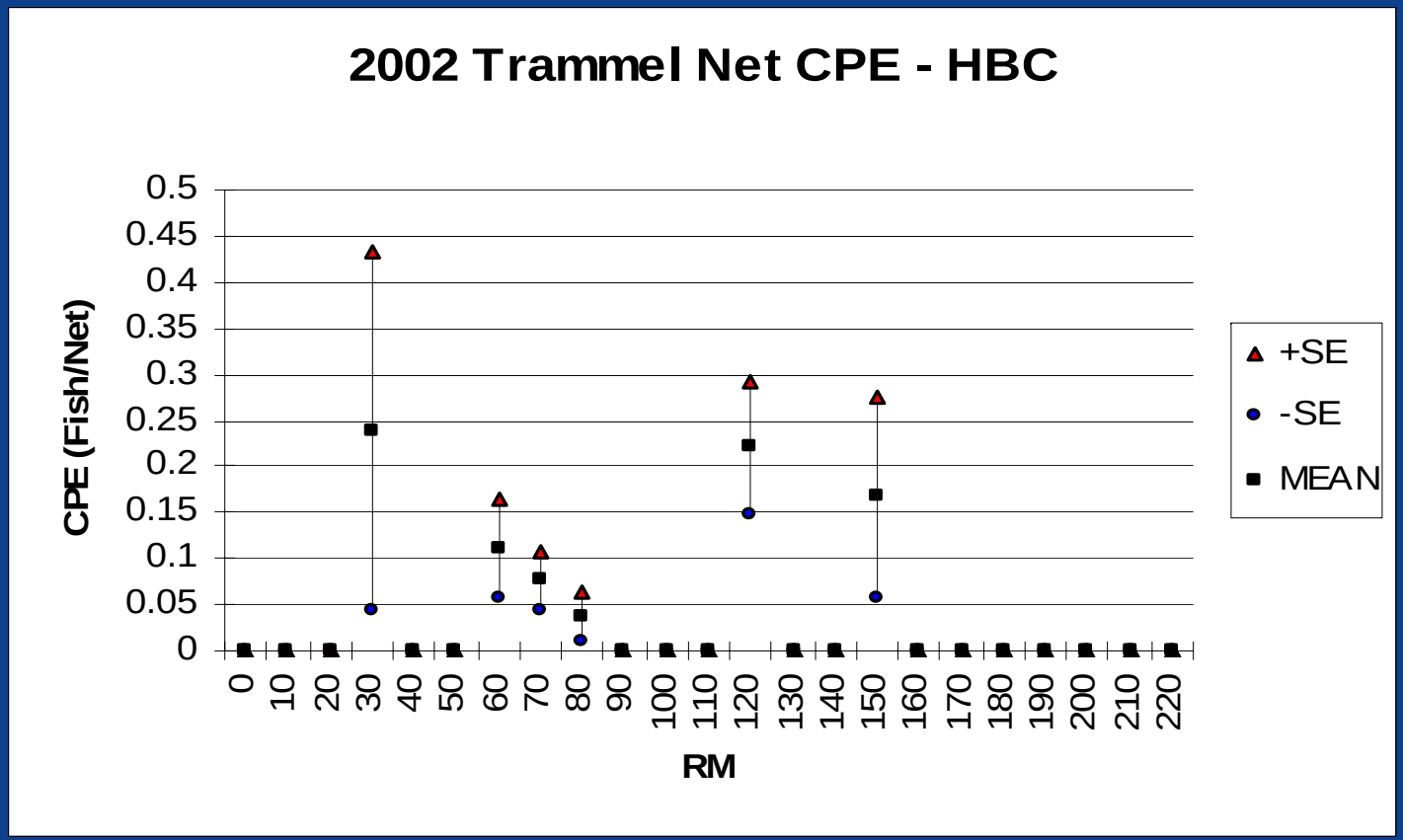
    (30 trammel, 2-hr sets; 36 hoop, overnight sets)
  - Yields number of nights per reach

