

RECLAMATION

Managing Water in the West

San Joaquin River Restoration Fisheries Studies Update

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U.S. Department of the Interior
Bureau of Reclamation



SJRR Fisheries Studies

-  **Evaluation of Hills Ferry Barrier Effectiveness at Restricting Chinook Salmon Passage**
-  **Central Valley Steelhead Monitoring Plan**
-  **San Joaquin River Basin-wide PIT Tag Monitoring Program Evaluation and Site-specific Technology Assessment**

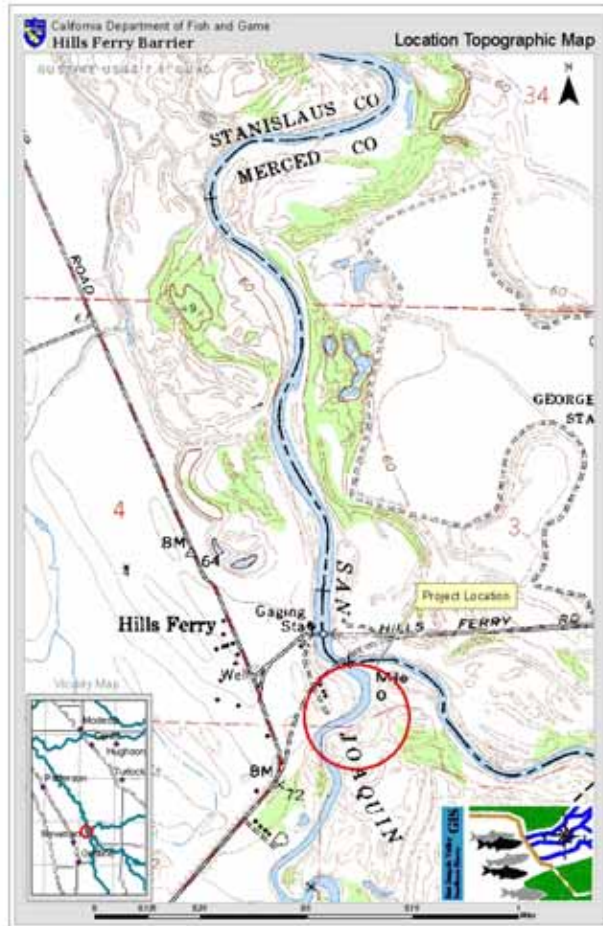


Evaluation of Hills Ferry Barrier Effectiveness at Restricting Chinook Salmon Passage





Hills Ferry Barrier Location



Purpose: To redirect upstream migrating adult fall-run Chinook salmon into suitable habitat of the Merced River



Hills Ferry Barrier History

- Prior to the Hills Ferry Barrier there was a trapping and egg salvage effort at Los Banos Wildlife Area (1988-1991)
- Barrier has been in seasonal operation since 1992 employing many different designs:
 - ✓ Smith-Root Electrical Barrier (1992)
 - ✓ Physical Weir (1993-1994)
 - ✓ Alaskan Weir (1995-2001)
 - ✓ Resistance Board Weir (2002)
 - ✓ Sliding Pipe-Resistance Board Weir (2003)
 - ✓ Sliding Pipe Weir (2004-2011)



2011 Sliding Pipe Weir



Daily Barrier Cleaning



Daily Barrier Maintenance





Hills Ferry Barrier Evaluation

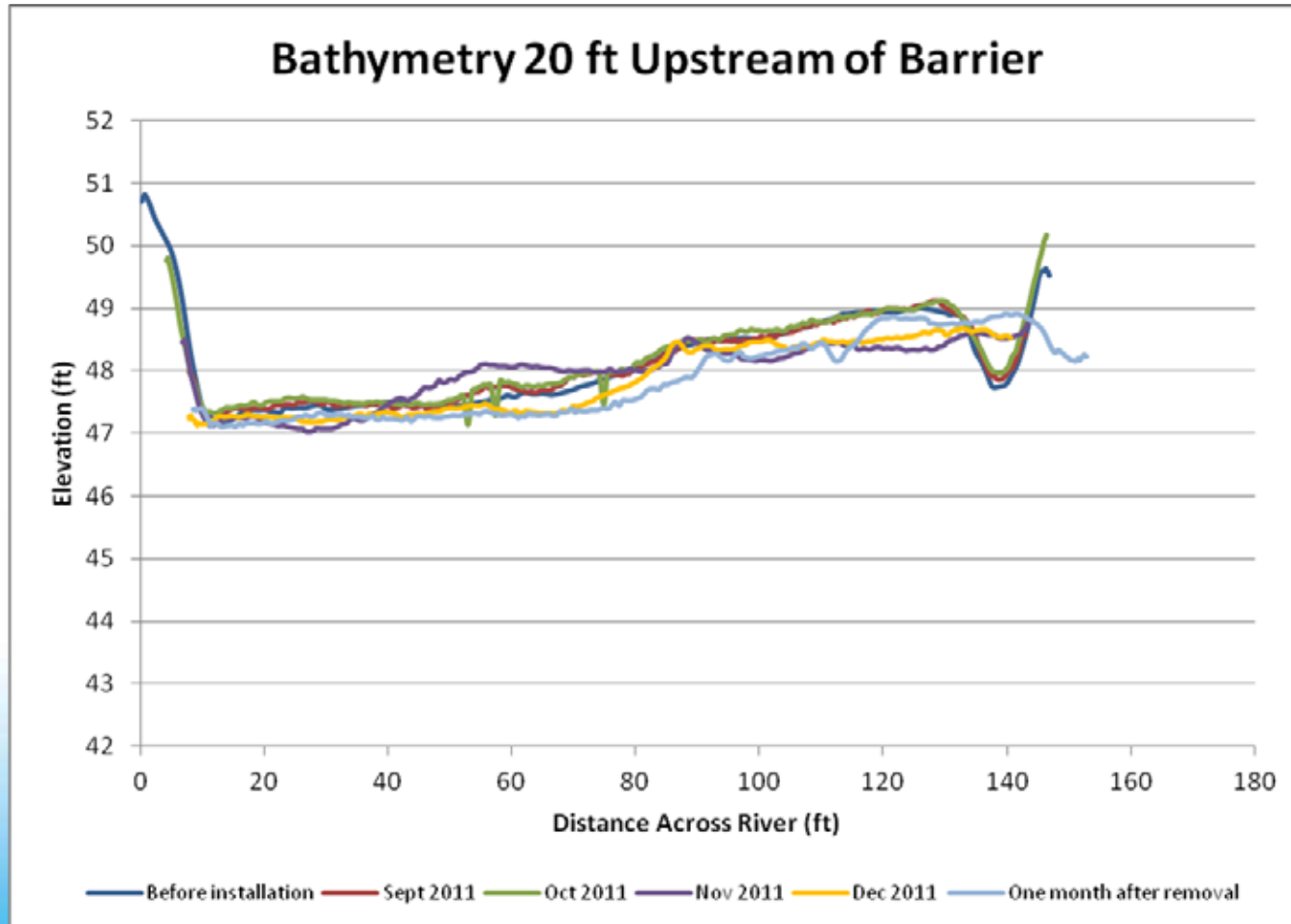
- **HFB effectiveness was monitored throughout the installation period and under a wide range of flows to understand the current limitations of the structure.**
- **Physical characteristics of the barrier and river were examined as well as fish behavior adjacent to the barrier.**
- **Dual-frequency identification sonar underwater camera (DIDSON™) and an Acoustic Doppler Current Profiler (ADCP) were used to identify problems and limitations.**
- **Information will be used to recommend improvements for barrier design, operation, and location.**
- **Scour holes and gaps in the barrier can be found and possibly predicted using erosion depth and sediment transition behavior.**

Bathymetry Mapping & Velocity Profiling



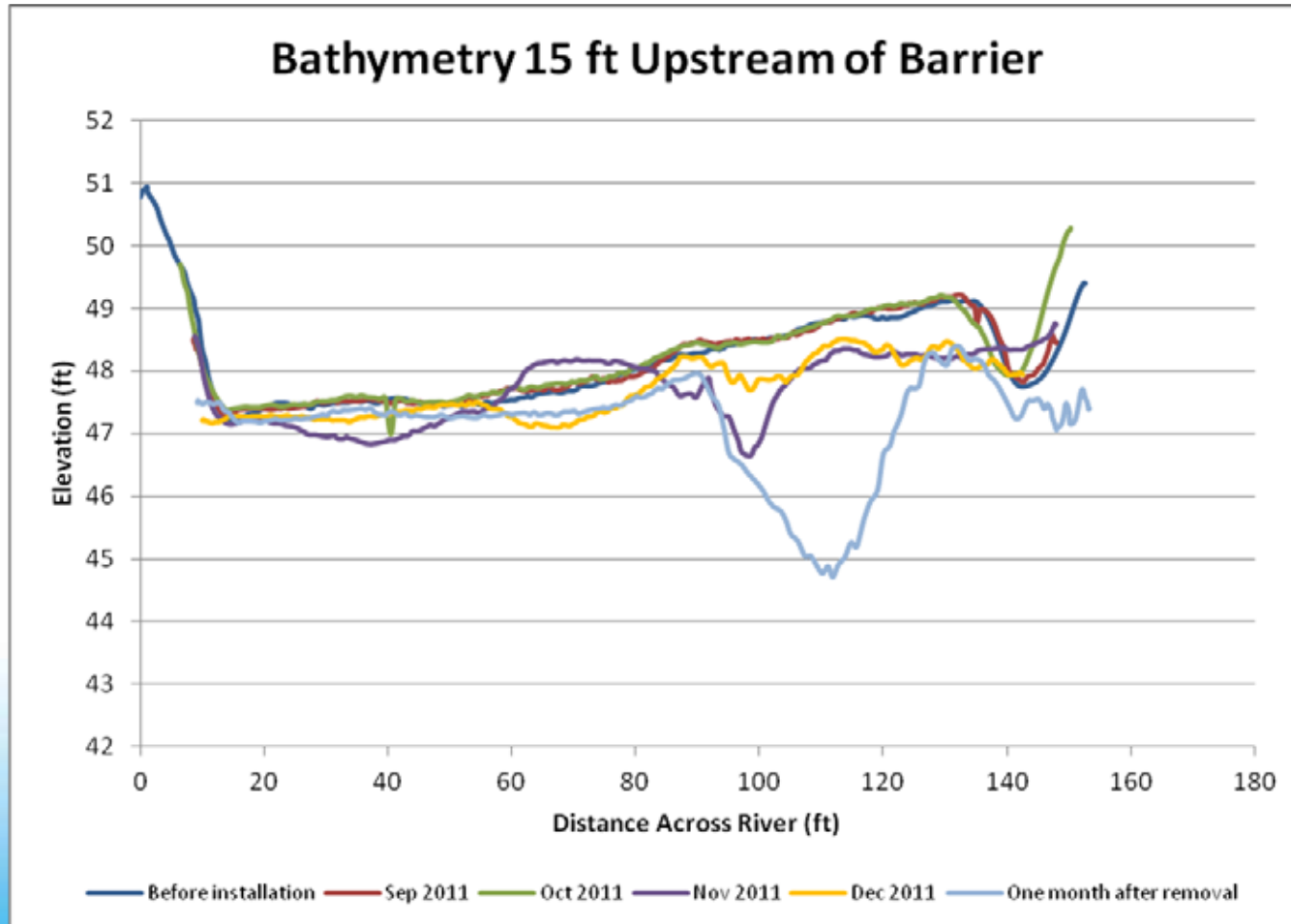
Measuring river velocity and bathymetric transects using a Teledyne RD Instruments StreamPro Acoustic Doppler Current Profiler.

