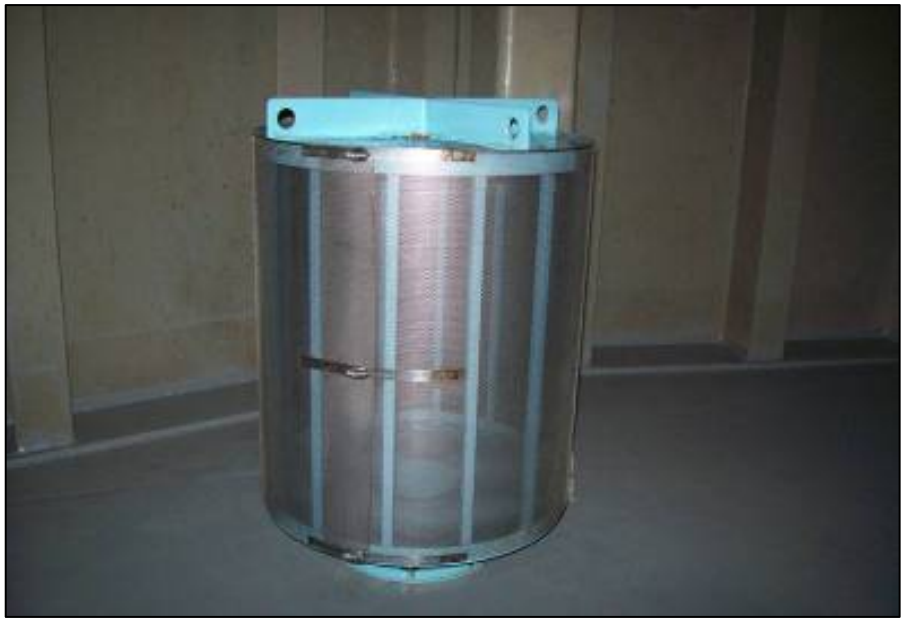
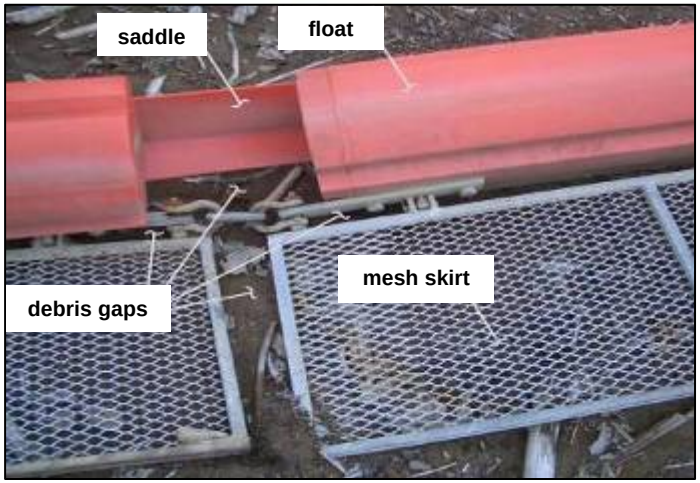
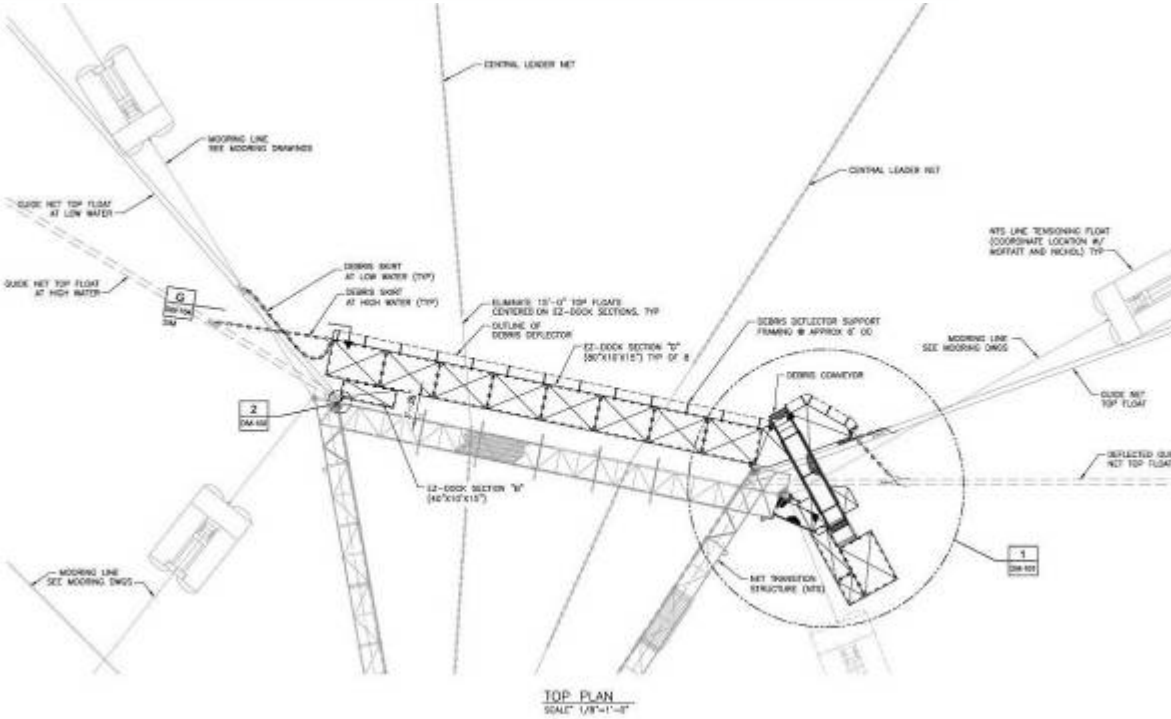
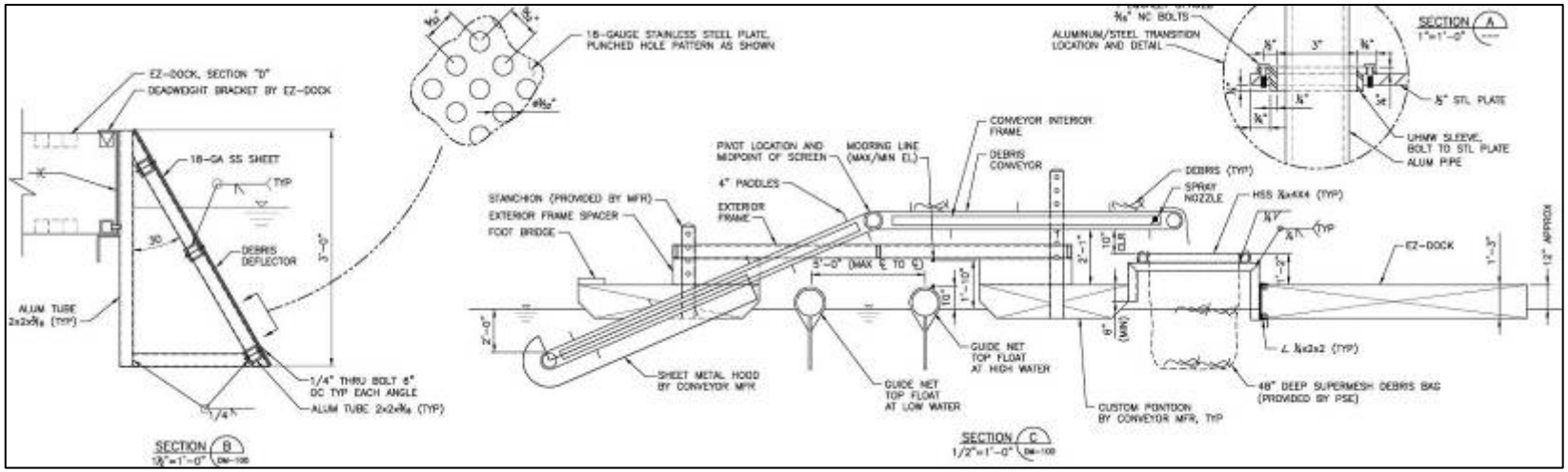
Debris



Debris


saddle
float
debris gaps
mesh skirt


CENTRAL LEADER NET
MOORING LINE
GUIDE NET TOP FLOAT AT LOW WATER
GUIDE NET TOP FLOAT AT HIGH WATER
DEBRIS SKIRT AT LOW WATER (TYP)
DEBRIS SKIRT AT HIGH WATER (TYP)
OUTLINE OF DEBRIS DEFLECTOR
EZ-DOCK SECTION "D"
DEBRIS DEFLECTOR SUPPORT FRAMING
DEBRIS CONVEYOR
MOORING LINE SEE MOORING DWGS
GUIDE NET TOP FLOAT
EZ-DOCK SECTION "B"
NET TRANSITION STRUCTURE
TOP PLAN


18-GAUGE STAINLESS STEEL PLATE, PUNCHED HOLE PATTERN AS SHOWN
EZ-DOCK, SECTION "D"
DEADWEIGHT BRACKET BY EZ-DOCK
18-GA SS SHEET
DEBRIS DEFLECTOR
ALUM TUBE
1/4" THRU BOLT 6" OC TYP EACH ANGLE
ALUM TUBE 2x2x3/16 (TYP)
SECTION B
3/8" NC BOLTS
ALUMINUM/STEEL TRANSITION LOCATION AND DETAIL
SECTION A
1/2" STL PLATE
UHMW SLEEVE, BOLT TO STL PLATE
ALUM PIPE
CONVEYOR INTERIOR FRAME
PIVOT LOCATION AND MIDPOINT OF SCREEN
MOORING LINE (MAX/MIN EL)
DEBRIS CONVEYOR
4" PADDLES
STANCHION (PROVIDED BY MFR)
EXTERIOR FRAME SPACER
FOOT BRIDGE
EXTERIOR FRAME
DEBRIS (TYP)
SPRAY NOZZLE
HSS 3/16x4x4 (TYP)
EZ-DOCK
3'-0" (MAX ℄ TO ℄)
SHEET METAL HOOD BY CONVEYOR MFR
GUIDE NET TOP FLOAT AT HIGH WATER
GUIDE NET TOP FLOAT AT LOW WATER
CUSTOM PONTOON BY CONVEYOR MFR, TYP
48" DEEP SUPERMESH DEBRIS BAG (PROVIDED BY PSE)
SECTION C

Transients

Voltage Spike Caused

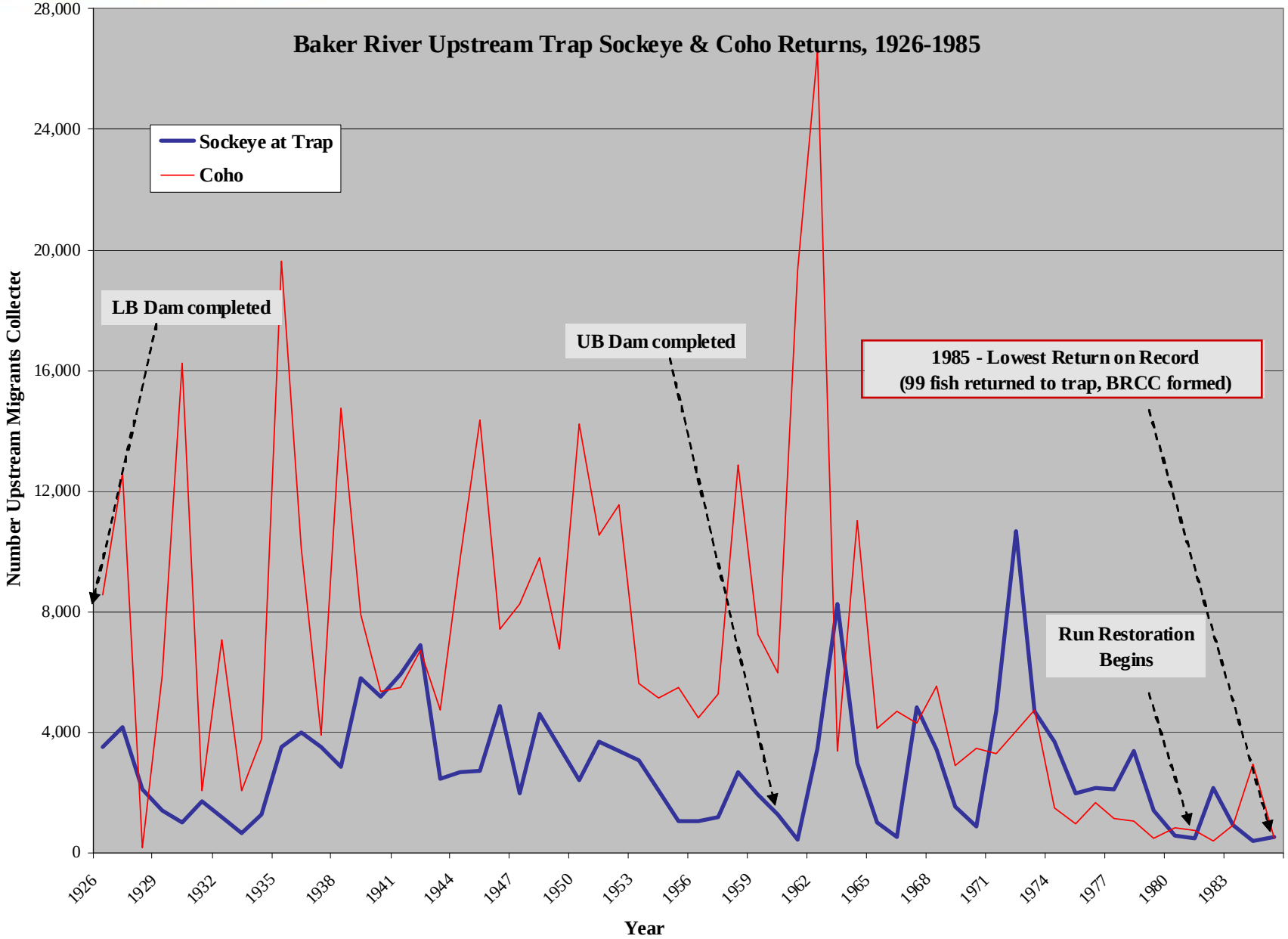
- 7 Pump VFD's failed
  - Blown capacitors
  - Destroyed circuit boards
  - Destroyed transistors
- Peak of outmigration

