Eel River Recovery Project
Water Temperature, Flow & Cyanobacteria
Citizen Monitoring in a 3600 Square Mile Watershed

Eel River Recovery Project

Founded in 2011

Engage, Enlighten, Empower

Working on Solutions – not an Advocacy Organization

Scope the Community

Identify Needs

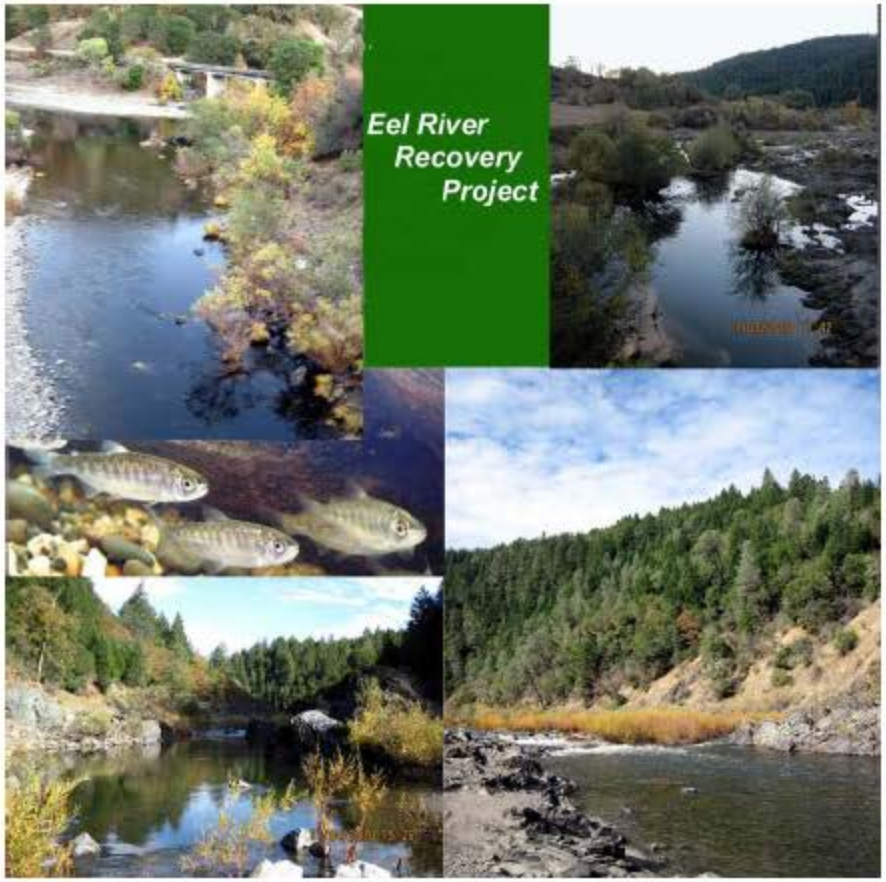
Find Resources to Solve Problems

Implement Projects

Monitor Results

Share Back w/Community

Eel River Recovery Project to Enable Residents to Monitor Water Quality and Fisheries and to Collectively Participate in Ecological Restoration



Concept Framework by:
Patrick Higgins
Consulting Fisheries Biologist

Sponsored by the Trees Foundation

May 30, 2011

Community Scoping Meetings in September 2011 in Fortuna, Redway and Willits were captured by HSU facilitation team. Citizen input was transcribed and formed the basis of discussions at subsequent retreat in late October 2011.

See www.eelriverrecovery.org on the web to read meeting records.

Retreats in October 2011 and 2012 Set Agendas – Action Plans

Committees Formed – Grants Acquired - Things Got Done

DRAFT

Eel River Recovery Project Contributions to the Eel River Action Plan

By **Patrick Higgins**
ERRP Volunteer Coordinator
(707) 223-7200

January 30, 2014

Community Concerns

- Is the river drying up?
- Are salmon and steelhead at risk of extinction?
- Why is the river developing toxic algae and is there anything we can do to reverse this condition?

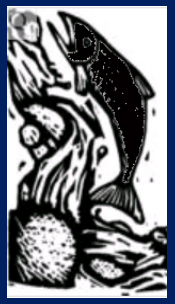
Solution

- Frame hypotheses, organize and support monitoring, & share information necessary for adaptive management.

Community Education

Co-Sponsors

Trees Foundation
Mateel Community Center
Sanctuary Forest
Redwood Forest Foundation
Friends of Van Duzen River
EPIC
Friends of Eel
Institute for Sustainable Forestry
Salmonid Restoration Federation
Mendocino County RCD
KMUD Radio
CalTrout



Underwriters

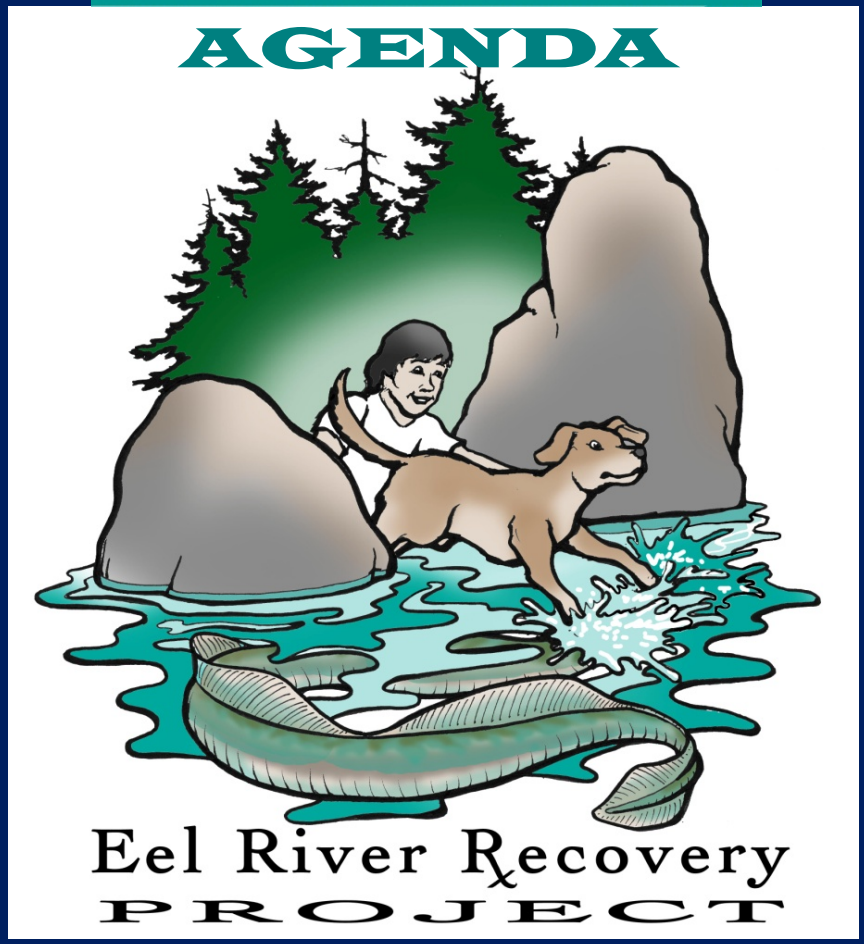
BioEngineering Associates
Chautauqua Natural Foods
Community Credit Union
Daisy Supply
Emerald Growers Association
Pacific Watershed Associates
Whitethorn Construction

Supporting Businesses

Eureka Natural Foods
Los Bagels
Lost Coast Brewery
Redway Liquors
ShopSmart
Signature Coffee
Sylvandale Nursery
Wyckoff's Plumbing (Meadows Bus. Park)

WATER DAY III

AGENDA



March 30, 2013

Mateel Community Center

Redway, California
















Eel River Recovery PROJECT

Salmon Awareness Festival

Thanks Round Valley Tribes

2015

Eel River Recovery Project
2012 Volunteer Water Quality, Photopoint and Fisheries Monitoring Plan

Performed for:
Eel River Recovery Project

By:
Patrick Higgins
Consulting Fisheries Biologist
791 Eighth Street, Suite N
Arcata, CA 95521
(707) 822-9428

May 19, 2012

ERRP 2012 Monitoring Project

1) Fall Chinook salmon monitoring in the lower Eel River from September to November (Higgins 2010a)

2) Water temperature monitoring in mainstem reaches and tributaries of the Eel River with gage location at sites of previous data collection (i.e. Kubicek 1972, Friedrichsen et al. 1998, HCRCD 1999, 2001, 2003), and

3) Toxic algae monitoring in the lower mainstem Eel, South Fork and Van Duzen rivers with correlative water temperatures at selected monitoring locations.

Questions Driving ERRP WQ and Algae Studies

Hypothesis #1: Is Eel River tributary flow decreasing due to changes in land use?

- ERRP is using water temperature as a surrogate for flow since we have baseline data (1972, 1995-2003)
  - Smaller volume of water will heat up more rapidly
  - Lower flows have longer transit time, which also causes stream warming. Detect flow depletion BEFORE streams go dry.

Hypothesis #2: Are flow depletion and nutrient increases causing toxic algae that was never a problem historically?

