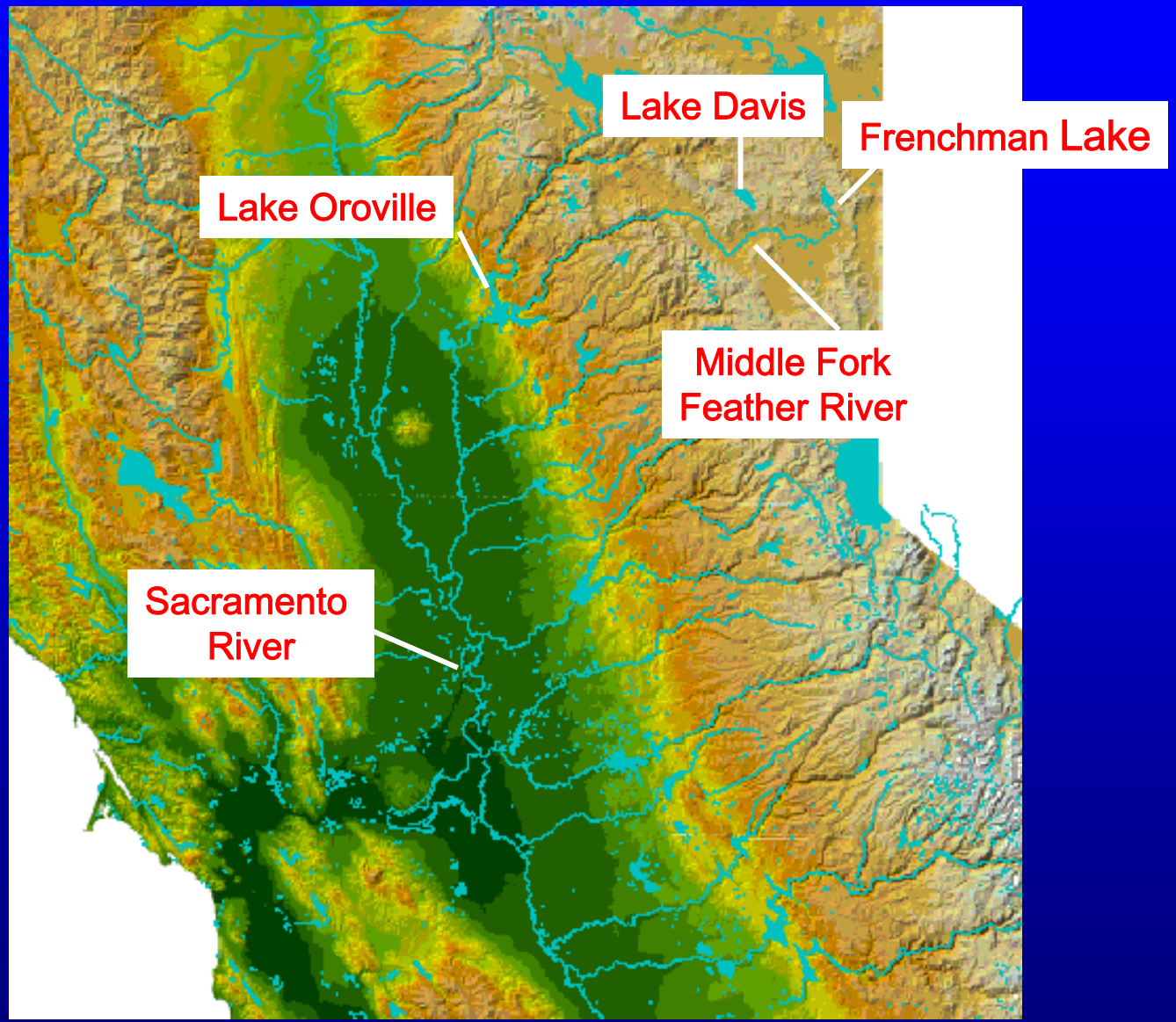