    (Total of 30 nights = two sample trips in July and September)
  - Assign start miles for each night with random numbers in excel
  - Place nets within sampleable area 1.0 to 1.5 miles – MUST include start mile
- **Seines**
  - Opportunistic: one backwater each 1 to 2 miles as available

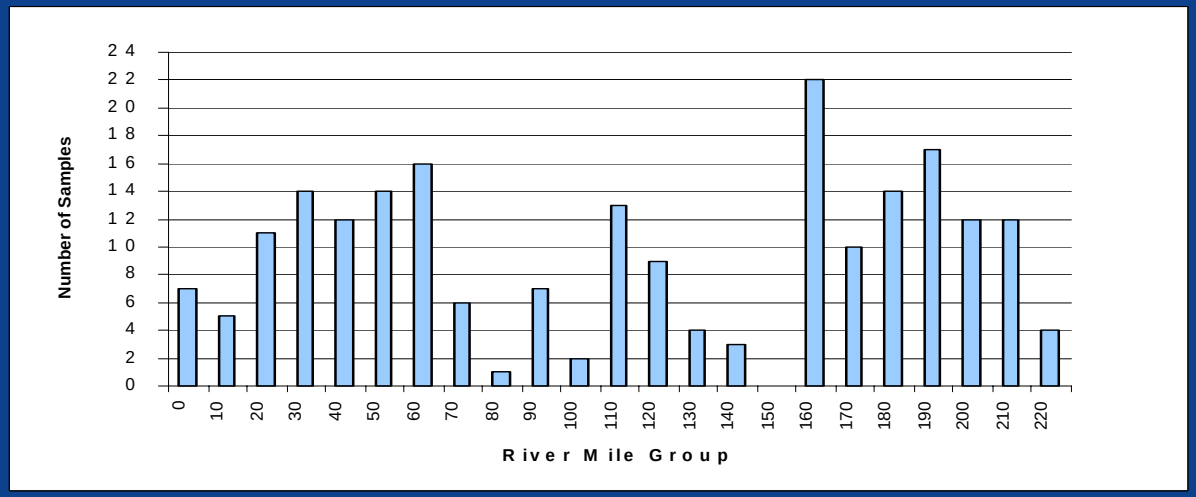
Distribution

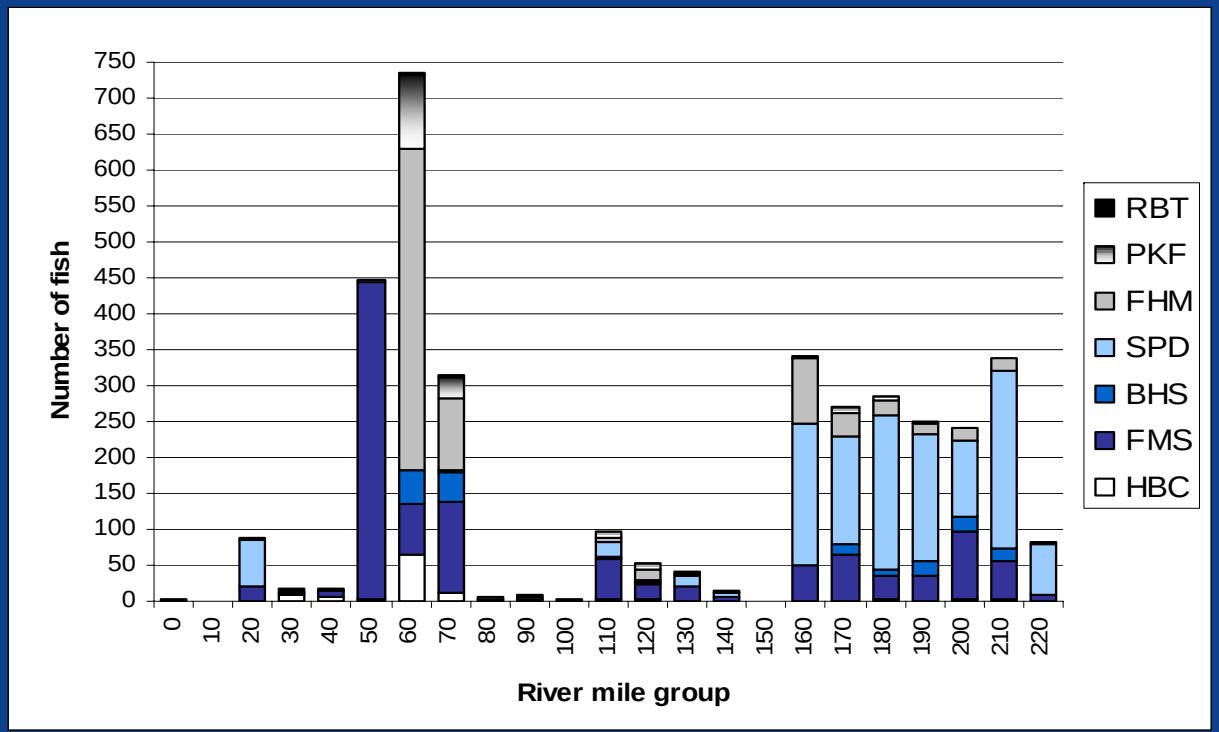


HBC aggregations



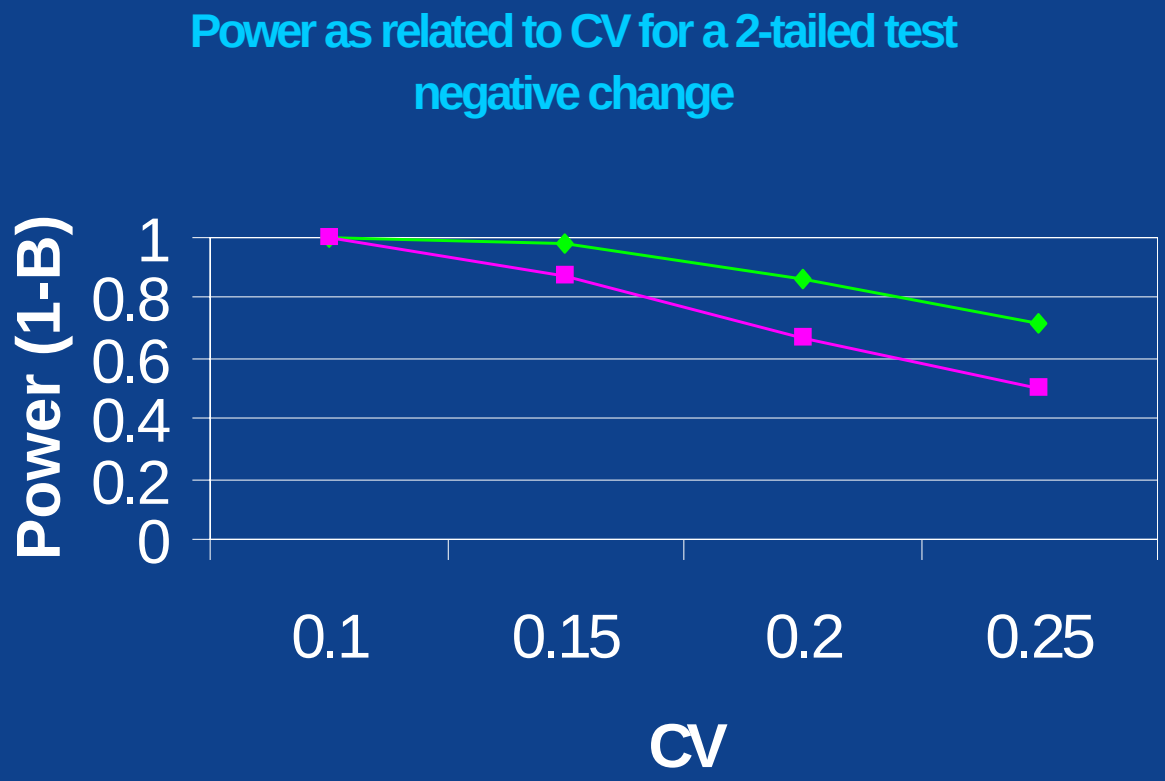
Seine


Number of Samples
24
22
20
18
16
14
12
10
8
6
4
2
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
River Mile Group