- ERRP and UCB are collecting baseline data to analyze factors that co-occur with toxic algae (i.e. water temperature, algae community)
- Presence/Absence of cyanotoxins
- Use algal densities to understand nutrient supply and cycling in the Eel River
- Monitor long term trends to discern where nutrient pollution reduction is working

Temperature & Flow Monitoring 2012

- Jerry Albright and June Ruckman
- Tam Adams
- Chuck Ream
- Larry Desmond
- Kelly Harris
- Wally Stahle
- Cathy Warren
- Maureen McIver
- Bruce Hillbach-Barger
- Dane Downing
- Geoff & Stephanie Davis
- Bill Reynolds
- Martin – Black Oak Ranch
- David Sopjes
- Sal Steinberg
- Paul Trichilo
- Karen & Scott Walsh
- Graham and Dotti Russell
- Wiyot Tribe Environmental Department

Funding By: Rose Foundation/Patagonia
Equipment: North Coast Regional Water Quality Control Board & Mendocino County Water Agency

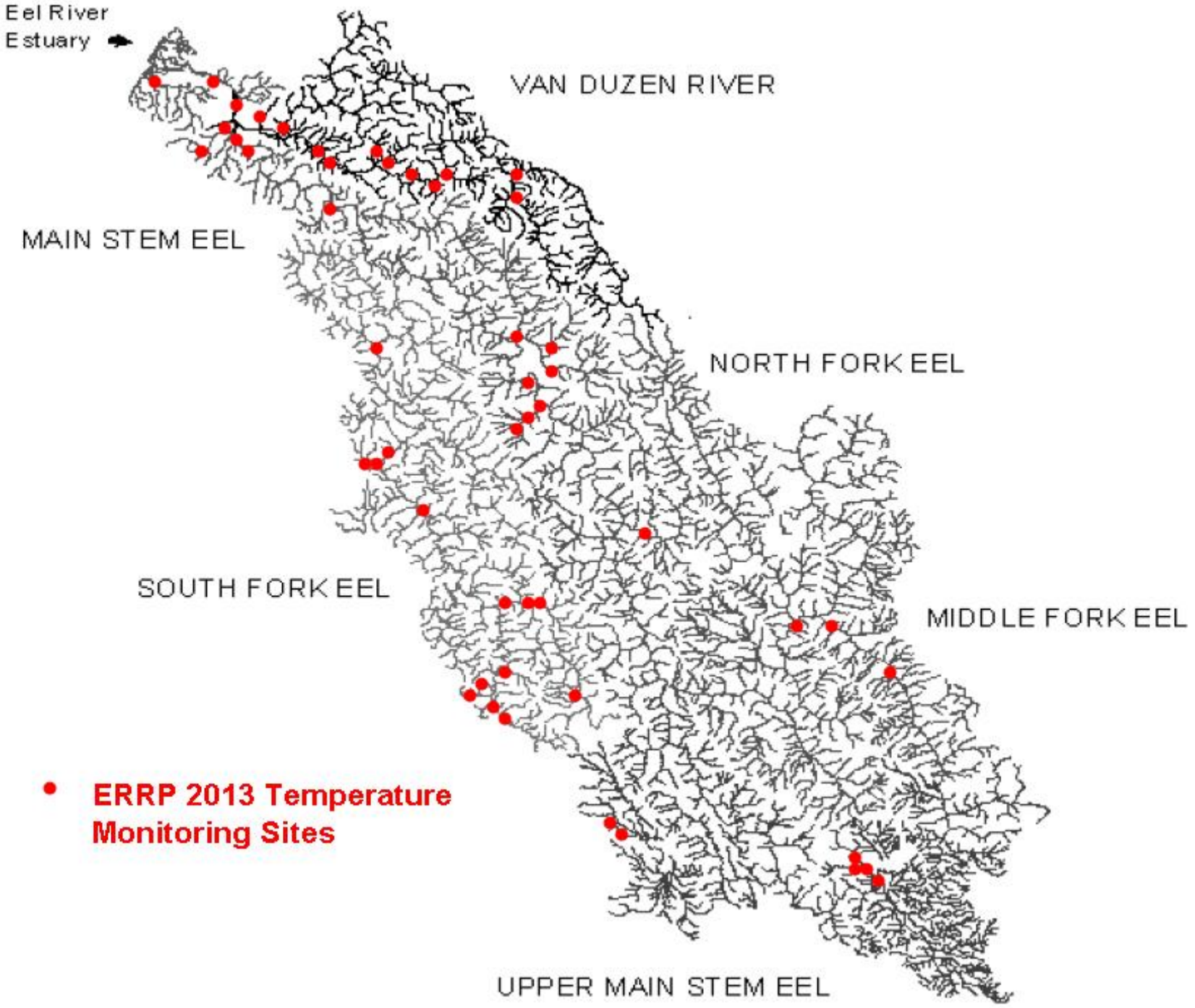
Temp/Flow Monitoring in 2013

- Dane Downing/Bruce Hilbach Barger (MF)
- Tam Adams & Chuck Ream (Main Eel – Hearst)
- David Weitzman & Jason Gauder (NF/Hulls Cr)
- Tom Grover (Redwood Cr/SF Eel)
- Larry Desmond, Kelly Harris, Wally Stahle (Outlet)
- Cathy Warren (lower Outlet, Eel)
- Maureen McIver, Graham & Dottie Russell (SF)
- Geoff & Stephanie Davis (Mid-Eel/Dobbyns)
- Sunshine Johnson, Seth Rick (Shively/Holmes)
- Martin Mitchell (Ten Mile/Laytonville)
- David Sopjes, Dennis Miranda (lower Eel)
- Sal Steinberg, Paul Trichilo, MKIW (Van Duzen)
- Six Rivers National Forest (VD/MKIW)
- Karen & Scott Walsh, Mark Howard (Upper SF)
- Jeff Hedin (SF at Standish Hickey/EBSF)
- Paul & Barbara Domanchuk (VD)
- Proud & Maria Savage, Walker Wise (Chemise)
- Humboldt Redwood Company
- Wiyot Tribe Environmental Department
- 65 Automated temp probes deployed
- ERRP Thanks the Rose Foundation's
- Grass Roots Fund ($4000 only to date)

Eel River Recovery Project
Summer-Fall 2015 Volunteers

Seth Rick
Diane Higgins
Sal Steinberg
Jim Rizza
Eric Stockwell
Amy Conway
Jeff Hedin
Andrew Hedin
John Evans
Martin Mitchell
Heather Downey
Lidge Britton
Dane Downing
Bret Lovelace
Heron Hilbach-Barger
Larry Desmond
Wally Stahle
Greg Byers
John Filce
Graham & Dotti Russell
Arianna Nuri
Larry Bruckenstein
Sunshine & Erick Johnston

Bob Froelich
Doug Parkinson
Phil Georgakakos
Keith Bouma-Gregson
Walker Wise
Dorje Bond
Tom Grover
Willie Grover
Cathy Warren
Gordon Crawford
Dean Bowler
Jake O'Rear
Josh Woodruff
David & Barbara Sopjes
Proud & Maria Savage
Eloisa Britton
Jerry Britton
Paul & Barbara Domanchuk
Bill Eastwood
Dan Carpenter
Mickey Bailey
Sharon & Dean Edell
Karen & Scott Walsh


Eel River
Estuary
VAN DUZEN RIVER
MAIN STEM EEL
NORTH FORK EEL
SOUTH FORK EEL
MIDDLE FORK EEL
UPPER MAIN STEM EEL
ERRP 2013 Temperature
Monitoring Sites

Suitability of water temperature of salmonids as an average of all yearly Maximum Floating Weekly Maximum (MWMT) values averaged from 1980-2015.

Methods

Water temperature data were collected following the methods of Lewis (1999) and Friedrichsen (1998).

- Probes properly calibrated in ice bath
- Placed in flowing water reflecting ambient stream conditions
- Placed out of direct sunlight

Potential problems arising are:

1) Exposure of the sensor to the air,
2) Improper calibration procedures,
3) Improper placement of the sensor in the stream,
4) Low battery,
5) Inherent malfunctions in the automated probe, and
6) Vandalism.

SF Dobbyns. Warm in 2013 with steelhead juveniles surviving, but also pikeminnow present and more abundant in late summer.

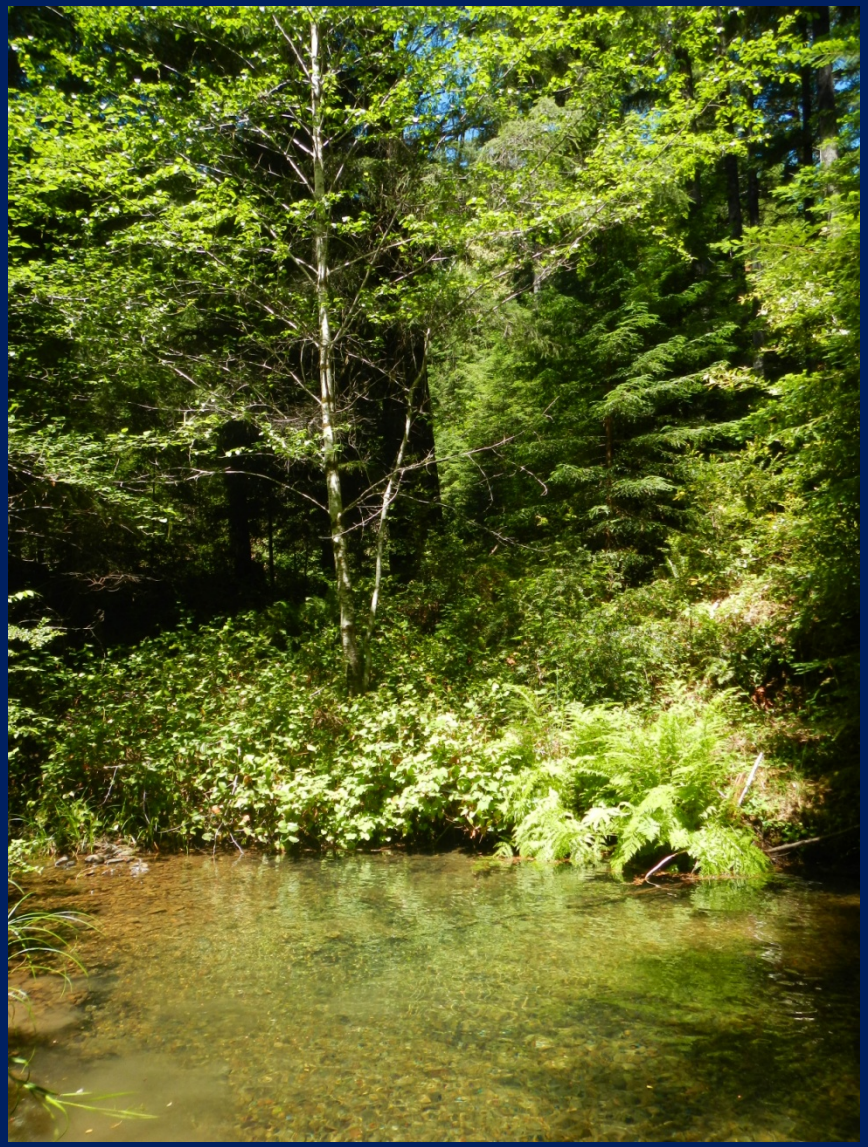
Chemise Creek maintained surface flow and the ability to support steelhead.

