

Learning Opportunities in Gravel Augmentation Projects The Stanislaus River

**Carl Mesick, Ph.D.
Carl Mesick Consultants
El Dorado, California**

Learning Opportunities

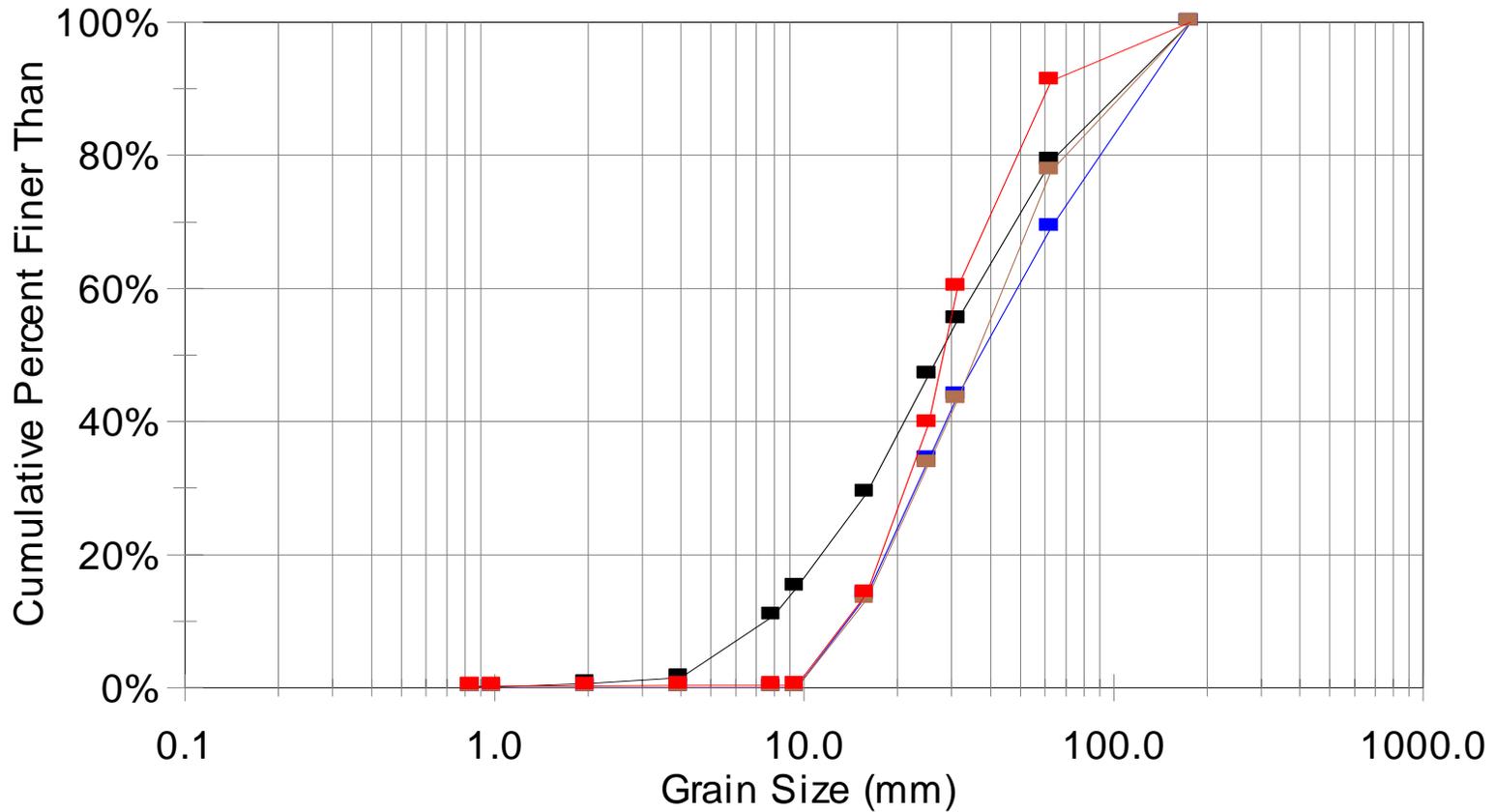
- **Will spawners use it?**
- **Were more fish produced?**
- **Why did it work?**

Will Spawners Use It?

