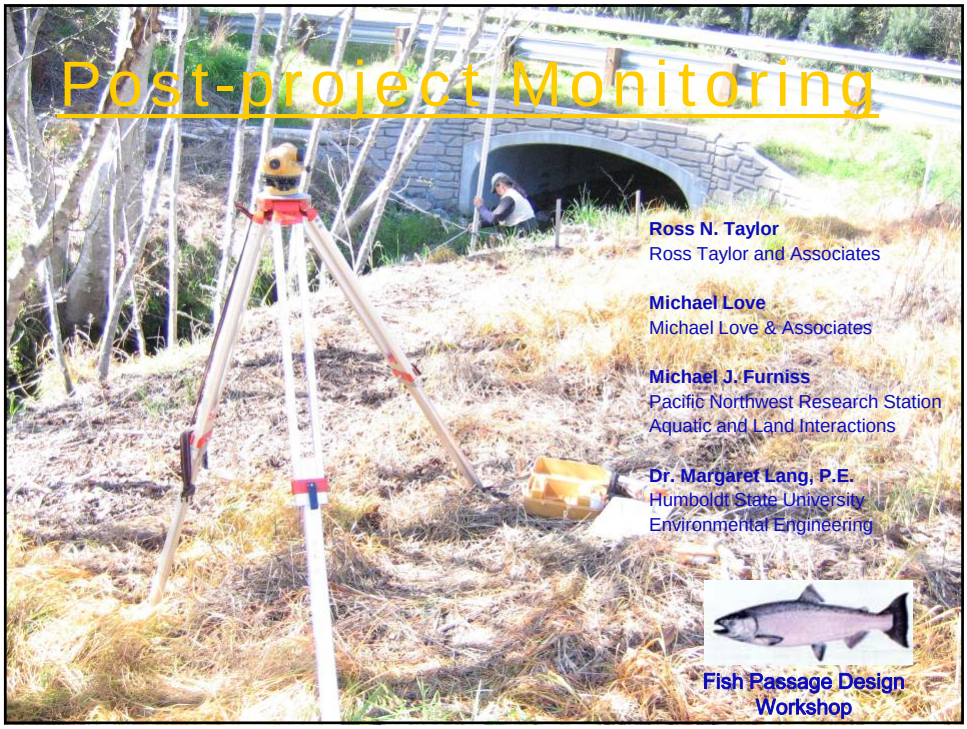

Post-project Monitoring
Ross N. Taylor
Ross Taylor and Associates
Michael Love
Michael Love & Associates
Michael J. Furniss
Pacific Northwest Research Station
Aquatic and Land Interactions
Dr. Margaret Lang, P.E.
Humboldt State University
Environmental Engineering
Fish Passage Design Workshop


Assume
Steady State

STREAMS CHANGE

Streams + Culverts = Channel
(dynamic) (static) Adjustment

1979

1998

Assessments Provide Baseline for Monitoring

- Assessment efforts are monitoring the performance of the existing infrastructure.
- Our baseline is drawn (almost).
- Passage Assessment Database (PAD). www.calfish.org

Five-Co. Assessments

- **Humboldt County – 160 crossings inventoried and 92 evaluated.**
- **Del Norte County – 67 crossings inventoried and 34 evaluated.**
- **Coastal Mendocino – 74 crossings inventoried and 34 evaluated.**
- **Siskiyou County – 118 crossings inventoried and 36 evaluated.**
- **Trinity County – 107 crossings inventoried and 51 evaluated.**

COUNTY	Poor Condition	Undersized (<10 yr)	Passage Assessment	High-Priority Sites
Humboldt	28%	57%	Red = 14 Gray = 51 Green = 2	20 sites
Del Norte	21%	79%	Red = 9 Gray = 17 Green = 2	6 sites
Siskiyou	19%	53%	Red = 25 Gray = 10 Green = 1	10 sites
Coastal Mendocino	39%	36%	Red= 15 Gray = 10 Green = 3	5 sites
Trinity	14%	73%	Red = 41 Gray = 9 Green = 1	13 sites
Clean-up Assessment	42%	74%	Red = 30 Gray = 9 Green = 1	5 sites
AVERAGE or TOTAL	**23%**	**62%**	**RED = 134 GRAY = 106 GREEN = 10**	**59 sites**

Five-Co. Projects Completed: 1998-2012

County	Completed Projects	Miles Made Accessible	Percent High Priority Completed	Remaining High Priority Sites
Del Norte	6	11	75%	2
Humboldt	26	39	71%	6
Mendocino	11	20	100%	0
Trinity	12	25	67%	3
Siskiyou	10	51	40%	9
TOTAL	**65**	**146**	**71%**	**20**