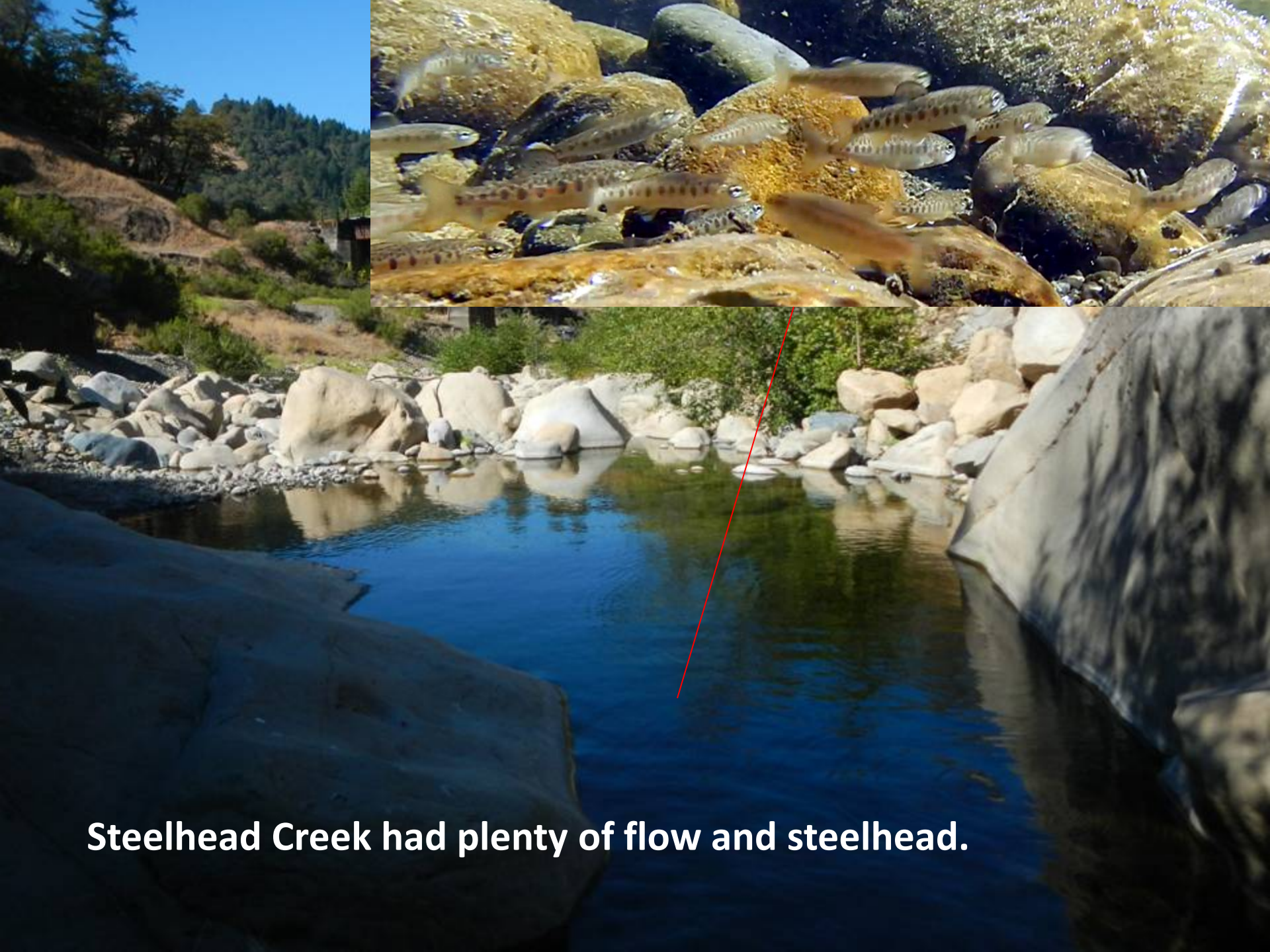
1997

2012

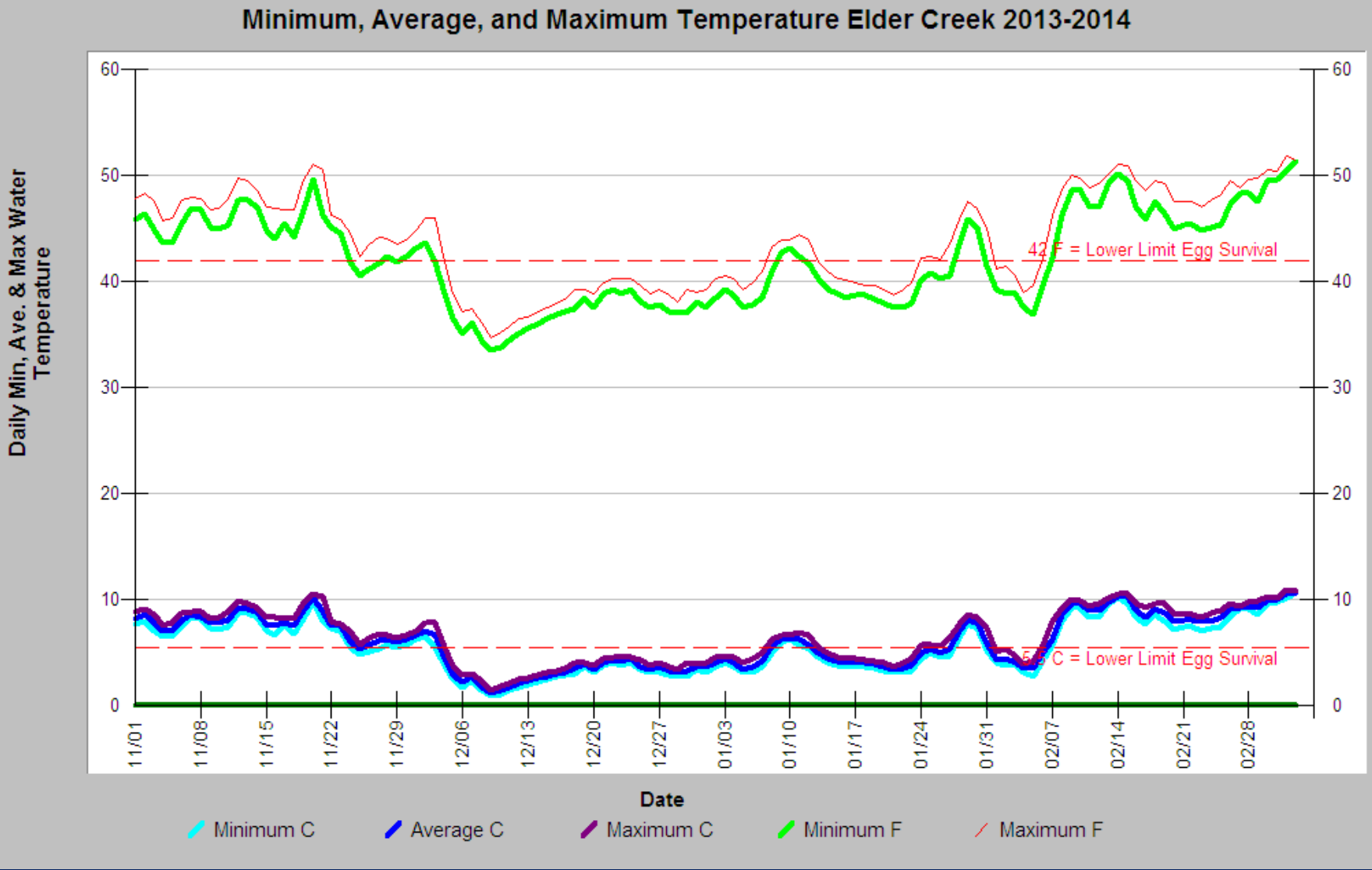
Bear Creek at left in January 1997 after New Years storm that caused the creek to become shallow, wide and warm. The photo above was taken in 2012 and shows the creek has cut down through the sediment deposited, which remains as flood terraces. The width to depth ratio is improving and an alder canopy has developed, which has helped promote cooling.

Where are the Refugia?





Steelhead Creek had plenty of flow and steelhead.


Minimum, Average, and Maximum Temperature Elder Creek 2013-2014
Daily Min, Ave. & Max Water Temperature
60
50
40
30
20
10
0
42 F = Lower Limit Egg Survival
5.6 C = Lower Limit Egg Survival
11/01
11/08
11/15
11/22
11/29
12/06
12/13
12/20
12/27
01/03
01/10
01/17
01/24
01/31
02/07
02/14
02/21
02/28
Date
Minimum C
Average C
Maximum C
Minimum F
Maximum F

Lower Outlet Creek

Historically maintained surface flow perennially

Tomki Creek was intermittent in flow at the Hearst-Willits Road low crossing where Rocktree Creek (left) joins upper Tomki Creek (bottom right). There was no reason to place a water temperature probe at this location as there were no salmonids in the isolated pool and no indication of cold groundwater influence.