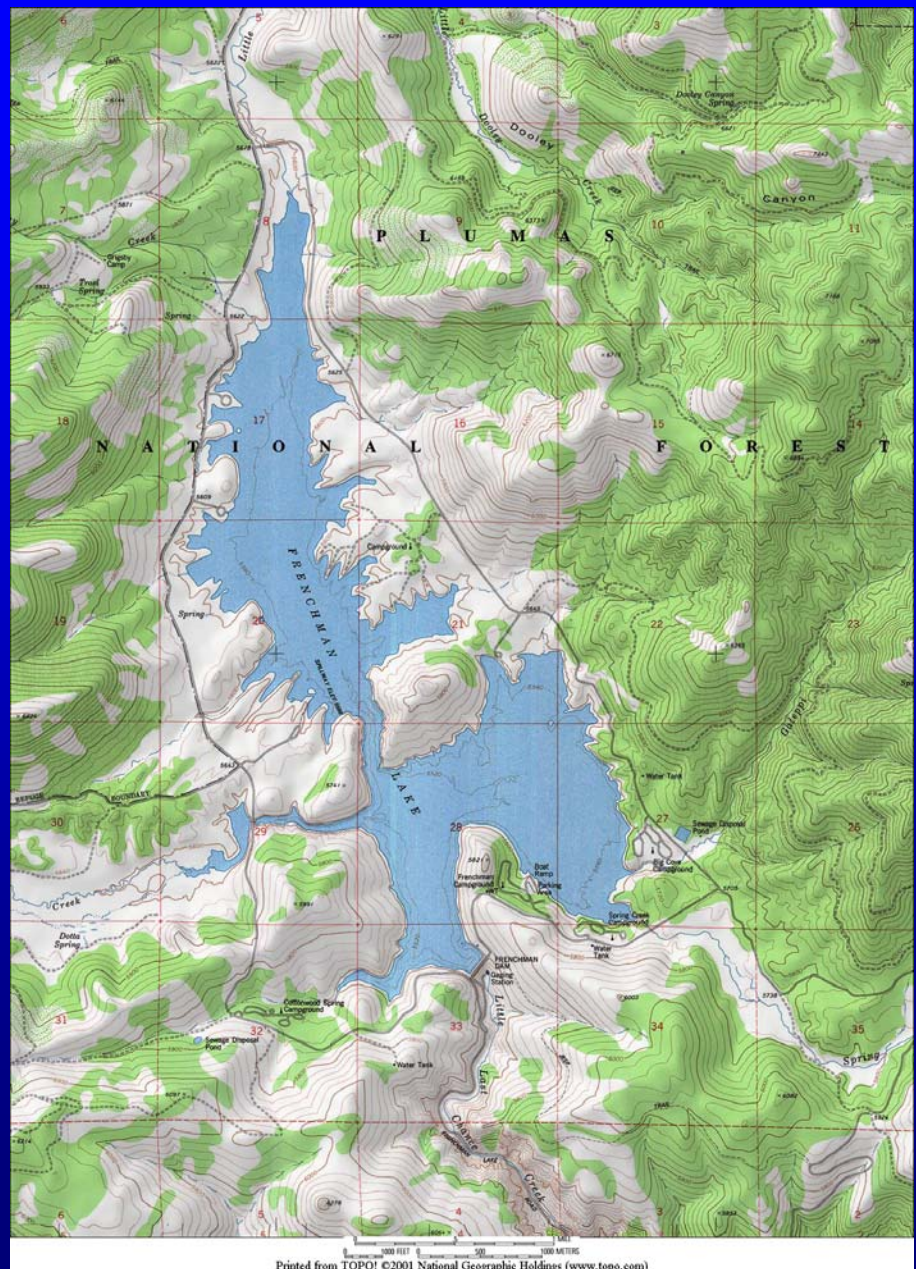

