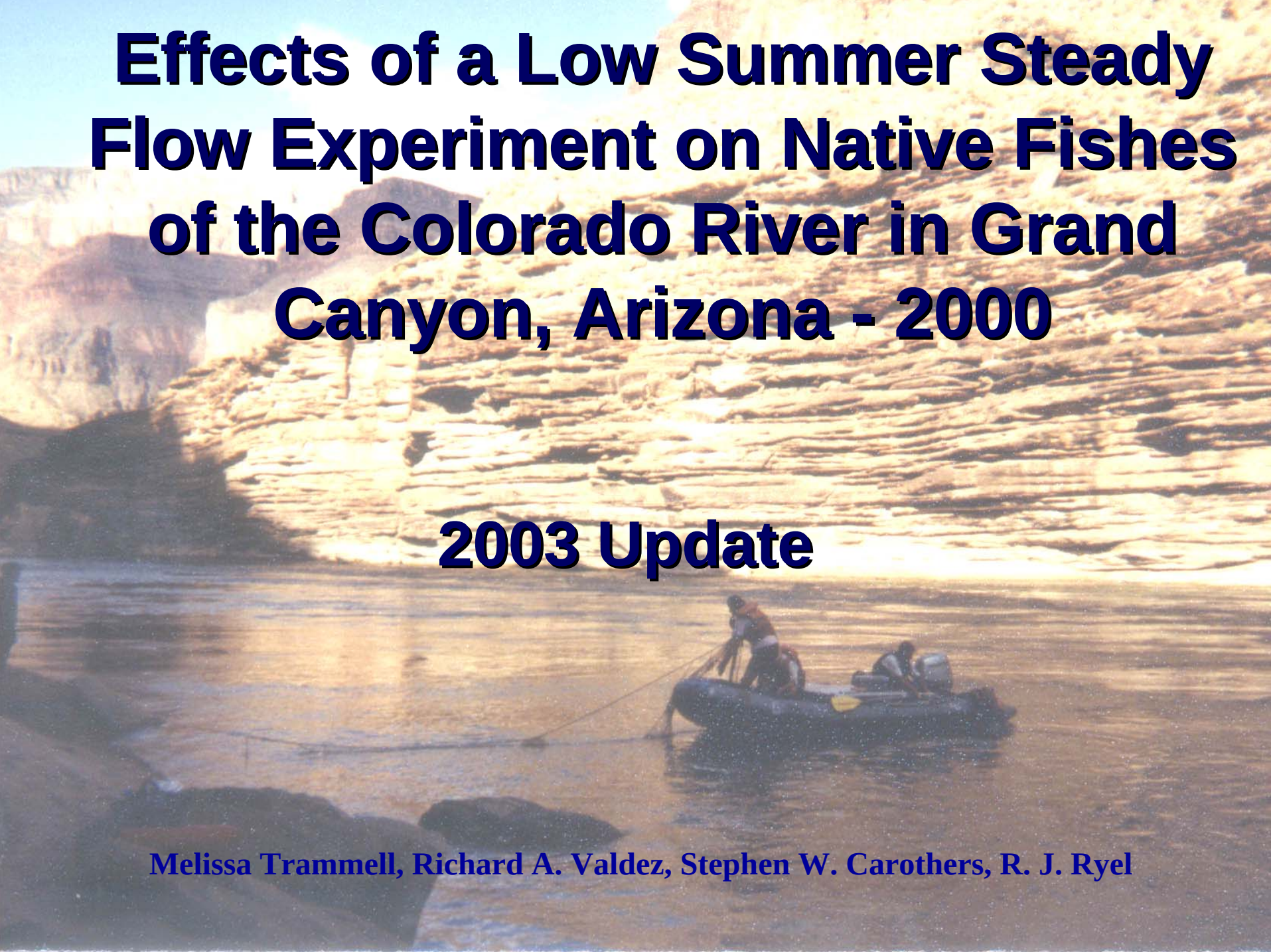
Effects of a Low Summer Steady Flow Experiment on Native Fishes of the Colorado River in Grand Canyon, Arizona - 2000