Three Monitoring Types

- Implementation – "Did we build it as intended?" ODF Survey
- Effectiveness – "Did it work?" Smith River PIT, Reba
- Validation – "Are the assumptions correct?" Lang, Love & Trush

Two Types of Stream Crossing Monitoring

- **Qualitative**
  - All replaced or retrofit crossings, selected performance checks. Revisit should be scheduled (Implementation + Effectiveness).
- **Quantitative**
  - Just a few projects, but comprehensive (Effectiveness + Validation).

Define performance expectations (objectives); monitor against these.

Bed Stability
Sediment Distribution
Bank-Lines
Bank Stability
Water Depths
Velocities

Fish Migration/Delay
Population Densities
Habitat Utilization
Juvenile Passage

Implementation Monitoring

- Crucial elements to get right
  - Inadequate inspection
  - Unknowledgeable inspectors
- "As built" vs design
- Essential to evaluate and interpret effectiveness

Qualitative Monitoring:
Develop a Checklist

Bed adjustment and stability
- ✓ Is a channel setting up in the crossing?
- ✓ Aggradation and degradation?
- ✓ Permeability problems?

Channel adjustment and stability
- ✓ Bank stability
- ✓ Head-cutting
- ✓ Pool formation

Crossing condition
- ✓ Catching debris
- ✓ Accumulating sediment at inlet
- ✓ Structural issues

DFG Project Monitoring:

- **Quantitative protocols were developed, yet not implemented.**
- **Pre and post project qualitative protocols rely on photo points and check lists.**
- **Implementation monitoring on 100% of projects.**
- **Effectiveness monitoring on 10% of projects.**
- **Validation monitoring of biological response.**

Photo Monitoring

Upstream Channel

Culvert Outlet

Culvert Inlet

Downstream Channel

Effective Use of Photos

- ✓ Careful selection of vantages.
- ✓ Reference points and scale in shots.
- ✓ Wide angle or panoramas.
- ✓ Take lots, find the keepers.
- ✓ Metadata! (captioning). Never skip this.
- ✓ Effective archiving.
- ✓ Re-shoot the same frames on revisit.

Photo Monitoring – reference points

Photo Monitoring – Digger Ck. Mendo. Botanical Gardens

Photo Monitoring – McCready Gulch

Implementation

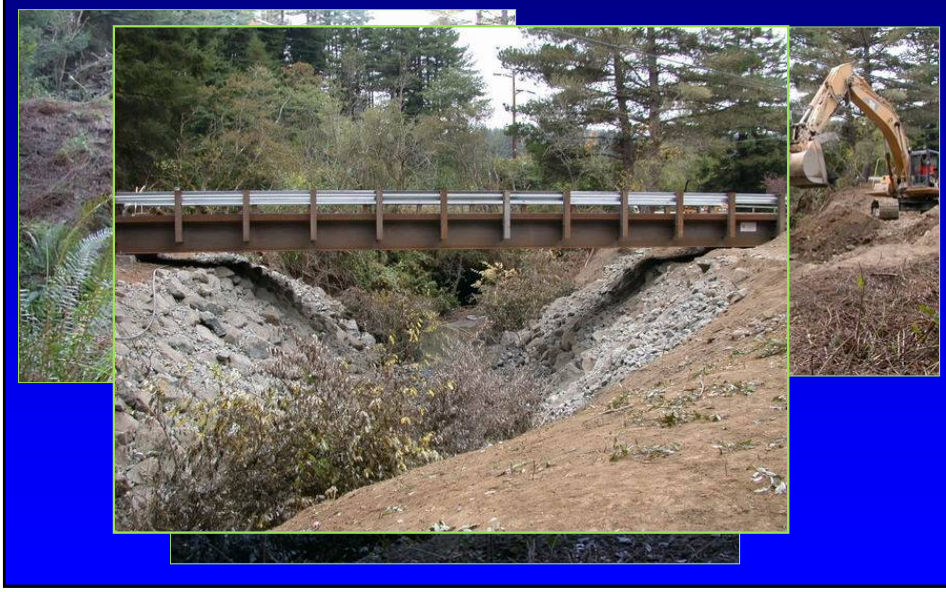


Photo Monitoring – McCready Gulch

Effectiveness

Quantitative Monitoring

Physical Monitoring

- **Longitudinal profiles**
- **Velocity distributions**
- **Substrate composition**
- **Bedload movement**

Detailed measurements needed over time

Quantitative Monitoring

Streambed Simulation Design Option:

- Slope w/in new crossing similar to natural channel?
- Velocities w/in new crossing similar to natural conditions?
- Minimum depths w/in new crossing similar to natural channel?