- Gravel size
- Native gravel
- Upstream areas
- Cover (hiding places)
- Intragravel oxygen content
- Is something better nearby?

Poorly used sites lack ≥ 2 features

Gravel Size Distribution & Source



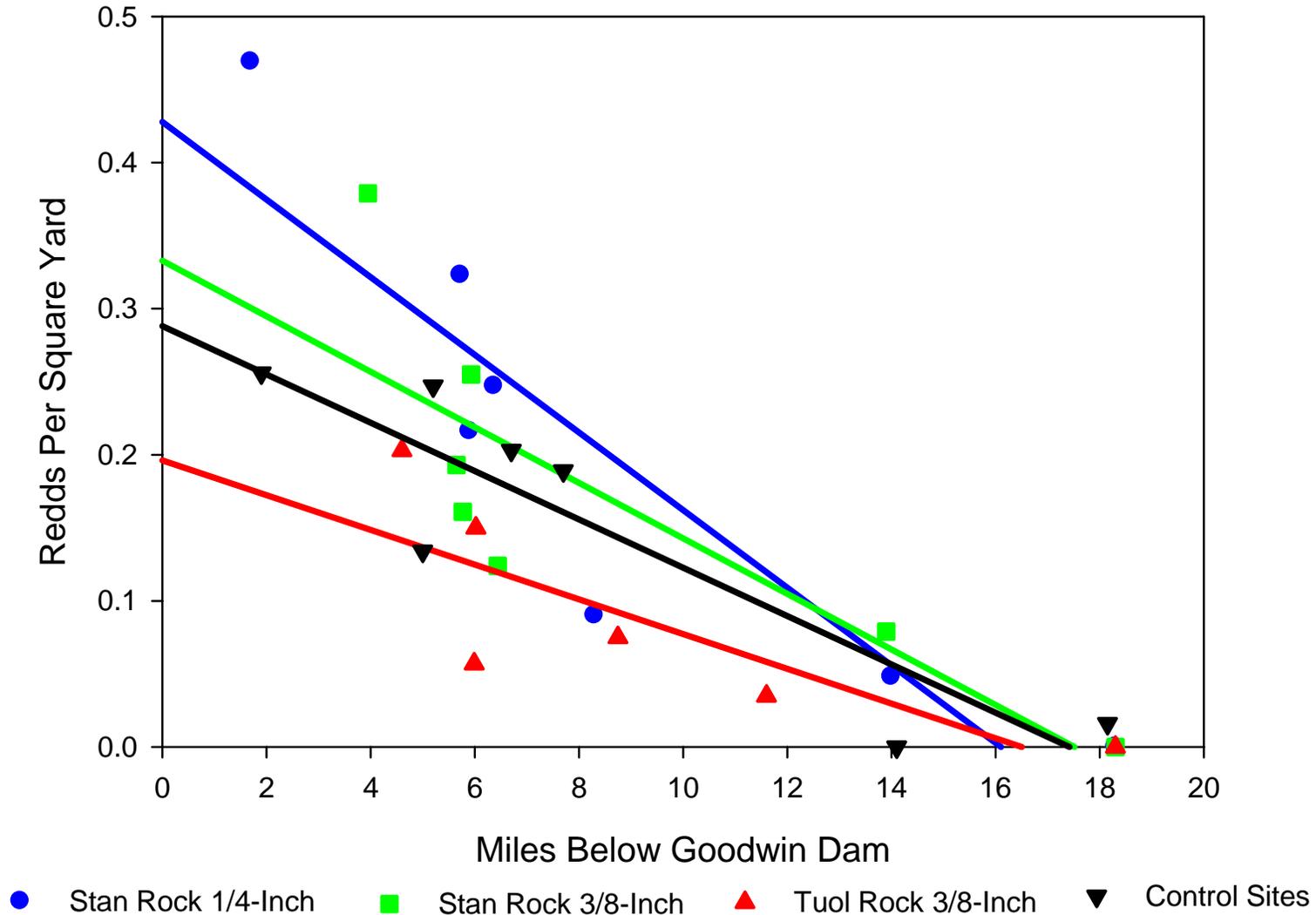
■ Stan 1/4 Inch

■ Stan 3/8 Inch

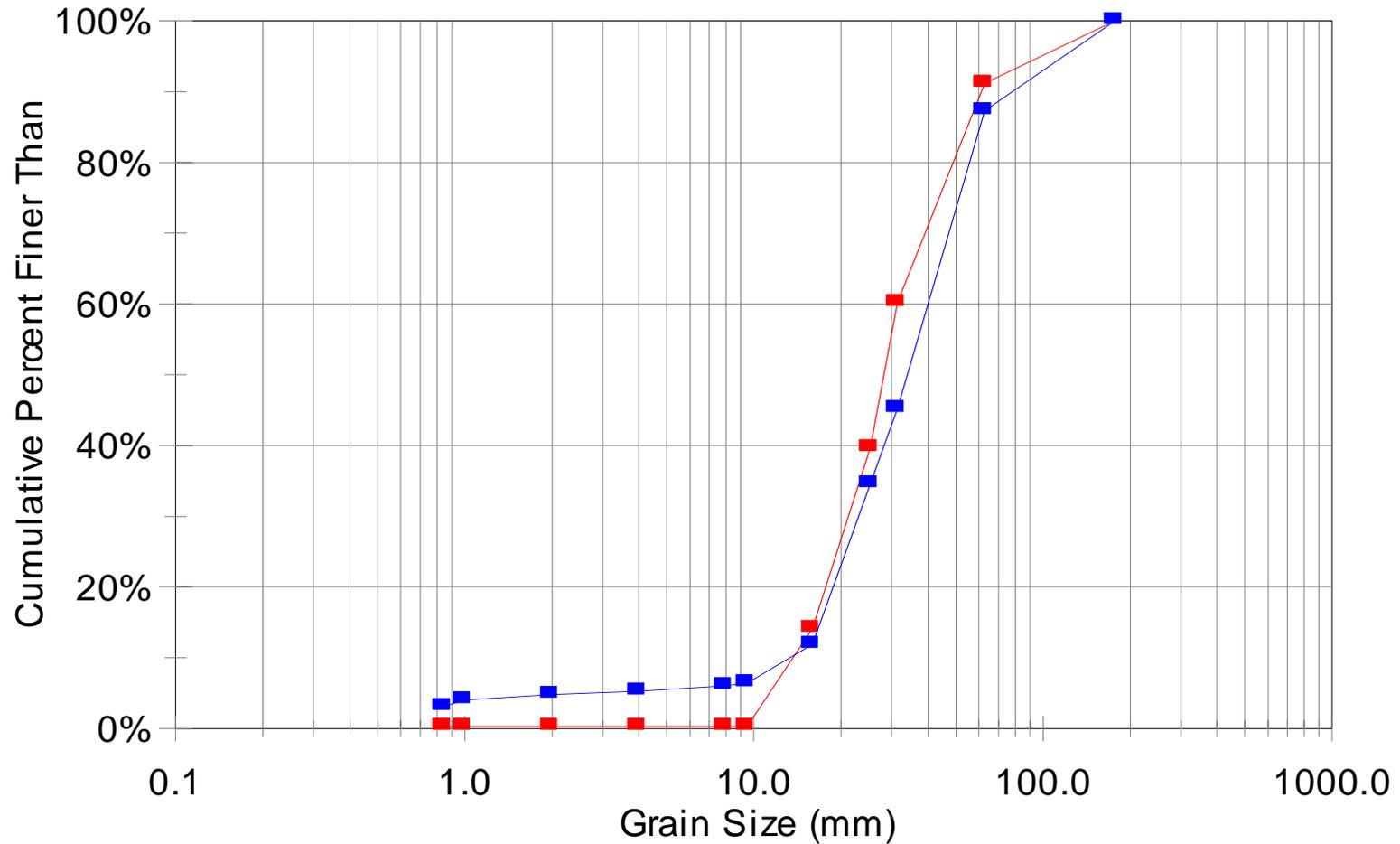
■ Tuol 3/8 Inch

■ Merced Rock 1995

1999 (Recent Construction)