Number of fish
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
River mile group
RBT
PKF
FHM
SPD
BHS
FMS
HBC

Trammel Nets CPE (Fish/Hour)

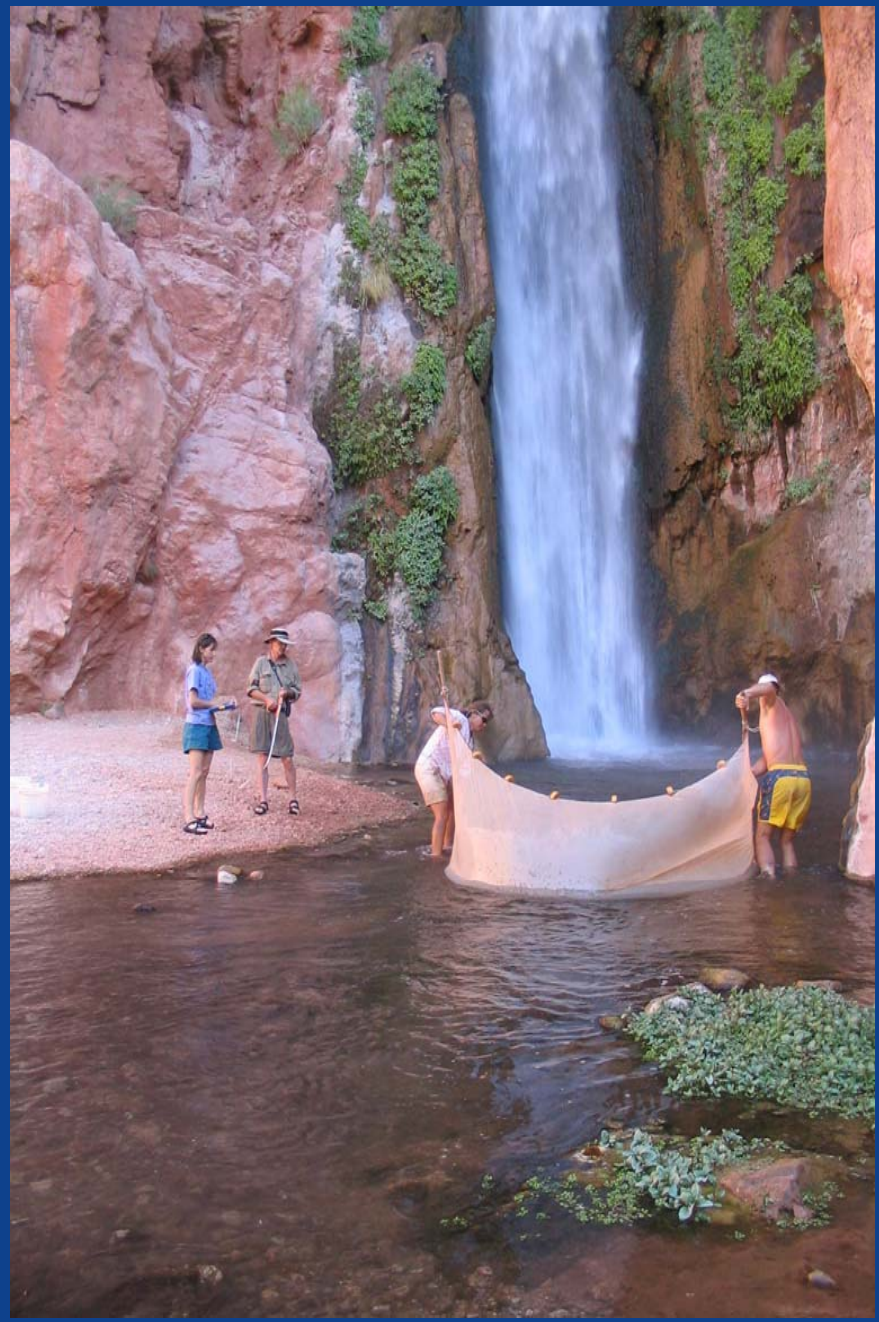
Trammel	BHS	BNT	CCF	CRP	FMS	HBC	RBT	STB	Total
Fish	54	70	26	35	52	38	163	3	441
Samples	818	818	818	818	818	818	818	818	818
Variance	0.02	0.07	0.01	0.02	0.02	0.03	0.21	0.00	0.40
Mean	0.04	0.04	0.02	0.02	0.03	0.02	0.10	0.00	0.28
ST Dev	0.15	0.26	0.12	0.12	0.15	0.16	0.46	0.03	0.64
ST Error	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.00	0.02
Var/Mean	0.66	1.47	0.89	0.69	0.69	1.03	2.08	0.50	1.44
CV (SE/Mean)	0.15	0.20	0.26	0.20	0.16	0.23	0.16	0.58	0.08
Sets with Fish	46	45	20	30	44	27	90	3	243
CV with Sample Size Doubled	0.11	0.14	0.18	0.14	0.11	0.16	0.11	0.41	0.08