Bathymetry Mapping & Velocity Profiling (continued)



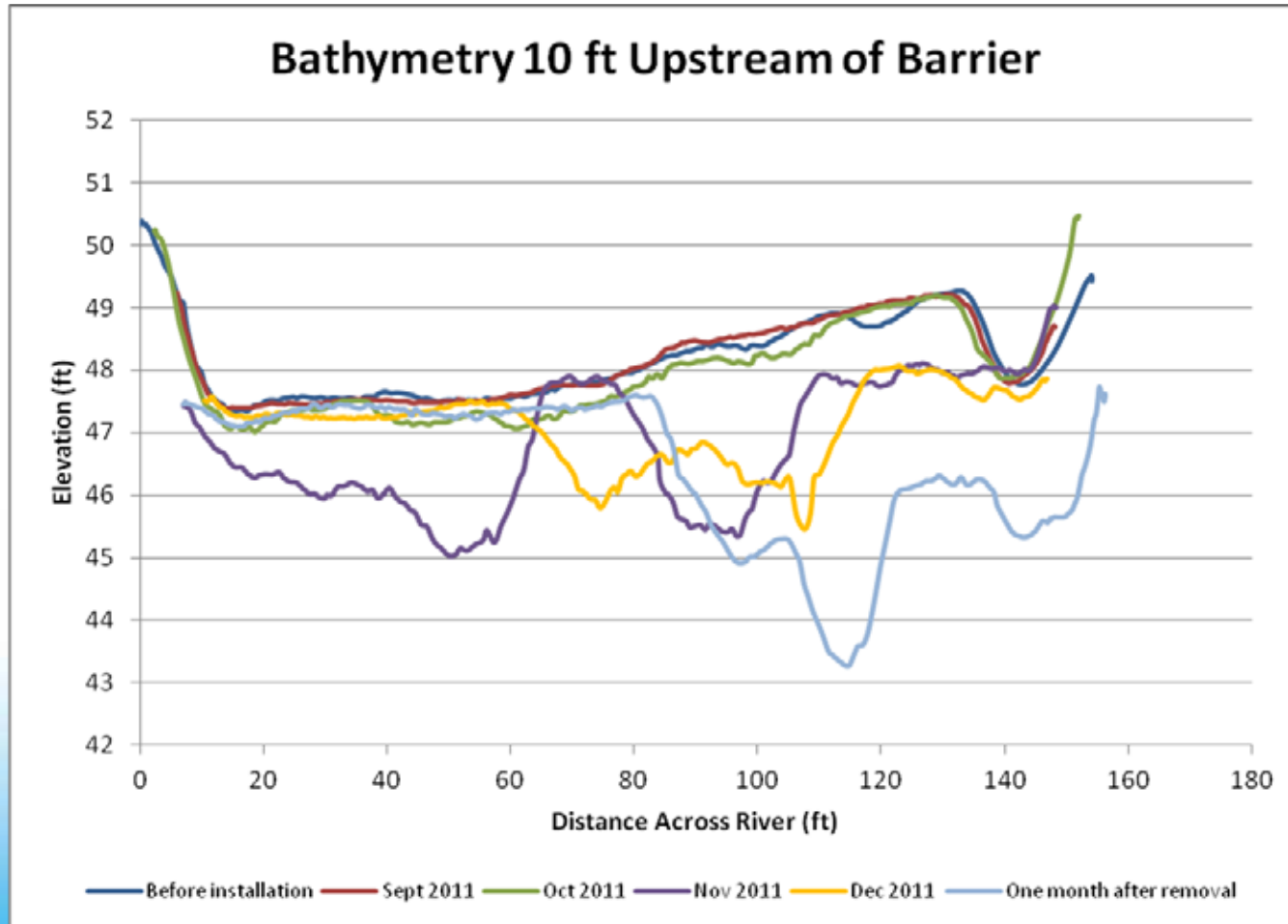
Monthly river transects collected with an Acoustic Doppler Current Profiler at 20 ft upstream of the Hills Ferry Barrier.

Bathymetry Mapping & Velocity Profiling (continued)



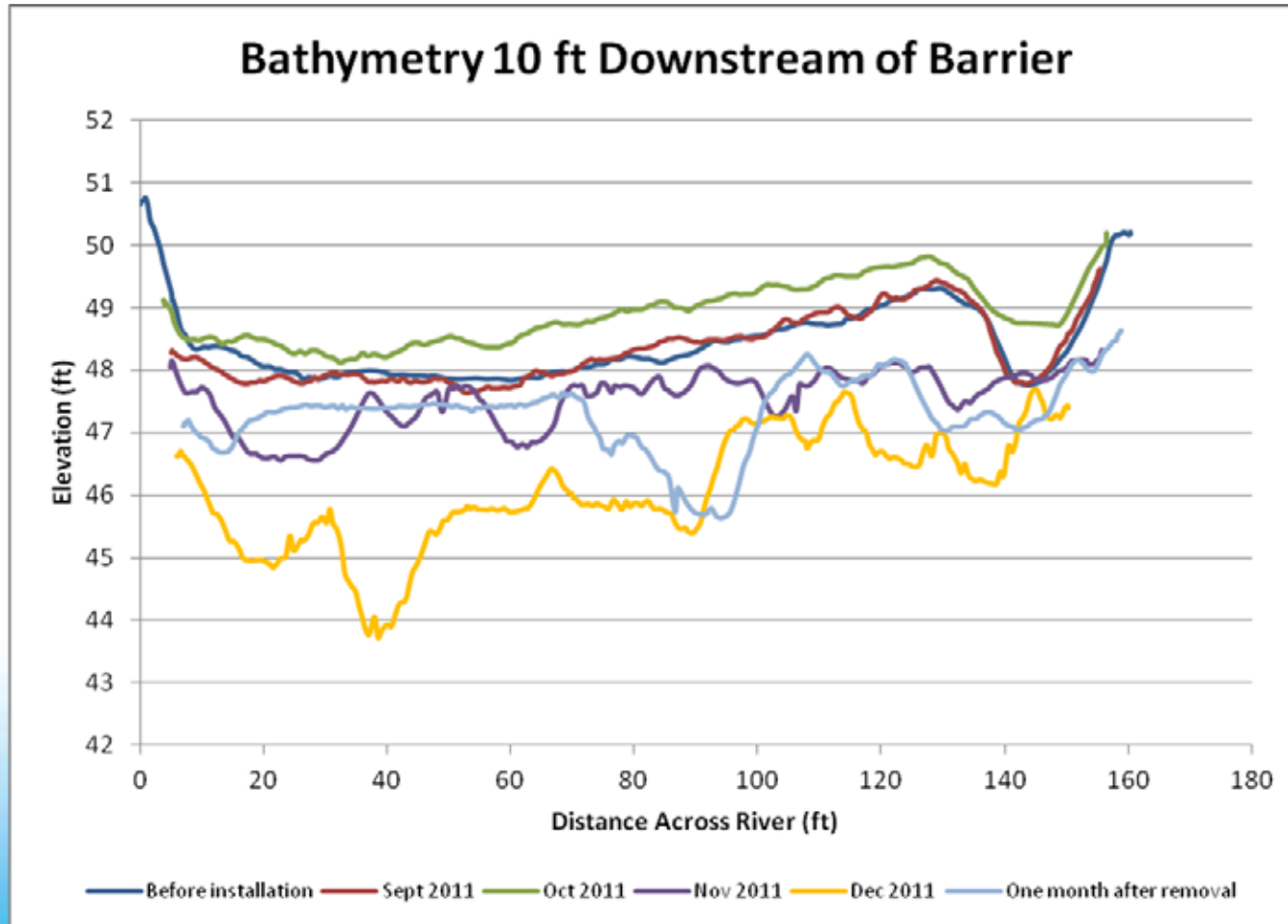
Monthly river transects collected with an Acoustic Doppler Current Profiler at 15 ft upstream of the Hills Ferry Barrier.

Bathymetry Mapping & Velocity Profiling (continued)



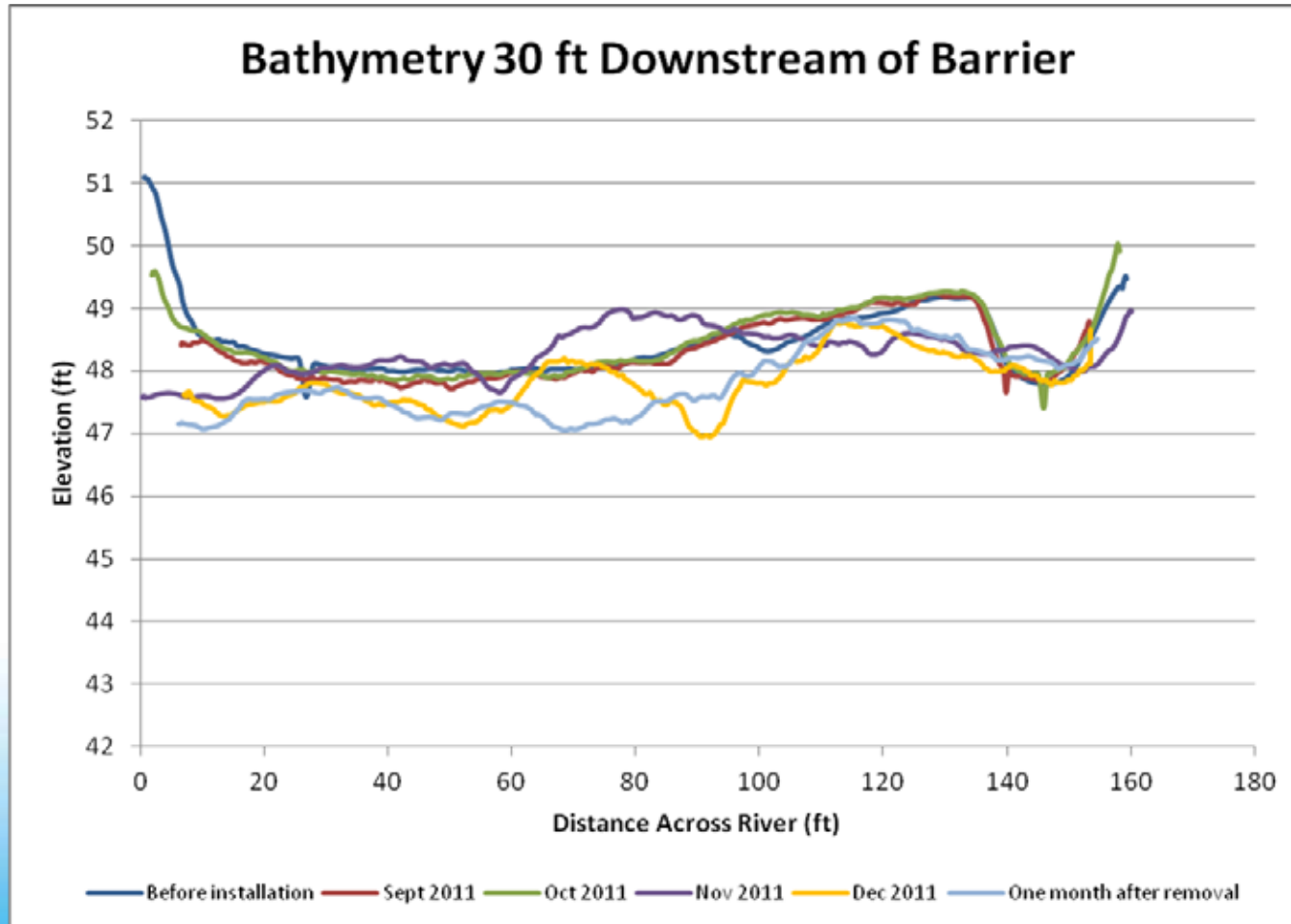
Monthly river transects collected with an Acoustic Doppler Current Profiler at 10 ft upstream of the Hills Ferry Barrier.