Install

- Transfer trip
- Surge protection

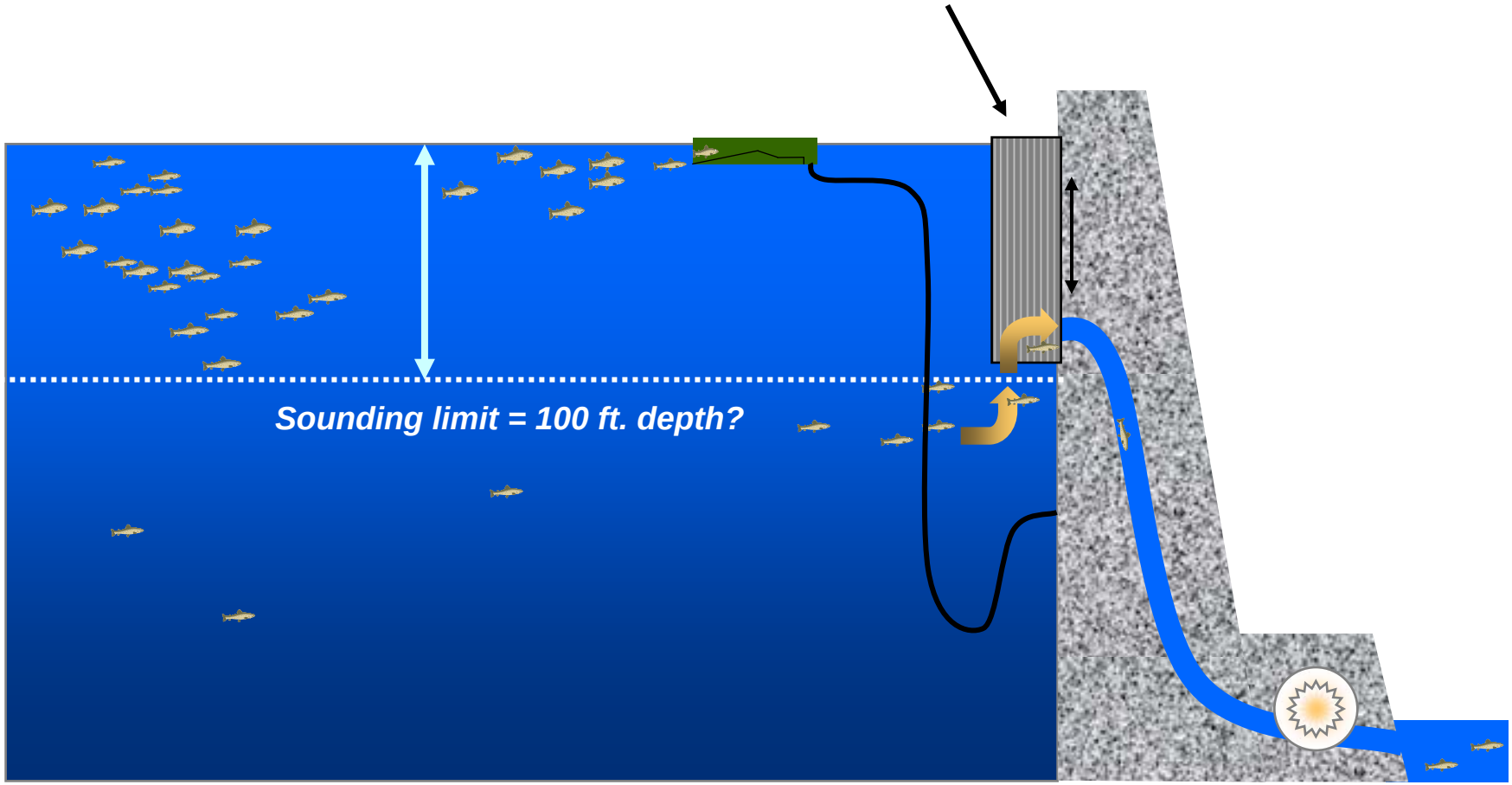
Fish, Guide Net, Performance

Why Nets? - Sockeye Trend



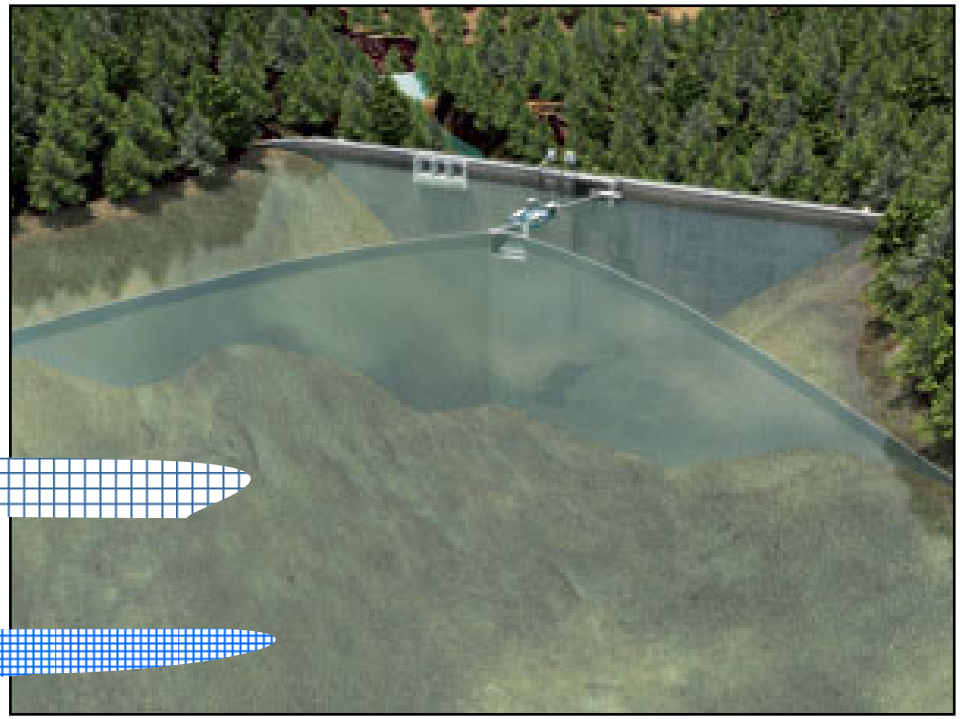
Net Concept

- Hydroacoustics – fish deeper than baffle

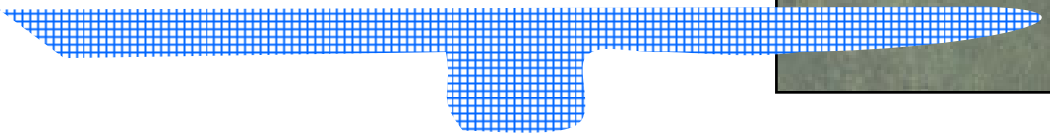


Net Development

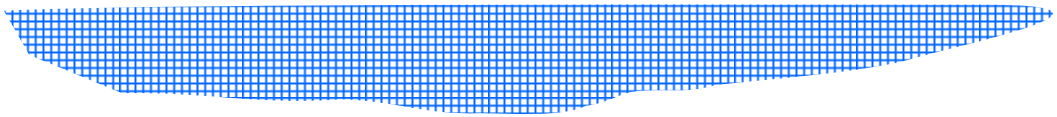
- Net evolution big part of success at Baker
- Project well-suited to nets



Stage I – 1” mesh x 100’ depth

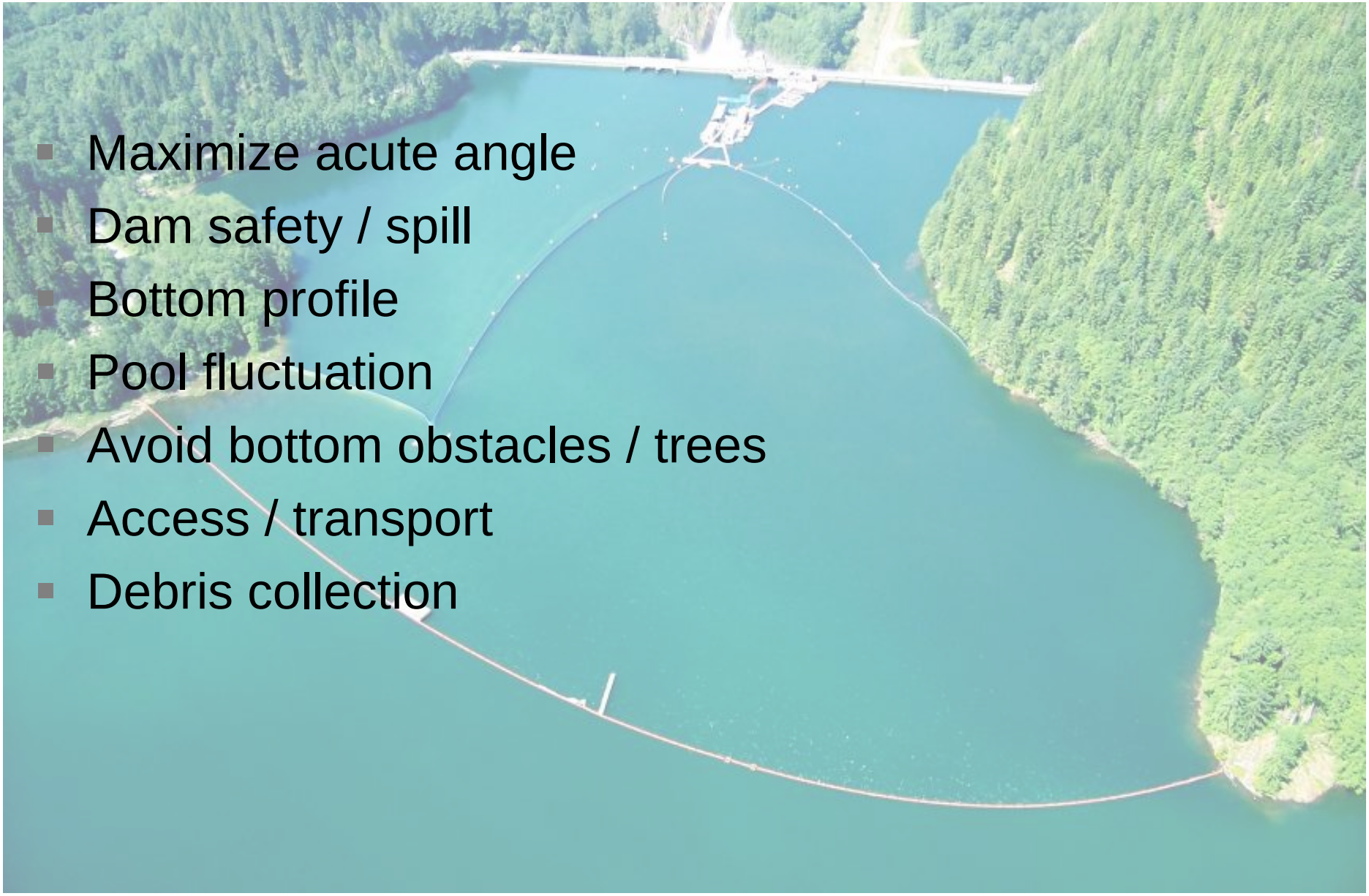


Stage II – 1/4” mesh x 100’ depth (4 deep panels)