2003 Update

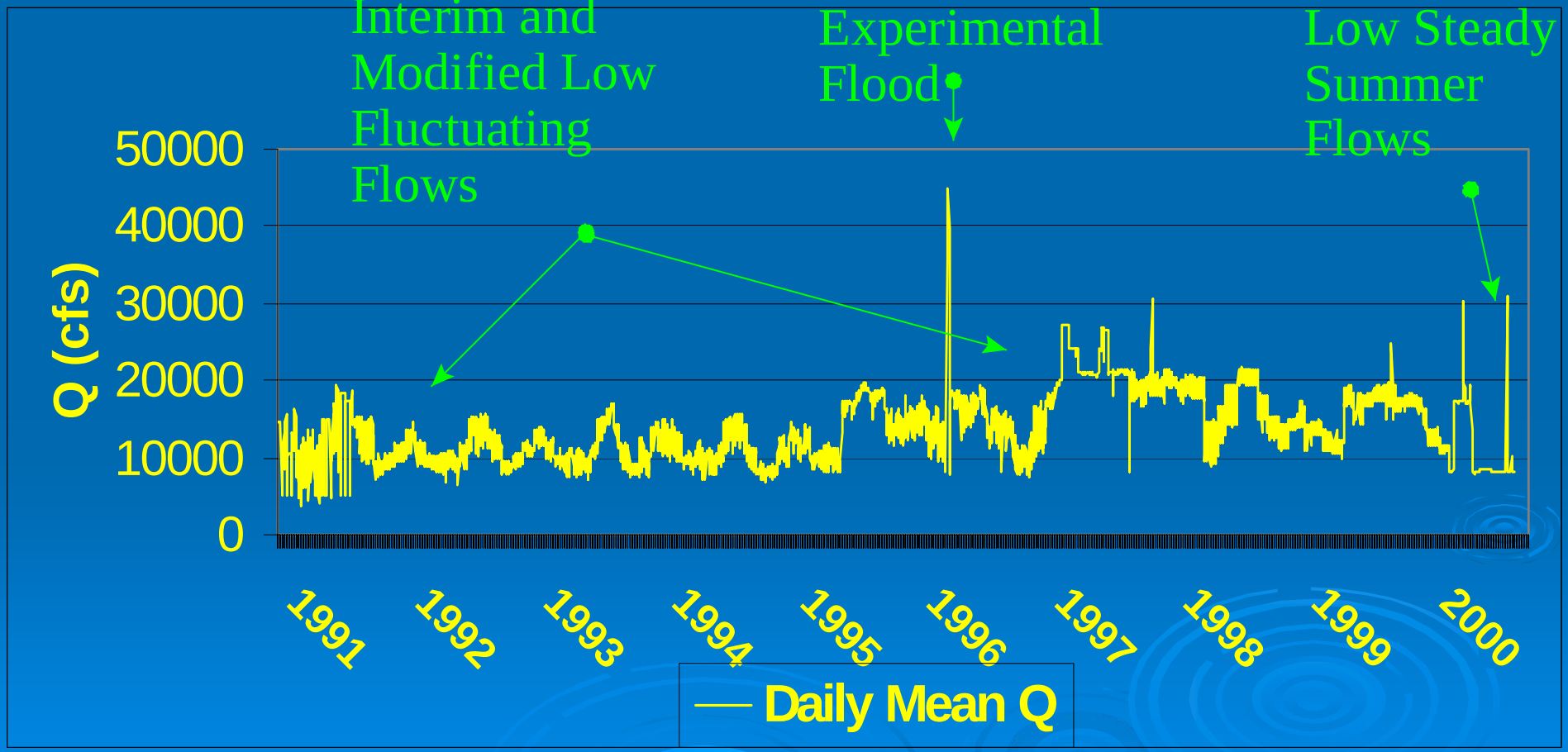


Melissa Trammell, Richard A. Valdez, Stephen W. Carothers, R. J. Ryel

LSSF

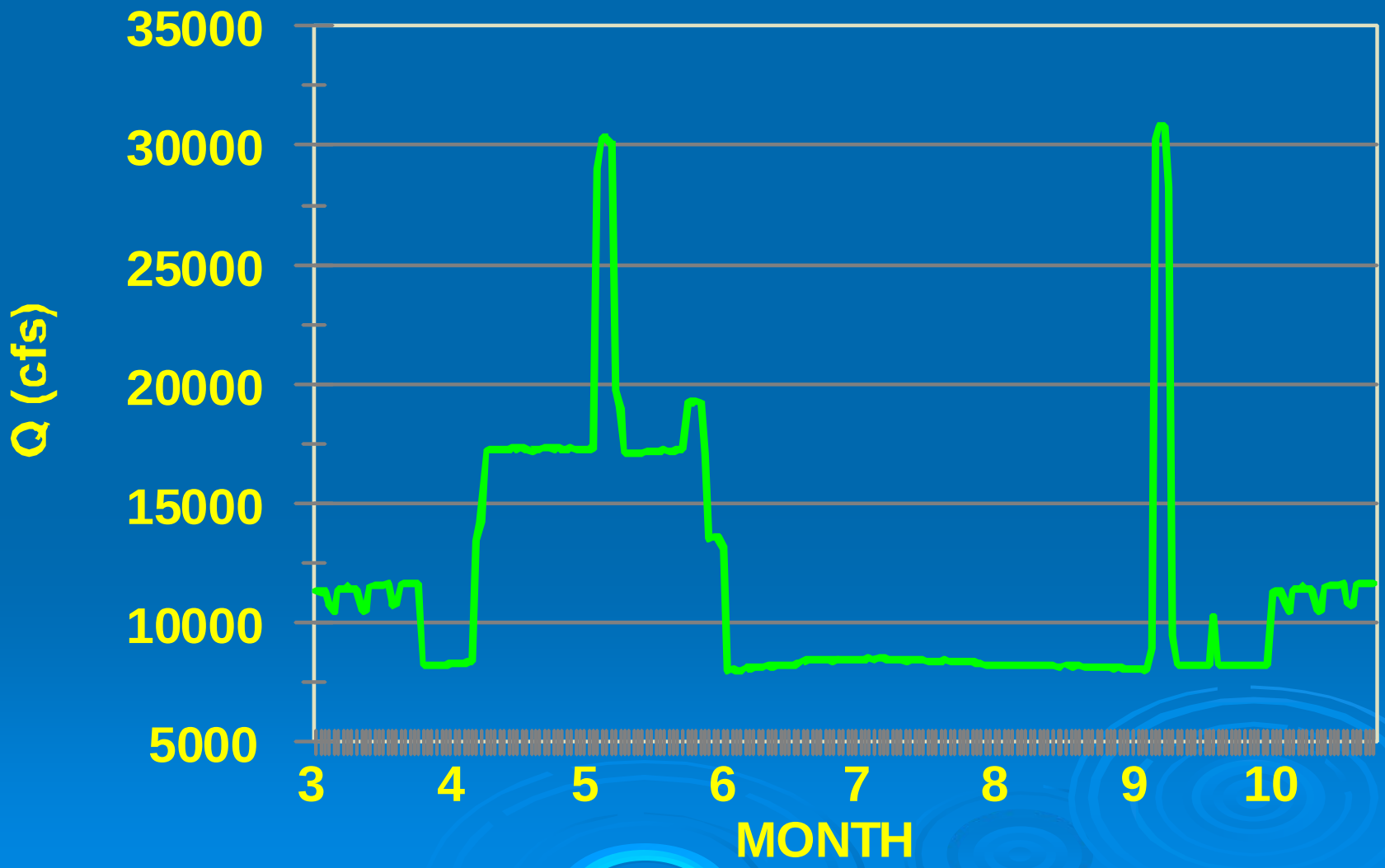
- Both short-term and long-term monitoring of fish populations are important to assess management actions
  - Short-term (Specifically directed research)
    - Identify immediate biological responses
    - Infer cause and effect
  - Long-term (population estimators, stock assessment models, time-series CPE)
    - Evaluate ultimate effects to populations
    - Track status and trends of populations

Recent historical hydrograph below Glen Canyon Dam 1991 - 2000



EXPERIMENTAL HYDROGRAPH IN 2000

LOW SUMMER STEADY FLOWS



LSSF 2000
GOALS and OBJECTIVES

- EVALUATE EFFECTS OF LSSF
  - Identify growth patterns for YOY native fishes and small non-native fishes in backwaters during LSSF
  - Identify changes in total and relative abundance
  - Identify possibility of mainstem spawning of native and small non-native fishes
- BASELINE FOR LONG TERM MONITORING
  - Identify distribution and estimate relative abundances of fish species

LSSF METHODS

- Multi-gear: targets habitat, size class, species
  - Short-term responses
    - Seining, minnow traps (backwaters, small-bodied native and non-native)
  - Baseline for Long Term Monitoring
    - Electrofishing, Hoop nets (shoreline, multiple size classes)
    - Trammel nets (deep eddies, adult native fishes)

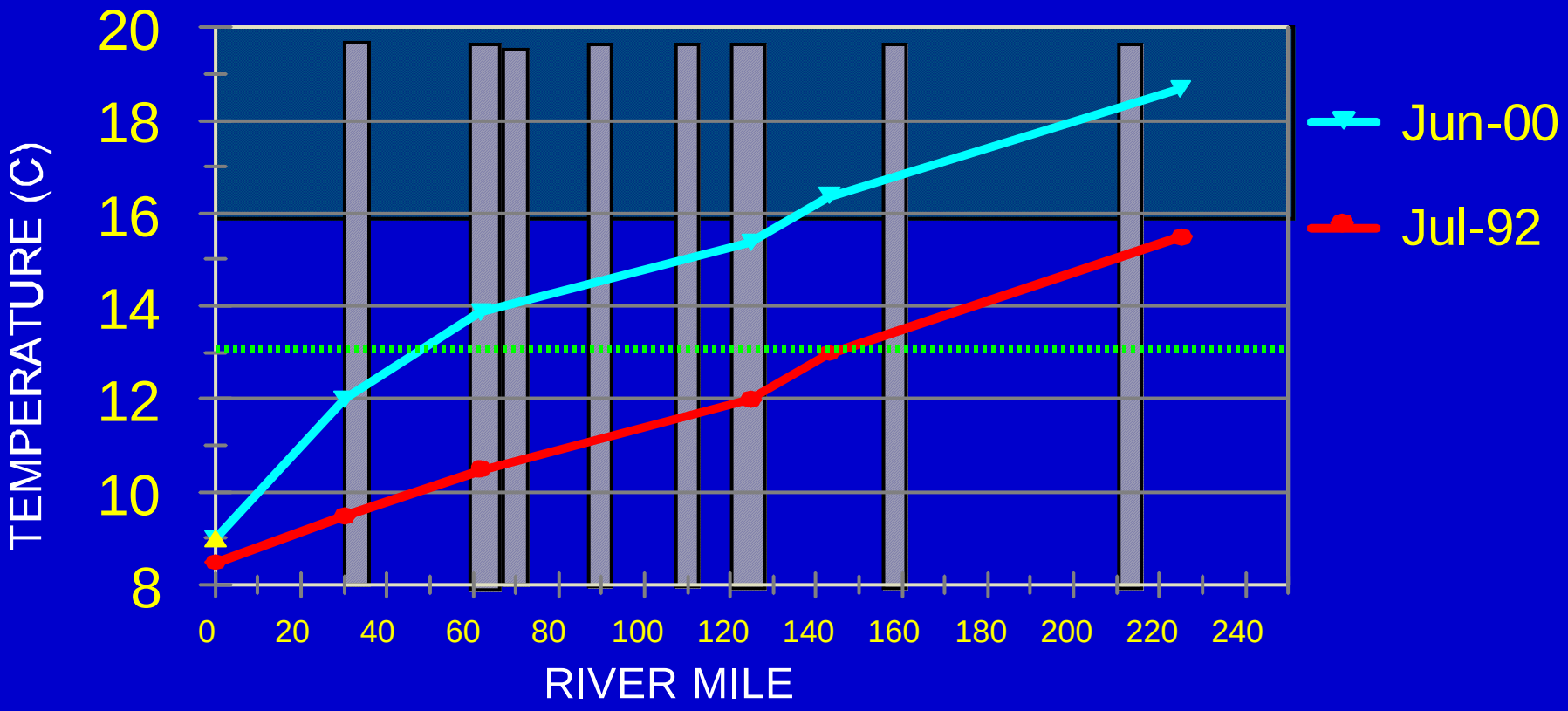
Anticipated short-term response to LSSF

- Positive
  - Main stem temperature increases
  - Near shore temperature increases
  - Increased stability and temperature of shoreline habitats (backwaters)
  - Enhanced spawning for native fishes
  - Increased growth and survival for native fishes