Bathymetry Mapping & Velocity Profiling (continued)



Monthly river transects collected with an Acoustic Doppler Current Profiler at 10 ft downstream of the Hills Ferry Barrier.

Bathymetry Mapping & Velocity Profiling (continued)



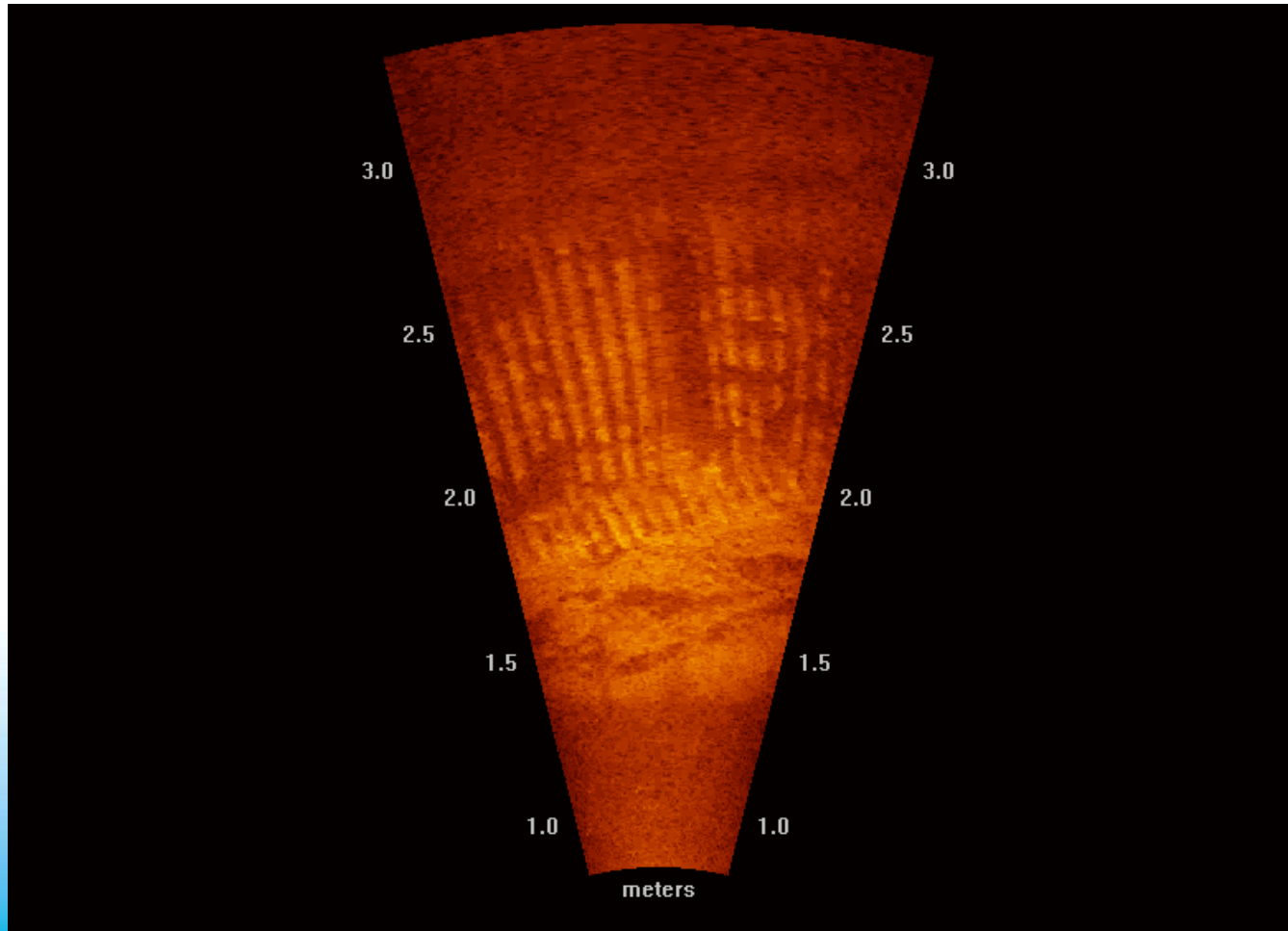
Monthly river transects collected with an Acoustic Doppler Current Profiler at 30 ft downstream of the Hills Ferry Barrier.

DIDSON Acoustic Camera



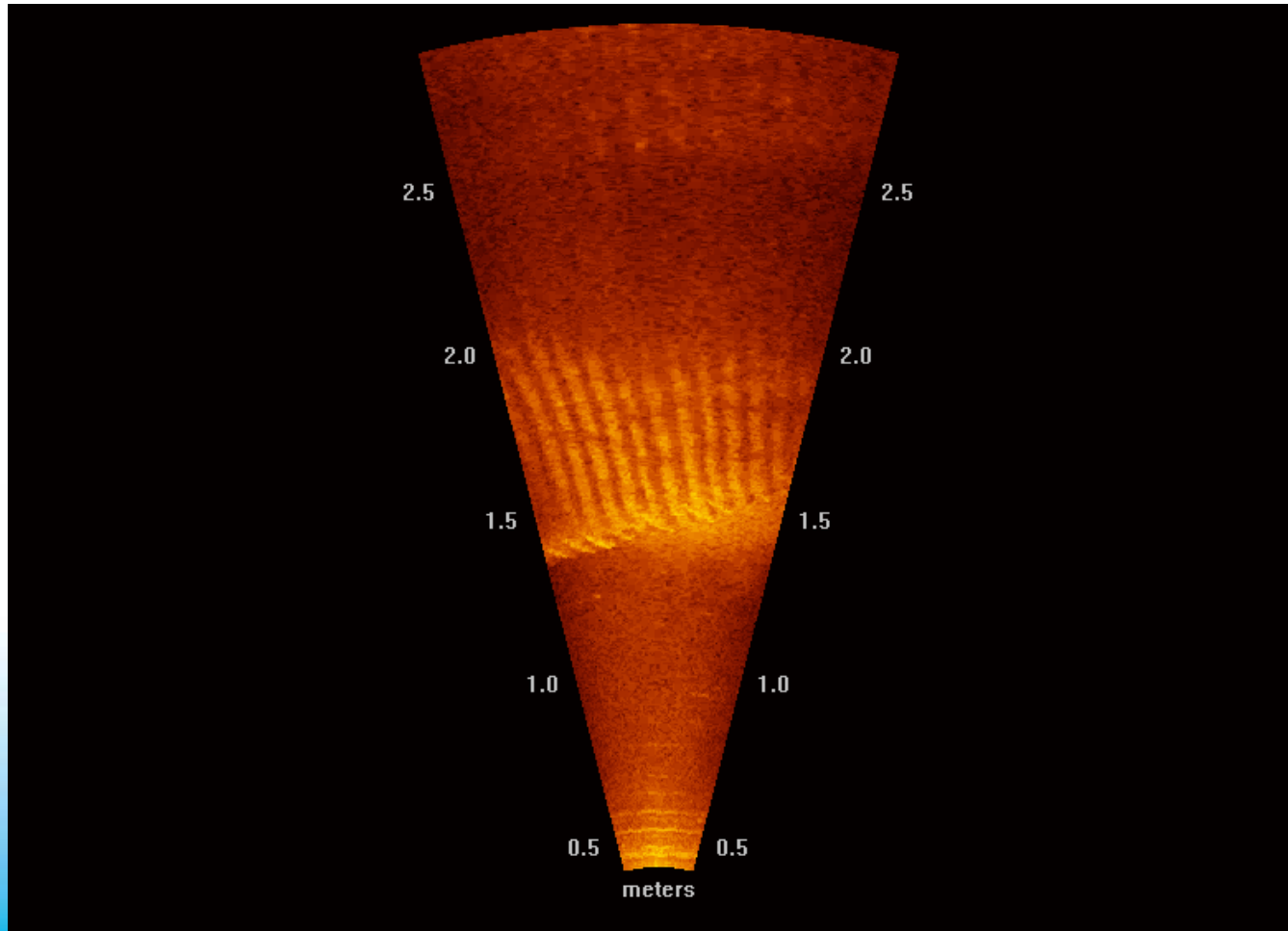
River-wide transects were recorded along the barrier to monitor scouring and passage issues along with fish behaviors using a DIDSON™ camera affixed to a transom mount of a jon boat and manually maneuvered across the channel directly adjacent the barrier.