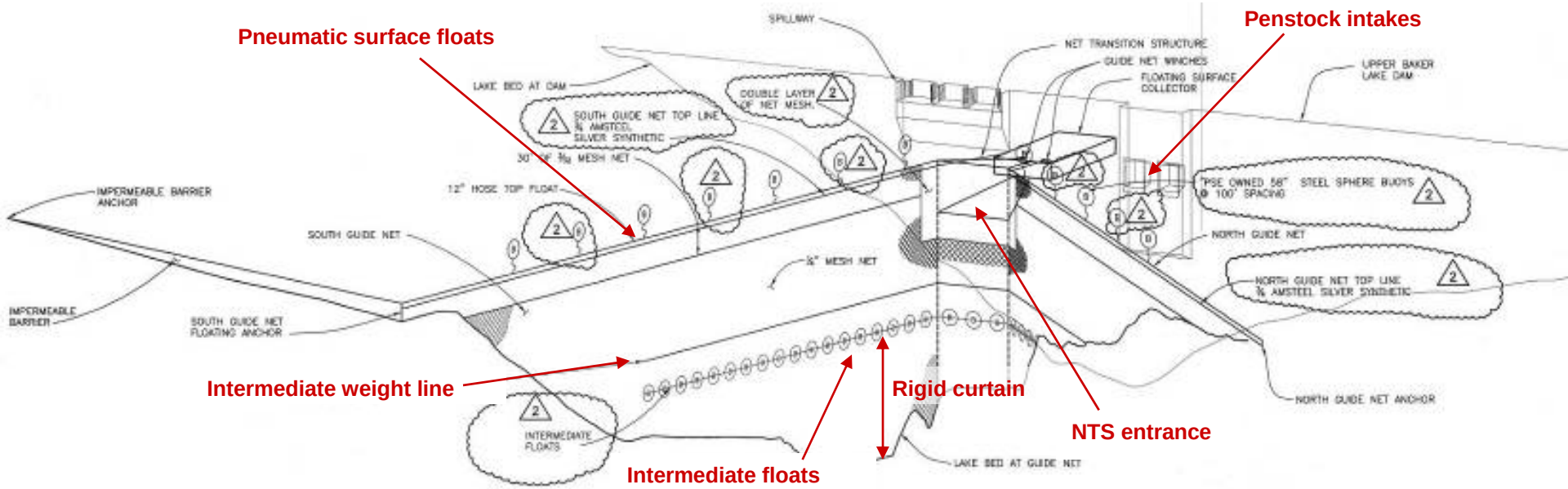
Stage III – 3/32” & 1/4” mesh, full depth, shore-to-shore, pneumatic control, intermediate floats

Design Goals - Net

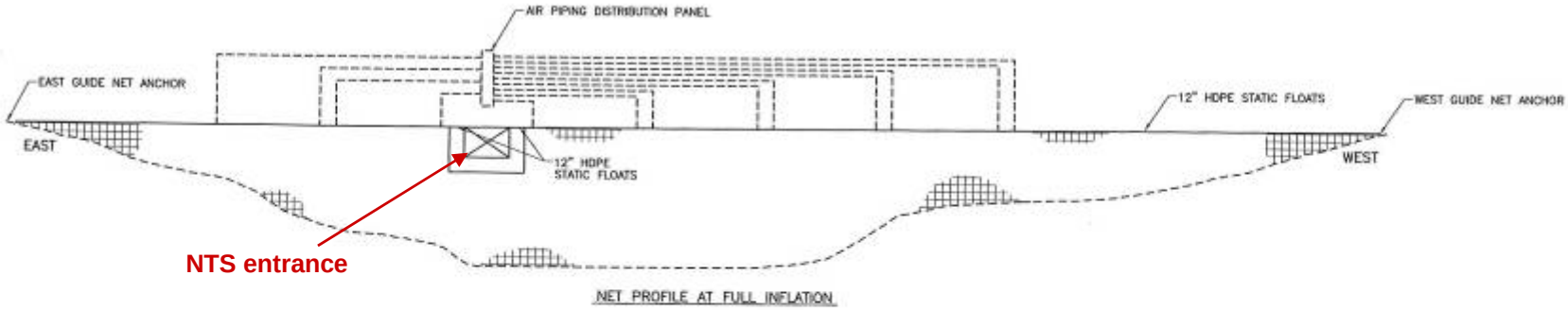


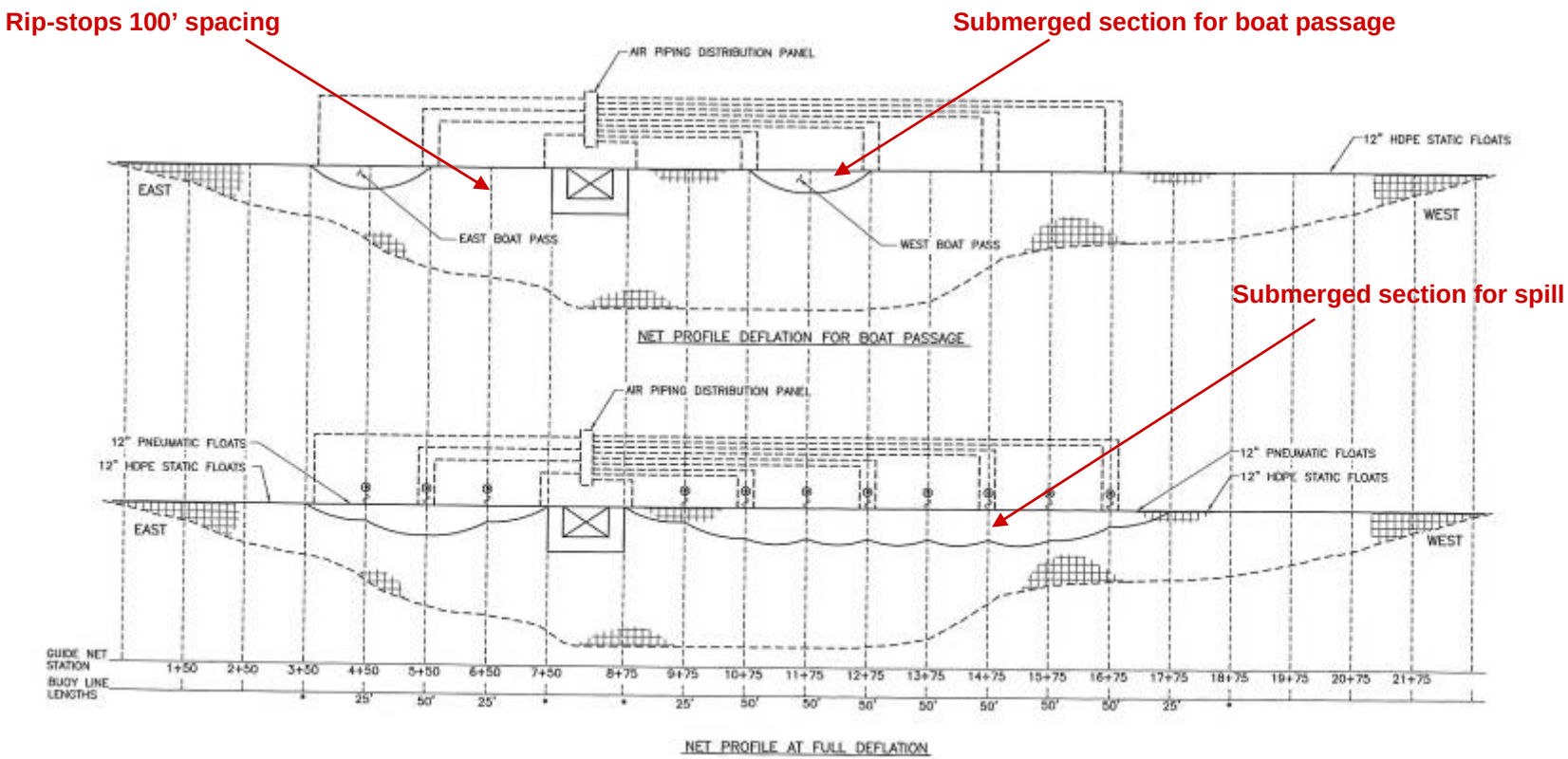
- Maximize acute angle
- Dam safety / spill
- Bottom profile
- Pool fluctuation
- Avoid bottom obstacles / trees
- Access / transport
- Debris collection