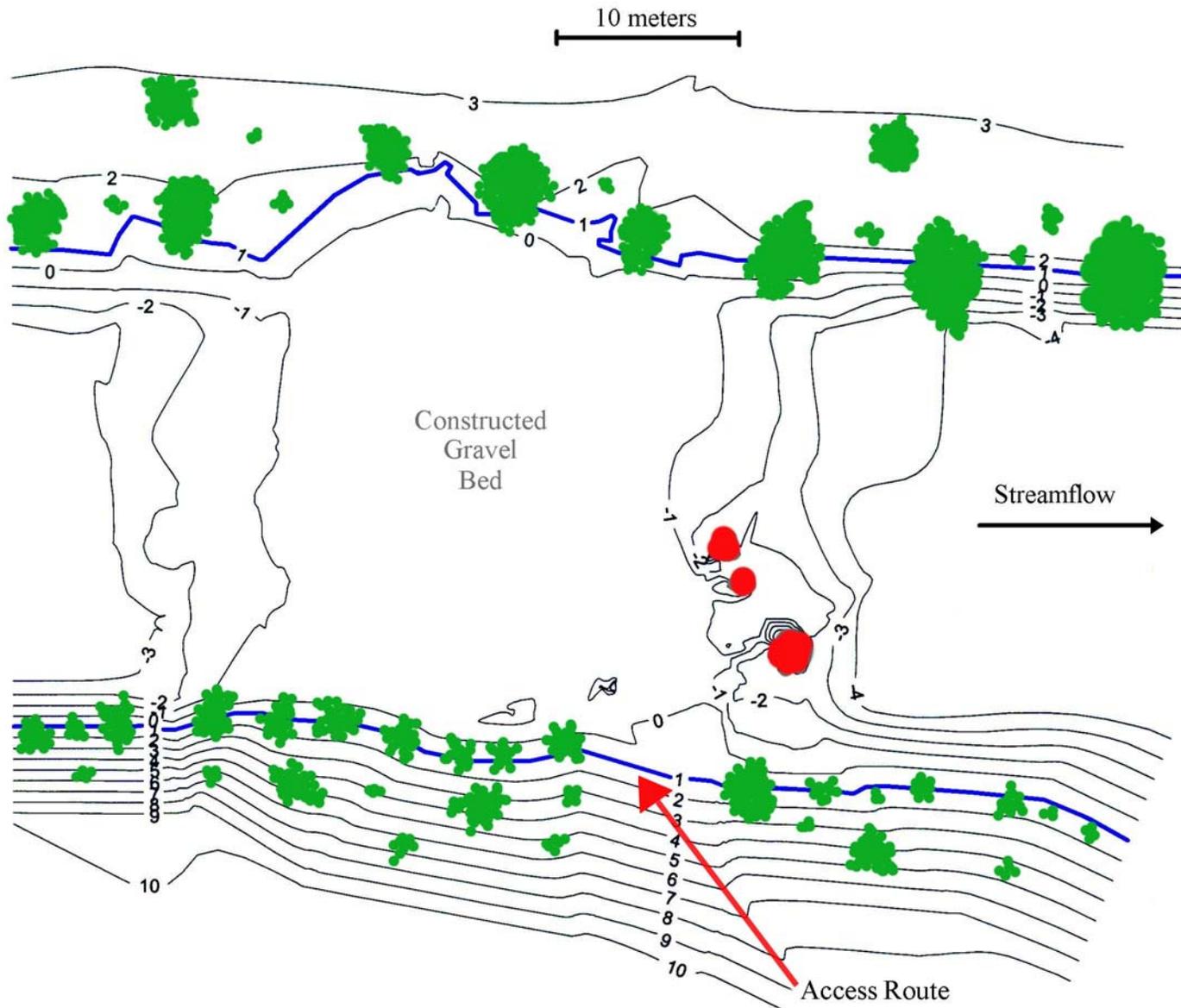
Seasoning?