Lake Davis
Frenchman Lake
Lake Oroville
Middle Fork
Feather River
Sacramento
River

Northern Pike (*Esox lucius*)

Native to :
northern Eurasia (Russia, Ukraine, and most of Europe)
northern North America (northeastern United States, interior Canada, and interior Alaska)

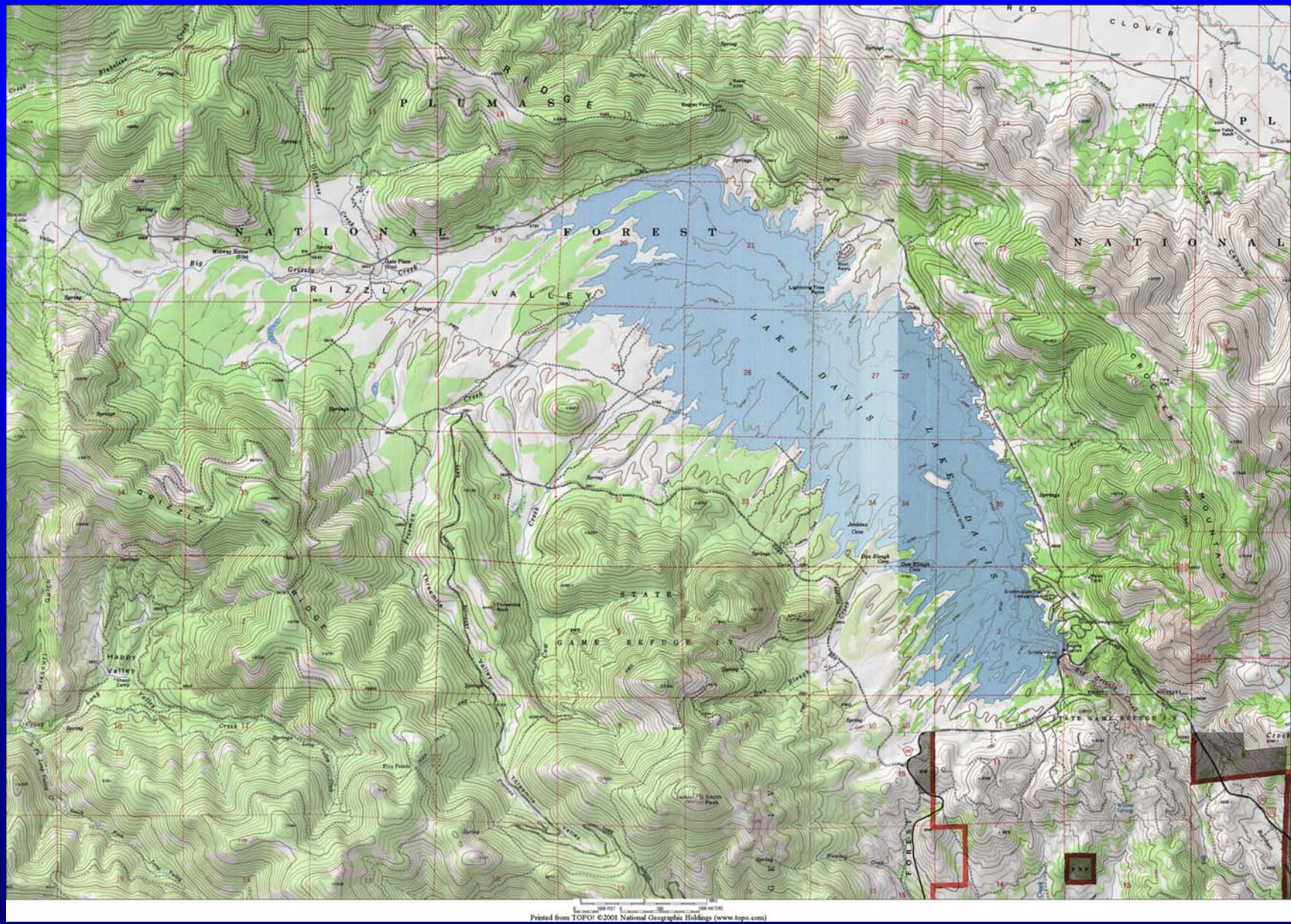
Frenchman Lake



Pike introductions in California

- 1988 - Discovered in Frenchman Lake ☹
  - 55,480 Acre feet
  - 1,580 Surface acres
  - Average depth 35 feet
  - Established reproducing population
  - 1991 chemical (rotenone) treatment
    - Treatment successful ☺