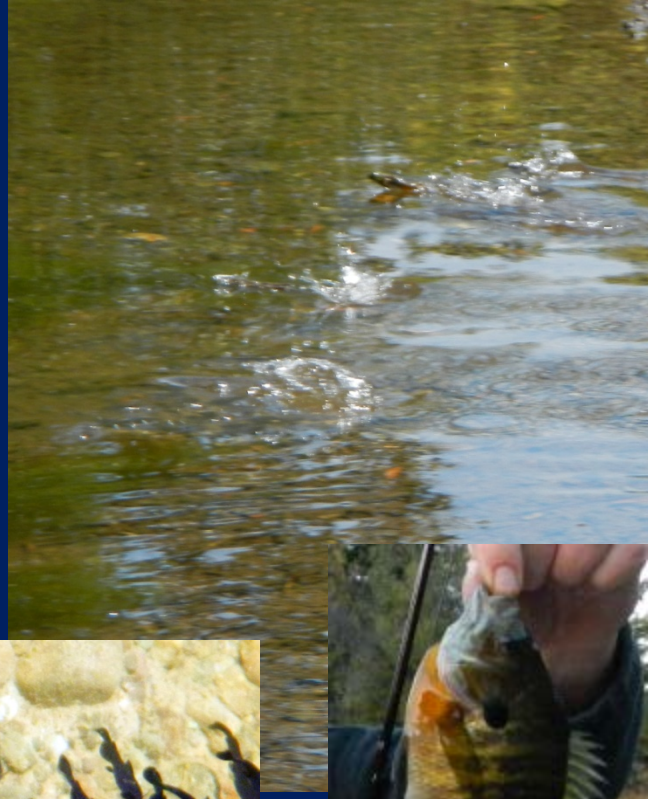
Tomki Creek – Going Dry
June 14, 2012

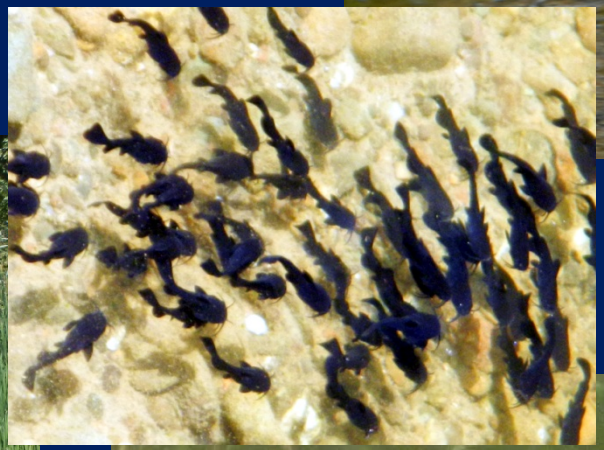
Ten Mile, Outlet and Tomki creeks went dry early in 2013.

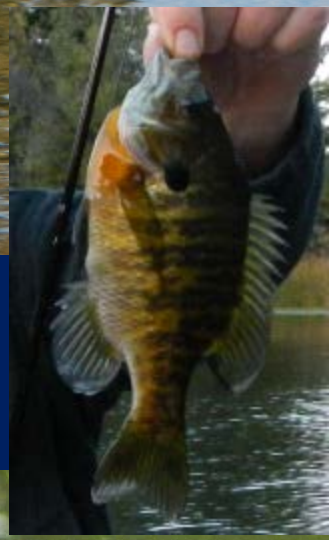
Ten Mile Creek

Hostile Take Over by Non-Native Species

Bullfrogs, green-eared sunfish, black catfish and thousands of bull frogs

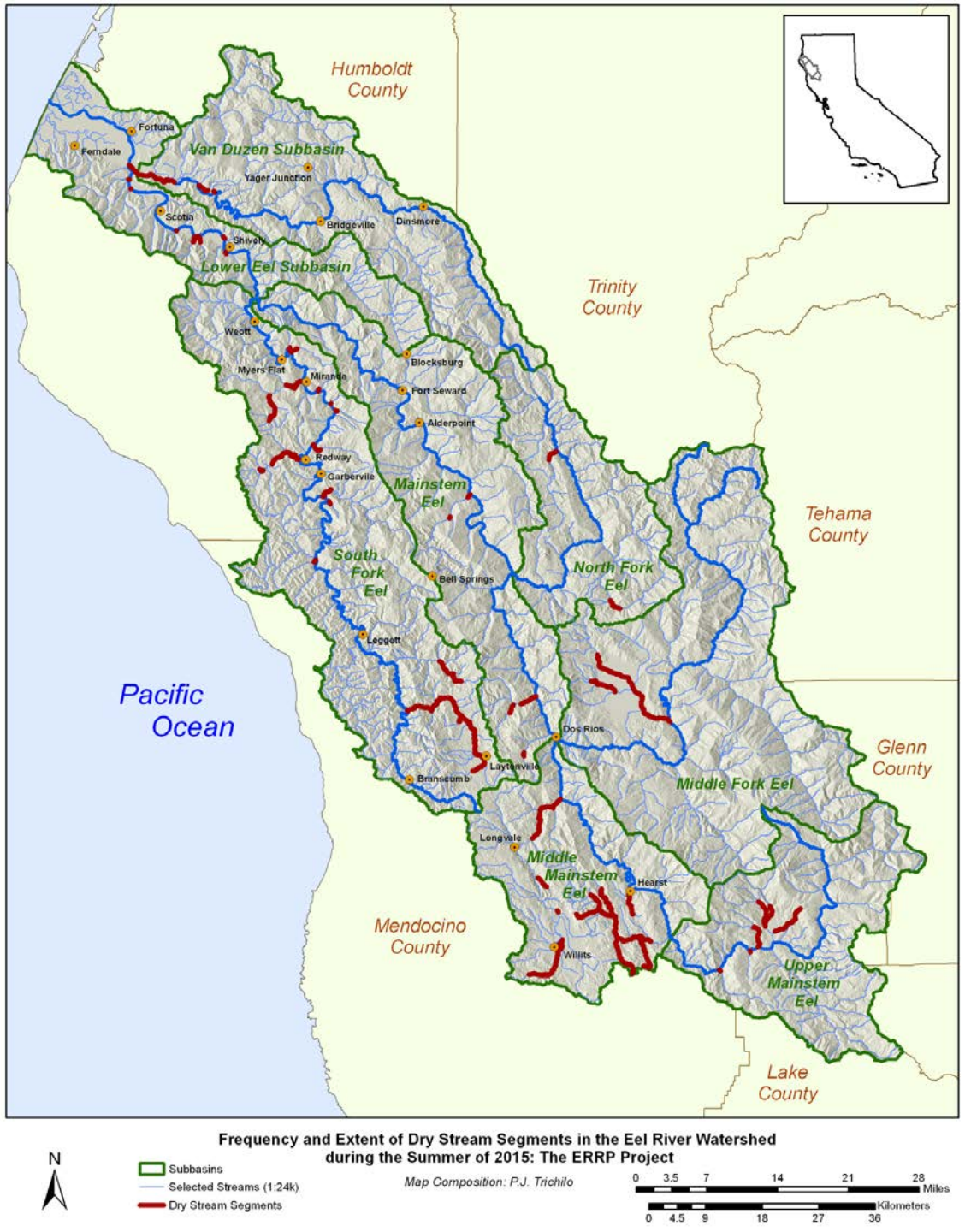






Redwood Creek (Redway) dry in early September 2013

Where Eel River tributaries went dry in 2015.



Location of Time Lapse Cameras placed by ERRP in 2015.


WINGSCAPES
CHEMISE
31 AUG 2015 06:30 pm


WINGSCAPES
CHEMISE
11 JAN 2016 02:53 pm


WINGSCAPES
CHEMISE
17 JAN 2016 01:00 pm


WINGSCAPES
CHEMISE
23 JAN 2016 03:00 pm

CYANOBACTERIA - TOXIC ALGAE

Expanded ERRP Algae Watch in 2013

If we do nothing, the non-normative toxic blooms will become the norm.


Much of the Eel River not
swimmable after July 31.

Toxic Algae 2012 Reconnaissance

Graham Russell
Miranda/Phillipsville

Paul Domanchuk
Van Duzen

Maureen McIver
Piercy

Bill Reynolds
Shively

- Photo document conditions on Van Duzen, lower SF, & lower Eel
- Communicate with Humboldt County Public Health
- Develop early warning system
- Collect water temperature data to see if relationships exist with toxic algae development

2012 ERRP Findings of Toxic Algae and Water Quality and Monitoring

- 2012 was not a problem year for toxic algae
- Wet late into spring and flows high enough to prevent stagnation
- Marine influence kept summer water temperatures moderate in summer and fall 2012

ERRP Partners w/ UC Berkeley for 2013 Toxic Algae Project

Keith Bouma-Gregson

Dr. Paul Domanchuk (r) & Ranger Pat (c)

David & Barbara Sopjes

Cyanotoxin Monitoring July 17, 2013

UC Berkeley Algae Retreat June 28-30

Diane Higgins & Sal Steinberg

- Keith Bouma-Gregson joins ERRP and heads Algae Committee
- Transects at 8 locations but teaching volunteers how to recognize algae species
- Volunteers help ID problems
- Collecting information on Cyanotoxins and analysis provided by UC Santa Cruz
- High risk season due to low flows and warm air temperatures.
- ERRP will get photos of Eel River and tributaries so people can visit their website and see conditions.

Attachment A
Deploying SPATT Samplers 2015

Storing SPATT samplers before deployment

- Keep samplers in ziplock bags in a refrigerator until deploying in the field.
- After retrieval keep samplers in ziplock bags with no water in the freezer

Equipment Checklist

- ✓ Deployment ziplock (w/ unused SPATT sampler inside)
- ✓ Empty ziplock bag to retrieve sampler
- ✓ Squeeze bottle
- ✓ Permanent marker
- ✓ Zipties
- ✓ Exacto knife
- ✓ Small cooler w/ ice
- ✓ Underwater camera

Timeline

- Monthly deployment and retrieval of SPATT samplers
- Check-up on SPATT samplers every 7-10 days. Remove any detritus/algae wrapped around the SPATT sampler and gently massage the mesh with your fingers to remove any accumulated biofilm.

While at the car and before entering the water

1. Write down the location, deployment date, and approximate deployment time on the deployment ziplock bag.
2. Write down the retrieval location, date, and time on the empty ziplock retrieval bag.