Power as related to CV for a 2-tailed test
negative change
Power (1-B)
1
0.8
0.6
0.4
0.2
0
0.1
0.15
0.2
0.25
CV

Conclusions

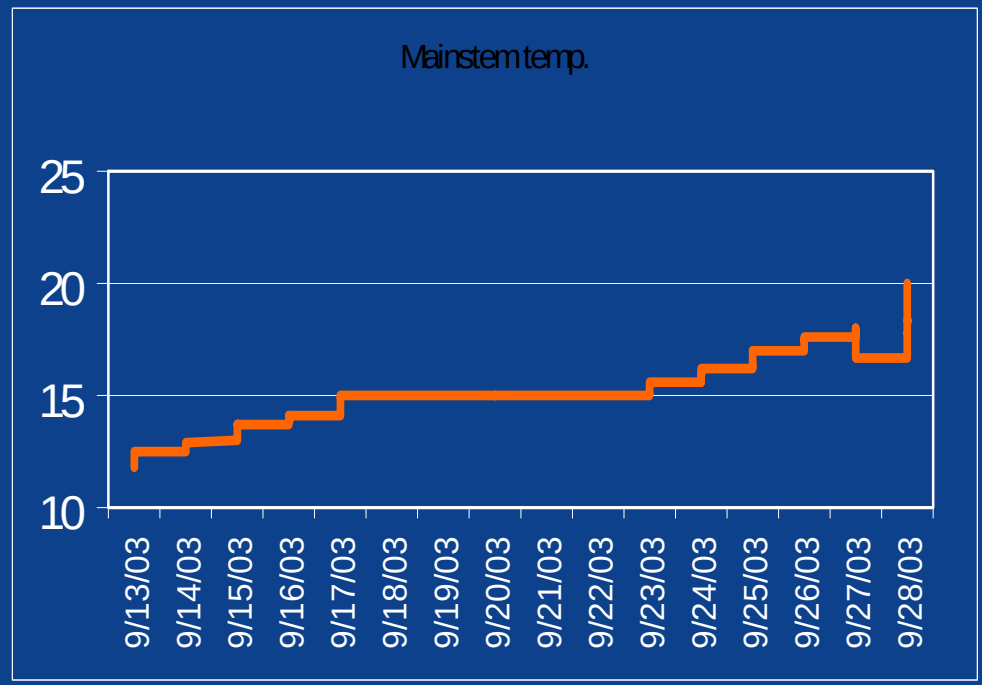
- Stratified-random sampling provides important baseline information from which to gauge effects of management actions