Lake Davis


PLUMAS
NATIONAL FOREST
GRIZZLY VALLEY
LAKE DAVIS
STATE GAME REFUGE
Happy Valley
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)

Pike introductions in California

- 1994 – Discovered in Lake Davis ☹
  - 84,000 Acre feet
  - 4,025 Surface acres
  - Average depth ~ 20 feet
  - Established reproducing population
  - Chemical (rotenone) treatment in October 1997

1997

Lake Davis was treated with rotenone to eradicate pike.

Pike introductions in California

- 1994 – Discovered in Lake Davis ☹
  - 84,000 Acre feet
  - 4,025 Surface acres
  - Average depth ~ 20 feet
  - Established reproducing population
  - Chemical (rotenone) treatment in October 1997
- 1999 – Pike rediscovered in Lake Davis ☹

2000 to present

Control and Containment Strategy

- Upstream and downstream barriers
- Pike removal
- Education and Enforcement
- Fish population monitoring

Barriers *Upstream & Downstream*

- To reduce spawning
- To contain in lake

Electrofishing

To catch & remove pike

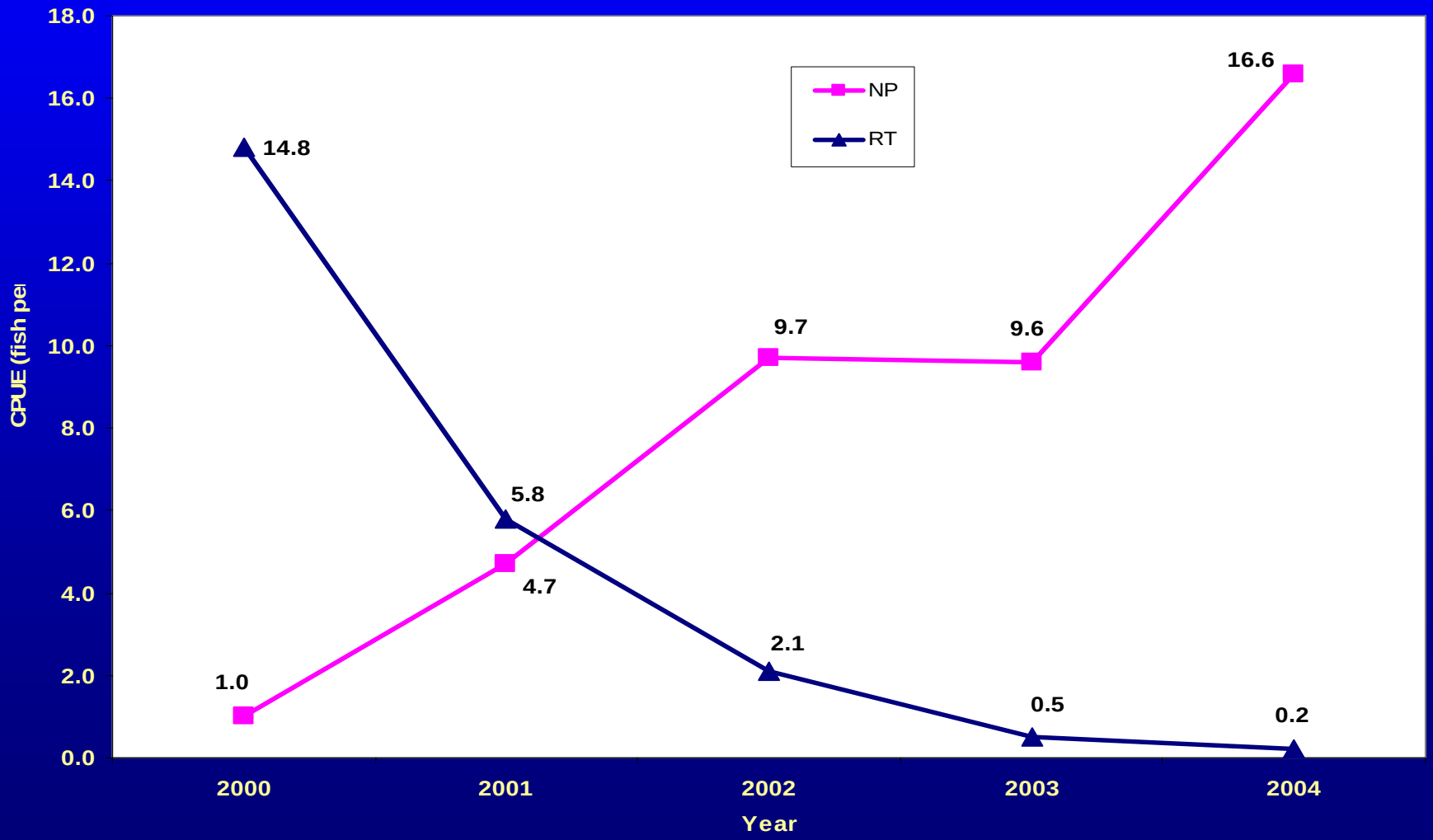
Traps and Nets

To catch & remove more pike

Detonation Cord

Cool but futile

Comparison of CPUE for Electrofishing for Northern Pike and Rainbow Trout



The proposed project:

- **Draw lake down to 10,000-20,000 acre-feet**
- **Use liquid formulation of rotenone to treat the lake and its tributaries**

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring

Protocols

Lake

- 20 coves along SouthWest shore identified for rich habitat
- 10 coves randomly chosen
- Vertical plankton net hauls at mouths of coves
- Slack net benthic invertebrate samples in coves

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring

Protocols

Lake

- Vertical plankton net hauls at mouths of coves
  - 3 samples per cove mouth
  - Depth ≥15 feet
  - 6 inch plankton net, 0.125 mm mesh
  - Net lowered to bottom, pulled to surface