Deploying and retrieving SPATT Samplers

1. Go into the river and remove the previous SPATT sampler.
2. Pour out the water in the new ziplock bag, and then ziptie the new sampler to the rebar. Don't ziptie too tight; be sure you can still slide the ziptie up and

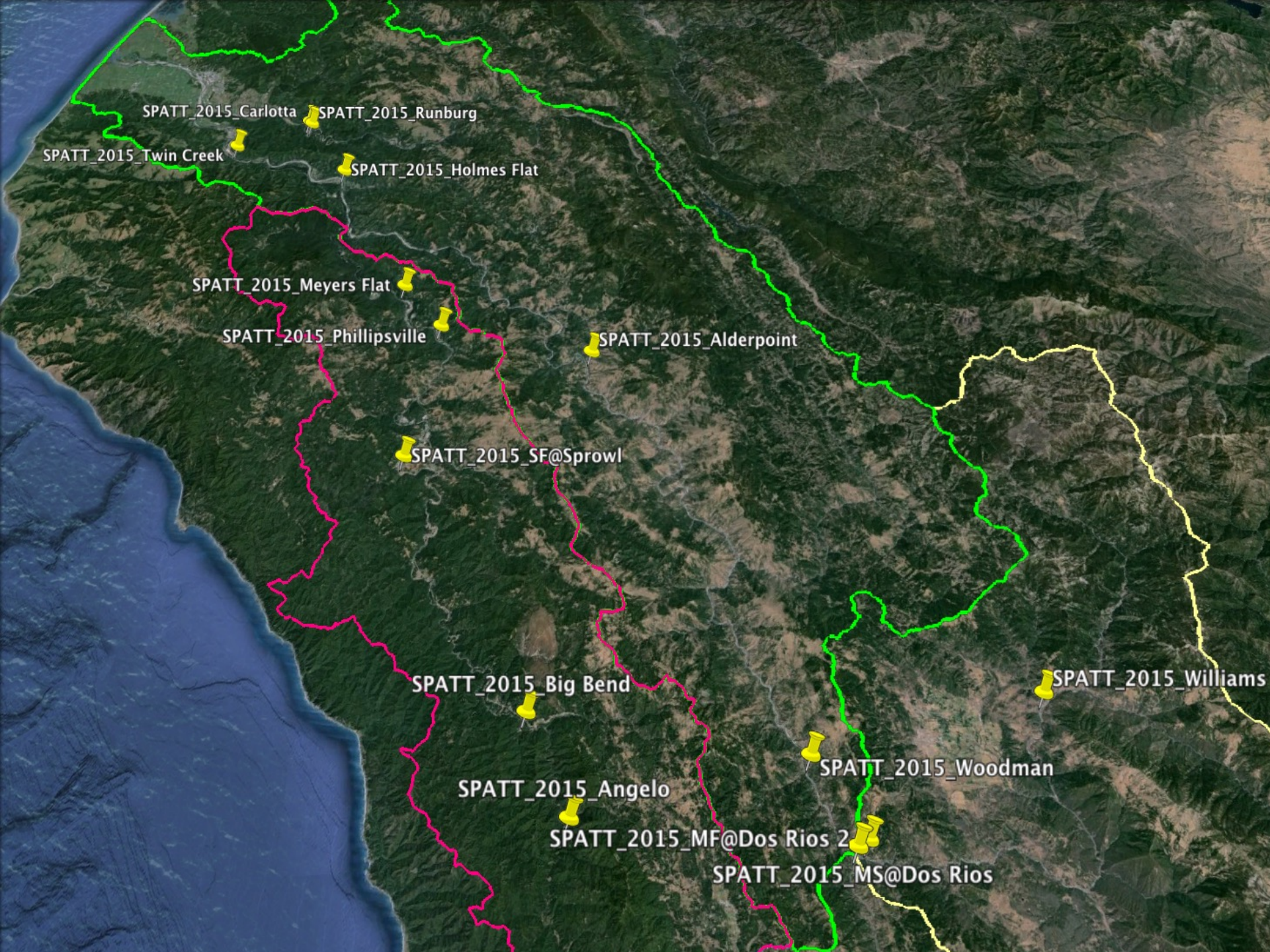
down to remove the sampler. The SPATT ring should sit in the middle of the water column.

3. Upon collection of the sampler, squirt field water from the squeeze bottle to rinse as much silt and debris from the flexi-hoop ring as possible (~1/4 of the squeeze bottle).
4. Place the sampler in the retrieval ziplock bag (there does not need to be any water in the bag).
5. Place retrieved sampler in the small cooler with ice.
6. Save the empty ziplock bag for the retrieval next week of the newly placed SPATT sampler (you can pour out any water remaining in the bag).
7. Ensure the ziplock with retrieved SPATT sampler is labeled correctly then place it in the freezer until collection.

Pictures of deployed SPATT samplers

Cyanotoxin Monitoring Team in 2015.

John Evans – Big Bend Lodge

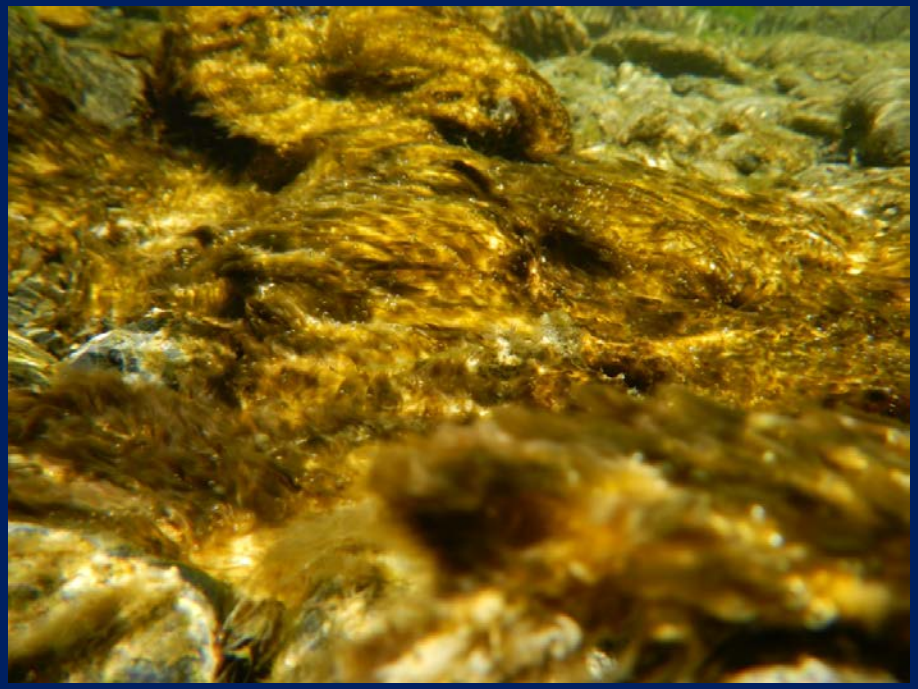

SPATT_2015_Carlotta
SPATT_2015_Runburg
SPATT_2015_Twin Creek
SPATT_2015_Holmes Flat
SPATT_2015_Meyers Flat
SPATT_2015_Phillipsville
SPATT_2015_Alderpoint
SPATT_2015_SF@Sprowl
SPATT_2015_Big Bend
SPATT_2015_Williams
SPATT_2015_Woodman
SPATT_2015_Angelo
SPATT_2015_MF@Dos Rios 2
SPATT_2015_MS@Dos Rios

Algae in the Eel River: Tipping Towards Toxicity?

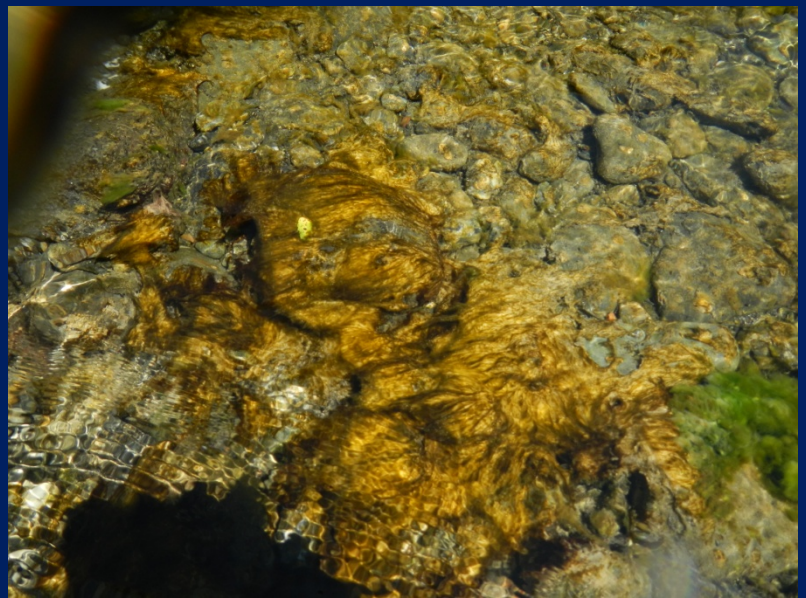
Keith Bouma-Gregson | UC Berkeley | kbg@berkeley.edu