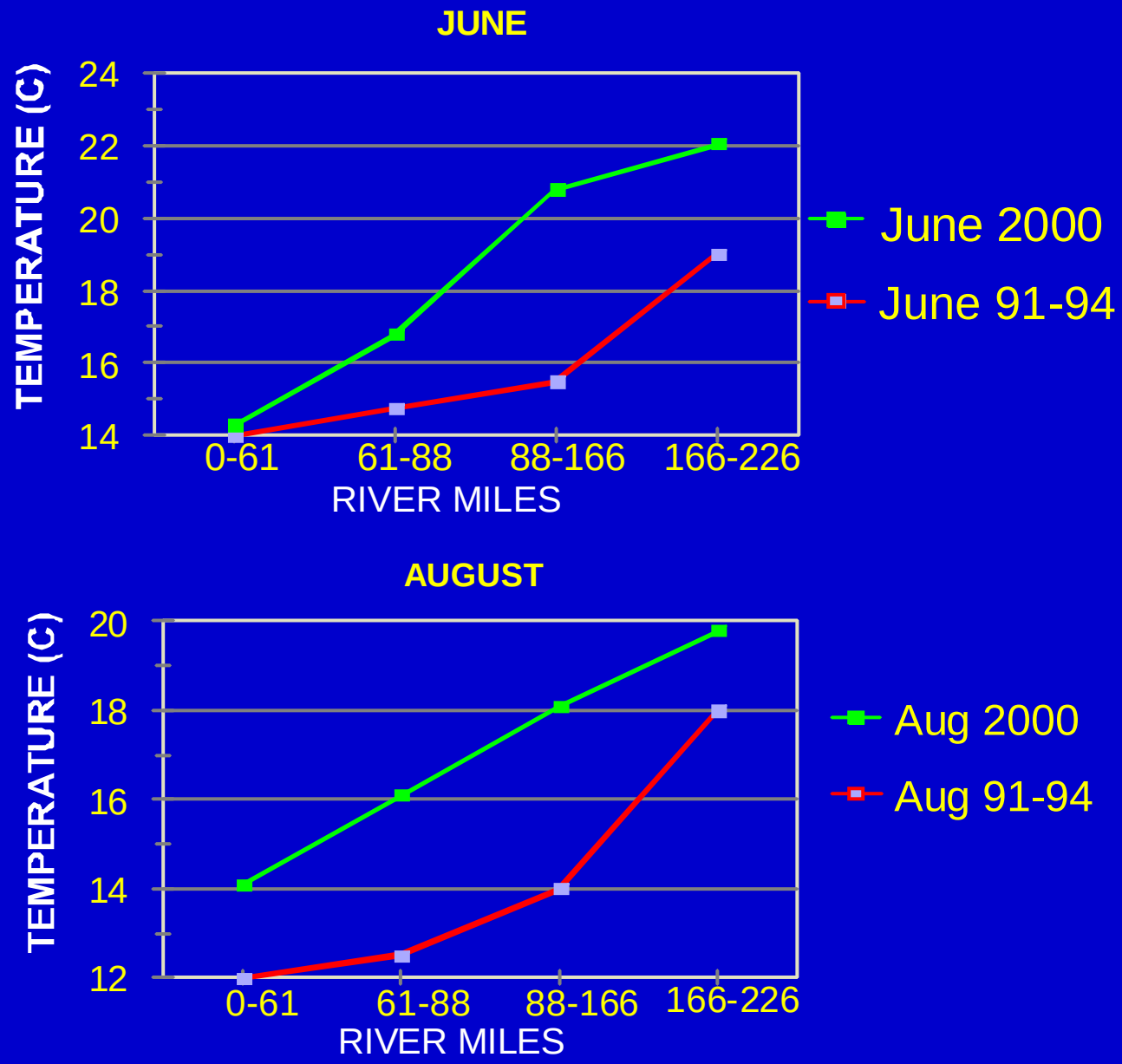
Anticipated short-term response to LSSF

- Negative
  - Increased growth, survival and abundance for non-native fishes
  - Expanded distribution for warm water non-native fishes