  - Multiple pulls per sample, record pull numbers and depths

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring

Protocols

Lake

- Slack net benthic littoral invertebrate samples in coves
  - 3 randomly selected transects
  - Transects run perpendicular to shoreline
  - Transects run from 4 foot depth to shoreline
  - Slack net with 12 x 18 inch opening, 0.5 mm mesh
  - Starting at 4 foot depth, net gently bumped along bottom to shore

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring

Sampling Dates	Time Relative to Treatment	Zooplankton Sampled?	Littoral Zone Sampled?
July 22-23, 1997	3 months prior	Yes	No
September 25-26, 1997	18 days prior	Yes	Yes
October 21-23, 1997	7 days post	Yes	Yes
July 28-30, 1998	9 months post	Yes	Yes
August 18, 1999	22 months post	Yes	Yes

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring - Zooplankton

Sampling Date	Zooplankton/liter	Total Zooplankton Collected	Taxa Richness
July, 1997	10	116,482	9
September, 1997	7	131,639	7
October, 1997	<1	710	3
July, 1998	24	396,260	9
August, 1999	12	323,227	8

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring - Macroinvertebrates

Mean Biological Metric Values (% Coef. Vari.)				
Metrics	Sept. 1997	Oct. 1997	July 1998	Aug. 1999
Abundance	5,077 (61)	2,891 (64)	2,947 (68)	3,094 (41)
Taxa Richness	19 (15)	16 (12)	26 (14)	21 (19)
EPT Taxa	3.9 (27)	2.5 (35)	2.1 (42)	2.6 (32)
EPT Index	26 (47)	23 (50)	4 (67)	52 (41)
% Dominant Taxa	33 (24)	39 (23)	26 (32)	47 (38)
Shannon Diversity	2.08 (10)	1.86 (11)	2.47 (10)	1.87 (23)

Lake Davis Aquatic Invertebrates Study: 1997 Monitoring - Macroinvertebrates

Cumulative Number of Littoral Invertebrate Taxa				
	Sept. 1997	Oct. 1997	July 1998	Aug. 1999
Cumulative Taxa (CT)	41	38	59	54
Coleoptera Taxa (Co)	2	1	12	9
Hemiptera Taxa (He)	4	1	6	5
CT minus Co and He	35	36	41	40