Net Isometric



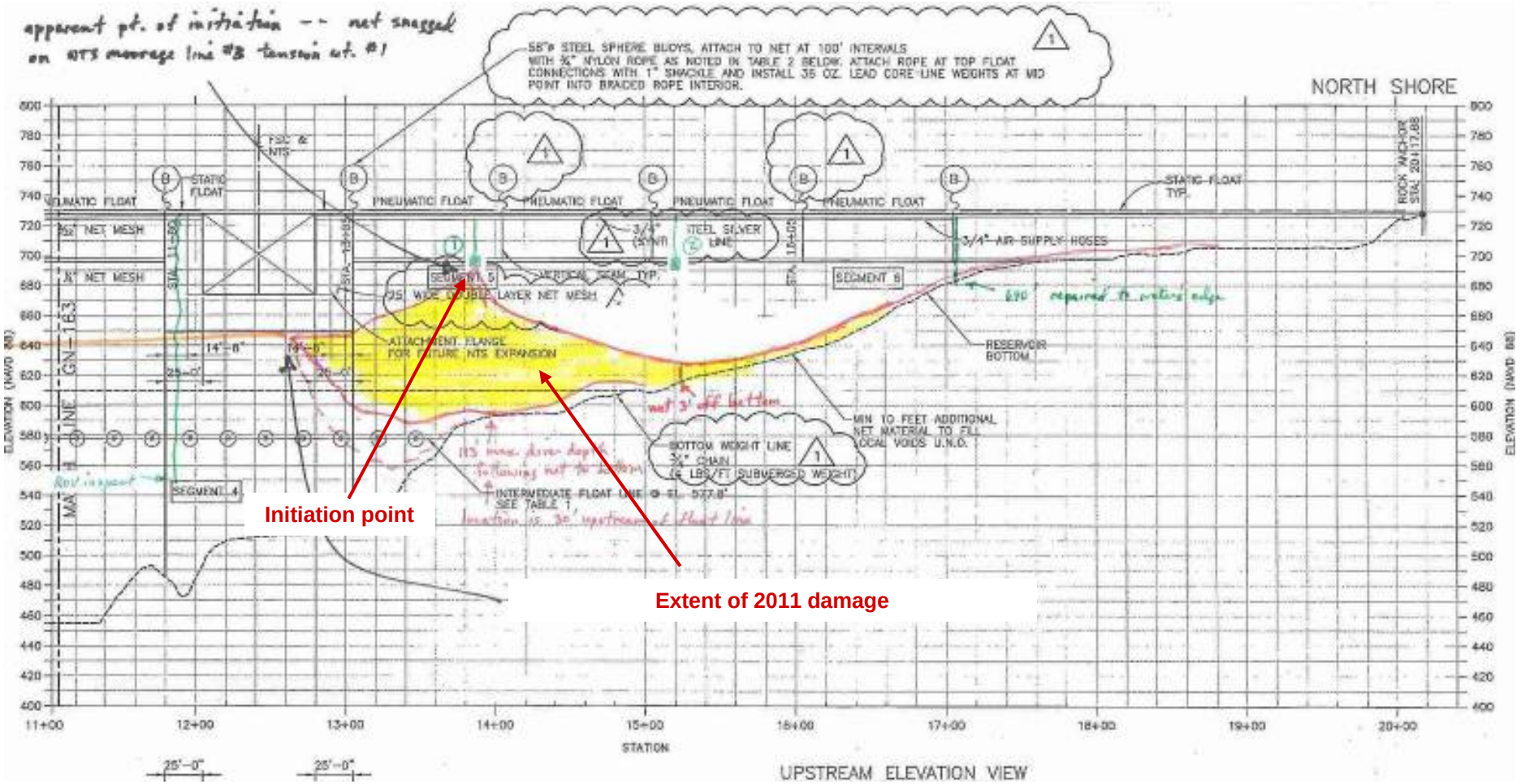
Deflation Sequence





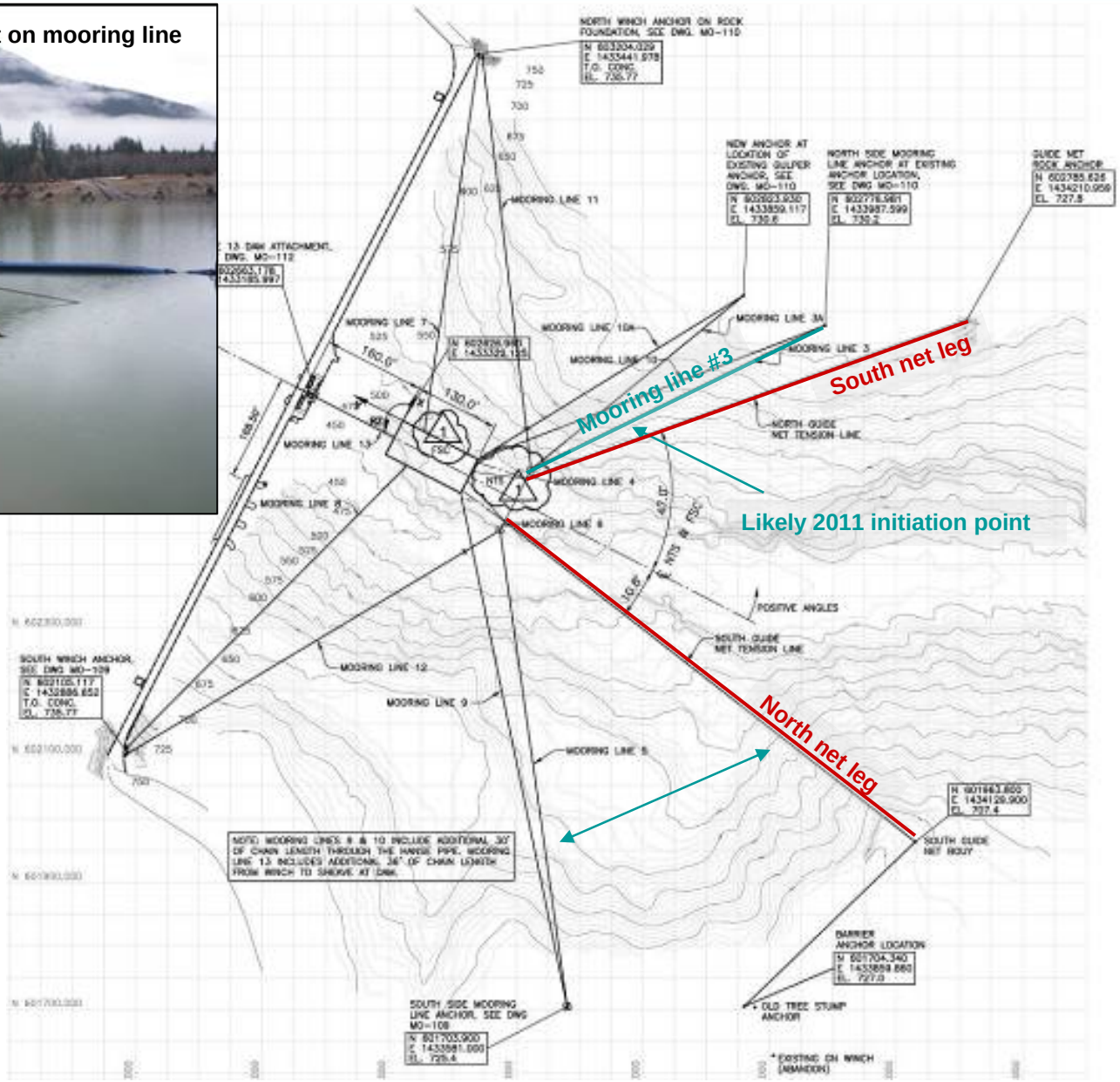
Nets and Issues

2011 Event



apparent pt. of initiation -- net snagged on NTS moorage line #3 tension wt. #1
58"ø STEEL SPHERE BUOYS, ATTACH TO NET AT 100' INTERVALS WITH ¾" NYLON ROPE AS NOTED IN TABLE 2 BELOW. ATTACH ROPE AT TOP FLOAT CONNECTIONS WITH 1" SHACKLE AND INSTALL 35 OZ. LEAD CORE LINE WEIGHTS AT MID POINT INTO BRAIDED ROPE INTERIOR.
NORTH SHORE
PNEUMATIC FLOAT
STATIC FLOAT
STATIC FLOAT TYP.
ROCK ANCHOR STA. 20+17.88
3/4" AIR SUPPLY HOSES
STEEL SILVER LINE
VERTICAL SEAM TYP.
SEGMENT 5
SEGMENT 6
SEGMENT 4
25' WIDE DOUBLE LAYER NET MESH
ATTACHMENT FLANGE FOR FUTURE NTS EXPANSION
RESERVOIR BOTTOM
MIN 10 FEET ADDITIONAL NET MATERIAL TO FILL LOCAL VOIDS U.N.O.
BOTTOM WEIGHT LINE ¾" CHAIN (4 LBS/FT SUBMERGED WEIGHT)
INTERMEDIATE FLOAT LINE @ EL. 577.8' SEE TABLE 1
Initiation point
Extent of 2011 damage
ELEVATION (NAVD 88)
STATION
UPSTREAM ELEVATION VIEW

Caternary, Conflicts



Inspections

Annually with ROV (Aug)

- ineffective in low-visibility Oct-May
- period of highest risk Oct-May
- limited perspective / diagnosis
- short response time
- no other method yet identified

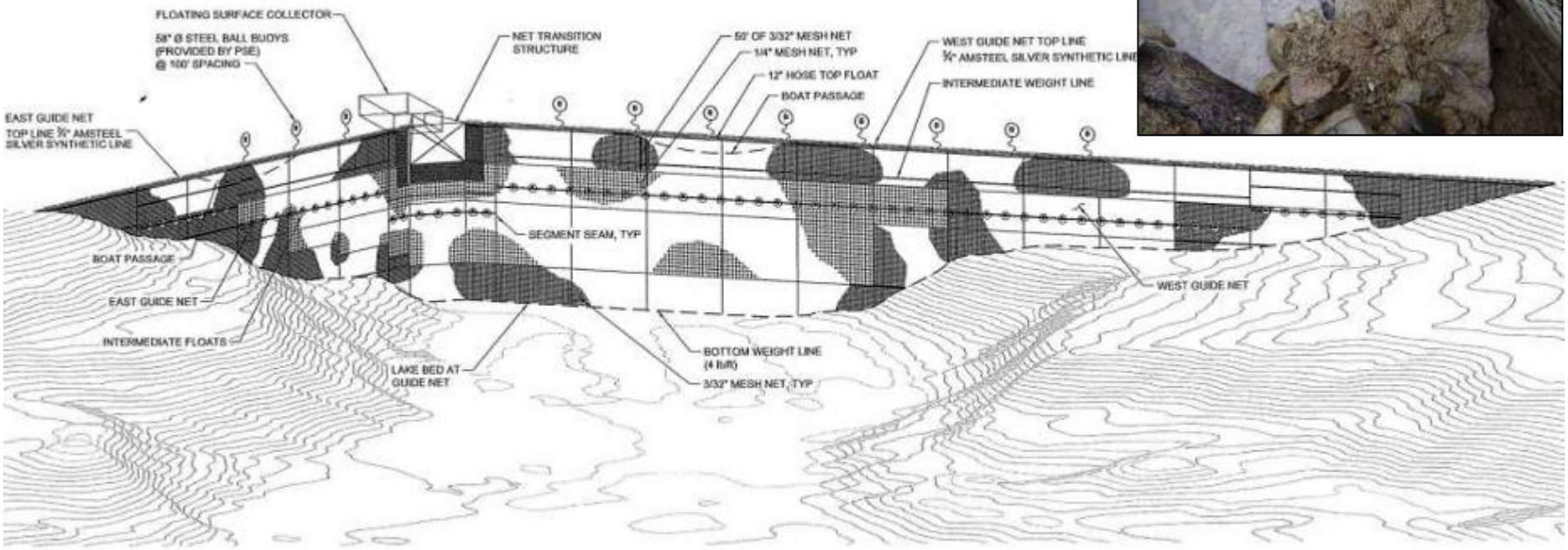
Repair

Alternatives

- Secure end pt. & drape patch
- Lift & repair existing net
- Remove & repair entire net

Suggestions

- Hire net design consultant
- Don’t outsource
- Develop in-house expertise
- Don’t underestimate complexity
- Plan for failure, design for repair



Nets …

PUGET SOUND ENERGY

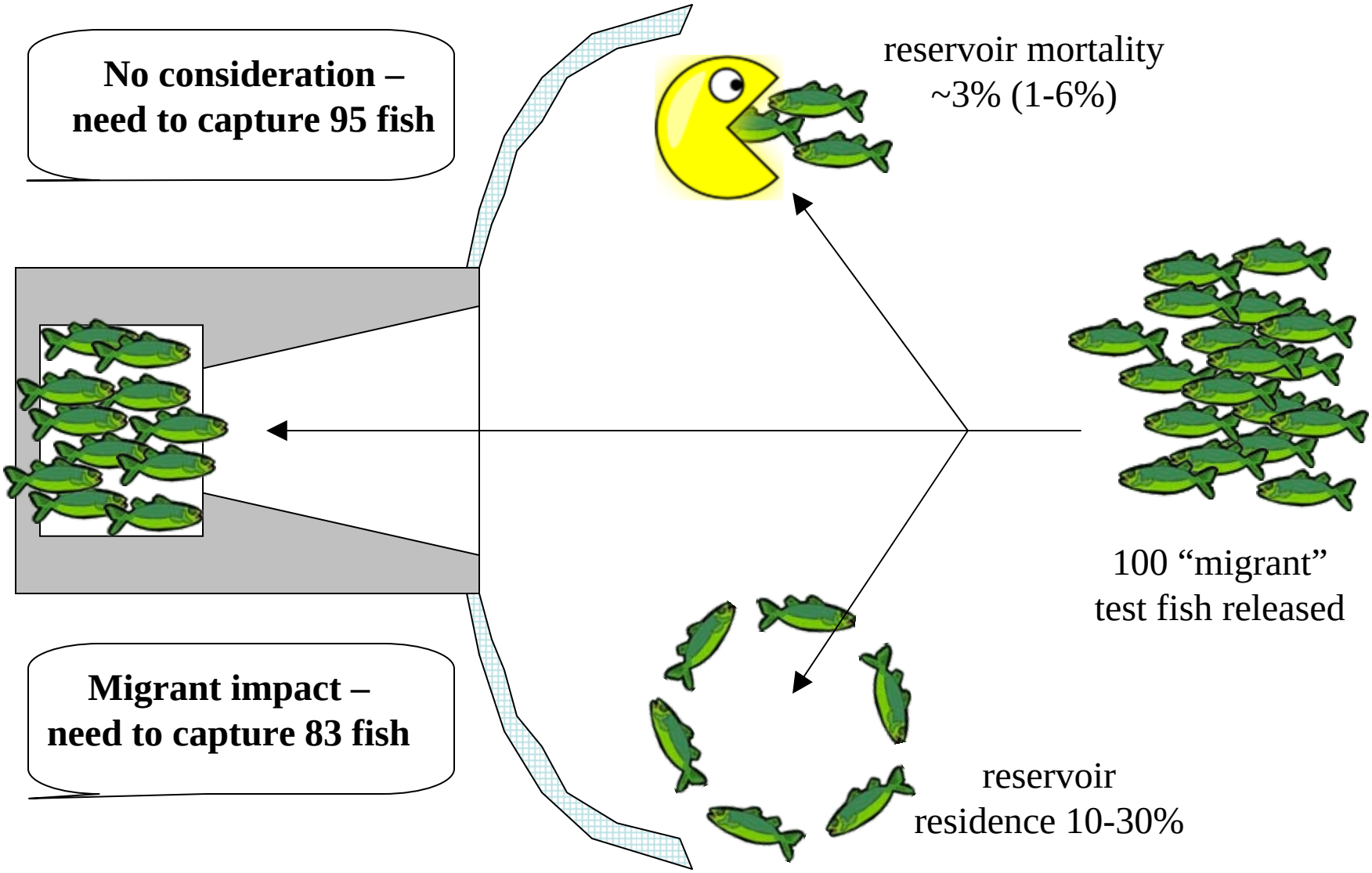
Nets and Issues

Performance Criteria

Description	Standard
Collection *(C)*	95%
Survival (within the facilities) *(S)*	98%
Reservoir passage *(R)*	80%
Efficiency (overall survival) *(CxSxR)*	75%

- *Install dates: UB – 2008, LB – 2013*
- *Evaluate 500-cfs & 1,000-cfs flow*
- *Expand to 1000 cfs screens if FSC fails to meet performance criteria*

Non-Migrant Effect



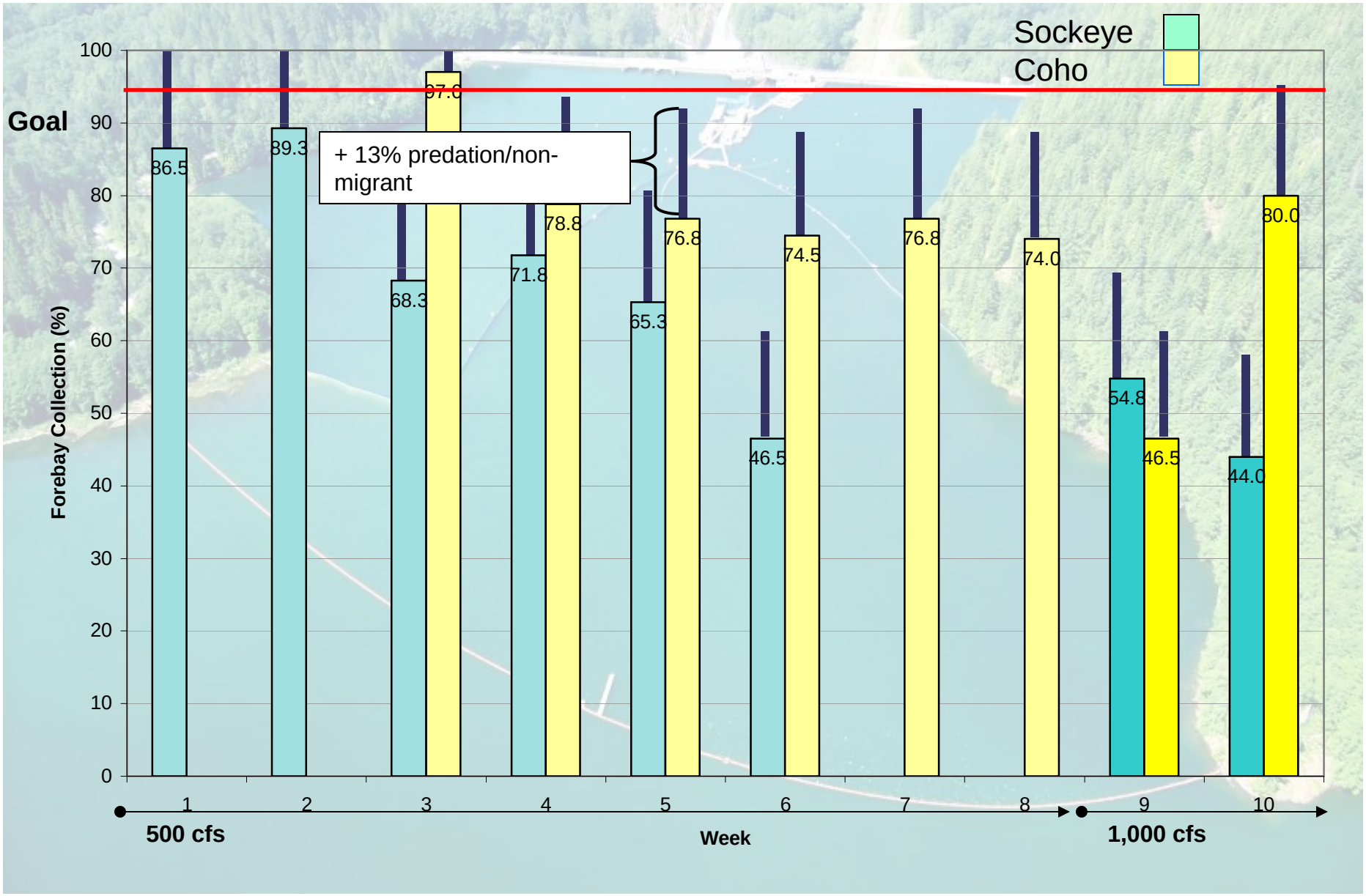
Performance Results – 95% Std

% recovery (unadjusted)	2008	2009	2011
Coho peak	97.0	89.5*	71.7
Coho mean	81.0	87.0*	70.6
Sockeye peak	89.3	73.5*	85.3
Sockeye mean	76.0	72.0*	84.8