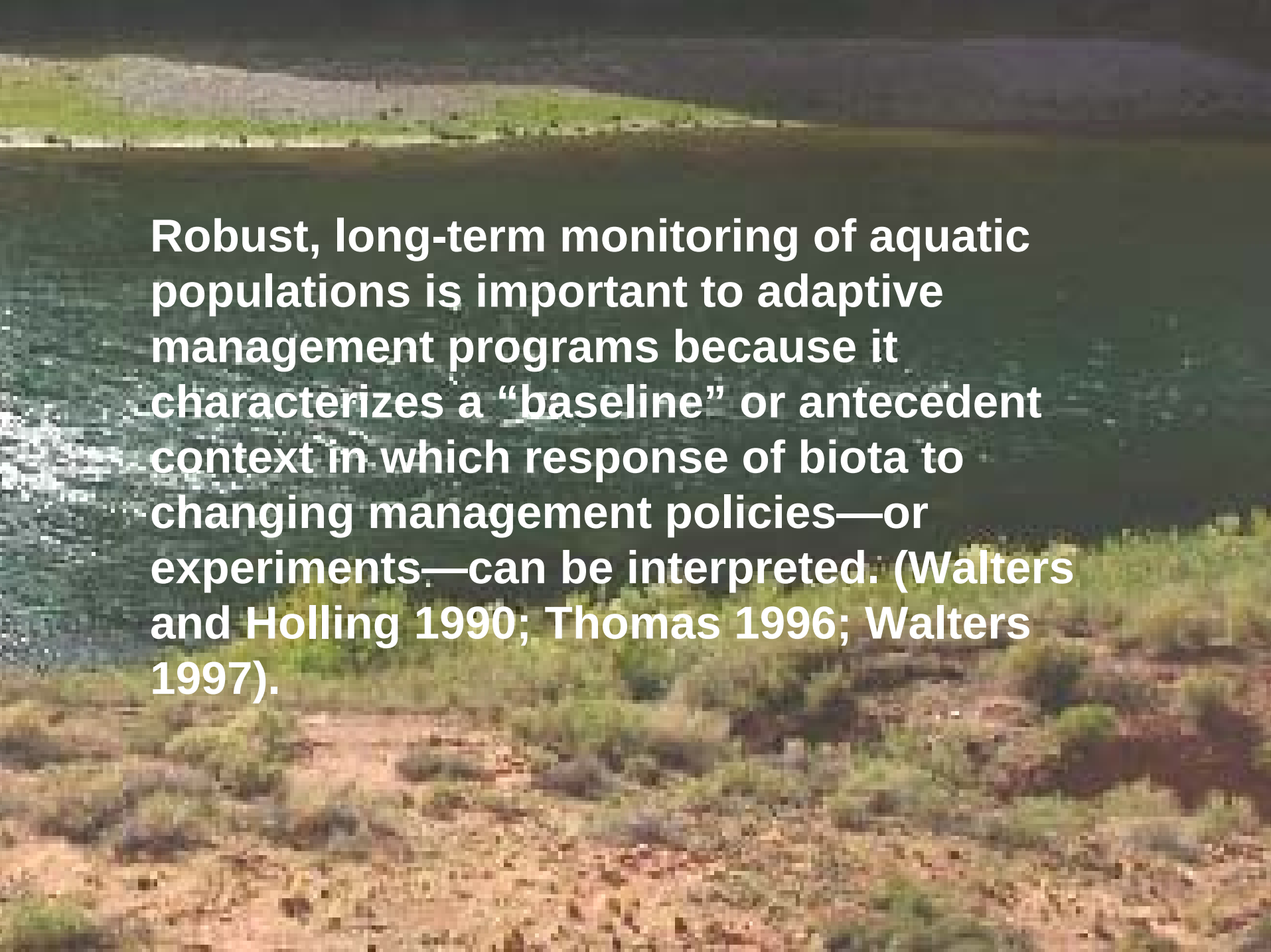
- We have some work to do:
  - Adjust sampling strategy to address CV problem
  - Repopulate sample allocation program with new data
  - Account for HBC aggregations
  - Address need for Population Estimates without compromising long-term monitoring