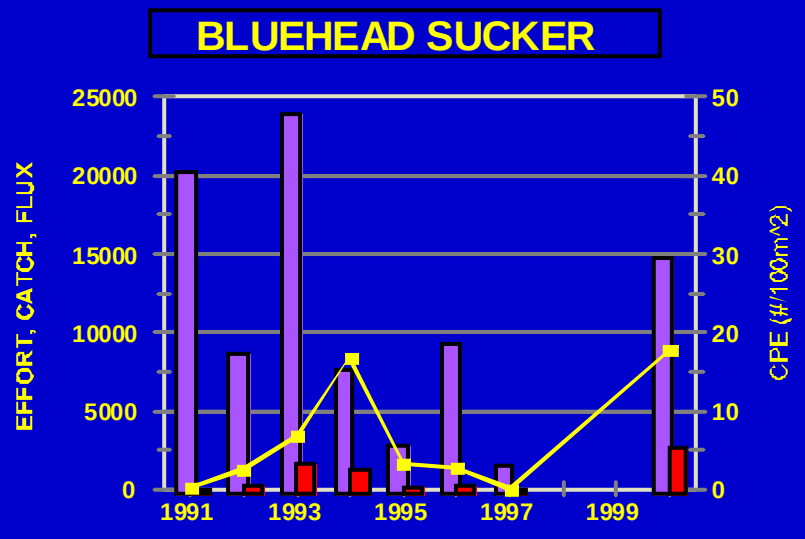
RELATIONSHIP OF MAINSTEM TEMPERATURES TO HBC AGGREGATIONS

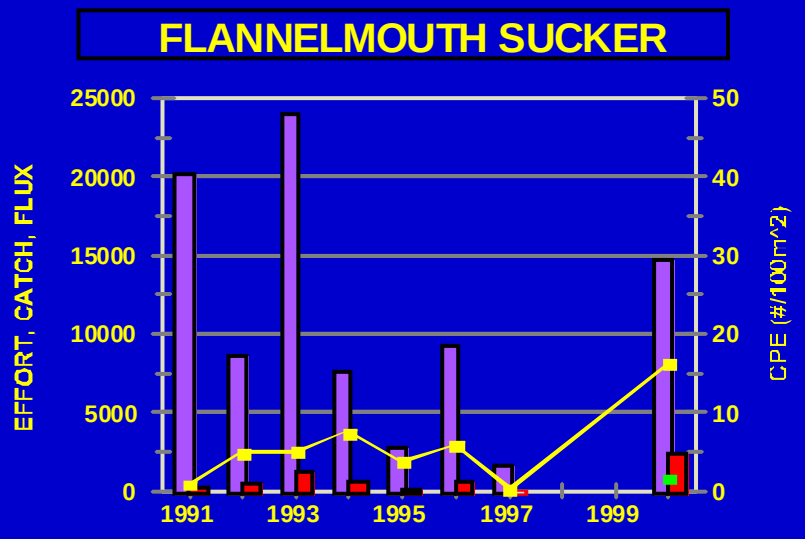


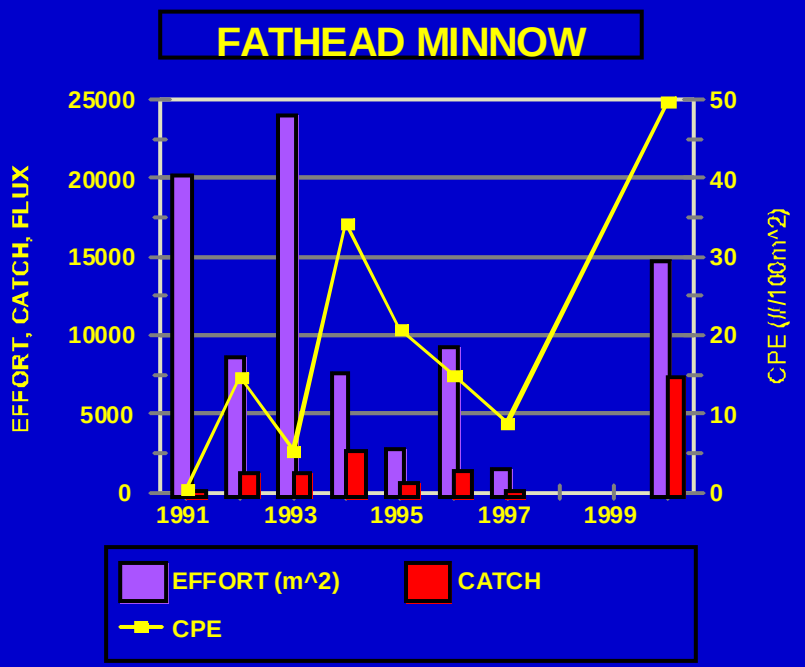
Mean Backwater Temperatures

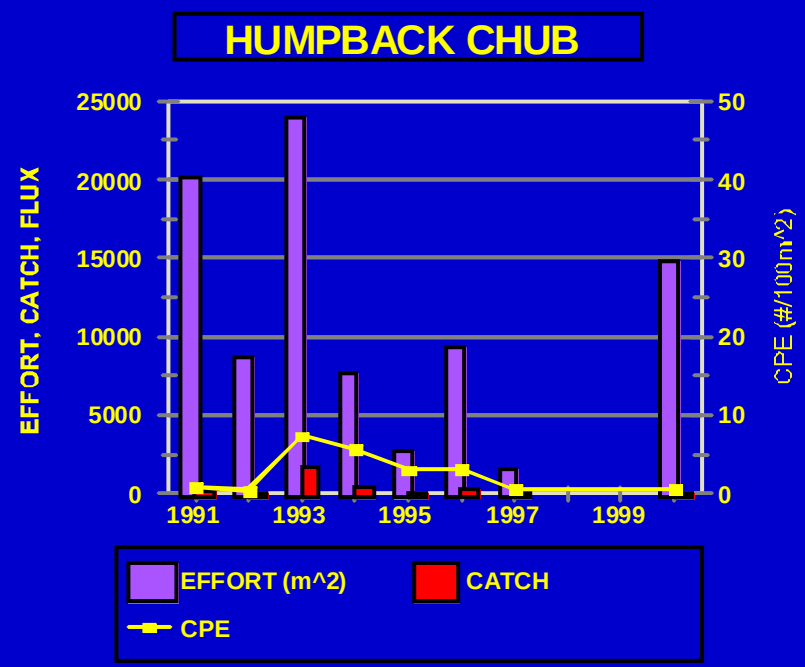


Total Effort, Catch and CPE: 1991-1997 and 2000

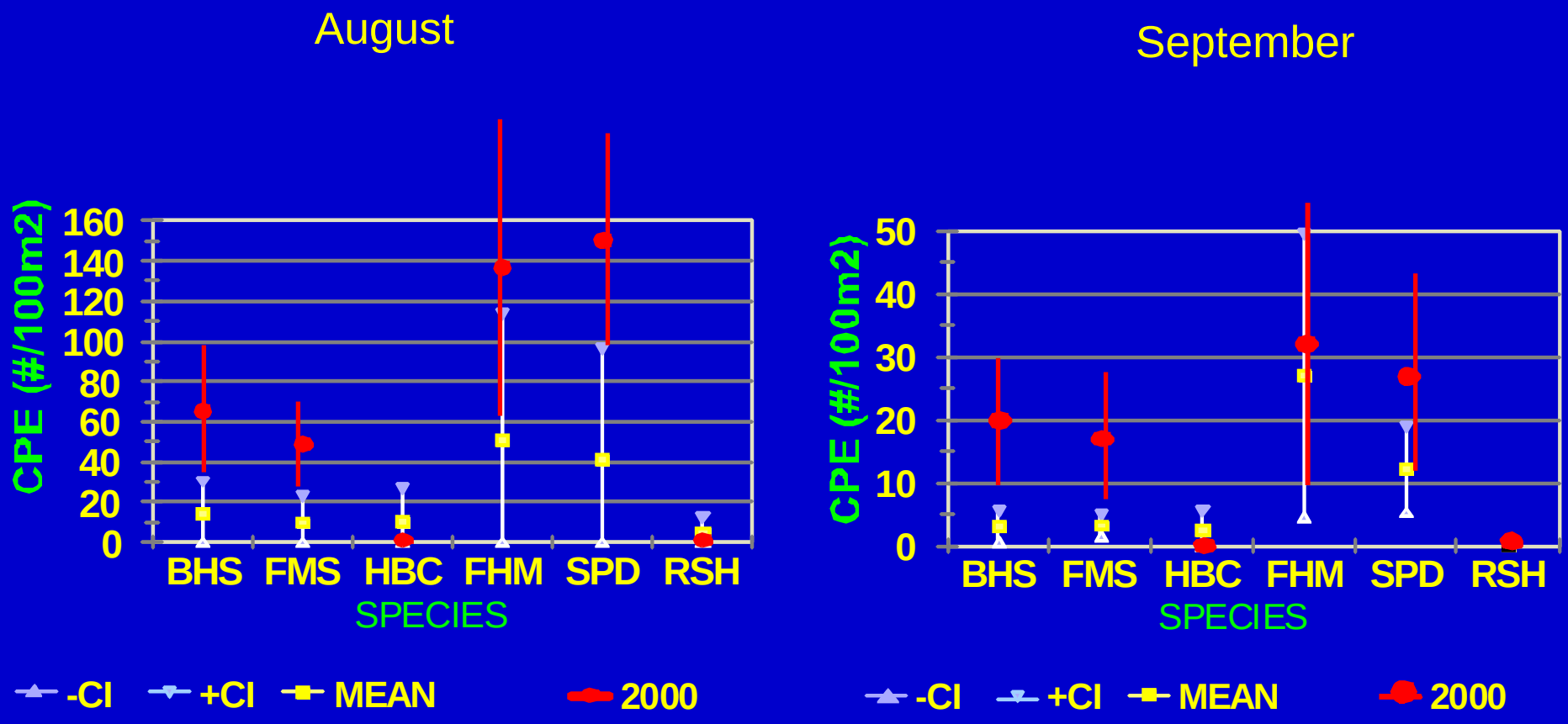




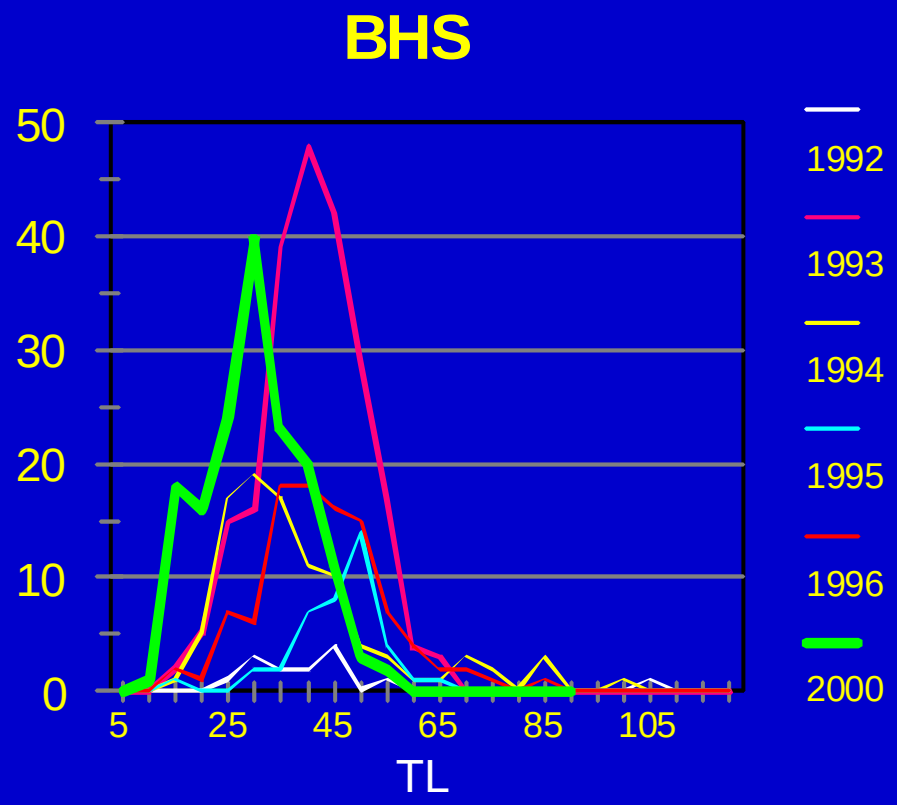


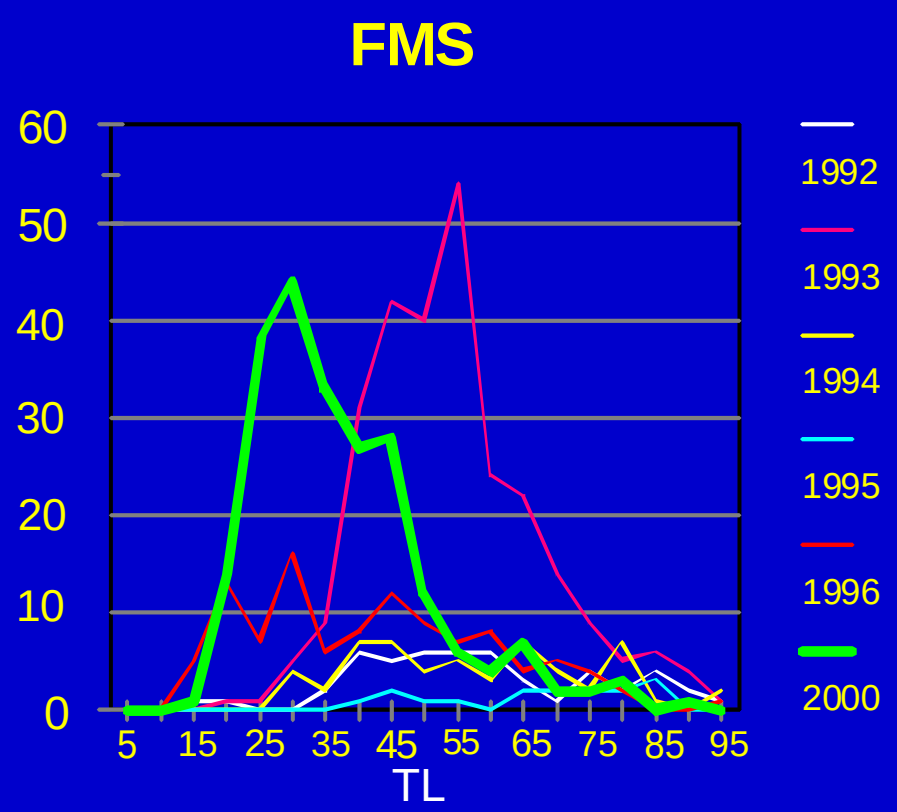


Mean CPE (#/100m^2) 1991-1997, and 2000



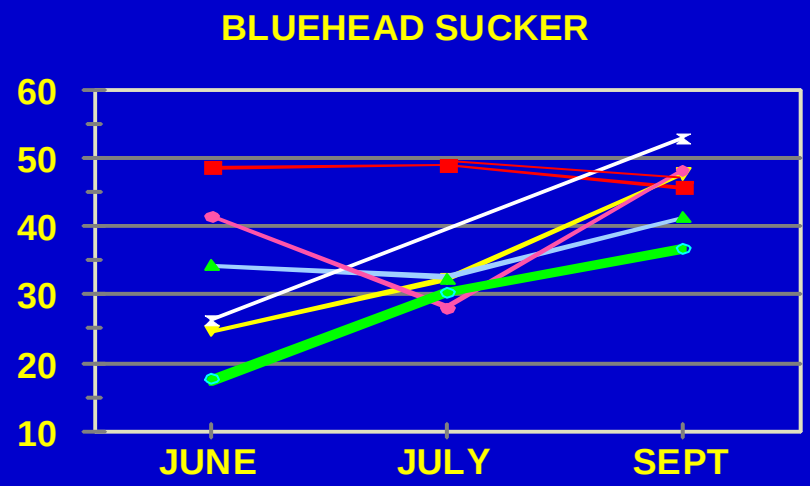
LENGTH FREQUENCY OF BLUEHEAD AND FLANNELMOUTH SUCKER September 1992-1996 and 2000