DIDSON Observations



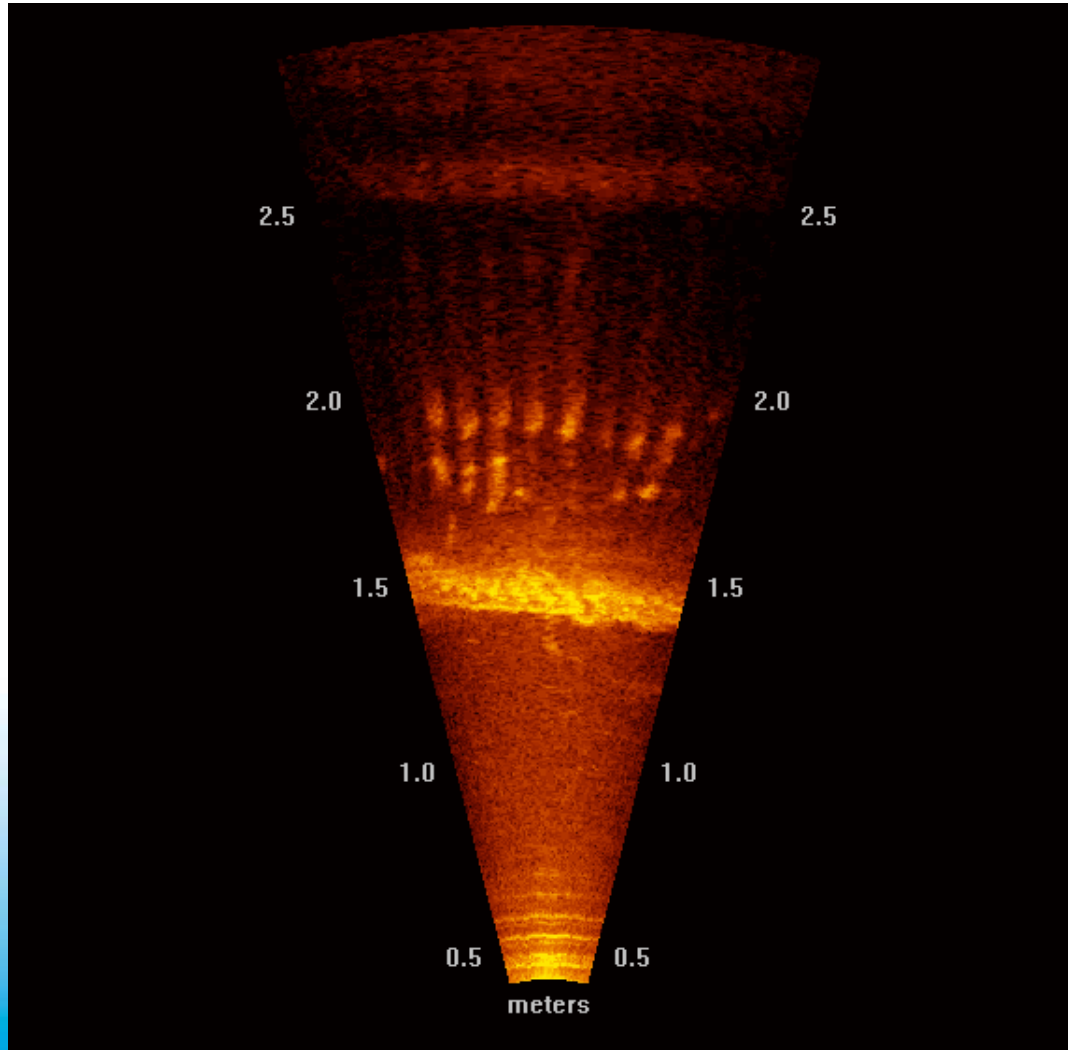
Barrier Examination using DIDSON camera

DIDSON Observations (continued)



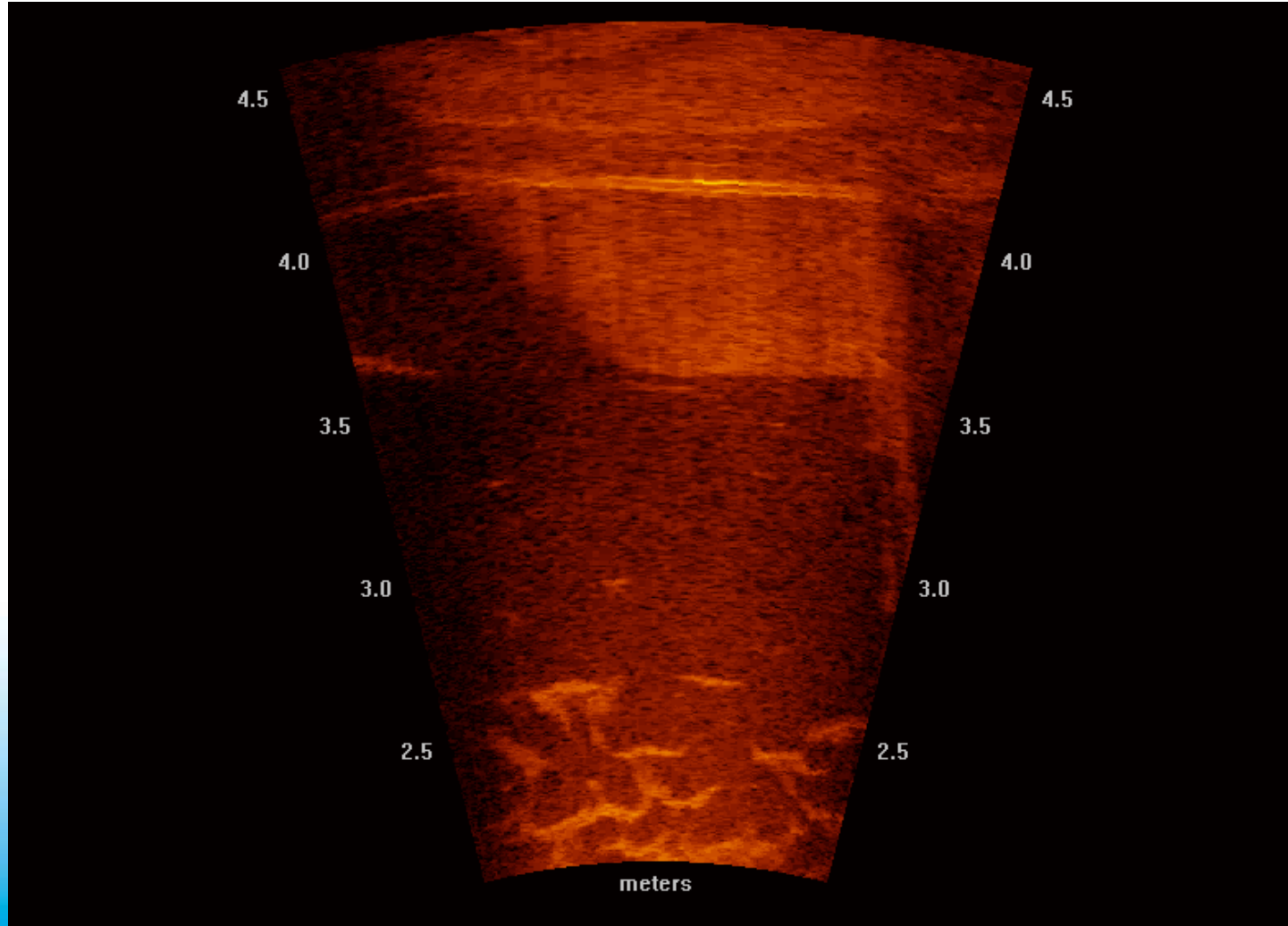
Picket Gaps in HFB

DIDSON Observations (continued)



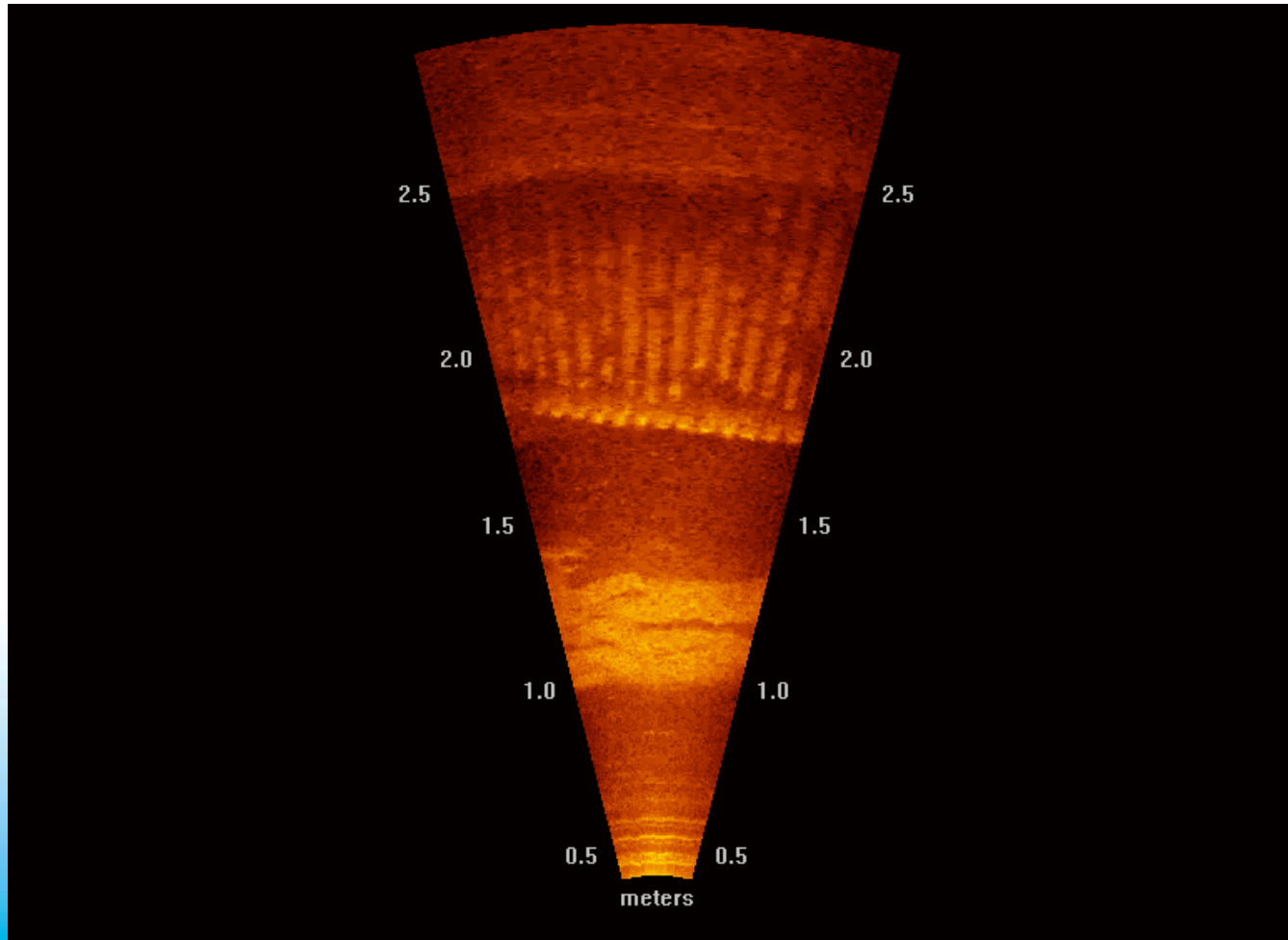
Chinook Salmon Upstream of HFB

DIDSON Observations (continued)