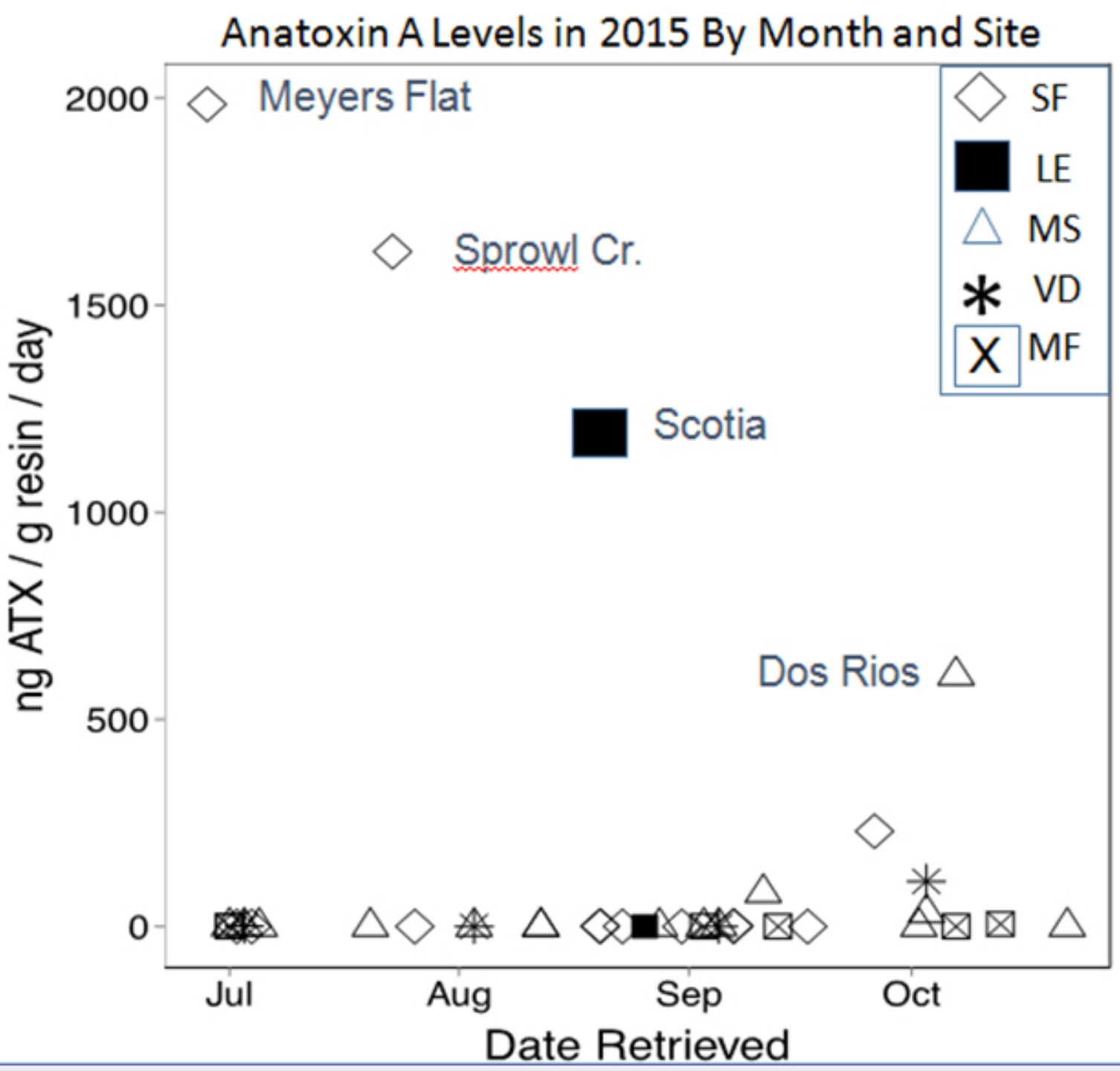
ERRP Water Day, Redway, CA

April 13, 2014

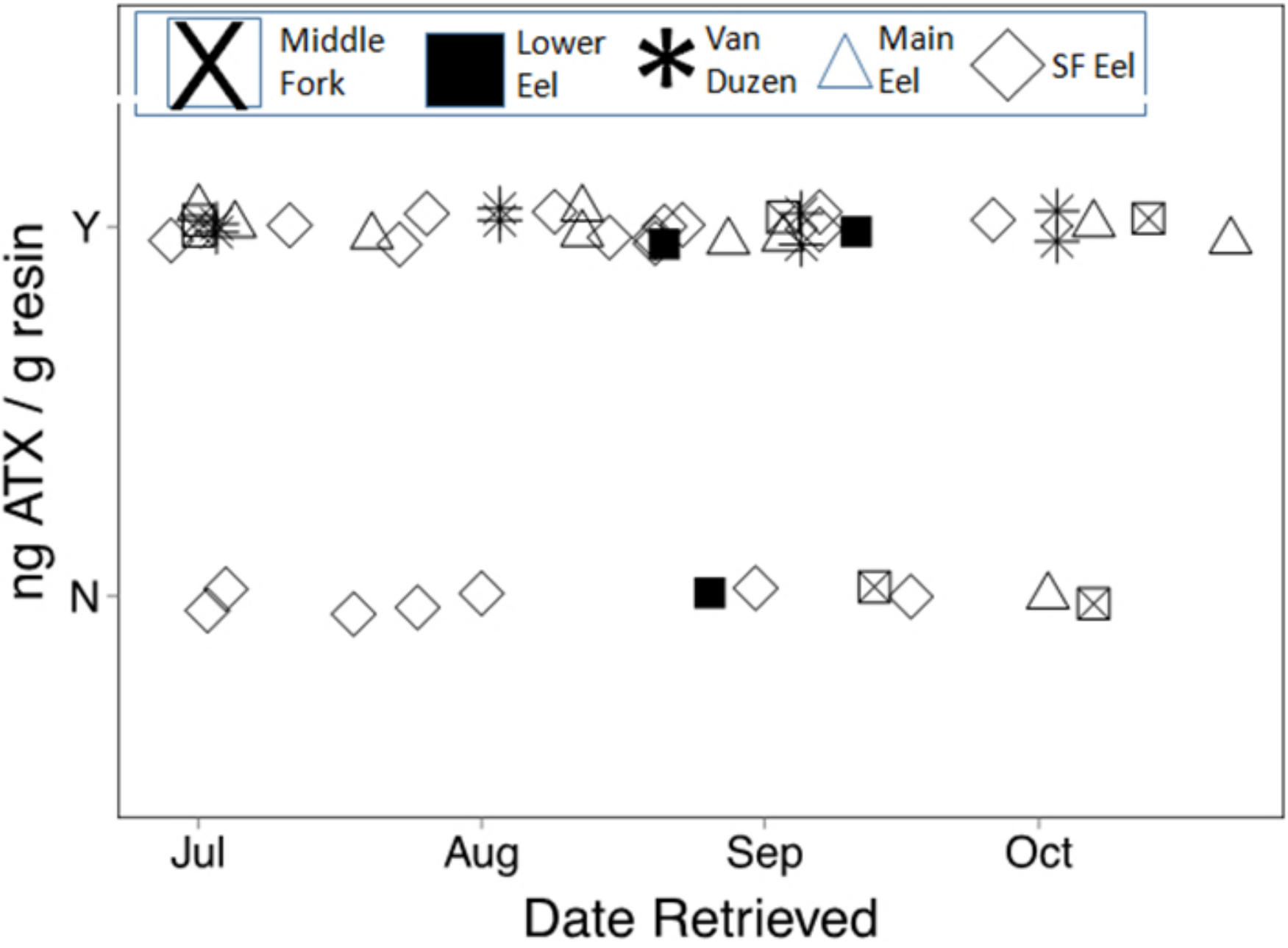


Cyanotoxin Producing Species




Anatoxin A Levels in 2015 By Month and Site
Meyers Flat
Sprowl Cr.
Scotia
Dos Rios
SF
LE
MS
VD
MF
2000
1500
1000
500
0
ng ATX / g resin / day
Jul
Aug
Sep
Oct
Date Retrieved

ATX Presence and Absence by Month and Reach 2015



Cyanobacteria Factsheet

Eel River Recovery Project

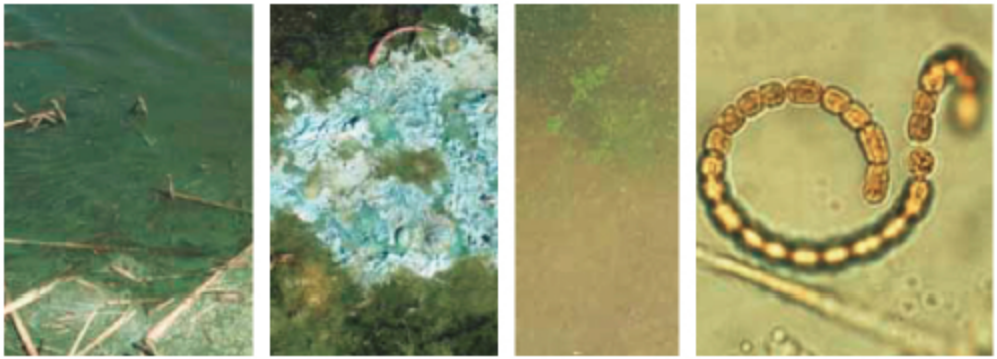
www.eelriverrecovery.org

What are Cyanobacteria?

- Cyanobacteria are photosynthetic bacteria that are found in aquatic environments.
- Although once known as blue-green algae, cyanobacteria are not true algae because they lack cell structures like a nucleus.
- Individual cyanobacteria can only be seen under a microscope, but cyanobacteria can form colonies that are visible to the naked eye.

What Causes Cyanobacteria Blooms?

- Cyanobacteria are usually present in freshwater systems, but under certain environmental conditions cyanobacteria "bloom" (or rapidly reproduce) and become the dominant organism in an area. Cyanobacteria blooms can have negative ecological and public health effects.
- The following conditions are favorable for cyanobacteria blooms:
  - The water is warm.
  - The water is slow-flowing.
  - There is adequate sunlight.
  - There are additional nutrients (nitrogen and phosphorous) present in the water, e.g. agricultural or urban runoff from fertilizers or improper sewage disposal.
- Blooms can be many different colors, from blue-green to dark green, red, purple, or brown.