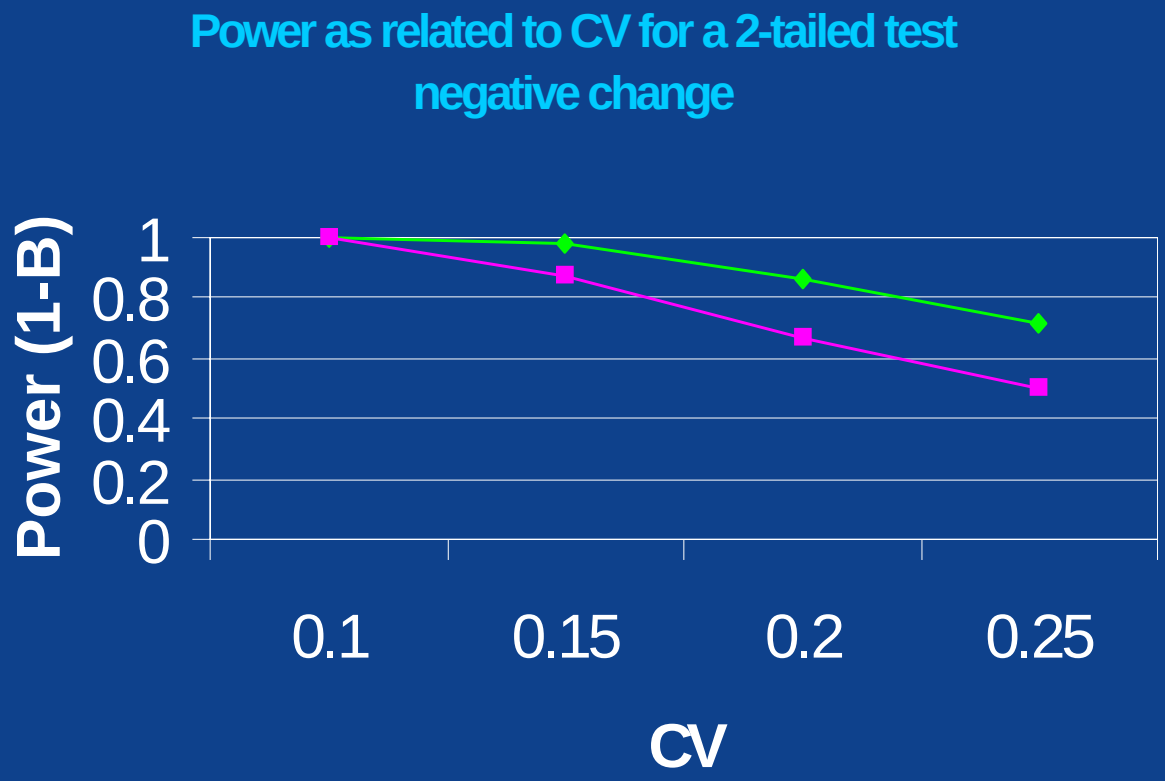
Conclusions

- Backwaters continue to be important for young fish
- Mainstem water temperatures are warming do to low lake levels





Robust, long-term monitoring of aquatic populations is important to adaptive management programs because it characterizes a “baseline” or antecedent context in which response of biota to changing management policies—or experiments—can be interpreted. (Walters and Holling 1990; Thomas 1996; Walters 1997).


Power as related to CV for a 2-tailed test
negative change
Power (1-B)
1
0.8
0.6
0.4
0.2
0
0.1
0.15
0.2
0.25
CV