—■— Merced Rock 1995 —■— Merced Rock 1999

Types of Cover (Hiding Places)

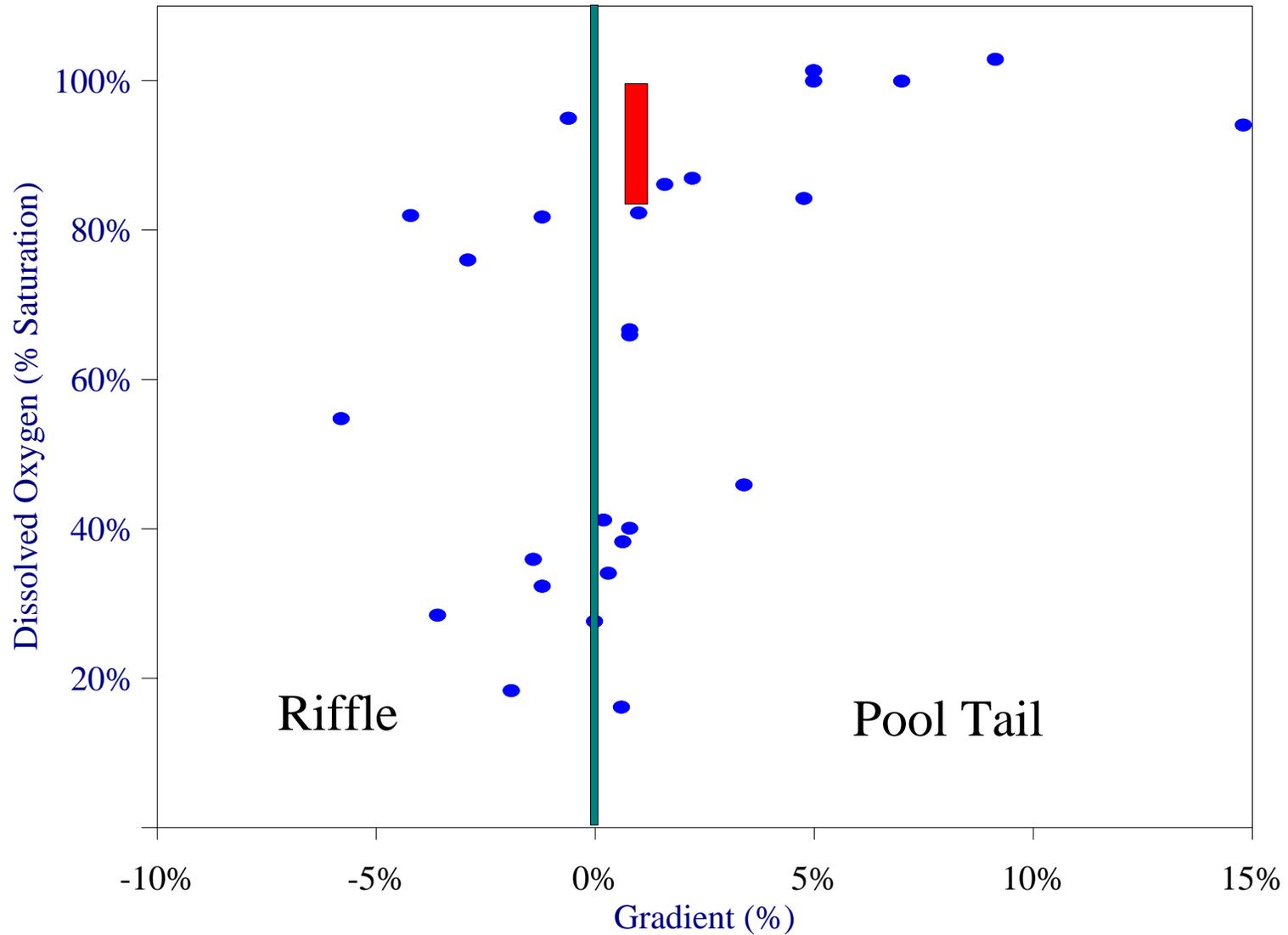
- Deep water (pool tails – salmon)
- Turbulence (riffles - *O. mykiss*)
- Large woody debris (*O. mykiss*)
- Overhanging vegetation
- Shade







Intragravel Dissolved Oxygen



Learning Opportunities

Hypotheses:

1. Spawners require cover;

Deep water, shade, turbulence, and/or vegetation?