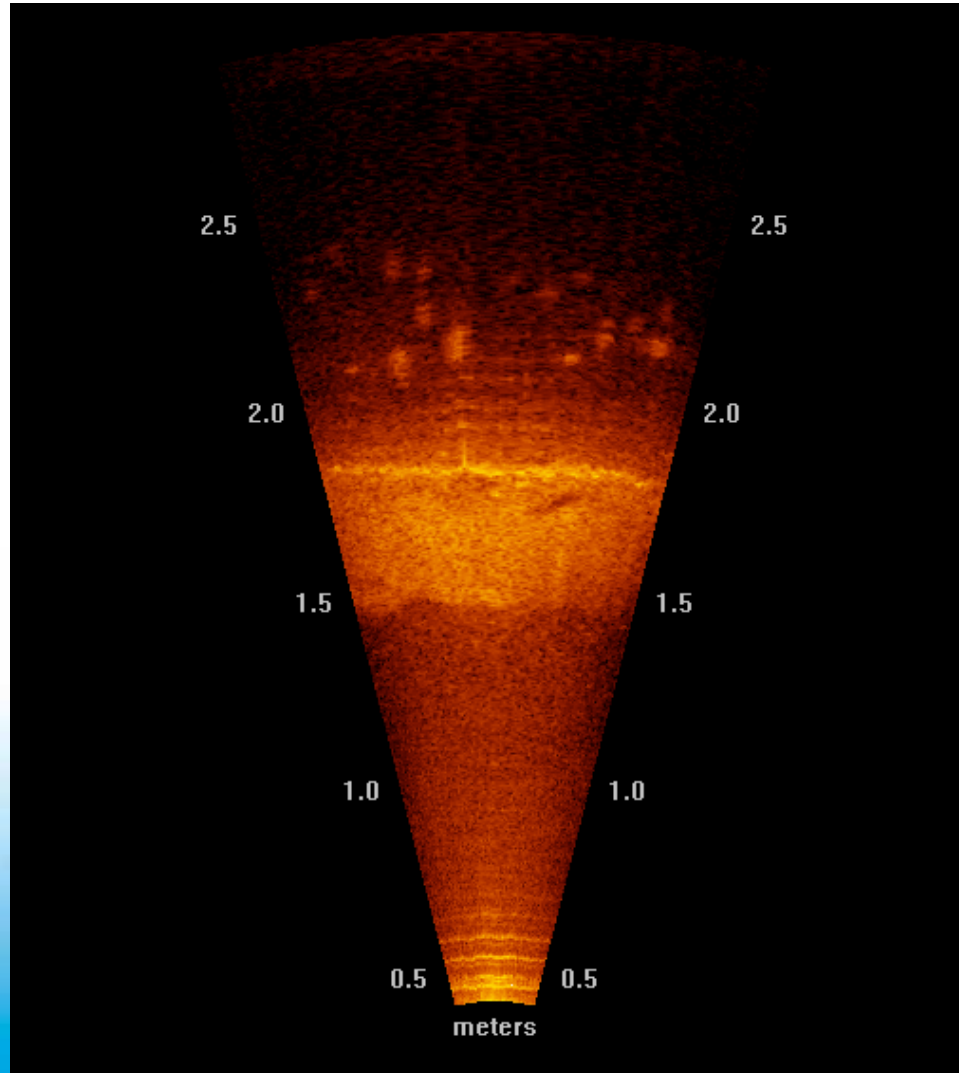
Schooling Fish at HFB

DIDSON Observations (continued)



Predation at HFB

DIDSON Observations (continued)



Sturgeon Upstream of HFB

Sampling at Hills Ferry Barrier

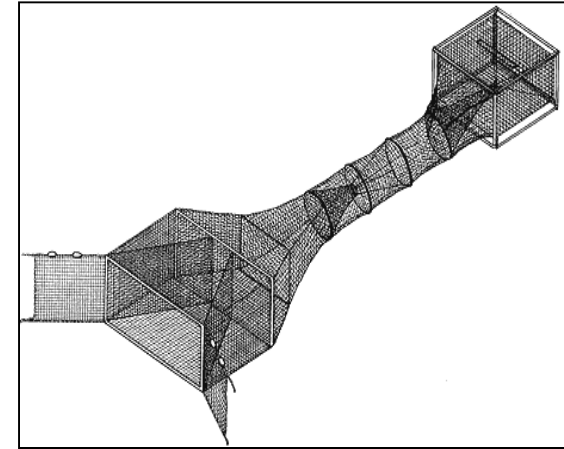




Fish Trap with Wing Walls

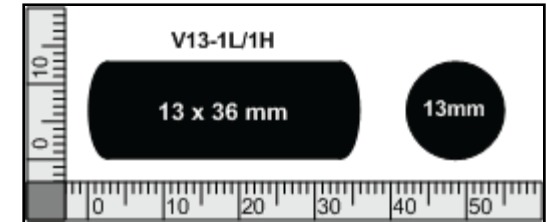


2011 Fish Trap Design



Acoustic Telemetry

Esophageal Insertion of Acoustic Transmitter



V13 Transmitter

- ✓ Modified bovine pill inserter with glycerin lubrication
- ✓ Floy tag for external identification



Acoustic Telemetry (continued)



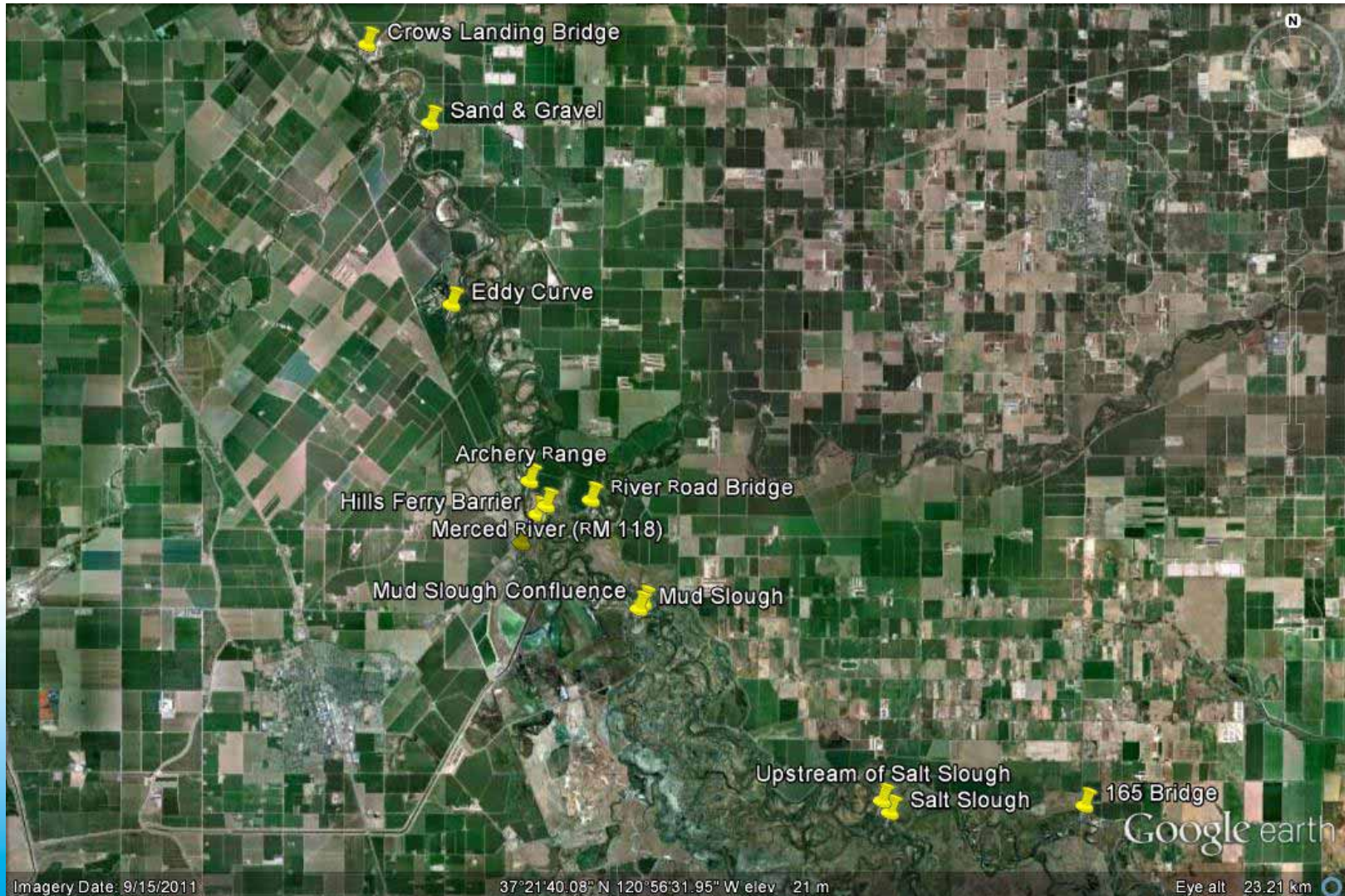
Manual tracking of an acoustically-tagged Chinook salmon using a VR100 receiver with a VH110 ultrasonic directional hydrophone.



VR2W Single Channel Receiver
(Photo courtesy of Vemco)