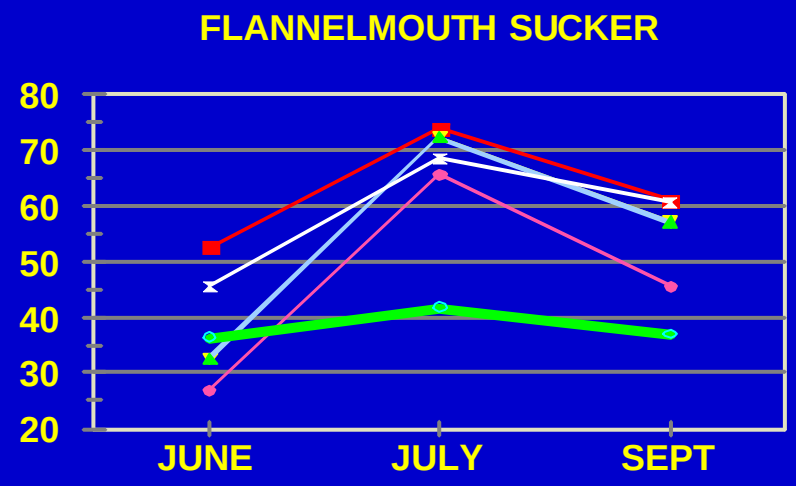


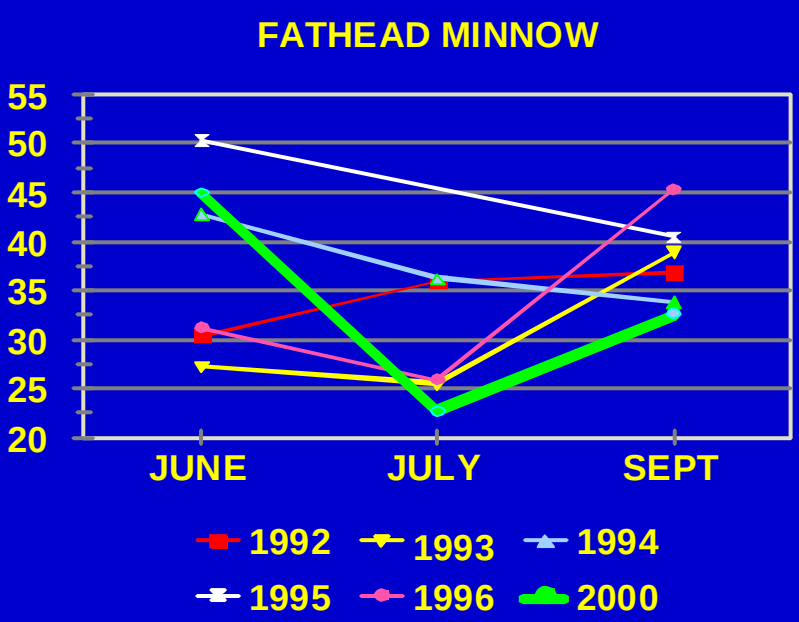


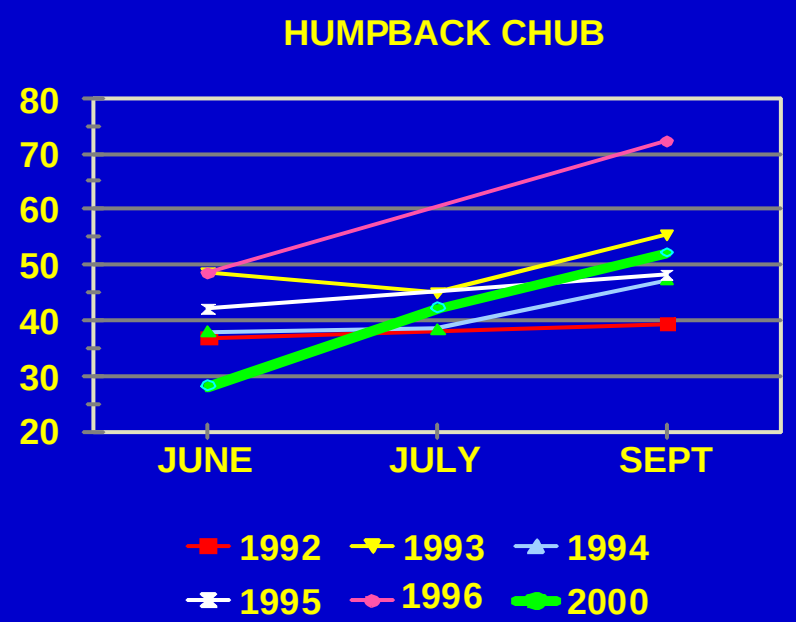
Higher proportion of fish <30mm in 2000

MEAN TL FROM 1991-1997 and 2000

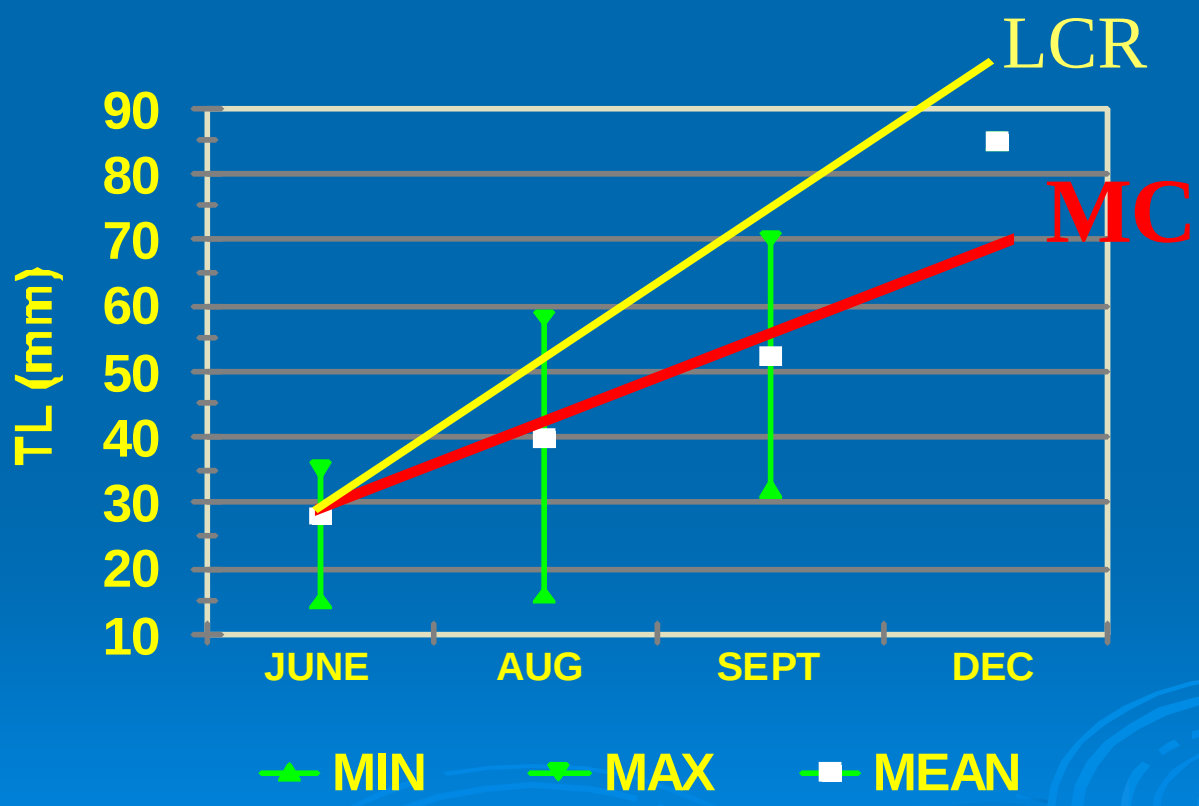






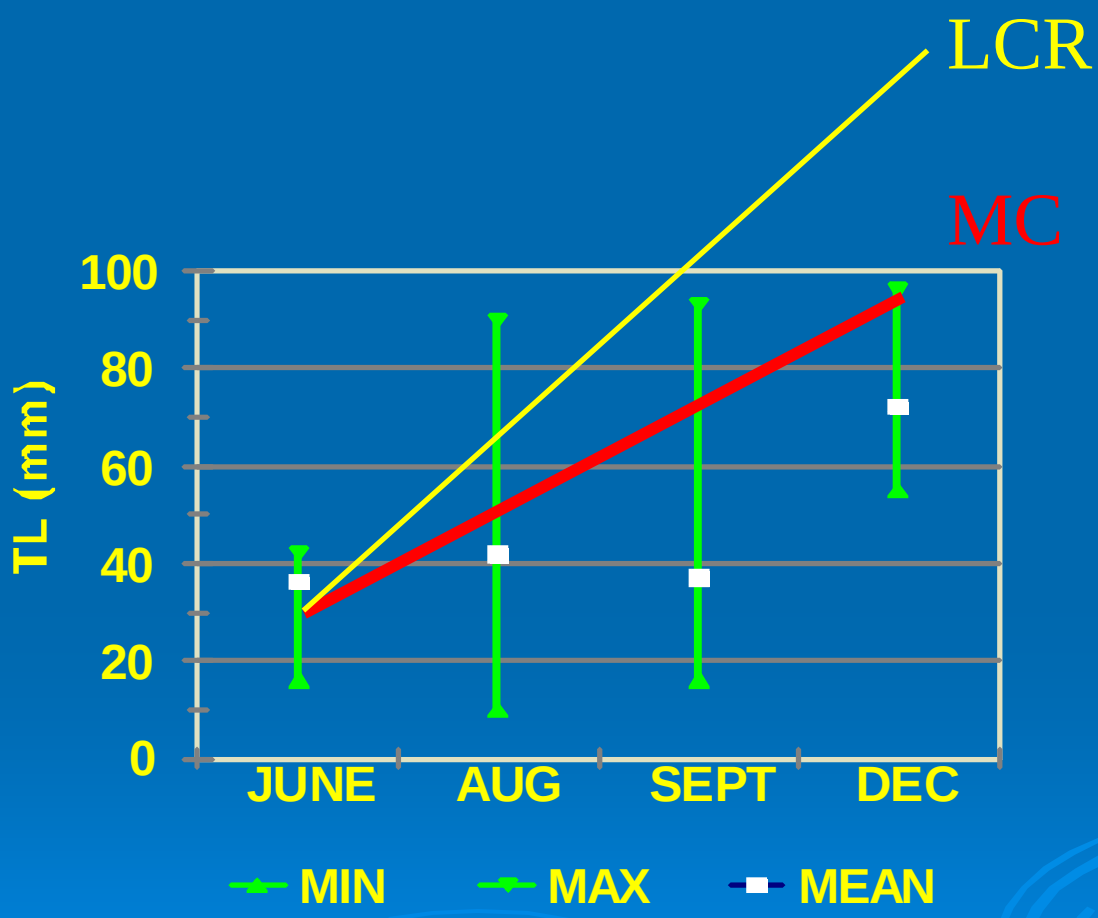


Growth of HBC in 2000



Obligate chub picture

Growth of FMS in 2000



Summary of 2000 RESULTS

- Short-term monitoring
  - Increases in mainstem and backwater temperatures
  - Mainstem reproduction of native suckers
  - Possible mainstem reproduction of humpback chub
  - Detected mainstem reproduction (in backwaters) and increased abundance of non-native fathead minnow
  - Following fall spike flow - detected significant decreases in fathead minnow and native suckers
  - Did not observe increased growth of native fishes

Summary of 2000 RESULTS

- Long Term Monitoring
  - Described relative abundance and size structure of fish species
  - Detected no immediate effect of LSSF on adult fishes

“Future long-term monitoring

- May detect success or failure of recruitment in 3-4 years (changes in abundance or age structure as a result of LSSF)
- If recruitment from the LSSF 2000 year class is not strong: without information from short-term research performed during LSSF, managers must conclude no effect ”

Post LSSF sampling:

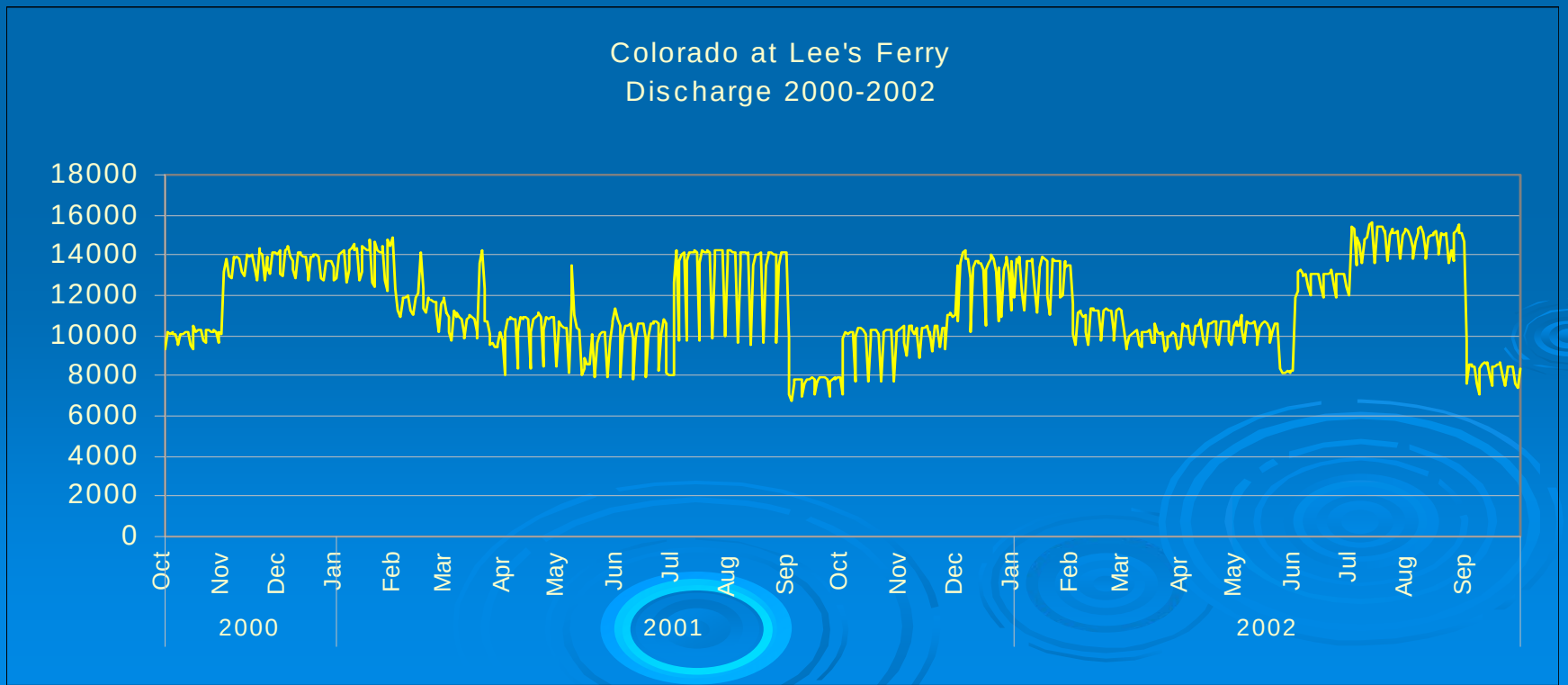
- 2001
  - Mainstem population estimate of HBC near LCR
  - No distributional downstream trammel nets or seines
  - Distributional mainstem electrofishing reduced, gear calibration
- 2002
  - Stratified random mainstem sampling implemented
    - Trammel nets, hoop nets, seines, electrofishing
- 2003
  - Stratified random mainstem sampling continued
    - Field work finished in September

Post LSSF sampling:

- AGFD electrofishing was the most consistent sampling method in the mainstem from 2000 through 2003
- Seines were not used in 2001
- Trammel net and hoop net sampling in 2000 was not directly comparable to other years due to changes in sampling purpose and design