Lake Davis Aquatic Invertebrates Study: Drainage Inventory

2005/2006

Summer

- Qualitative Multi-Habitat Inventory
- Sweep Net Sampling (Adults)

Fall

- Qualitative Multi-Habitat Inventory
- Sweep Net Sampling (Adults)

Spring

- Qualitative Multi-Habitat Inventory
- Sweep Net Sampling (Adults)
- Emergence Trapping/Malaise Traps (Run into Summer)

USGS
science for a changing world

Revised Protocols for Sampling Algal, Invertebrate, and Fish Communities as Part of the National Water-Quality Assessment Program

Open-File Report 02-150

U.S. Department of the Interior
U.S. Geological Survey

Lake Davis Aquatic Invertebrates Study: Drainage Inventory

Protocols

Field sampling – Qualitative Multi-Habitat Inventory

- Performed by professional entomologist
- Identify and sample all habitats available at site
- D-ring kick net, 0.5 mm mesh
- Hand-pick organisms from substrate when necessary


BIOLOGY FOR
Life

Lake Davis Aquatic Invertebrates Study: Drainage Inventory

Protocols

Laboratory

- Performed by professional entomologist
- 2.5 hour sample pick
- Identify all organisms to species when possible
- Send un-identified organisms to appropriate expert
- Archive all organisms

Sample Site Locations: Major Streams

- Headwaters
- Upstream of Gradient Break
- Downstream of Gradient Break
- Lower Reach

Sample Site Locations: Major Streams - Headwaters

Sample Site Locations: Major Streams – High Gradient

Sample Site Locations: Major Streams – Low Gradient

Sample Site Locations:
Major Streams – Other Low Gradient

Sample Site Locations: Small Streams and Springs

- All small streams will be sampled when watered
  - At least one site per wetted stream
  - Multiple sites will be sampled across gradient breaks
- All spring sources will be sampled

Sample Site Locations: Small Streams and Springs

Sample Site Locations: Small Streams and Springs

Lake Davis Aquatic Invertebrates Study: Bioassessment Monitoring

2006/2007

Fall (Pre-Drawdown)

Stream Bioassessment - Aquatic Macro-invertebrate Sampling

Lake Monitoring - Littoral Benthic Sampling/Zooplankton Sampling

Lake Davis Aquatic Invertebrates Study: Bioassessment Monitoring

2007/2008

Fall (Pre-Treatment)

- Stream Bioassessment - Aquatic Macro-invertebrate Sampling
- Lake Monitoring - Littoral Benthic Sampling/Zooplankton Sampling

Fall (Post-Treatment)

- Stream Bioassessment - Aquatic Macro-invertebrate Sampling
- Lake Monitoring - Littoral Benthic Sampling/Zooplankton Sampling

Spring (Post-Treatment)

- Stream Bioassessment - Aquatic Macro-invertebrate Sampling
- Lake Monitoring - Littoral Benthic Sampling/Zooplankton Sampling

Lake Davis Aquatic Invertebrates Study: Bioassessment Monitoring

2008/2009

Fall (Post-Treatment, 1 Year After)

- **Stream Bioassessment - Aquatic Macro-invertebrate Sampling**
- **Lake Monitoring - Littoral Benthic Sampling/Zooplankton Sampling**

Lake Davis Aquatic Invertebrates Study: Bioassessment Monitoring

Protocols

Streams

California Stream Bioassessment Procedure (CSBP)

'… a standardized protocol for assessing biological and physical/habitat conditions of wadeable streams in California.'

Lake

Protocols to be developed.

Lake Davis Aquatic Invertebrates Study: Drainage Inventory

Where are we now?

Summer sampling

- 23 sites sampled
- Sample picking nearing completion

Fall sampling

- 27 sites sampled

Lake Davis Aquatic Invertebrates Study: Drainage Inventory – Site Locations