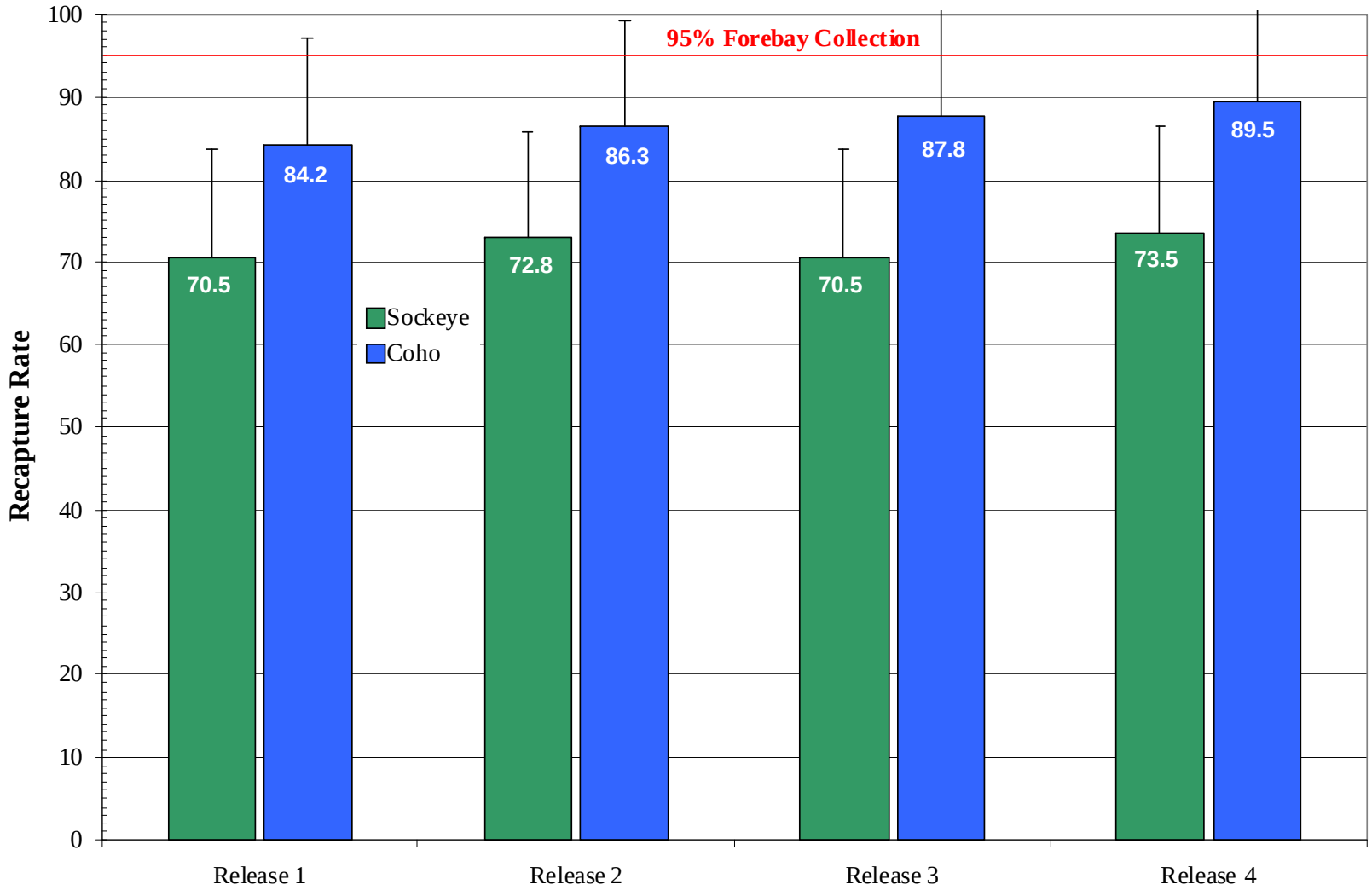
* Does not include ~12% predation/non-migrant

2010 study – flow preference only (500- vs 1000-cfs)