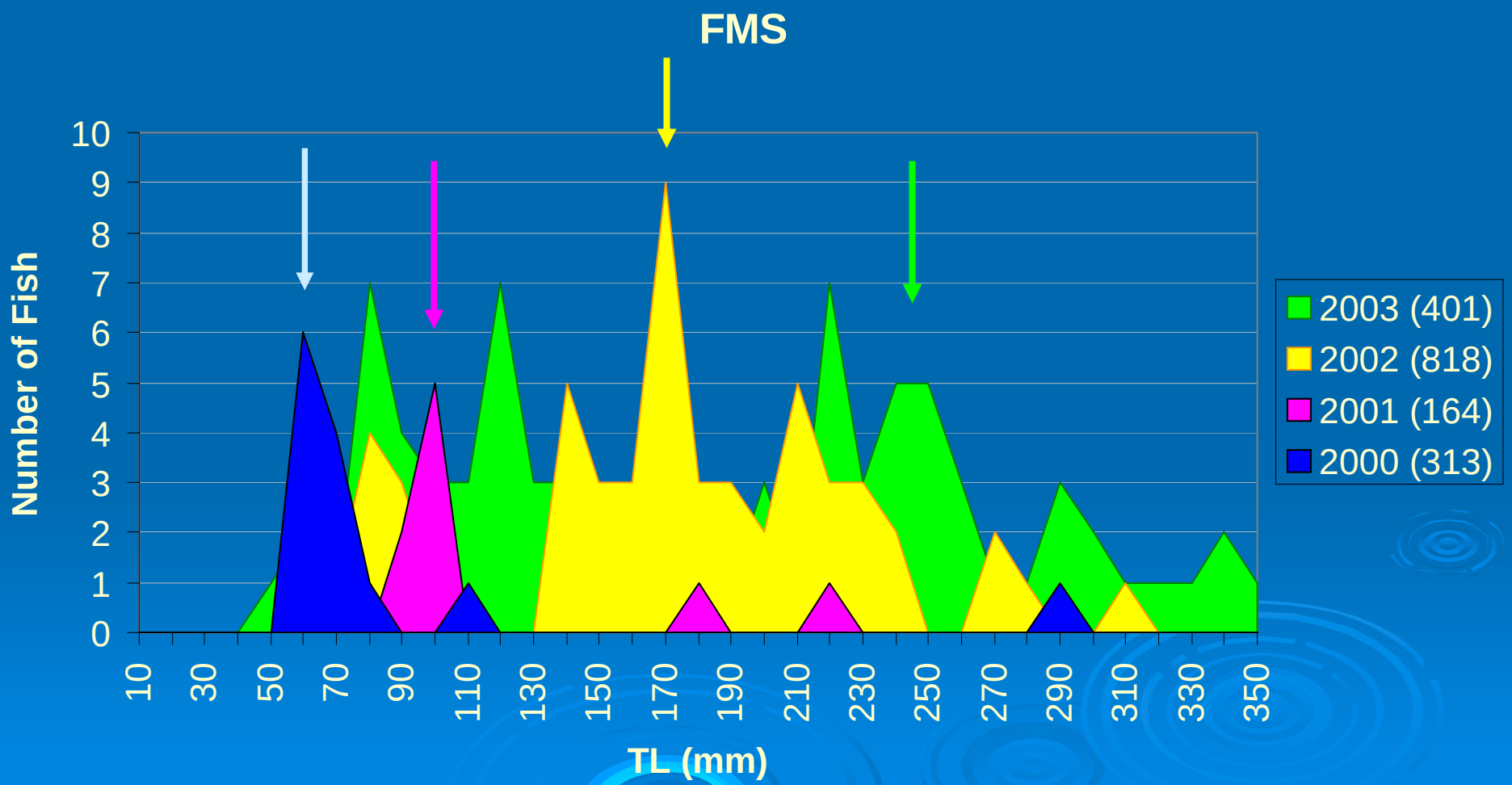
Hydrograph 2001-2003

- 2001-2002
  - Resembled early 1990's, MLFF
- 2003
  - Experimental high fluctuations in early 2003
  - MLFF from April-September