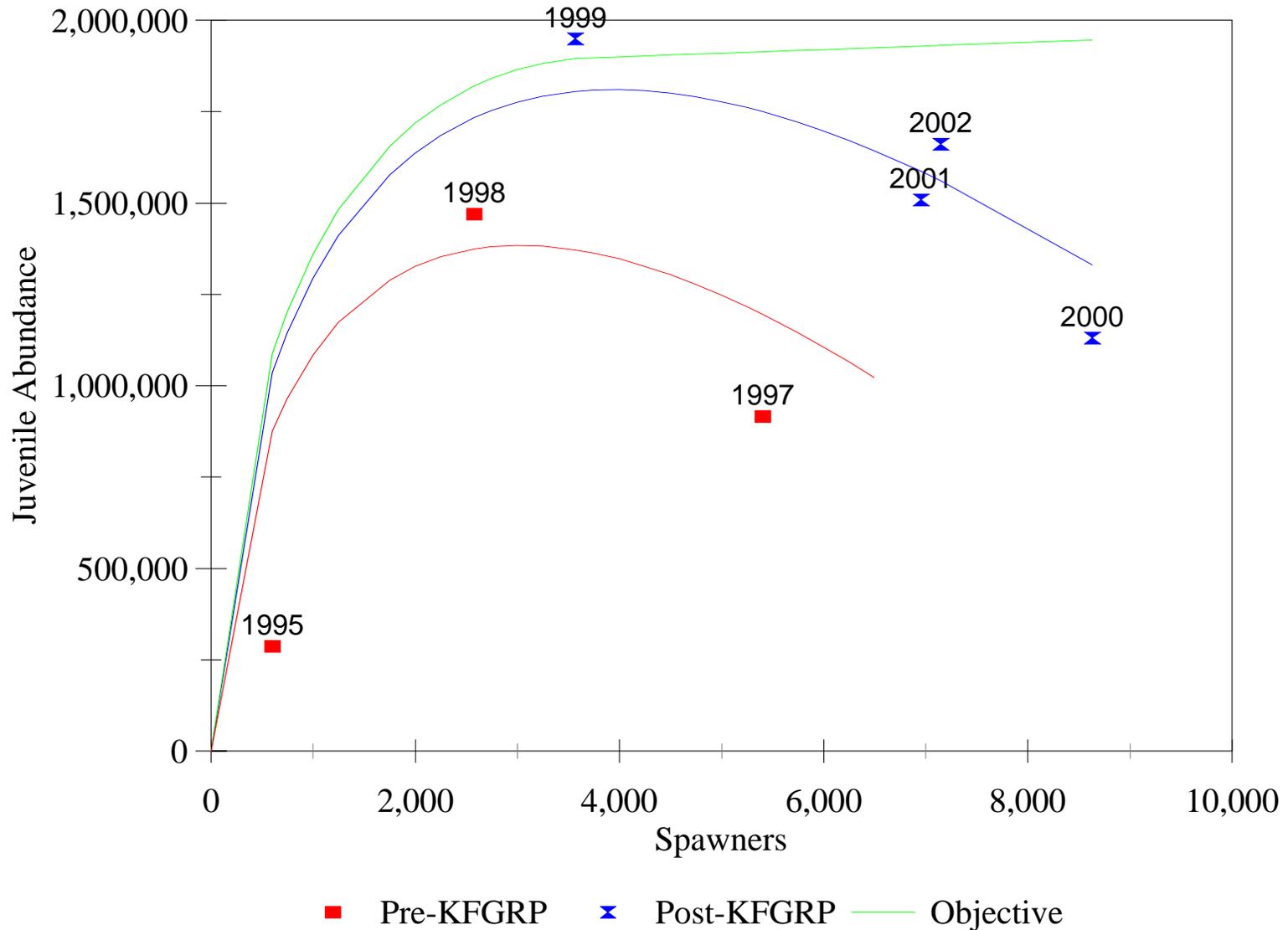
2. Salmon use pool tails; trout use riffles;