Quantitative Monitoring

Hydraulic Design Option:

- Resurvey crossing and long. profile.
- Re-run new crossing with FishXing.

Five-Co. Monitoring – Case Studies

- **Morrison Gulch/Quarry Road – Humboldt County.**
- **Digger Creek/Ocean Drive – Mendocino County.**

Morrison Gulch – Case Study

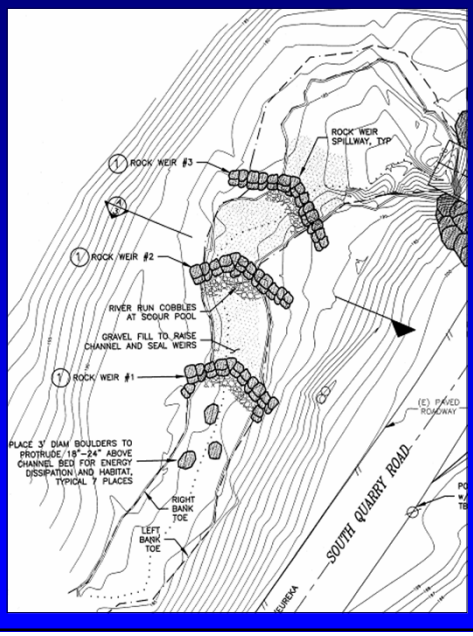
- **High-priority – severity of barrier and fish presence.**
- **High likelihood of re-colonization raised site to #1 priority.**
- **Hydraulic design option selected.**
- **Grade-control structures utilized.**

Morrison Gulch – Case Study of Design versus As-built

Morrison Gulch – Design Features

- **Slope through culvert = 0.0%.**
- **Elevation of downstream weir relative to culvert outlet = 0.5 feet higher.**
- **Design concept – install culvert, then construct grade-control weirs.**

Morrison Gulch – Design Features

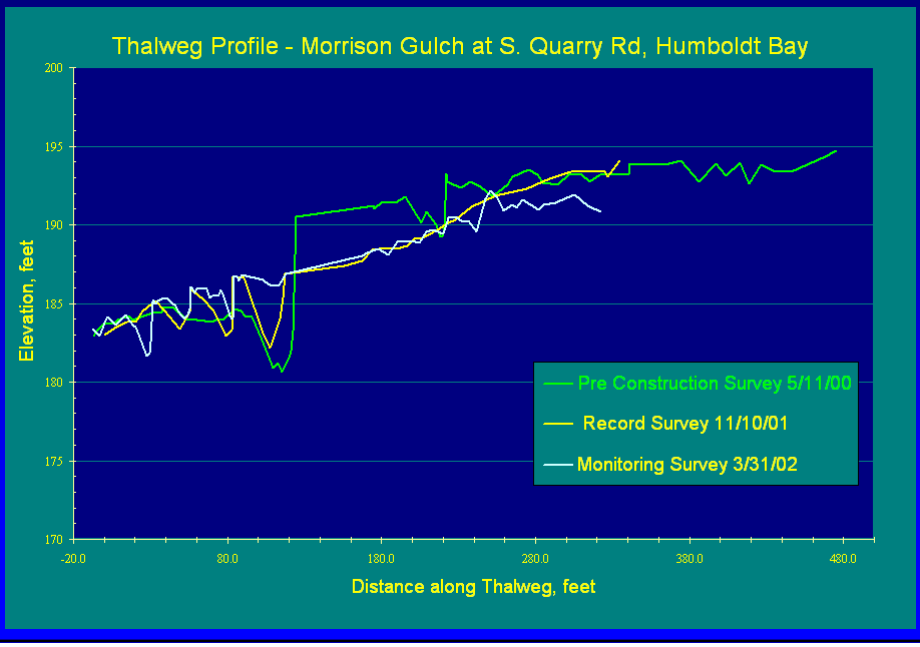


Morrison Gulch – As-Built Features

- **Slope through culvert = 1.17%.**
- **Elevation of downstream weir relative to culvert outlet = set at same elevation.**
- **Grade-control weirs were constructed first - then culvert was installed.**