In situ: S. Murrell

Microscale (M. Graham and S. Murrell)

Figure 1. Images of the cyanobacteria *Anabaena*. (Huynh, M. and N. Serediak. 2008. Algae Identification Field Guide Agriculture and

Eel River Recovery Project

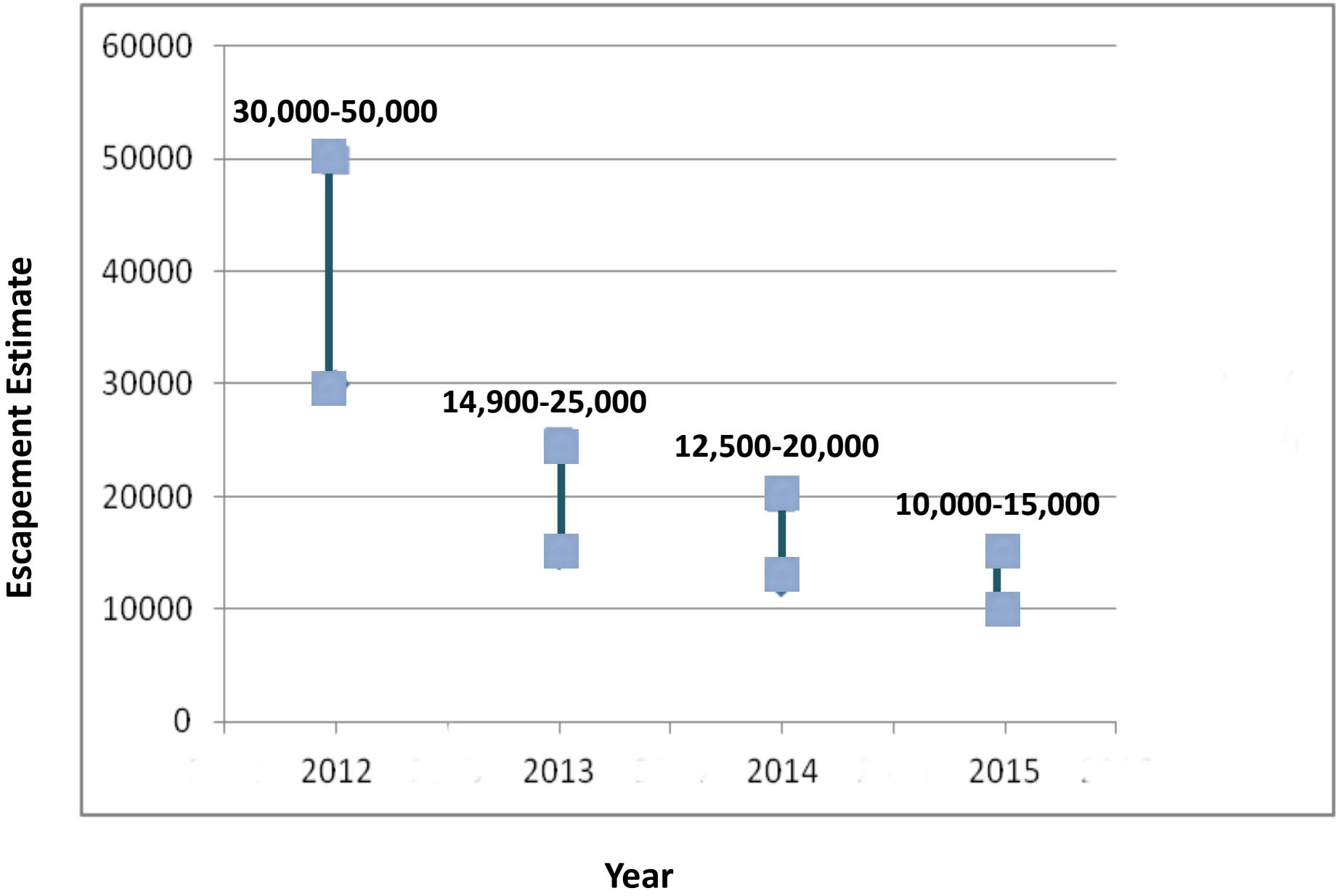
Is It Swimmable?

The Eel River Recovery Project wants to help the community cope with toxic algae and the potential seasonal problems that it can cause for human and animal health. Send us photos of your favorite Eel River swimming spot using social media and we will post the photos to the Internet so people can know what conditions are like and whether it is safe to take the family to the river.

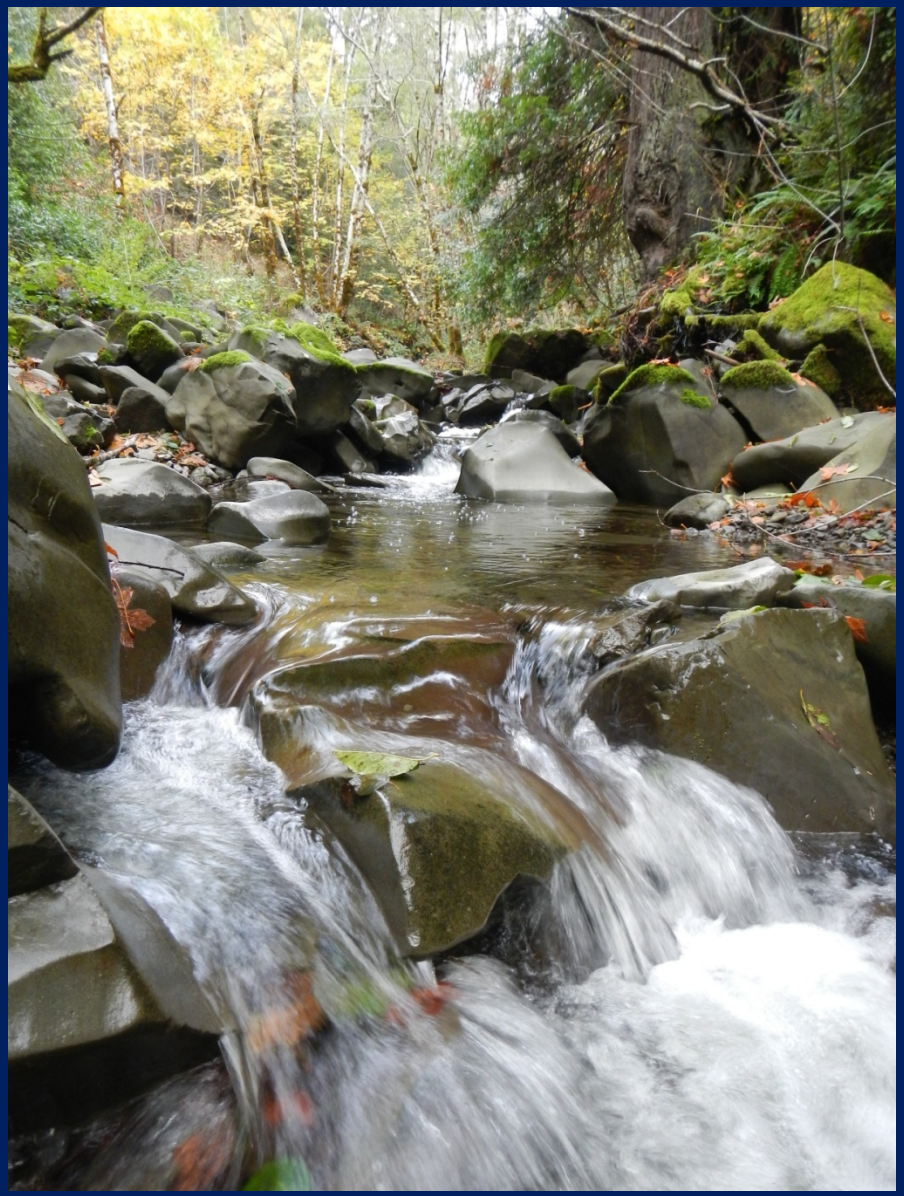
Eel River Recovery Project
2015-2016 Fall Chinook Monitoring

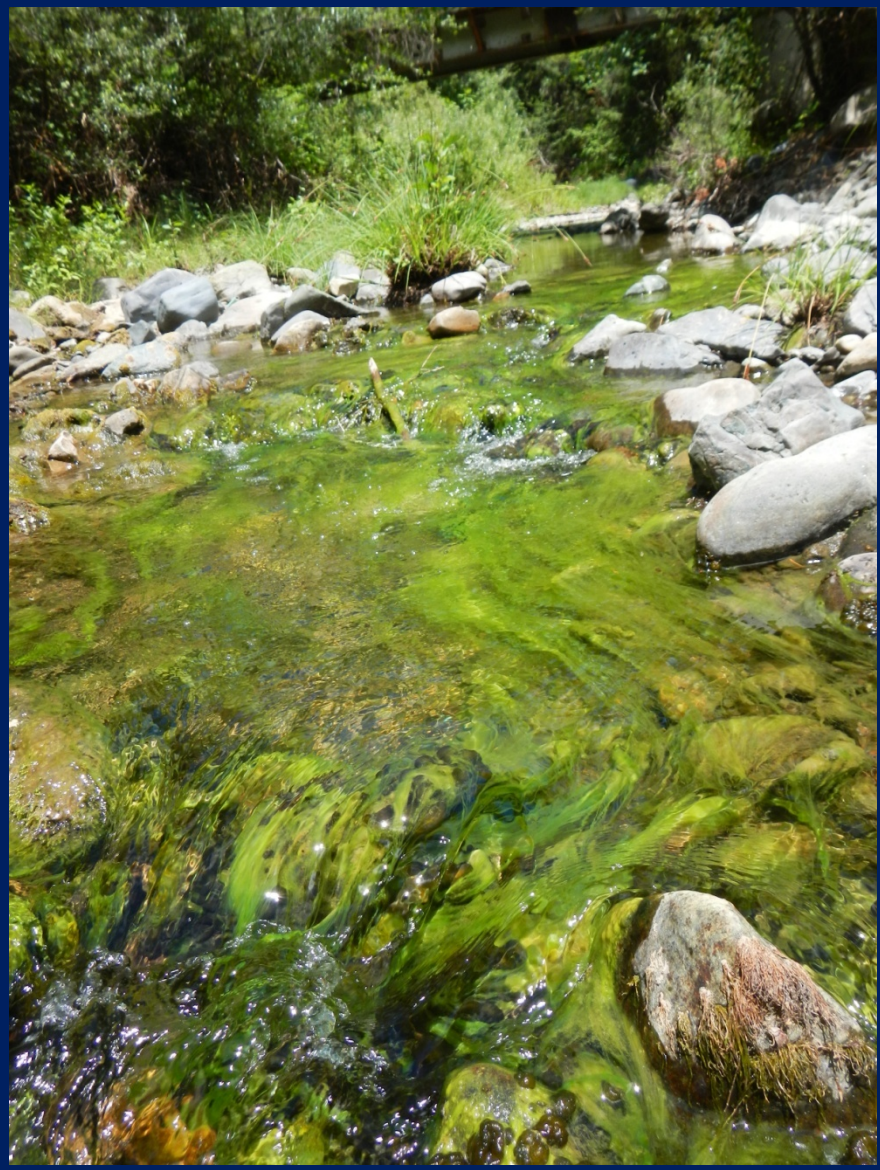
Salmon went blind waiting for rain in 2015.