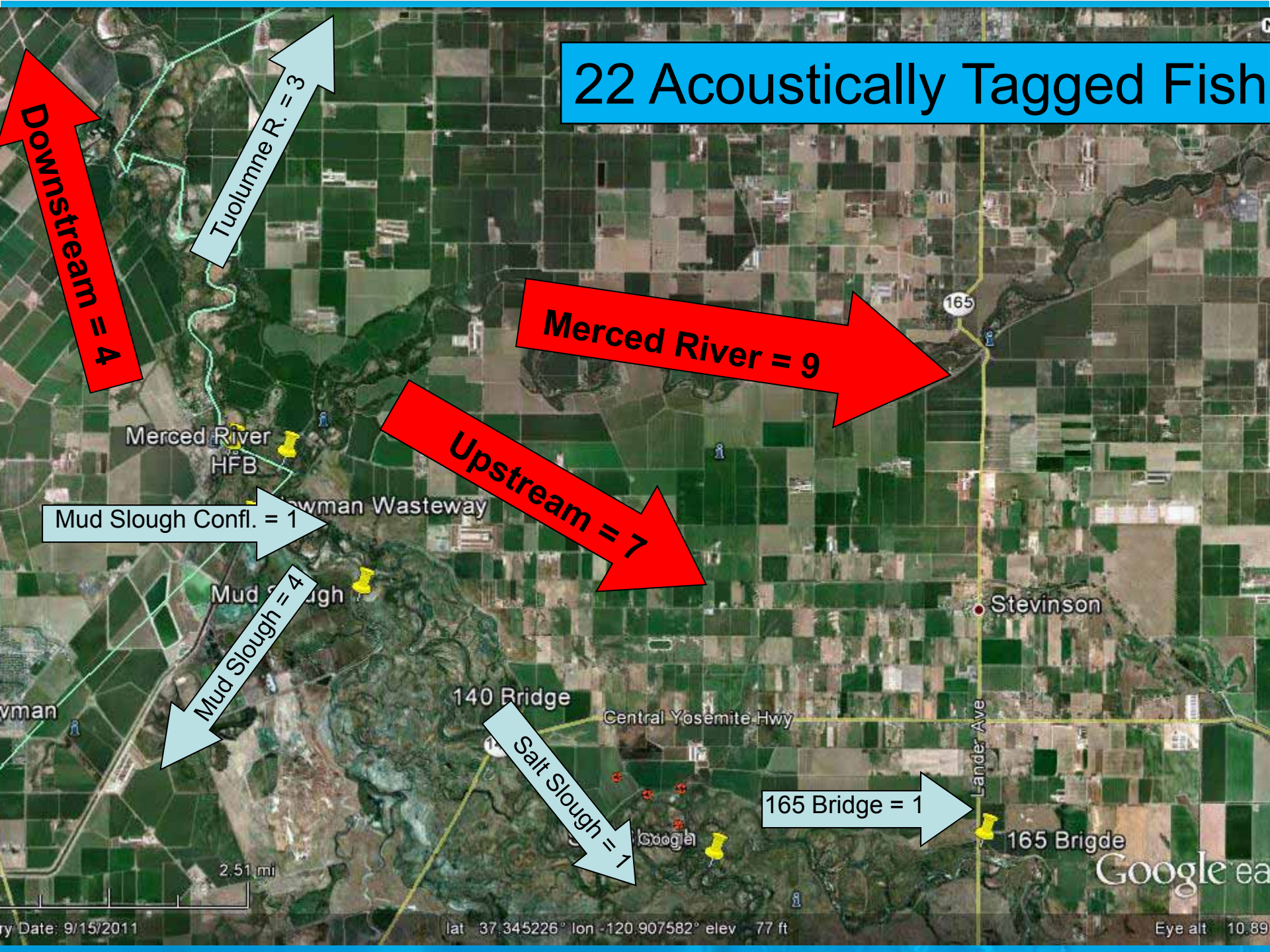


Acoustic Telemetry (continued)



Locations of fixed VR2W Single Channel Receivers

22 Acoustically Tagged Fish



Fish 2977 Male (captured upstream of barrier)

Archery range

12/10 22:46 Archery Range (RM 117.5)

12/11 1:20 Eddy Curve RM 113

12/11 3:45 Sand & Gravel RM 109

12/11 4:45 Crows Landing Bridge RM 107

12/11 16:15 SJRUSTUOL (RM 84)

Released 12/9 below barrier

HFB



Merced River

12/10 11:30 HFB (RM 118)

12/10 16:15 HFB

12/10 11:00 Butch's (RM 118.5)

12/10 13:30 Butch's

Butch's

© 2012 Google

Google Earth

Fish 3093 Male (captured downstream of barrier)

Archery range

11/17 0:38 Merced R. @ River Rd. Bridge

11/16 23:30 Lower Merced R.

Kelley Rd

HFB

Released 11/16 below barrier @ 17:03

Merced River

Fish 3093 swam to Merced River Hatchery

Hills Ferry Rd

River Rd

Butch's

1568 ft

© 2012 Google

Google ea

Fish 2968 Female (captured downstream of barrier)

Archery range

12/10 01:31 Archery Range

Kelley Rd

River Rd

HFB

Released 12/9 below barrier

12/14 01:53 HFB

Hills Ferry Rd

12/14 02:31 Butch's

12/14 04:34 Mud Slough Confluence

12/14 04:42 Mud Slough

Butch's

1568 ft

2012 Google



Recommendations

- ✓ Install concrete apron placed on the river bottom in front of and in back of the weir to form a stable foundation to prevent erosion.
- ✓ Use locations that are shallower and wider to keep depths/velocities manageable.
- ✓ DFG intends to operate a double barrier for Fall 2012.
- ✓ Increase staff to meet demands of vegetative debris and scouring.
- ✓ Alternative: Do not install HFB — Sack Dam as permanent barrier and screen smaller tributaries.



Questions and Comments?



Central Valley Steelhead Monitoring Plan








Steelhead Monitoring Plan

- Monitor for steelhead on the San Joaquin River upstream of the Merced River confluence
- In the event that Steelhead are captured; transport to access to suitable habitats downstream of the mouth of the Merced River



History

-  Steelhead are currently extirpated from all waters upstream of the Merced-San Joaquin river confluence (Eilers *et al.* 2010)
-  Believed to have been historically abundant in the SJR and may have spawned at least as far upstream as the natural barrier located at the present-day site of Mammoth Pool and the upper reaches of SJR tributaries.
-  Steelhead abundance and distribution in the SJR Basin have substantially decreased and steelhead have been extirpated from the Restoration Area due to the construction of Friant Dam blocking access to historical upstream spawning and rearing habitat (McEwan 2001)



Monitoring

Period:

- Sampling conducted from December 1 — March 15

Location:

- SJR-Merced Confluence to 1.5 miles upstream of Hwy 165 Bridge (Reach 5)

Sampling Methods:

- Boat Electrofishing
- Fyke nets with wing walls and fish traps
- Steelhead-specific trammel nets
- Hills Ferry Barrier and Fyke Trap

Sampling Methods

Boat Electrofishing



Sampling Methods

Fyke net traps with wing walls



Sampling Methods

Steelhead-specific trammel nets



Sampling Methods

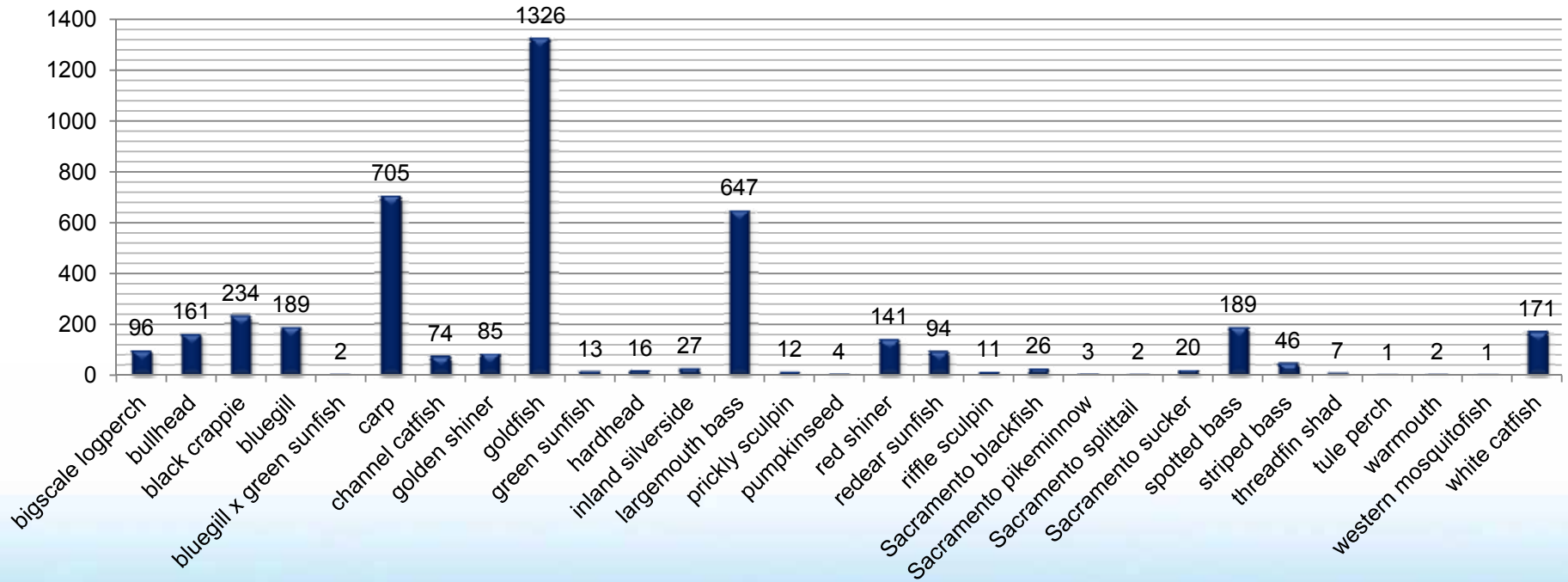
Hills Ferry Barrier and Fyke Trap





Results

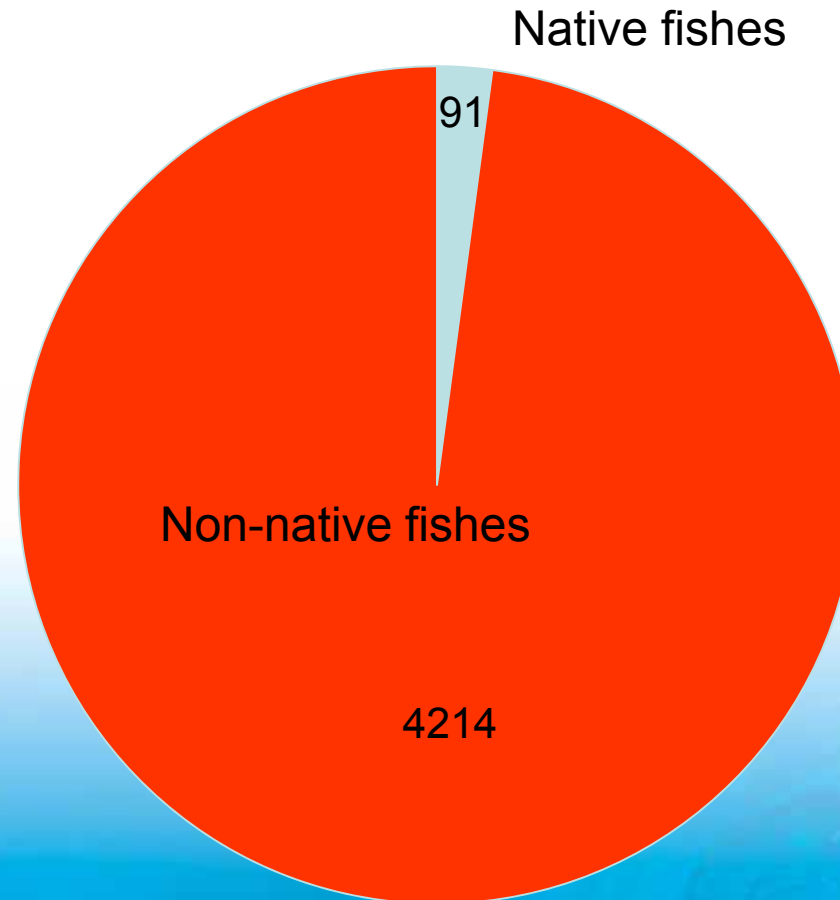
Total Number of Individual Species





Results

Endemic fish composition





Results





Sampling technique

	E-Fishing	Fyke Trap	Trammel Net
Species Captured	2671	1490	144
Native	67	8	16
Non-native	2604	1482	128





Conclusions

-  No Central Valley Steelhead were observed or captured during monitoring
-  Collected additional fish community composition data
-  Identified productive fish habitat types and locations within river
-  Sampling will be performed from the confluence to the furthest upstream section of continuous wetted river channel December 1 — March 15



Questions and Comments?