Channel Bed Adjustment

Channel Bed Adjustment



Quantitative Monitoring – Passage Evaluation

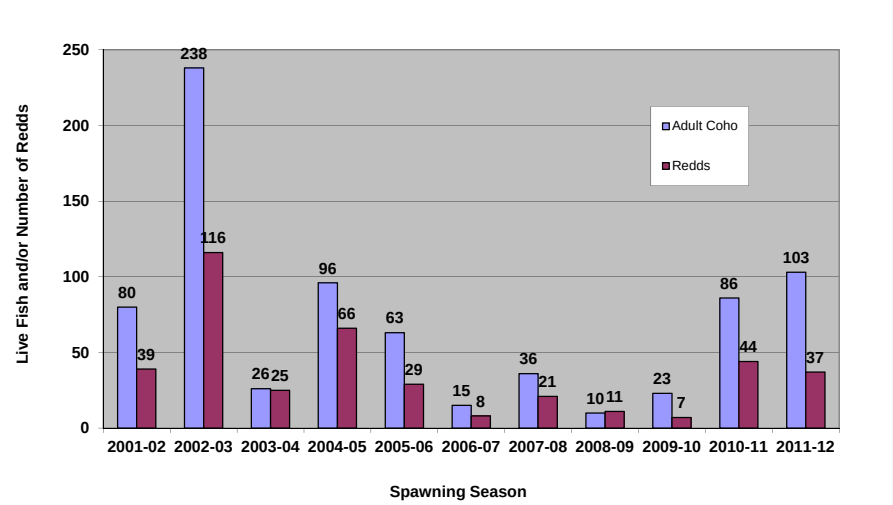
- Utilized re-survey data and new culvert specification.
- Assessed with FishXing.
- Adult passage = 90% - insufficient depth.
- Resident/2+ passage = 30% - excessive velocity.
- 1+/y-o-y passage = 0% - excessive velocity.
- Have visually observed y-o-y upstream of culvert, failing to pass grade-control weirs.

Quantitative Monitoring - Biological

Pre- and post-project:

- Visual observations
- Spawner or redd surveys
- Snorkel counts

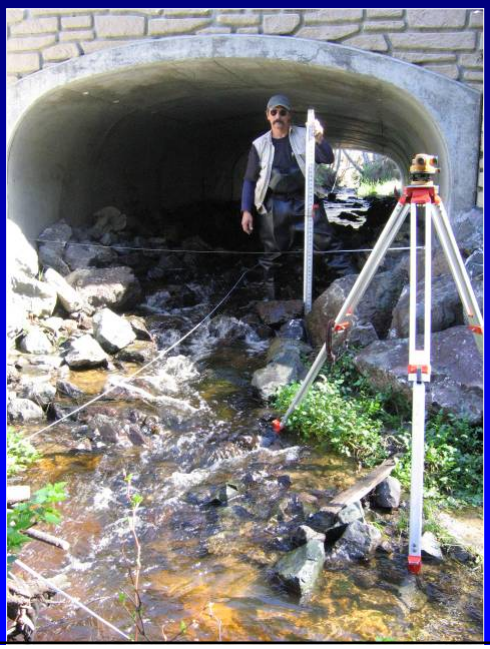
Quantitative Monitoring –



Digger Creek – Case Study

- **High-priority – severity of barrier, poor sizing + condition, length of potential upstream habitat.**
- **No current fish presence.**
- **Raised in priority based on funding opportunities.**
- **Stream simulation design option selected.**
- **Grade-control structures not utilized.**

Digger Creek – Case Study



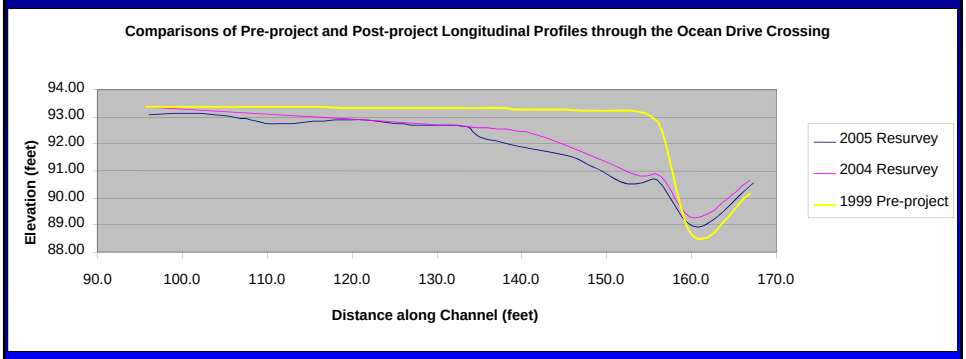
Quantitative Monitoring:
Evaluation of Crossing vs. Channel Condtions