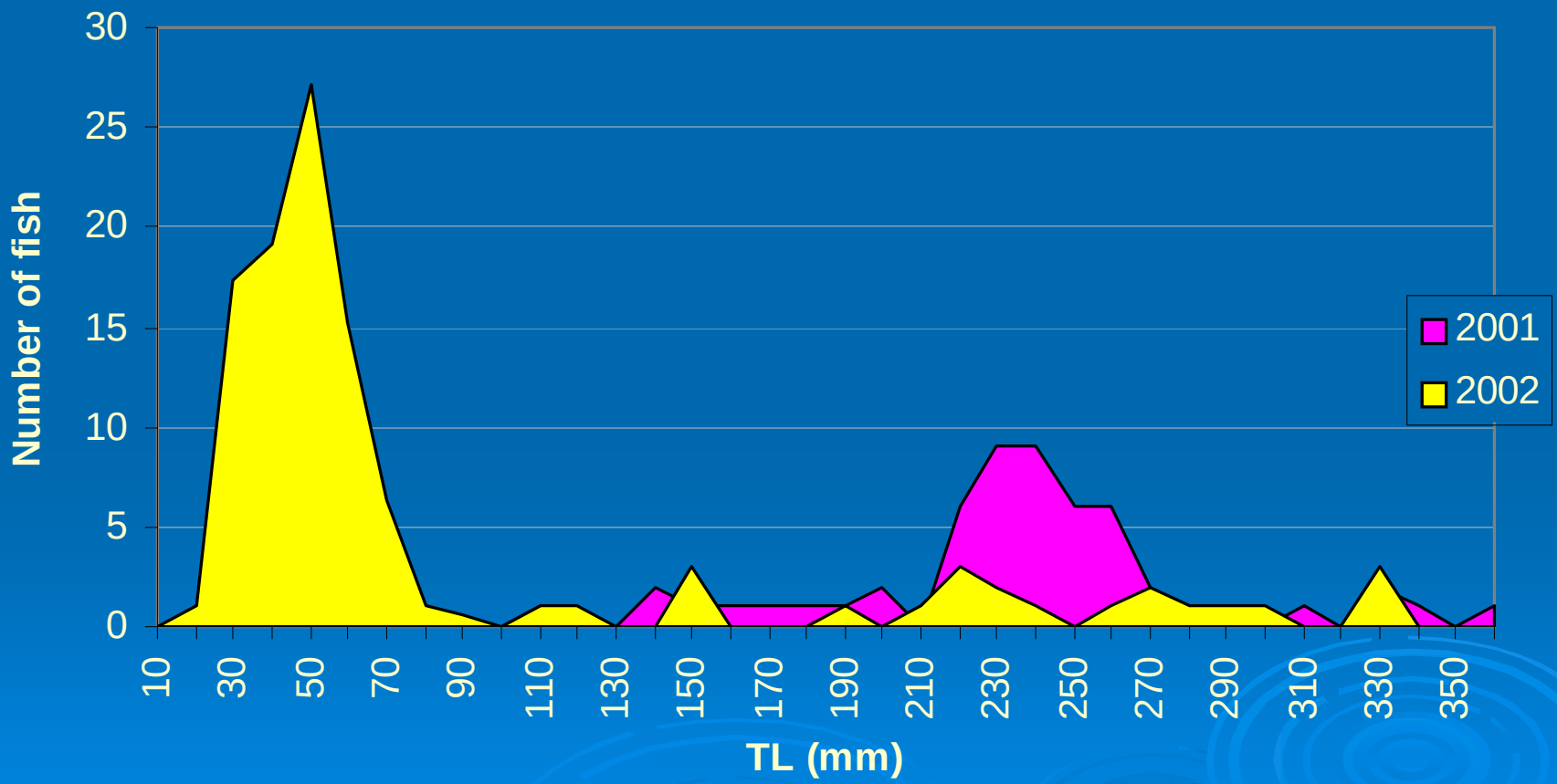


Electrofishing Length Frequency

Arizona Game and Fish Department
S. Rogers, D. Ward, A. Makinster

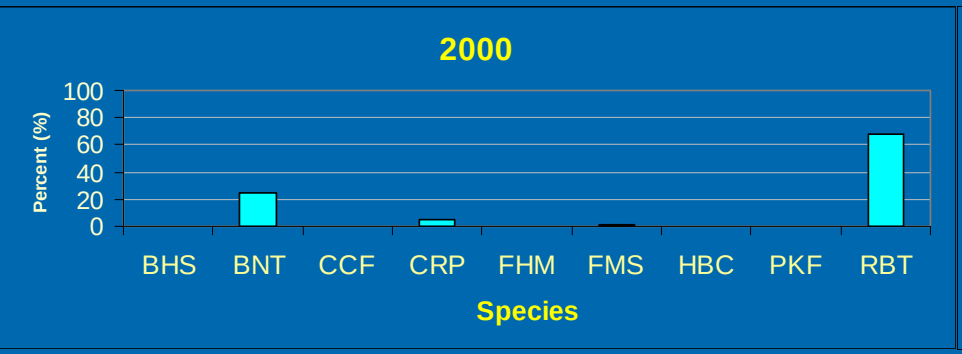


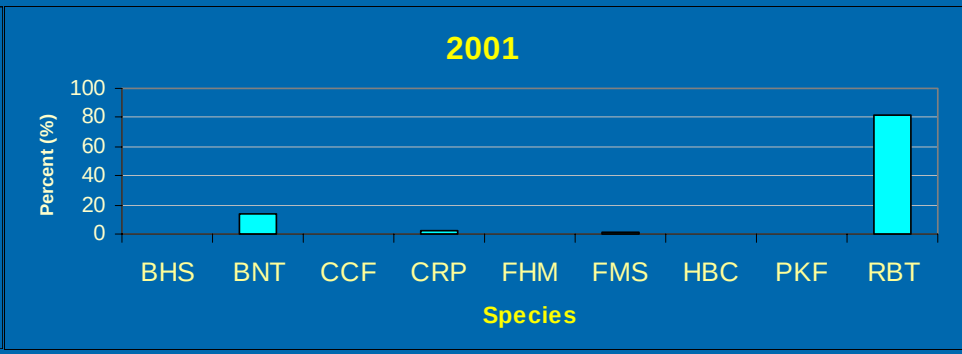
Netting and Seining LF FMS

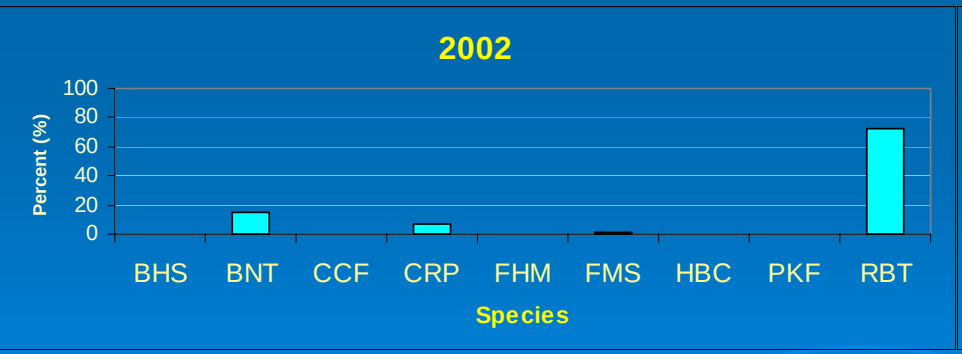


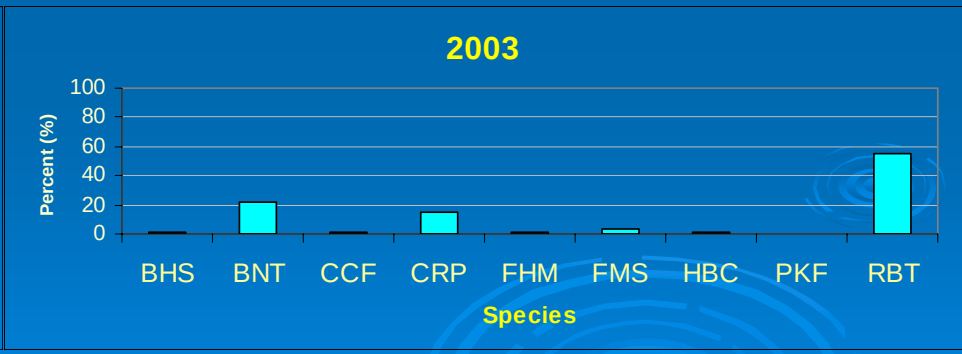
Electrofishing Species Composition

Arizona Game and Fish Department
S. Rogers, D. Ward, A. Makinster

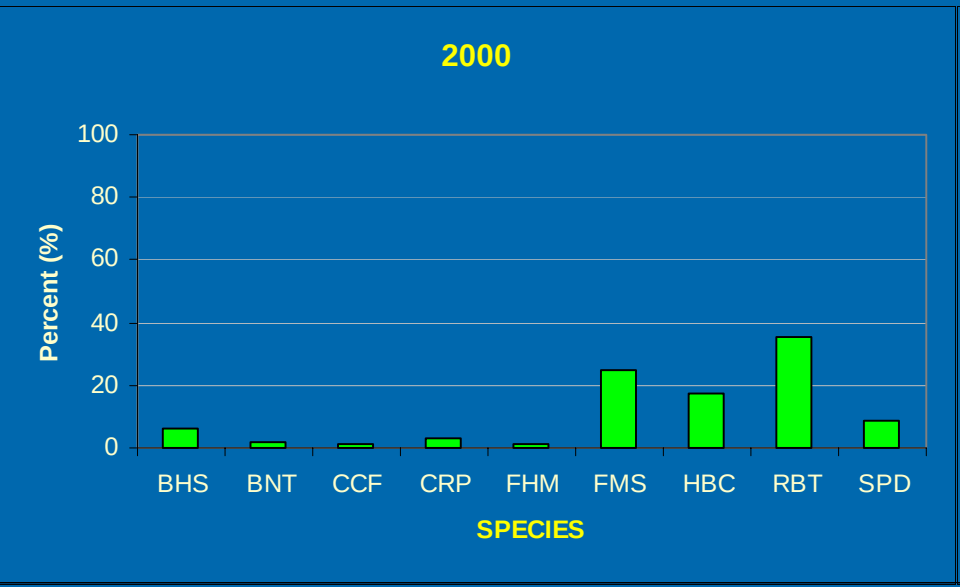


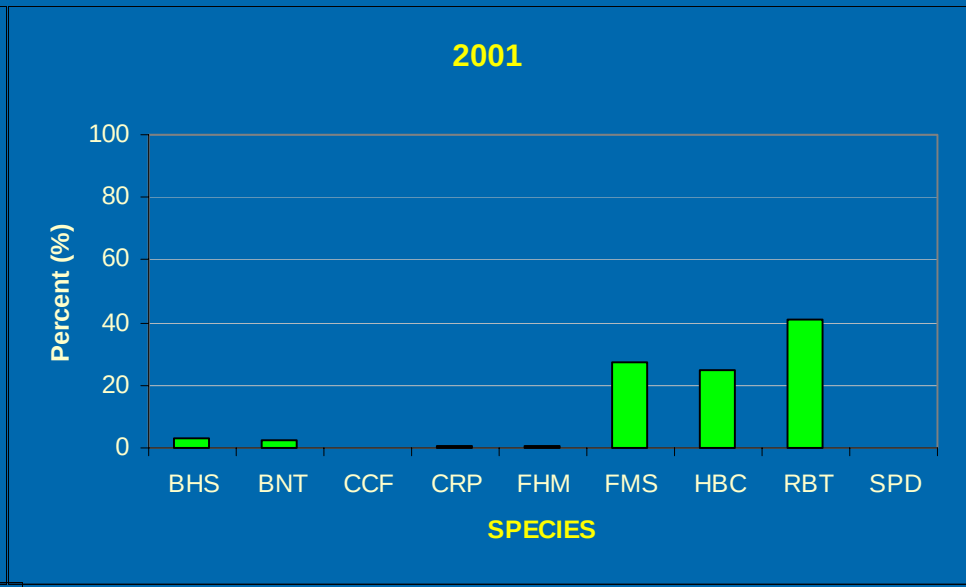


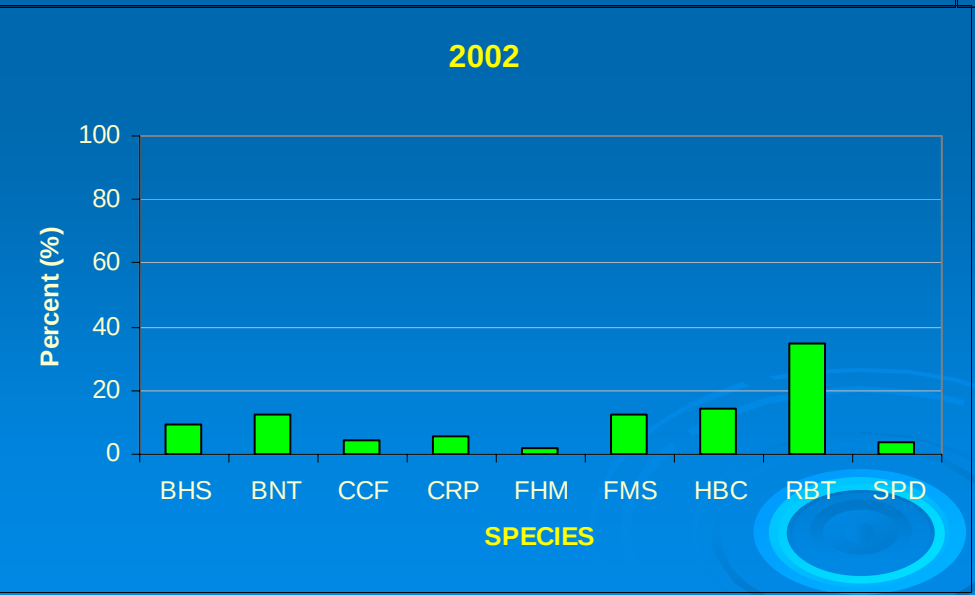




Netting species composition







Trammel net
2002 power analysis

TRAMMEL Net	BHS	BNT	CCF	CRP	FMS	HBC	RBT	STB	Total
FISH	54	70	26	35	52	38	163	3	441
MEAN	0.04	0.04	0.02	0.02	0.03	0.02	0.10	0.00	0.28
ST ERROR	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.00	0.02
CV (SE/MEAN) (818 samples)	0.15	0.20	0.26	0.20	0.16	0.23	0.16	0.58	0.08
CV with Sample Size Doubled (1600 samples)	0.11	0.14	0.18	0.14	0.11	0.16	0.11	0.41	0.08

Hoop net
2002 power analysis

HOOP Net	BHS	BNT	CCF	FHM	FMS	HBC	PKF	RBT	SPD	TOTAL
FISH	1	4	1	11	23	49	2	46	20	157
MEAN	0.01	0.01	0.00	0.05	0.11	0.11	0.00	0.09	0.10	0.48
ST ERROR	0.01	0.01	0.00	0.03	0.03	0.04	0.00	0.02	0.03	0.07
CV (SE/MEAN) (896 samples)	0.98	0.71	1.00	0.55	0.28	0.34	0.71	0.26	0.29	0.15
CV with Sample Size Doubled (1800 Samples)	0.69	0.50	0.71	0.39	0.20	0.24	0.50	0.18	0.20	0.11

Summary of 2003 RESULTS

Long Term Monitoring