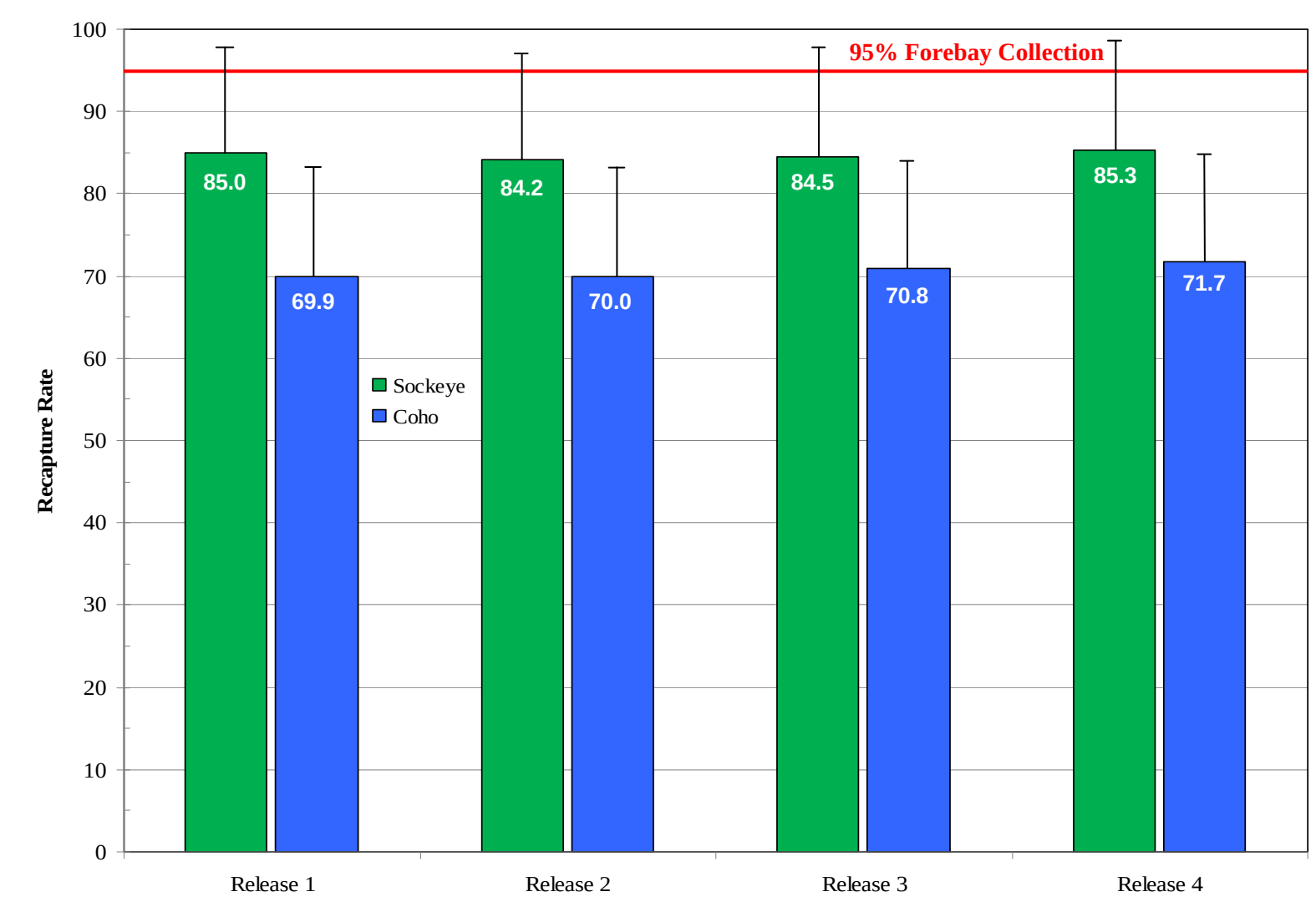
2008 Performance Results



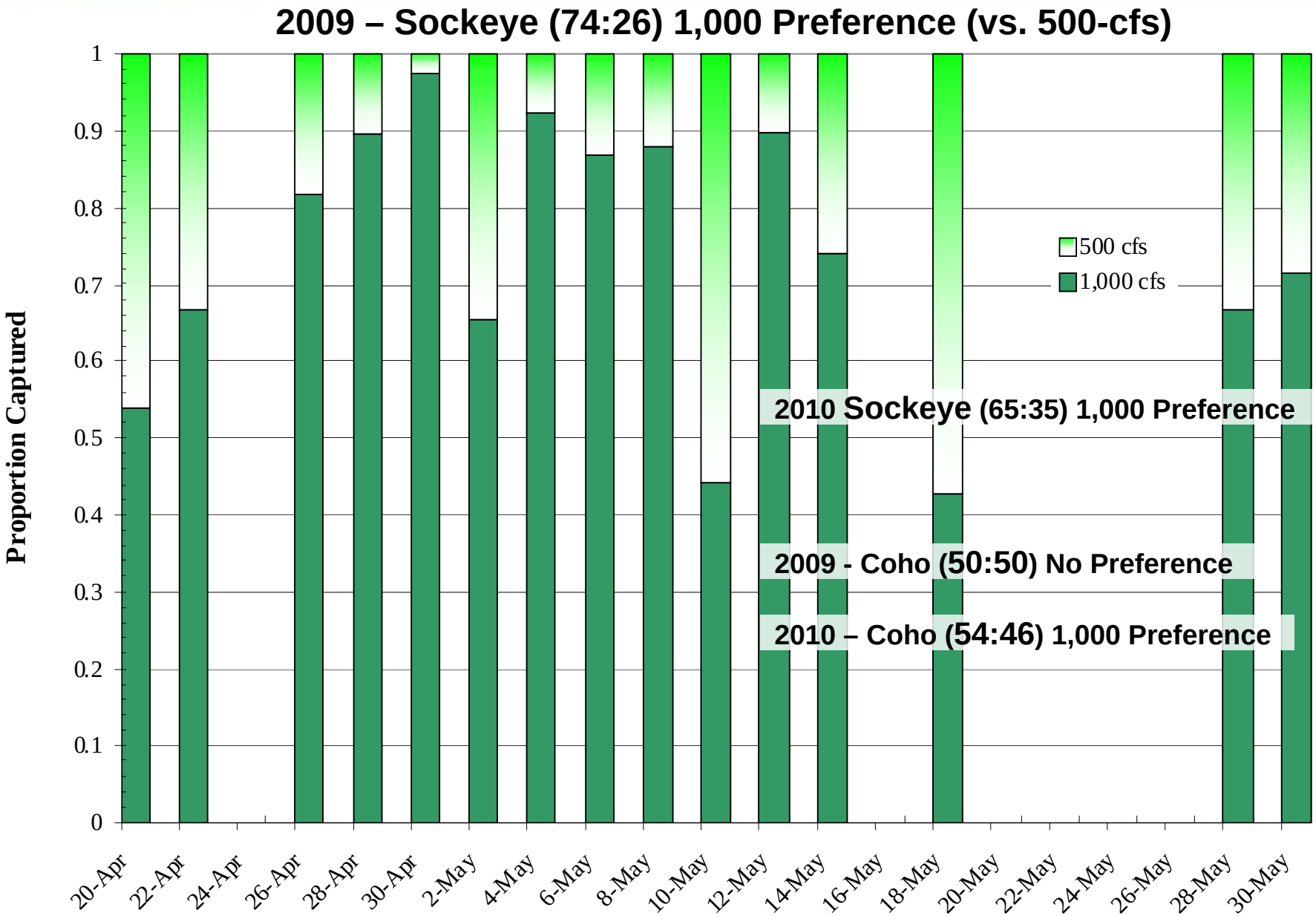
2009 Performance Results



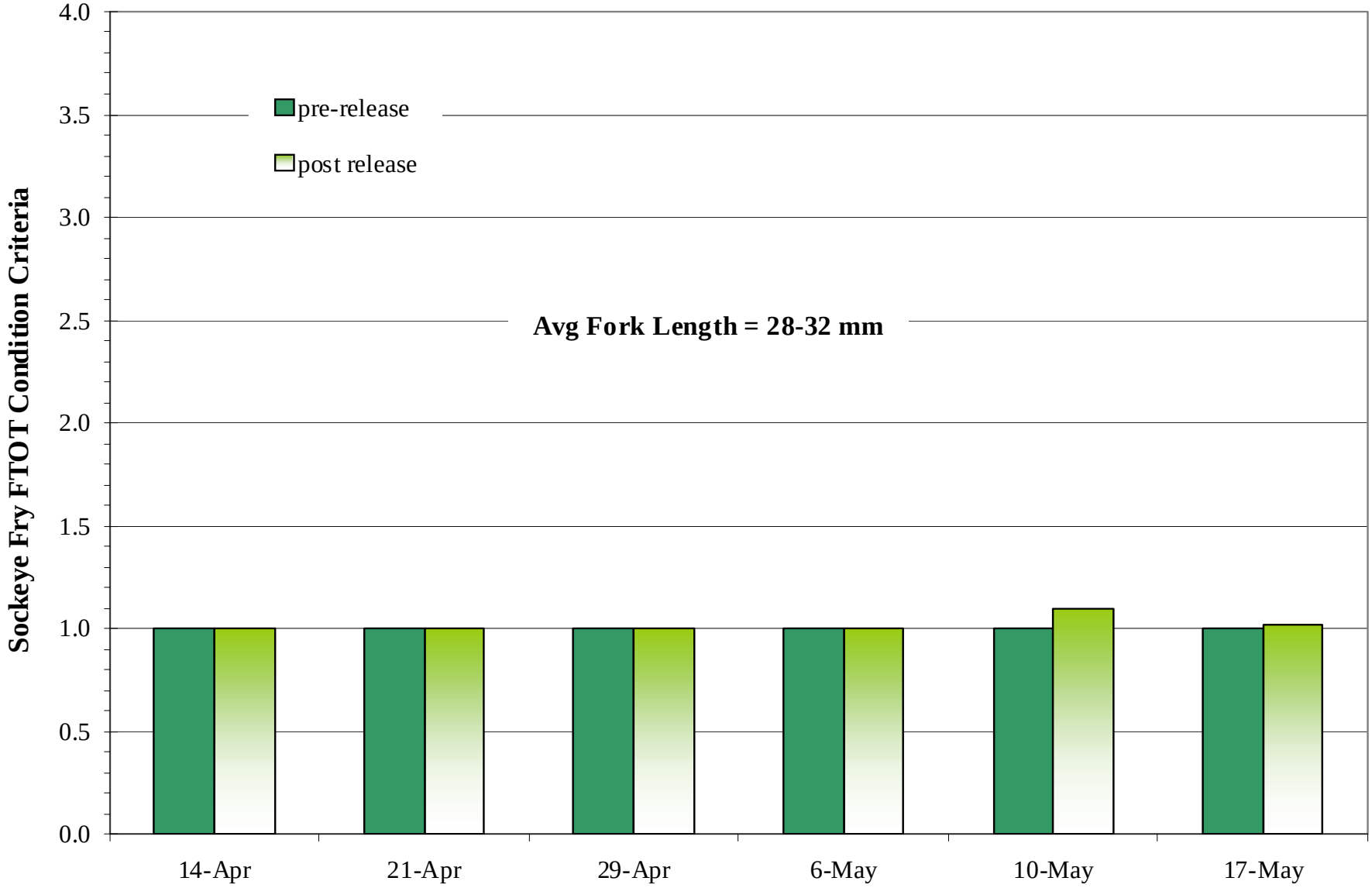
2011 Performance Results



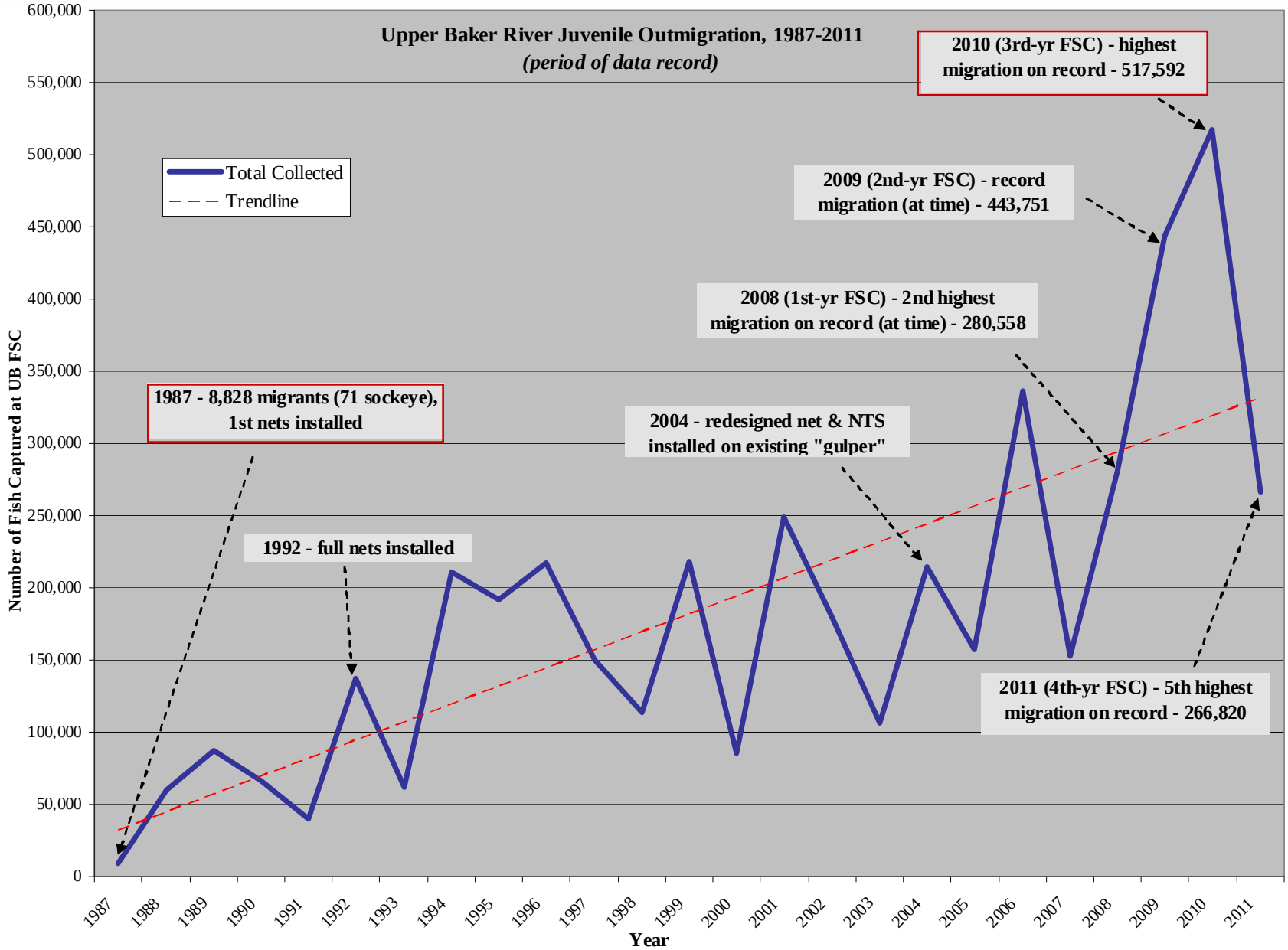
Flow Preference Testing



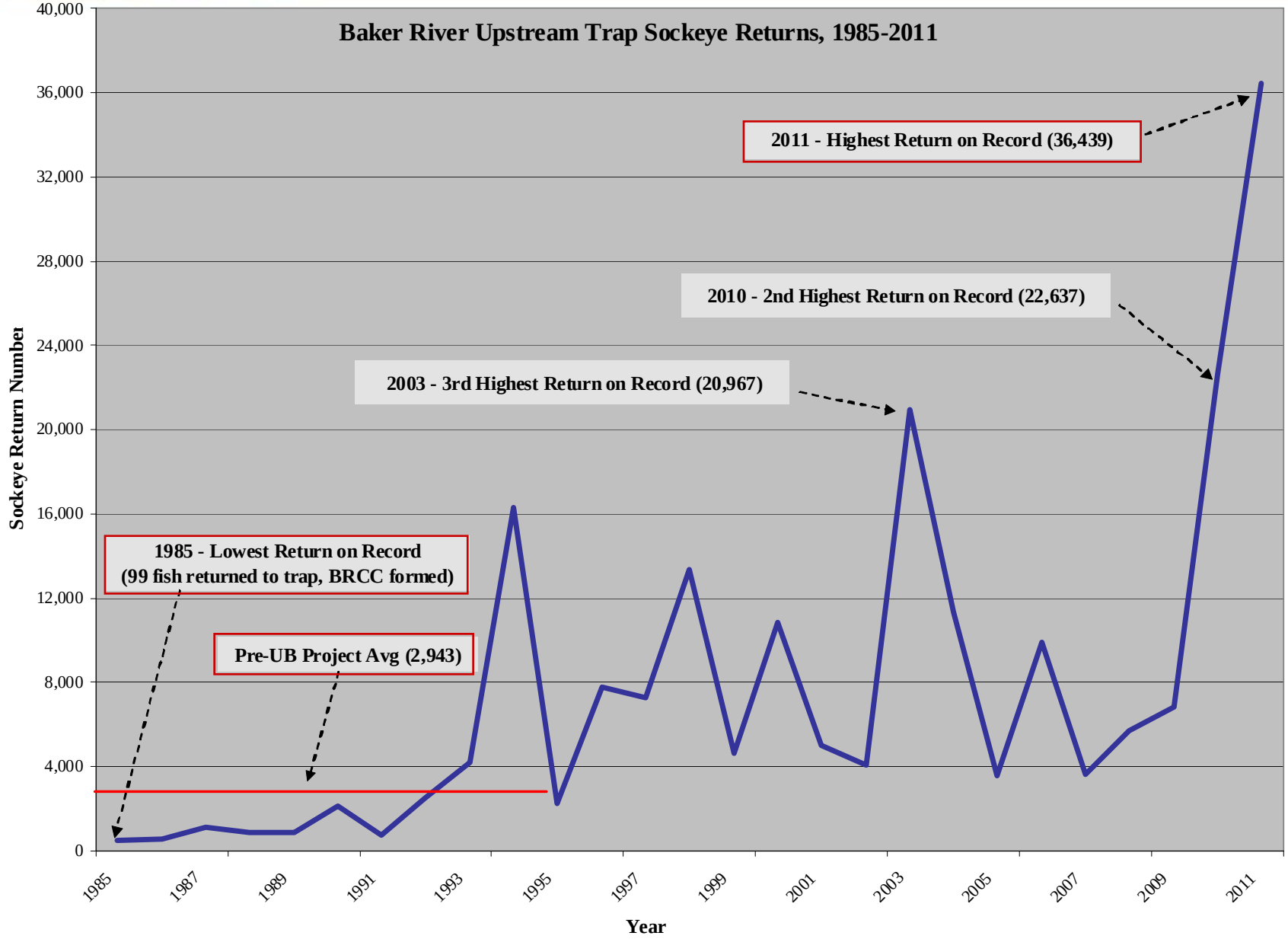
2010 – Sockeye Fry Condition



Response


Upper Baker River Juvenile Outmigration, 1987-2011
(period of data record)
Total Collected
Trendline
2010 (3rd-yr FSC) - highest migration on record - 517,592
2009 (2nd-yr FSC) - record migration (at time) - 443,751
2008 (1st-yr FSC) - 2nd highest migration on record (at time) - 280,558
1987 - 8,828 migrants (71 sockeye), 1st nets installed
2004 - redesigned net & NTS installed on existing "gulper"
1992 - full nets installed
2011 (4th-yr FSC) - 5th highest migration on record - 266,820
Number of Fish Captured at UB FSC
600,000
550,000
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Year

Response


Baker River Upstream Trap Sockeye Returns, 1985-2011
2011 - Highest Return on Record (36,439)
2010 - 2nd Highest Return on Record (22,637)
2003 - 3rd Highest Return on Record (20,967)
1985 - Lowest Return on Record
(99 fish returned to trap, BRCC formed)
Pre-UB Project Avg (2,943)
Sockeye Return Number
40,000
36,000
32,000
28,000
24,000
20,000
16,000
12,000
8,000
4,000
0
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
Year

Future?