- **Open-bottom ConSpan® arch - 2003.**
- **Re-surveyed in May 2004.**
- **Long profile from Highway 1 outlet to 115' below Ocean Drive = 717' total length.**
- **Slope thru Xing = 4.25%**
- **Channel slope u.s. = 1.95%; d.s. = 4.6%.**
- **Ave riffle depth w/in xing = 0.38'**
- **Ave riffle depth in channel = 0.36'**

Quantitative Monitoring:
Evaluation of Crossing vs. Channel Condtions

- **Second re-survey in March 2005.**
- **Long profile started 96' u.s of Ocean Drive = 250' total length.**
- **Slope thru Xing = 3.98%**
- **Channel slope u.s. = 2.0%; d.s. = 4.6%.**
- **Ave riffle depth w/in xing = 0.54'**
- **Ave riffle depth in channel = 0.52'**

Quantitative Monitoring:
Evaluation of Channel Profiles



Qualitative Monitoring – Crossing Retrofits

- Baffles and weirs within crossing.
- Grade-control structures.
- Re-visit photo points over time.
- Assess hydraulics during migration flows.
- Assess performance in passing storm debris.
- Assess longevity of structures.

Qualitative Monitoring - Retrofits

Additional Types of Biological Monitoring

- View Ports
- PIT Tag Antenna Array
- Time-Lapse Camera

Additional Types of Biological Monitoring

Frykman Gulch 2010 pre-project electrofishing

Downstream of barrier: juvenile steelhead, juvenile coho salmon, prickly sculpin and Pacific lamprey ammocetes.

Upstream of barrier: juvenile steelhead and prickly sculpin.

Additional Types of Biological Monitoring

Frykman Gulch 2012 post-project electrofishing

Downstream of Bridge: juvenile steelhead, juvenile coho salmon, prickly sculpin and Pacific lamprey ammocetes.

Upstream of Bridge: juvenile steelhead, juvenile coho salmon, and prickly sculpin.

Coho salmon – most likely non-natal. Juveniles often are initial colonizers of newly opened habitat (Pess et al. 2011).

Additional Types of Physical Monitoring

Glenbrook Gulch – Dam Removal Project

Downstream of barrier: channel scoured to bedrock.

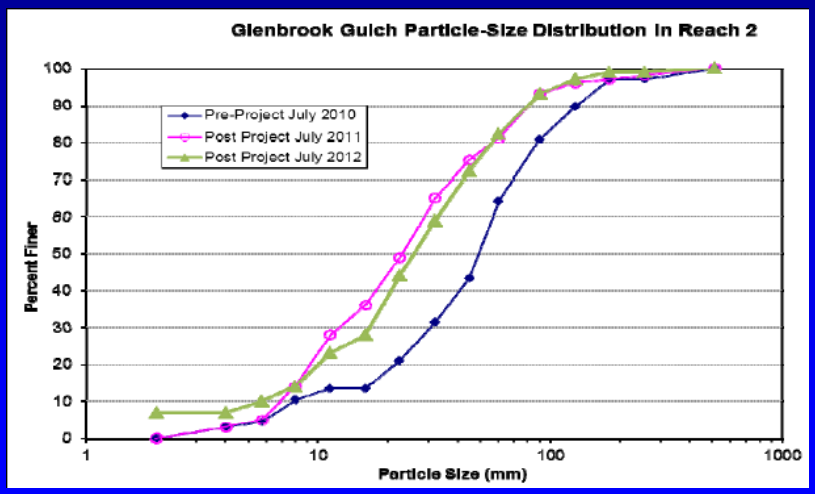
Secondary project objective: restore spawning habitat .

Solution– minimal removal of stored sediment during dam removal. Use of boulder and log structures to capture mobilized sediment.

Monitoring – photo points and pebble counts (pre and post).

Additional Types of Physical Monitoring

Glenbrook Gulch – Dam Removal Project



Additional Types of Physical Monitoring

Glenbrook Gulch – Dam Removal Project

Case Study Information

FishXing Website:

http://www.stream.fs.fed.us/fishxing/case.html

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ARTICLE

The Influences of Body Size, Habitat Quality, and Competition on the Movement and Survival of Juvenile Coho Salmon during the Early Stages of Stream Recolonization

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