- In LCR - No strong recruitment signal from 2000 in HBC in the LCR based on stock synthesis models
  - Current model does not evaluate 2000 recruitment – Lew Coggins, personal communication
- Mainstem electrofishing suggestive, but inconclusive
  - Electrofishing data most comparable from 2000-2003
  - LF shows 2000 year class modes in 2001, 2002 and 2003 for FMS where age classes formerly missing
  - No significant change in species composition or relative abundance
  - Difficulties with changes in methods, length-at-age
- Trammel net and hoop net mainstem sampling in 2002 not sensitive to changes in abundance (sample numbers too low)

- The goal of managers is to have a long-term monitoring program in place to accurately detect changes to the fish population as a result of management actions
  - Long-term monitoring program not established until 2002
  - Trammel net, hoop net, and seine sampling not sensitive enough to detect changes in abundance
  - Electrofishing sensitive to changes in trout and carp abundance, and possibly flannelmouth sucker, but not other species
- Current Long Term Monitoring Program is partially successful, but needs revision

Recommendations

- Management actions should be repeated for full evaluation
- The long-term monitoring program should be continued
- Electrofishing continued at current level
- Sample sizes for trammel nets increased
- Hoop net sampling continued for adequate representation of all age groups, but not increased
- Seine sampling continued to evaluate small-bodied fishes