ERRP Eel River Fall Chinook Escapement Estimates 2012-2015



More than 5,000 Chinook estimated on October 27 in the lower river and another 3,400 were counted by HRC on October 29 further upstream. Thousands of fish were already documented migrating throughout the basin. Total estimate was *20,000-50,000 Chinook salmon* in the Eel and its tributaries in 2012. Equivalent to last U.S. Fish and Wildlife Service basin-wide count from 1955-1958.





The test of sustainability will be whether we can return streams and watersheds to a state closer to their normal historic range of variability.

State Water Resources Control Board 2015 Grant

- **To assist citizen monitoring throughout the Eel River watershed**

- **To work at the grassroots to promote water conservation and pollution prevention**

Eel River Recovery Project
Citizen Monitoring &
Best Practices Outreach

SWRCB Clean Up & Abatement Fund
Agreement #14-679-550

Public Meetings

Eight public meetings were held throughout the Eel River watershed and minutes are on the ERRP website. Above - Casey O'Neil and ERRP's Bruce Hilbach-Barger lead discussion on water at Harwood Hall in Laytonville in a meeting co-sponsored by the California Growers Association on 3/26/16.

Technical Assistance

The grant enabled ERRP to sponsor 70 on-farm technical assistance visits from watershed professionals already trusted in the Eel River Basin. Pictured here are Anna Birkas and Noah Cornell of Ecosystem Villages. Other providers included Dan Mar of Hightide Permaculture and Larry Desmond of Mendocino WaterWorks.

Best Practices Resources

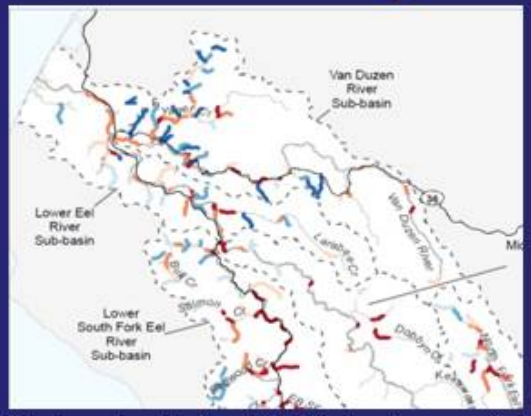
Eleven Best Practices videos were at Access Humboldt, aired on cable and available on-line. Experts noted above donated their services and provided great lessons.

Model Farm Tours

Restorationist Kyle Keegan explaining the simplicity and benefit of Grey water systems. He taught over 60 people at the Fools Farm in Salmon Creek in June 2015 and February 2016. Volunteer Duff Adelic (lower left) shot some great video available on-line on the ERRP Vimeo channel, at www.eelriverrecovery.org, and on DVD.

The Small Farmers Association co-sponsored a model farm tour in Covelo at the invitation of the conscious cannabis growing land owner that was

Citizen Monitoring



Water temperature data from 150 Eel River locations was collected or assimilated in 2015 and data from 2776 site years from 1980 to 2015 accumulated. ERRP also assisted small water districts with cyanotoxins sampling in cooperation with the University of California Berkeley. And time lapse cameras were placed at ten locations. Photo points established at more than 100 locations are linked to Google Fusion Table maps at eelriverrecovery.org.

An Eel River Library was established using Omeka web-tools which includes best practices documents and articles and photos scanned by ERRP. Brochures and posters have also created and made available.

Beyond Compliance!

The ERRP Best Practices team helped clients understand permitting, but stressed they go "beyond compliance" to help accelerate Eel River recovery for the fish, wildlife, and downstream neighbors. ERRP hopes to assist citizens track recovery as the cannabis culture gets more in Harmony with Nature. Above, one South Fork Eel River tributary maintains clear water and robust

Noah Cornell – Village Ecosystems

Compost Tea Made Easy

Getting in Harmony with Nature

Slow it, spread it, sink it – Help rebuild the watershed sponge

Prevent erosion from roads – decommission, re-contour, prevent failures

Practice permaculture to store water in the landscape and create areas for dry farming or areas that require less water

Build living soils and prevent loss of any nutrients through runoff

Improve forest health by thinning from below

Create a water budget, practice conservation

Increase water storage and fill during appropriate seasons

Be careful of where you build ponds and what life forms you put in them

Use organic farming methods

Prevent pollution by safely storing of hazardous materials

Work with your neighbors to achieve solutions at a watershed scale.

Restoring the Balance – Watershed Hydrology

Overstocked stands need to be thinned from below

- Speeds the maturity of merchantable timber
- Reduces moisture stress on trees lessening likelihood of bug infestations
- Reduces risk of catastrophic stand replacing fire
- Decreases evapotranspiration - WE GET MORE WATER

Road densities need to be reduced by decommissioning

Roads should be on ridges, not at mid-slope or in inner gorge

Roads need to be out-sloped with no side cast material or in-board ditches

Grassland hydrology needs to be restored, if possible

Reduce grazing

Restore native grass species where possible

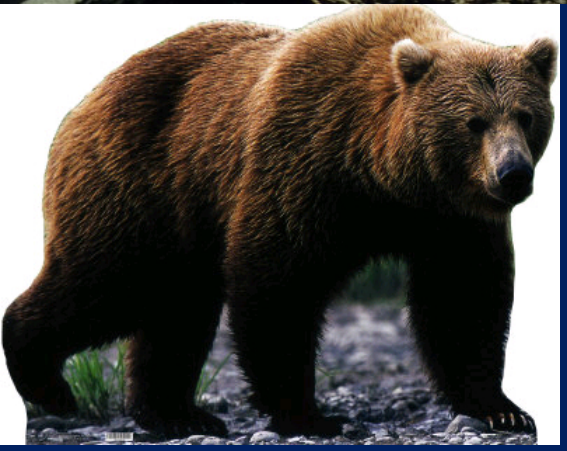
Don't build roads through grasslands or make sure you armor downspouts

Restore water table by fixing gullies with check dams and bioengineering

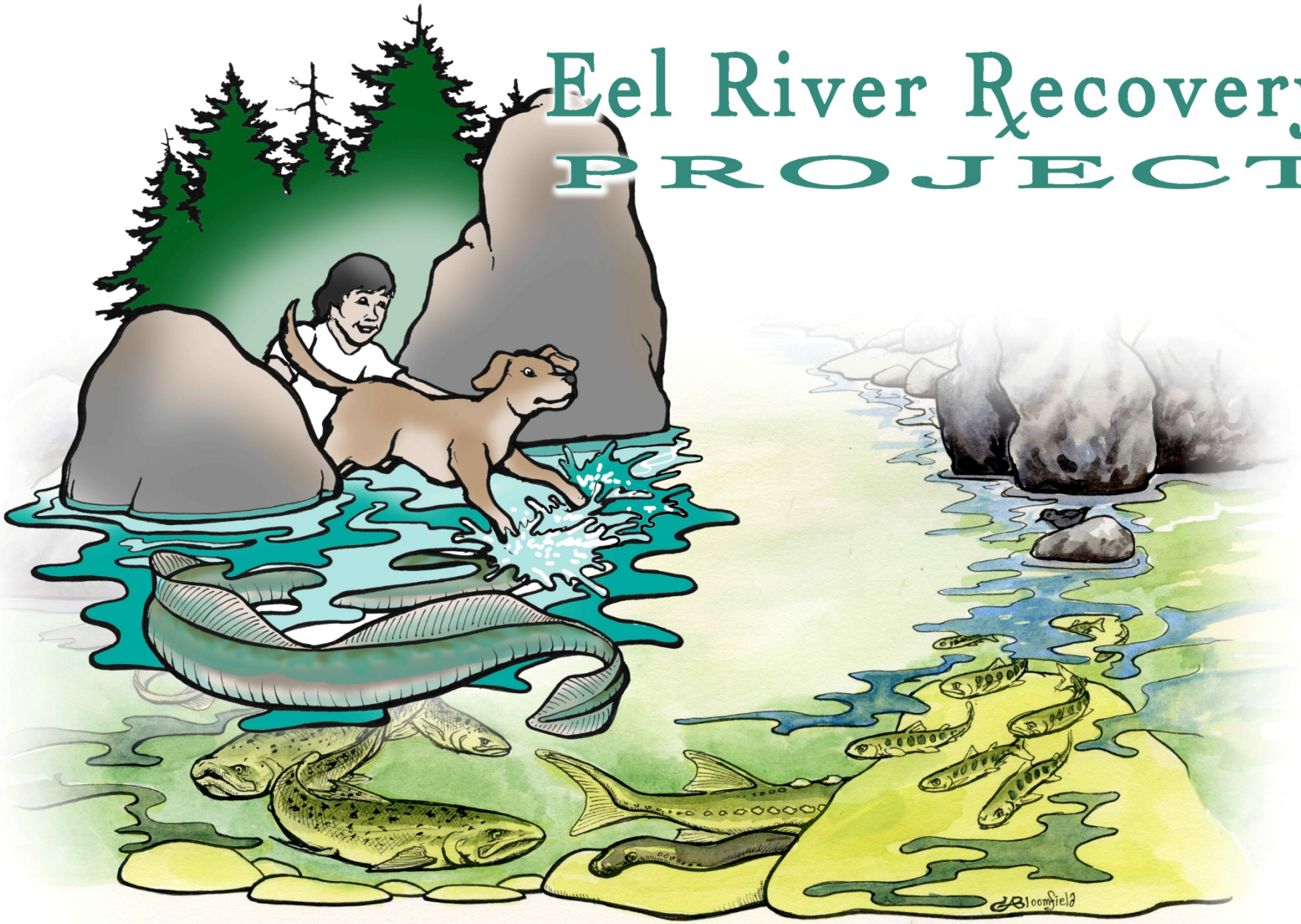
All life is interconnected.

Indian Harmony-Based Culture

"If you work with Nature, she will reward you. If you work against Nature, she will play tricks on you."



Eel River Recovery PROJECT



www.eelriverrecovery.org

Find us on Facebook

Questions?