San Joaquin River Basin-wide PIT Tag Monitoring Program Evaluation and Site-specific Technology Assessment





PIT Tag Monitoring

Purpose and Need:

- Feasibility study to determine if the monitoring program can exploit Passive Inductive Transponder (PIT) tag technology.
- To monitor Chinook salmon movement throughout their life history in the Restoration Area and to determine survival and return at adulthood.
 - Juvenile — emigration, movement, & entrainment
 - Adult — escapement, entrainment, and straying



PIT Tag Monitoring

Study Plan:

Phase I — Assessment of PIT tag technology & site-specific limitations

Phase II — Construction of arrays, fish tagging, monitoring, and database management throughout life cycle

What are PIT Tags?



Passive Inductive Transponder (PIT) tag

- 🐟 “Passive”- No internal power supply
- “Inductive”- Powered by magnetic fields
- 🐟 Magnetic field of antennae generates a few volts that powers the RFID (Radio-frequency identification) chip inside
- 🐟 Transmits unique identifying number
- 🐟 Smaller copper coils transfer less power = smaller the tag, more powerful the array



What are PIT Tag Arrays?

- PIT tag arrays are a useful tool to identify and track individuals within a large population to monitor movement, track behavior, fish distribution, seasonal migrations, individual growth, population abundance, life stage, and survival.
- Inexpensive tags with a unique identifying number.
- Stationary antennas capable of sampling the entire width of streams, culverts, spillways, or fish ladders provide water resource managers a cost-effective way to monitor fish populations.
- Adaptable to most natural and regulated stream environments
- PIT tags are inductively charged by the reader and so do not have a battery. Tags can remain operational for decades.

What are PIT Tag Arrays?- continued

- Fish are implanted with a PIT tag containing a specific code for each fish. The PIT-tagged fish swim through or in the vicinity of an antenna where the code, date and time of passage is detected by the antenna receiver, recorded, and stored.
- Reductions in fish capture and handling saves costs and deleterious impacts on fish growth and survival.



100 mm Chinook salmon with 12 mm HDX PIT Tag



Monitoring Individual Metrics

Remote PIT tag Detection:

Passively Monitor:

Dam Passage

Habitat Use

Entrainment

Determine Age

Track individual movements

Fish behavior

Life history parameters

Juvenile-to-adult survival and return to spawning areas

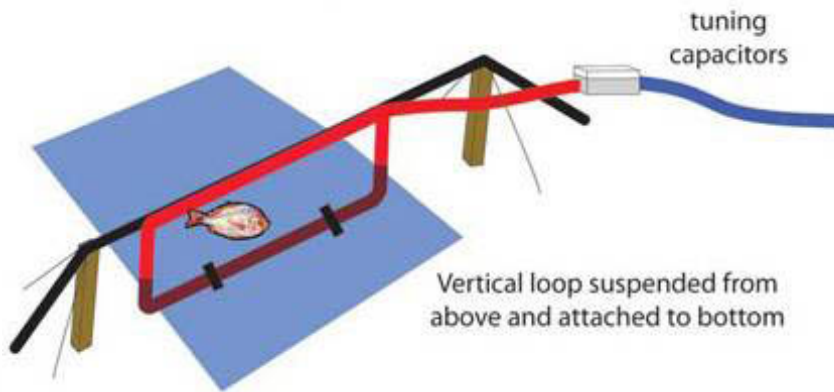
Recapture:

Growth

Abundance

PIT Tag Array Types

Pass-Through Rectangle

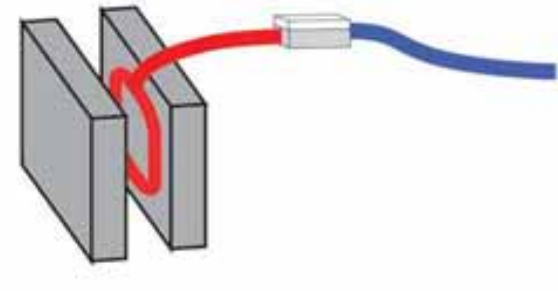


Pass-Over Loop



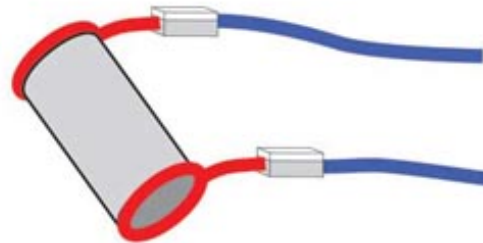
A loop laid flat on a surface has half of the read range of a vertical loop since only the field above the antenna is used.

Pass-by Loop



Circular Loop

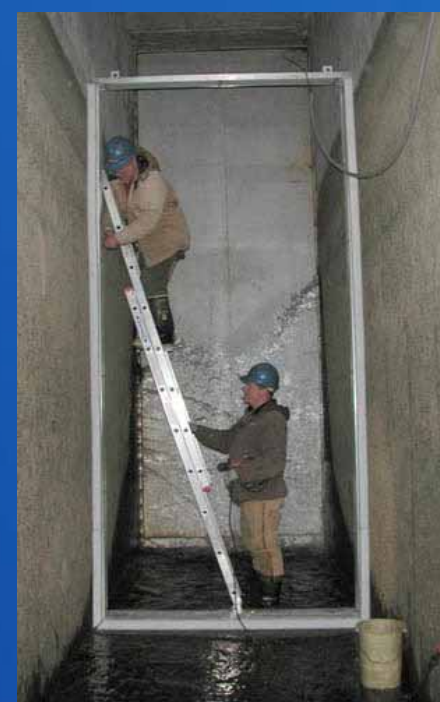
Two antennas to determine speed and direction.



The largest loop diameter is twice the read distance from the wire.

PIT Tag Array Applications









Slide from: Willamette Basin
Research

Vince Tranquilli and Mark Wade

Possible Future Array Locations



Downstream of Friant Dam



Skaggs Bridge County Park



Location,...



Location, Location,...



Mendota Dam



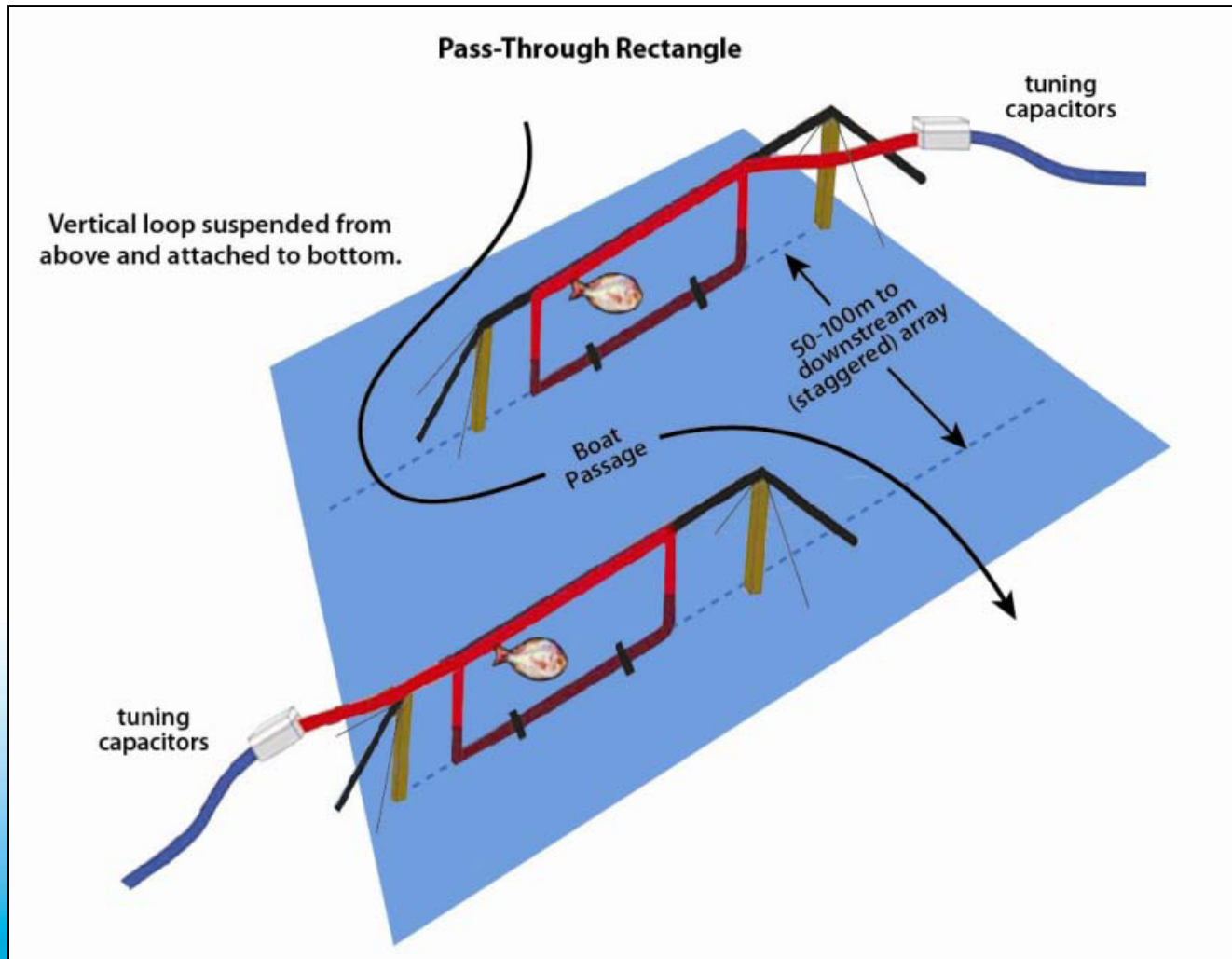
Sack Dam

Location, Location, Location...



Arroyo Canal

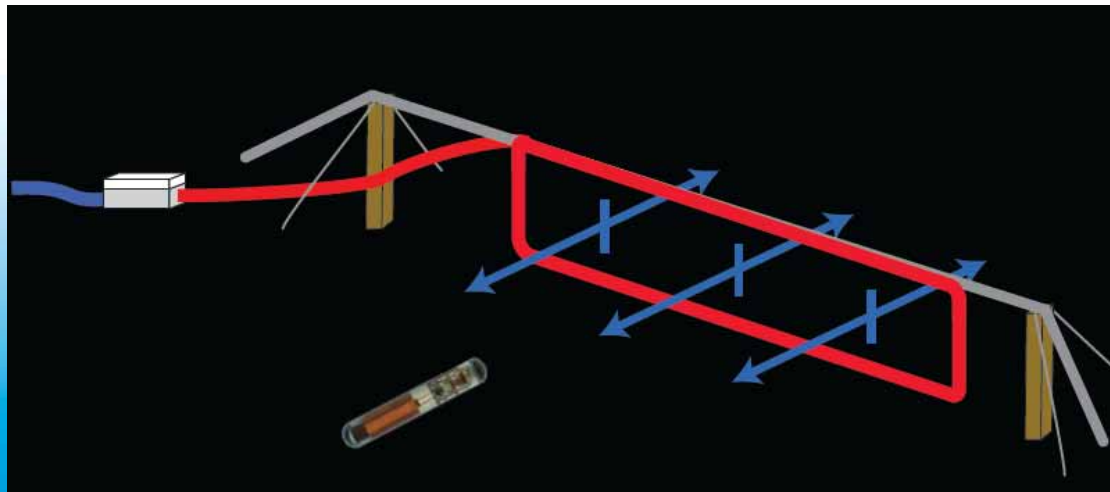
PIT Tag Array Design



Design used in April-May 2012 SJRR

PIT Tag Monitoring Period 2012

- 🐟 Temporary PIT tag arrays were built and installed during March and April of 2011 — prior to releasing juvenile Chinook salmon for the acoustic telemetry study.
- 🐟 Intended to be functional 8 weeks from March 19 — May 11.