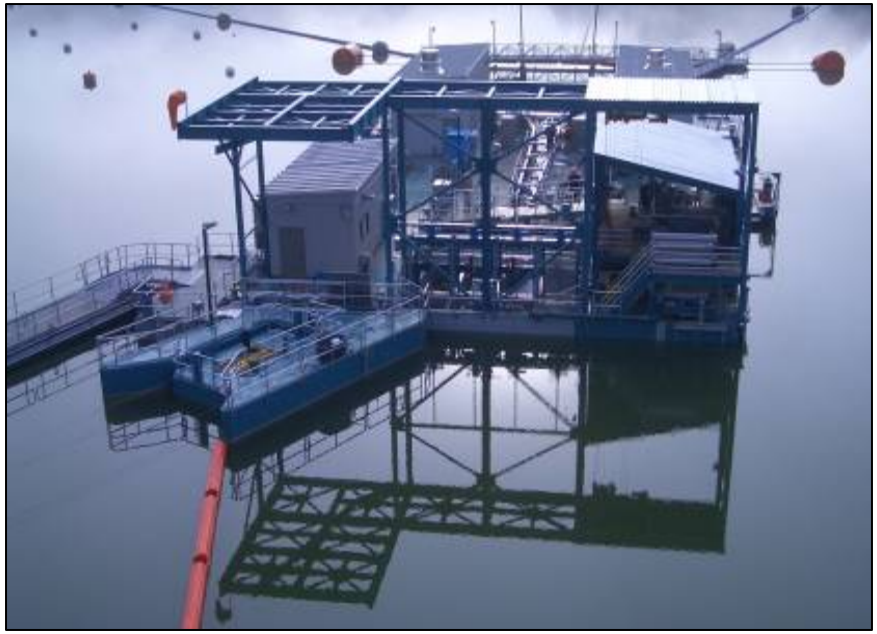
New Upstream Trap 2010

New Hatchery 2010

New LB FSC 2013

New Powerhouse 2013

Questions?



PSE Contacts:

- Cary Feldmann, 425-462-3088
- Matt Macartney, 425-462-3651
- Nick Verretto, 425-462-3441

PSE PUGET SOUND ENERGY

Summary Performance

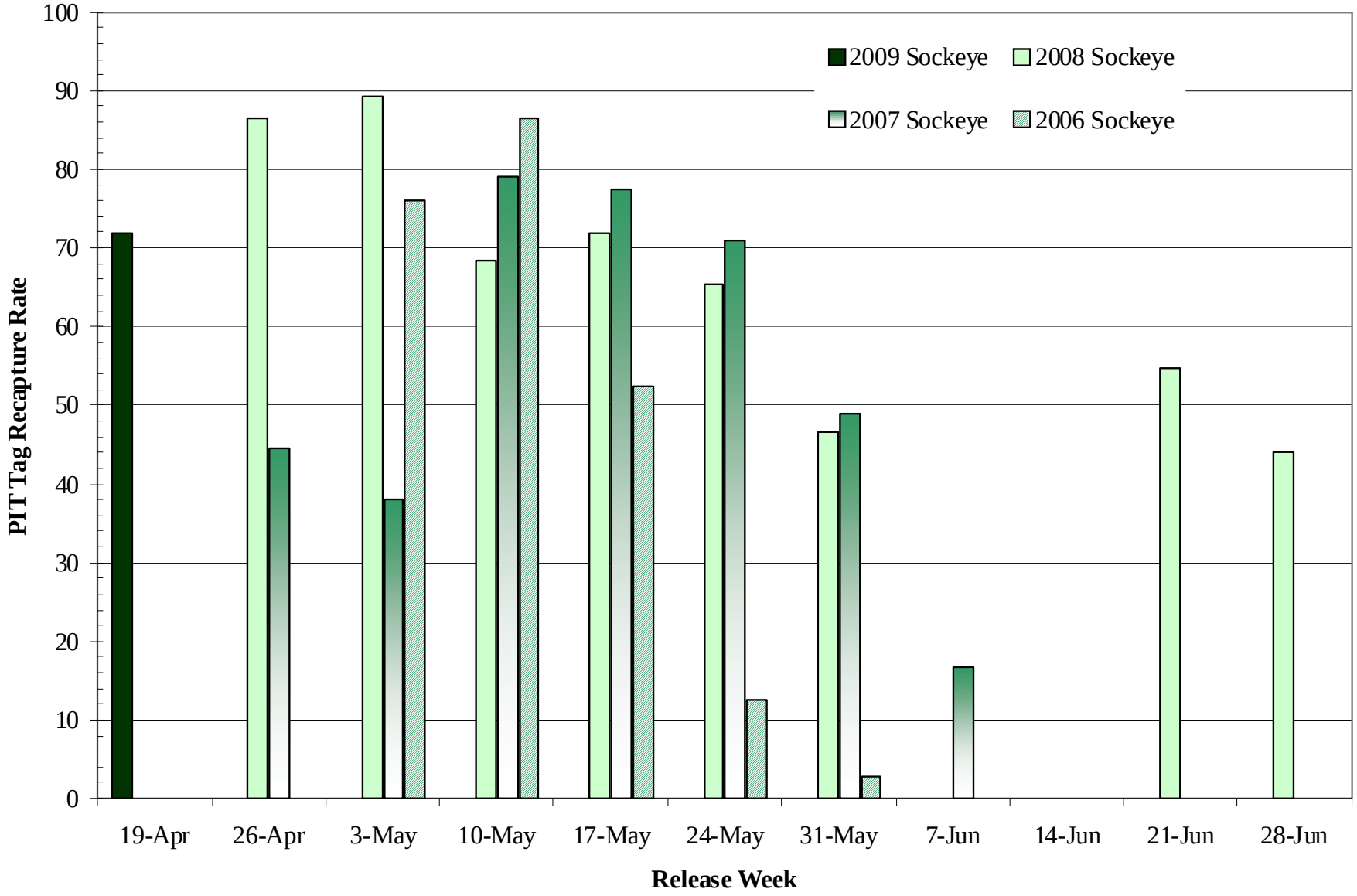
Metric	2002	2006	2007	2008	2009	2010	2011
Performance Recapture Rate (PIT tag, %)							
Coho Mean	55.1	50.2	55.5	79.7	87.0	-	70.6
Coho Peak	73.9	77.3	62.0	97.0	89.5	-	71.7
Sockeye Mean	46.0	-	53.7	71.3	71.8	-	84.8
Sockeye Peak	86.4	-	79.0	89.3	73.5	-	85.3
Preference Capture Ratio							
Coho 500cfs:1,000 cfs	-	-	-	-	50%:50%	46%:54%	-
Sock. 500cfs:1,000 cfs	-	-	-	-	26%:74%	35%:65%	-
Non-migrant Proportion							
Coho Mean	-	16.0	10.0	10.0	10.0	-	10.0
Sockeye Mean	-	-	30.0	10.0	10.0	-	10.0
Predation Proportion	-	-	-	3.0	2.0	-	2.0
Performance (w/non-migrants & predation)							
Coho Mean	55.1	60.2	65.5	92.7	99.0	-	82.6
Sockeye Mean	46.0	-	63.7	84.3	83.8	-	96.8

- Not in study year objectives

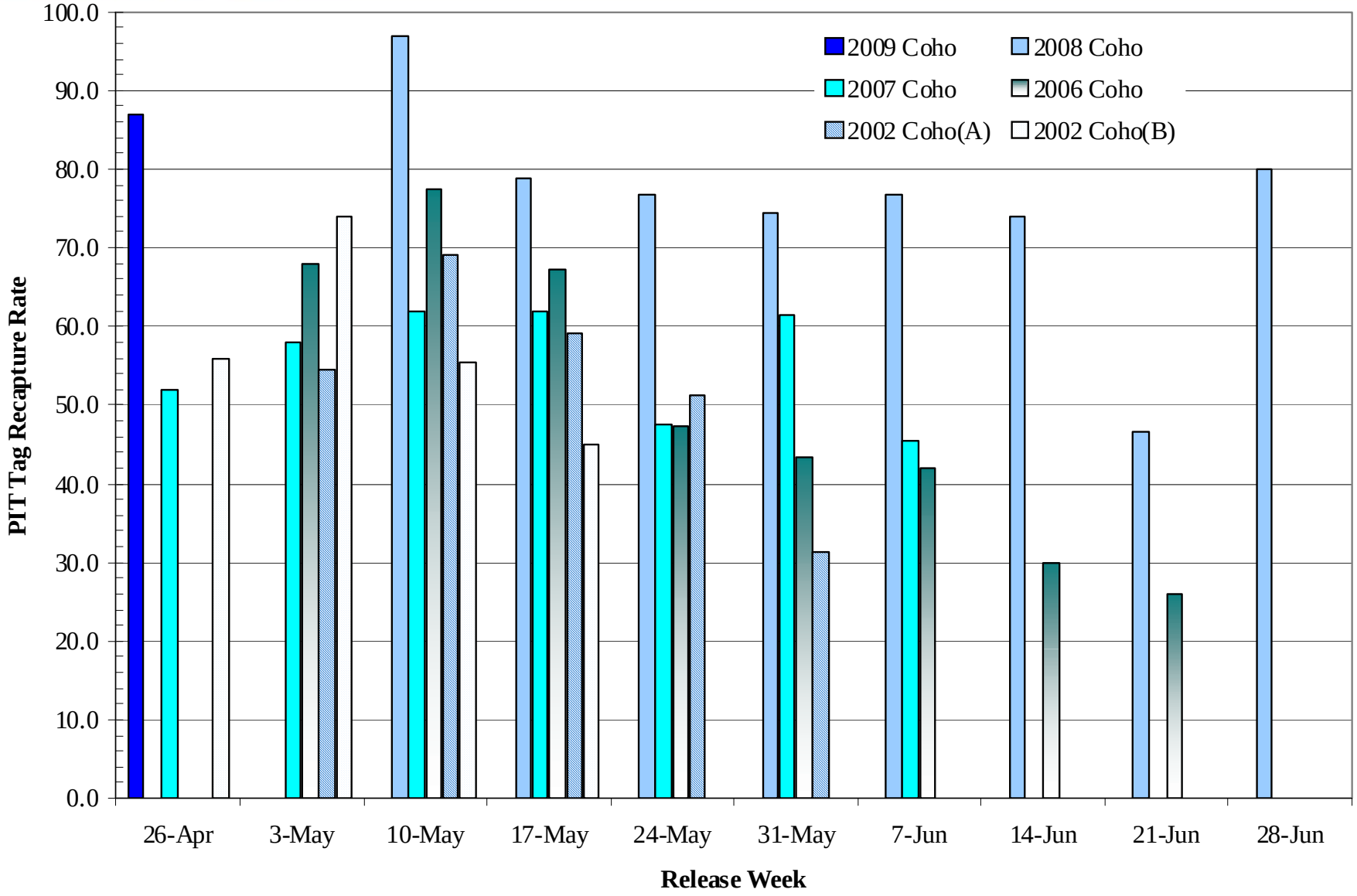
Time for Action

- Committee formed
- Migration studies
- Net pens
- Gulpers moved for attraction
- Smolt traps
- Trap-and-haul vs. pipeline
- New spawning beach
- Hydroacoustics
- Nets