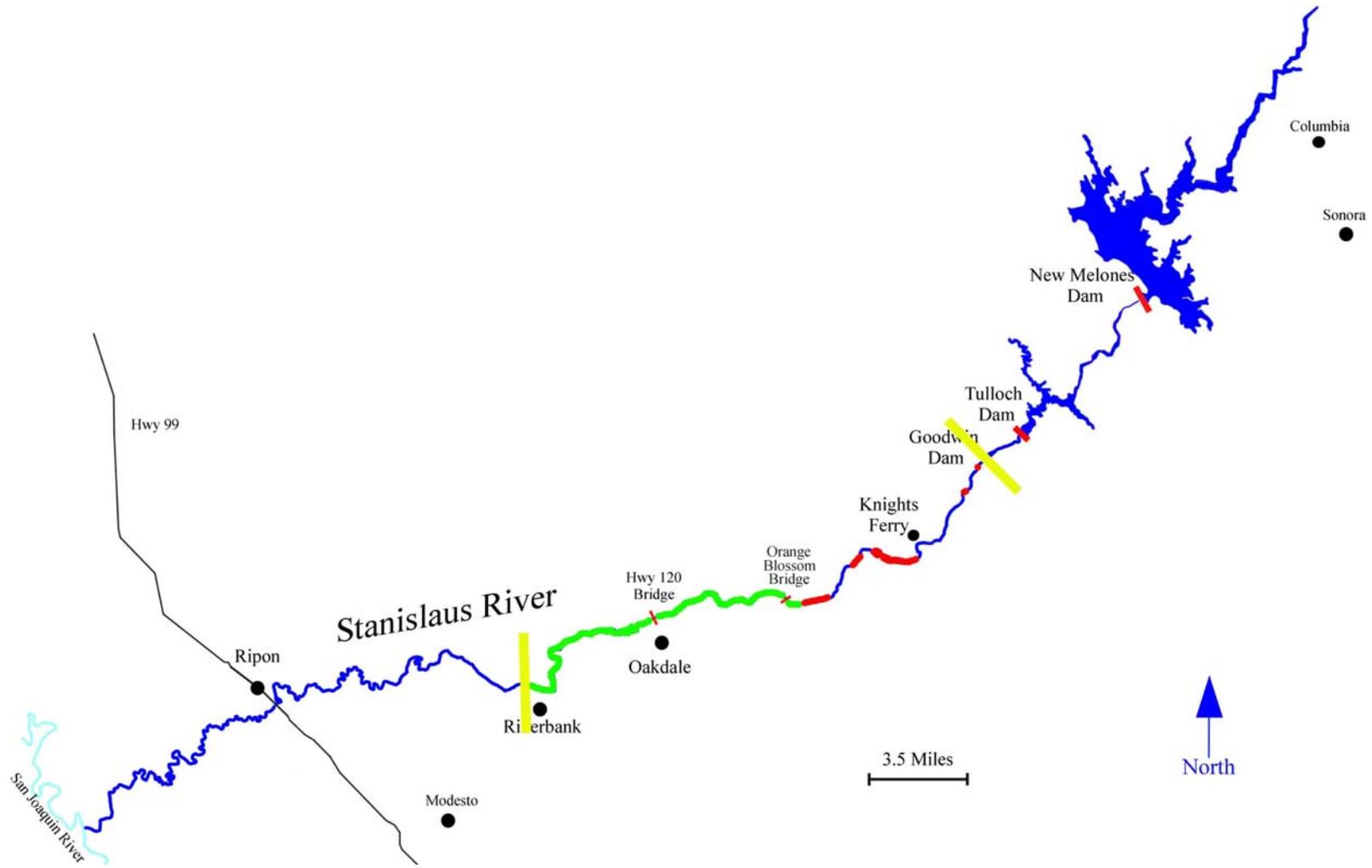
3. Spawners prefer unconsolidated gravel;

Importance of gravel mobilizing flow?

4. Few benefits from 1/2-inch plus gravel.

Were More Fish Produced?





Why Did It Work (or Fail)?