PIT Tag Array Sites 2012

Locations:

- Lost Lake State Park, Fresno County
- Highway 41 (upstream of bridge behind trailer park)
- Scout Island
- Skaggs Bridge County Park
- Flood Plain downstream of Chowchilla Bifurcation Structure
- San Mateo Crossing



PIT Tag Array Sites 2012

Locations:

- Lost Lake State Park, Fresno County





Lost Lake (Downstream)



Lost Lake (Upstream)

PIT Tag Array Sites 2012

Locations:

- Highway 41 (upstream of bridge behind trailer park)



Upstream



Downstream

PIT Tag Array Sites 2012

Locations:

- Scout Island



Upstream



Downstream

PIT Tag Array Sites 2012

Locations:

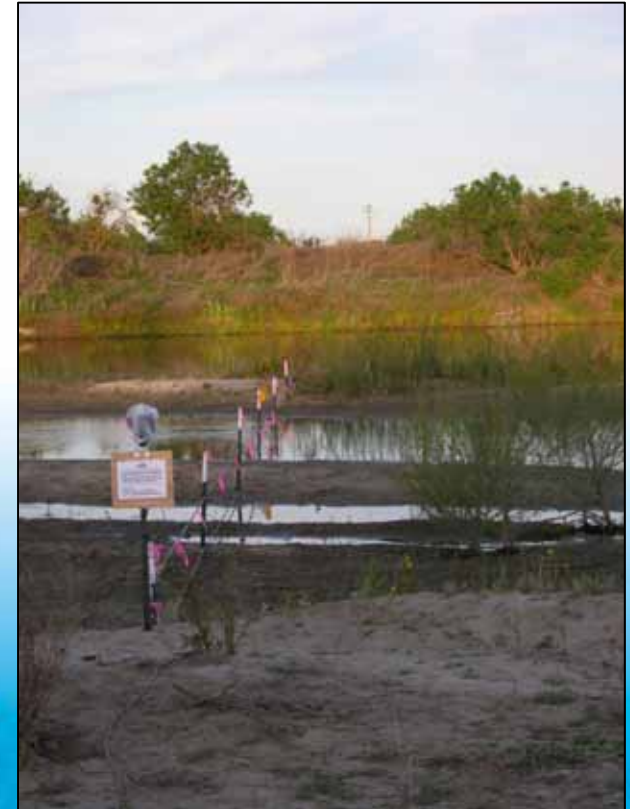
- Skaggs Bridge County Park



PIT Tag Array Sites 2012

Locations:

- Flood Plain downstream of Chowchilla Bifurcation Structure



PIT Tag Array Sites 2012

Locations:

- San Mateo Crossing



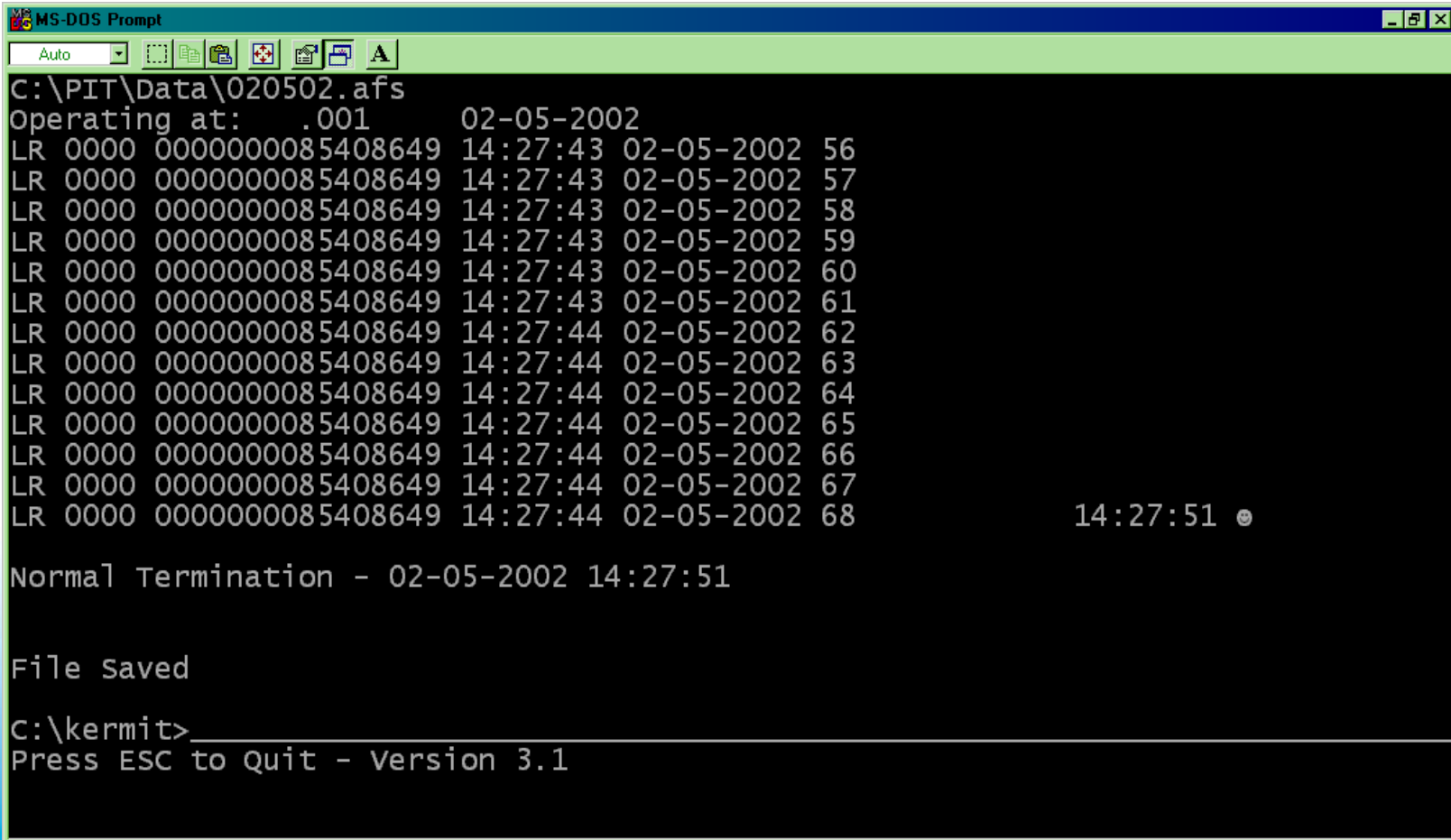
What's Next?

Data Download



What's Next?

Data Analysis



```
MS-DOS Prompt
Auto
C:\PIT\Data\020502.afs
Operating at: .001 02-05-2002
LR 0000 0000000085408649 14:27:43 02-05-2002 56
LR 0000 0000000085408649 14:27:43 02-05-2002 57
LR 0000 0000000085408649 14:27:43 02-05-2002 58
LR 0000 0000000085408649 14:27:43 02-05-2002 59
LR 0000 0000000085408649 14:27:43 02-05-2002 60
LR 0000 0000000085408649 14:27:43 02-05-2002 61
LR 0000 0000000085408649 14:27:44 02-05-2002 62
LR 0000 0000000085408649 14:27:44 02-05-2002 63
LR 0000 0000000085408649 14:27:44 02-05-2002 64
LR 0000 0000000085408649 14:27:44 02-05-2002 65
LR 0000 0000000085408649 14:27:44 02-05-2002 66
LR 0000 0000000085408649 14:27:44 02-05-2002 67
LR 0000 0000000085408649 14:27:44 02-05-2002 68
14:27:51
Normal Termination - 02-05-2002 14:27:51
File saved
C:\kermit>
Press ESC to Quit - Version 3.1
```

Software: records unique identification code, time, and date



What's Next?

Data Management

Native Fish Lab- PIT Tag search - Internet Explorer, optimized for Bing and MSN

http://nativefishlab.net/nfwg/

File Edit View Favorites Tools Help

Native Fish Lab- PIT Tag search

Submit

Database search for: 1c2d0612ce

Date	Tag Number	History	Location	Collector	Sex	TL (mm)	Weight (g)	Rearing	Year Class	Health Legend	Comments
10/31/2008	1C2D0612CE	Repatriate Release	Laughlin Lagoon	BR	J	355	0	Willow Beach NFH	2005 and 2006		
2/11/2009	1C2D0612CE	Repatriate Capture	Blankenship Bend (north of)	BR	J	355	453	Willow Beach NFH	2005 and 2006		

Database search for: 1c2c83c4e5

Date	Tag Number	History	Location	Collector	Sex	TL (mm)	Weight (g)	Rearing	Year Class	Health Legend	Comments
10/30/2008	1C2C83C4E5	Repatriate Capture	Pulpit Rock Cove	BR	M	494	0	Unknown			FC taken
2/12/2009	1C2C83C4E5	Repatriate Capture	Park Moabi Marina	BR	M	505	1501	Unknown		KYPH	

Database search for: 1c2c8409c9

Date	Tag Number	History	Location	Collector	Sex	TL (mm)	Weight (g)	Rearing	Year Class	Health Legend	Comments
3/19/2008	1C2C8409C9	Repatriate Release	Needles Dredge Yard	BR	J	305	0	Willow Beach NFH	2005 and 2006		
10/30/2008	1C2C8409C9	Repatriate Capture	Park Moabi	BR	M	435	0	Willow Beach NFH	2005 and 2006		
2/12/2009	1C2C8409C9	Repatriate Capture	Park Moabi Marina	BR	M	445	1025	Willow Beach NFH	2005 and 2006	TUB	

[Fiscal Year 2008 Stocking Summary](#)

[Fiscal Year 2009 Stocking Summary](#)

Done Internet 130%

Start Inbox - Microsoft ... Untitled - Message ... Native Fish Lab-...

11:04 AM



Recommendations

- ✓ Design permanent arrays on structures in river
- ✓ Develop better flat plate array designs
- ✓ Continue to install a small number of temporary array designs during spring and fall fish movements
- ✓ Better outreach to river recreationist?
- ✓ Secure more secure, vandalism-free locations

Questions and Comments?