Hypotheses

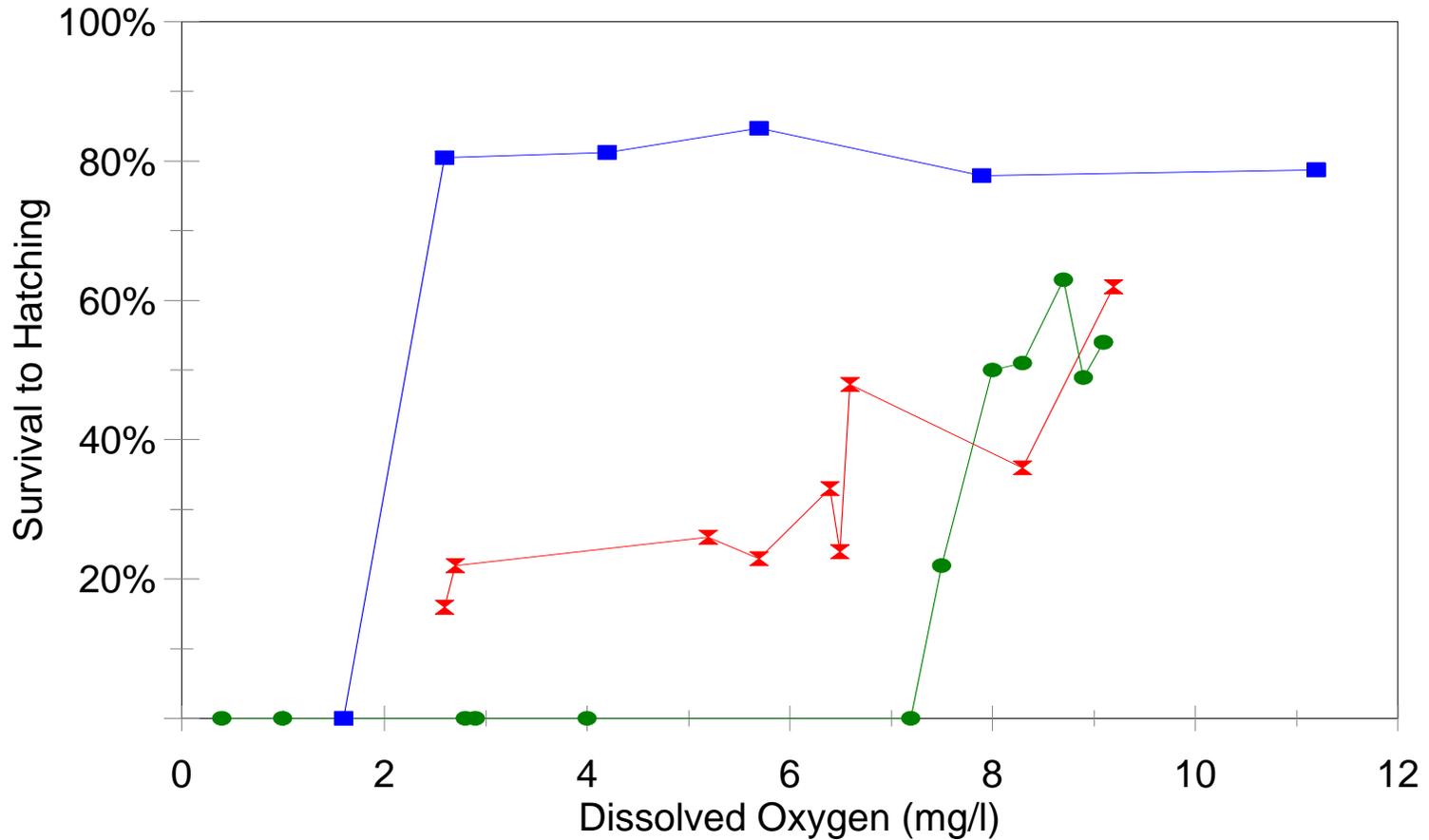
1. Redd superimposition kills eggs & entombs alevins.
2. Turbid runoff suffocates eggs.
3. Organic input from floodplains increases juvenile survival.
4. Predation of juveniles is reduced.

Methods – Redd Superimposition

- 1. Artificial redds indicator of superimposition rates**
- 2. Excavate superimposed redds to measure entombment rates**

Turbid Runoff Effects

Steelhead



—x— Stream —●— Stream —■— Laboratory