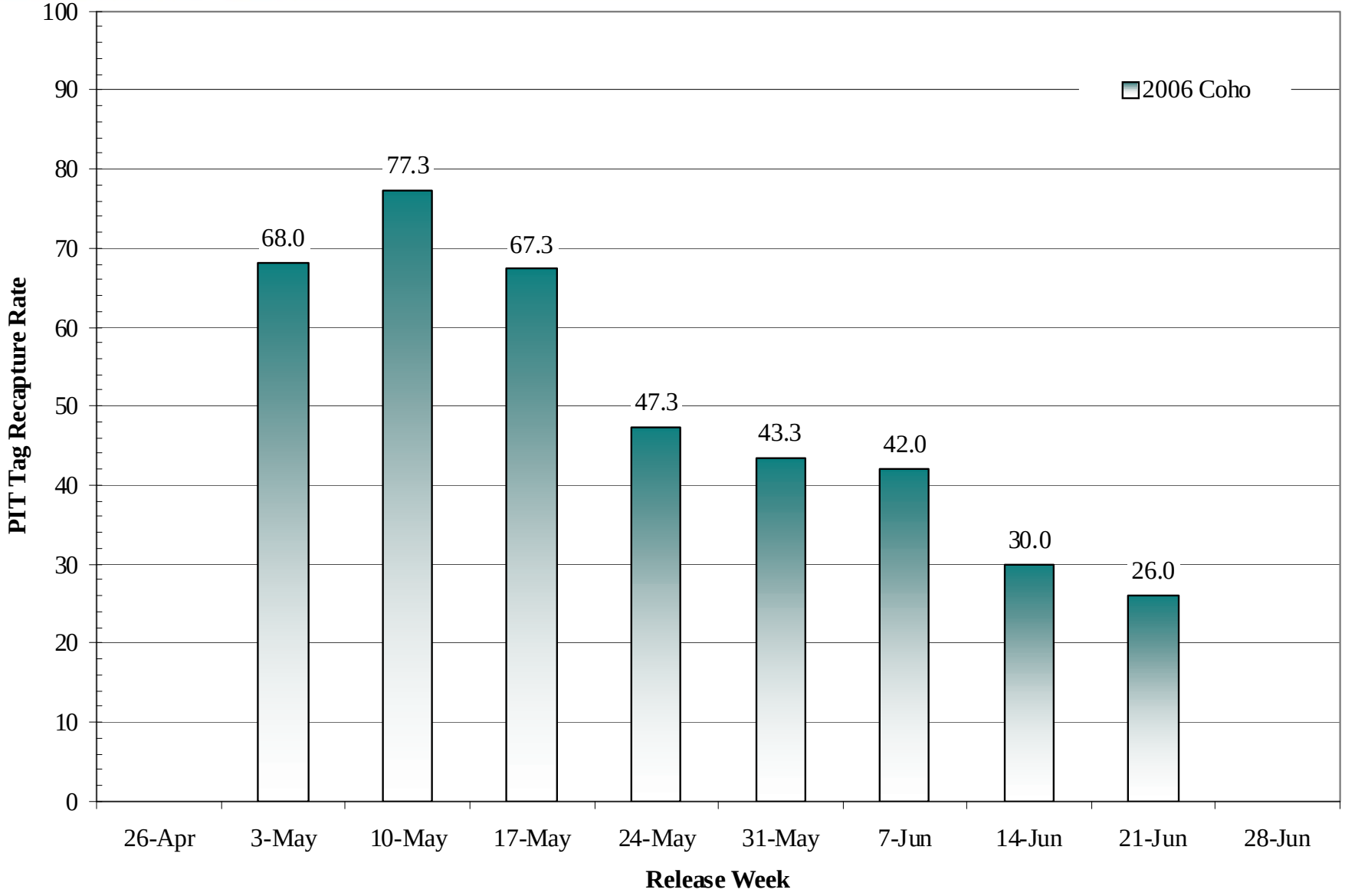
Historical Sockeye



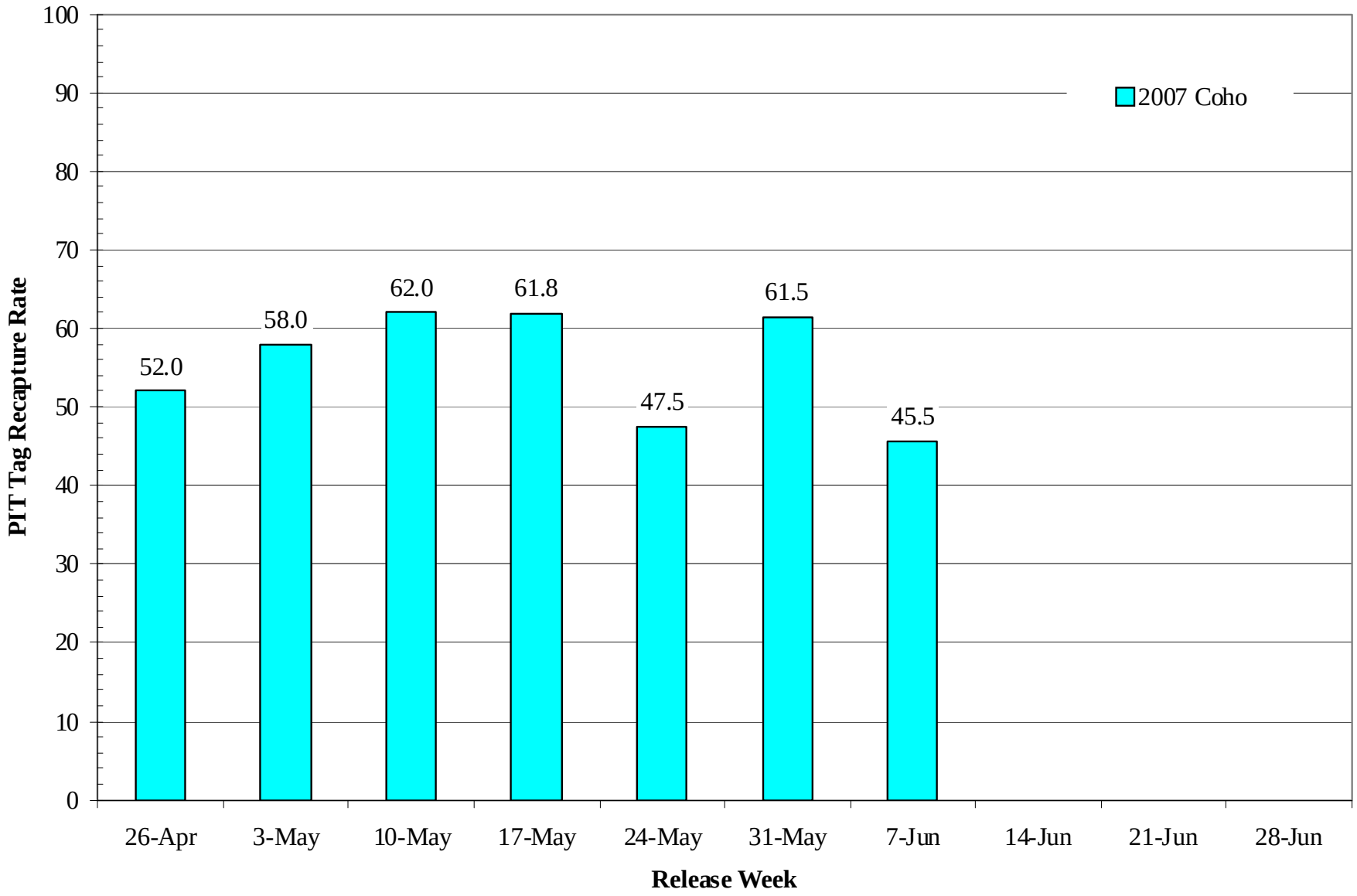
Historical Coho



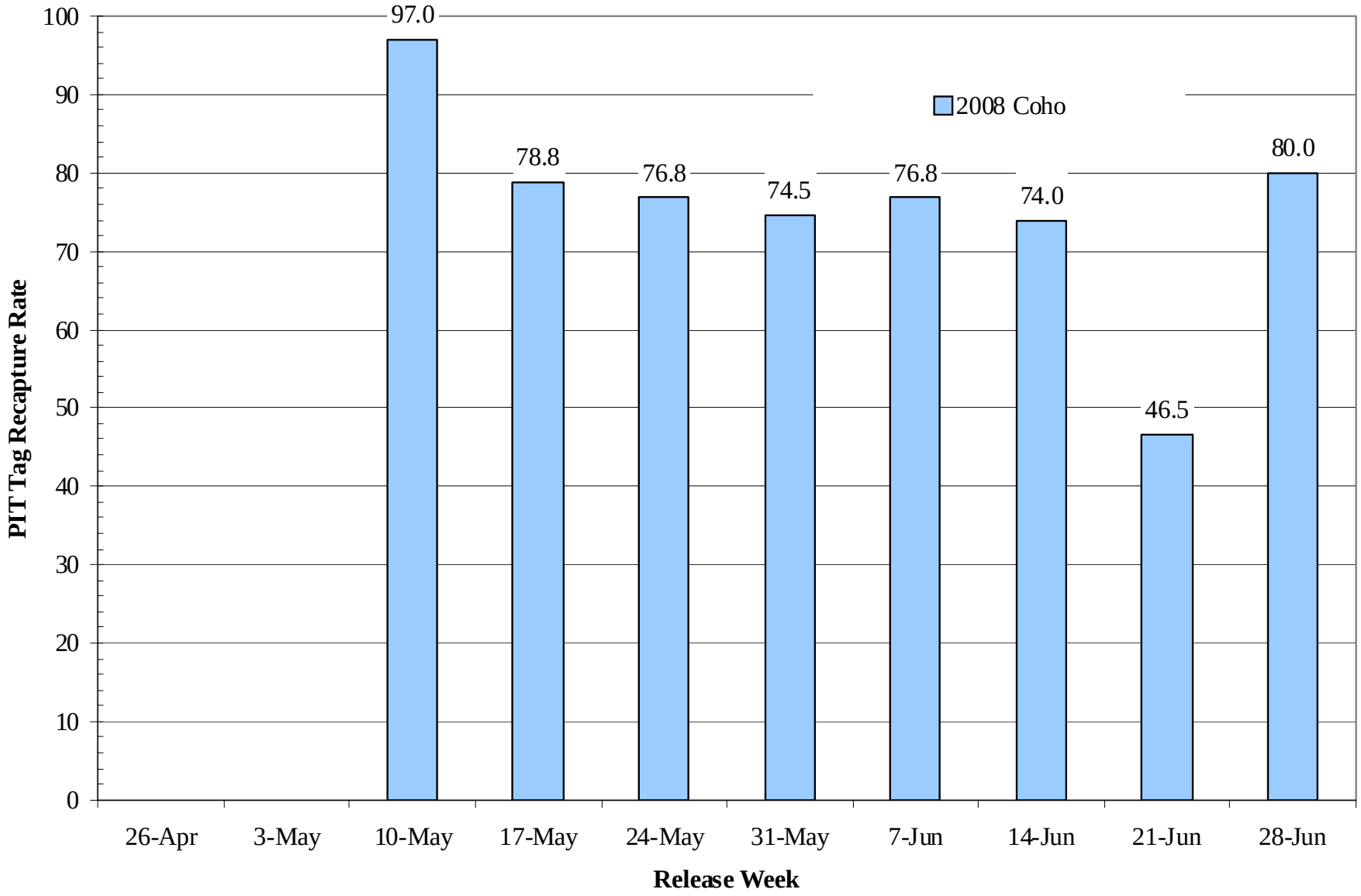
2006 Gulper Coho



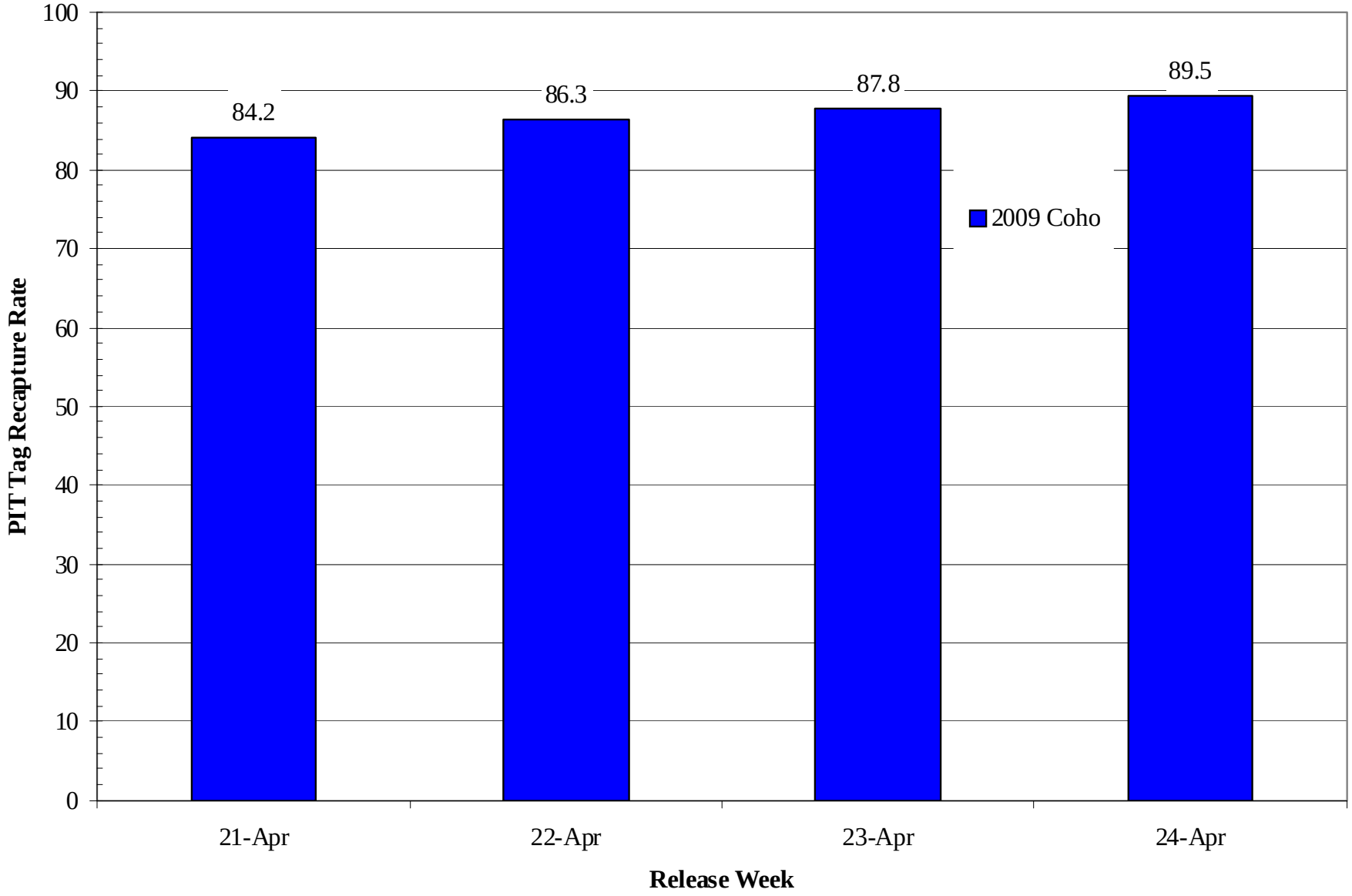
2007 Gulper Coho



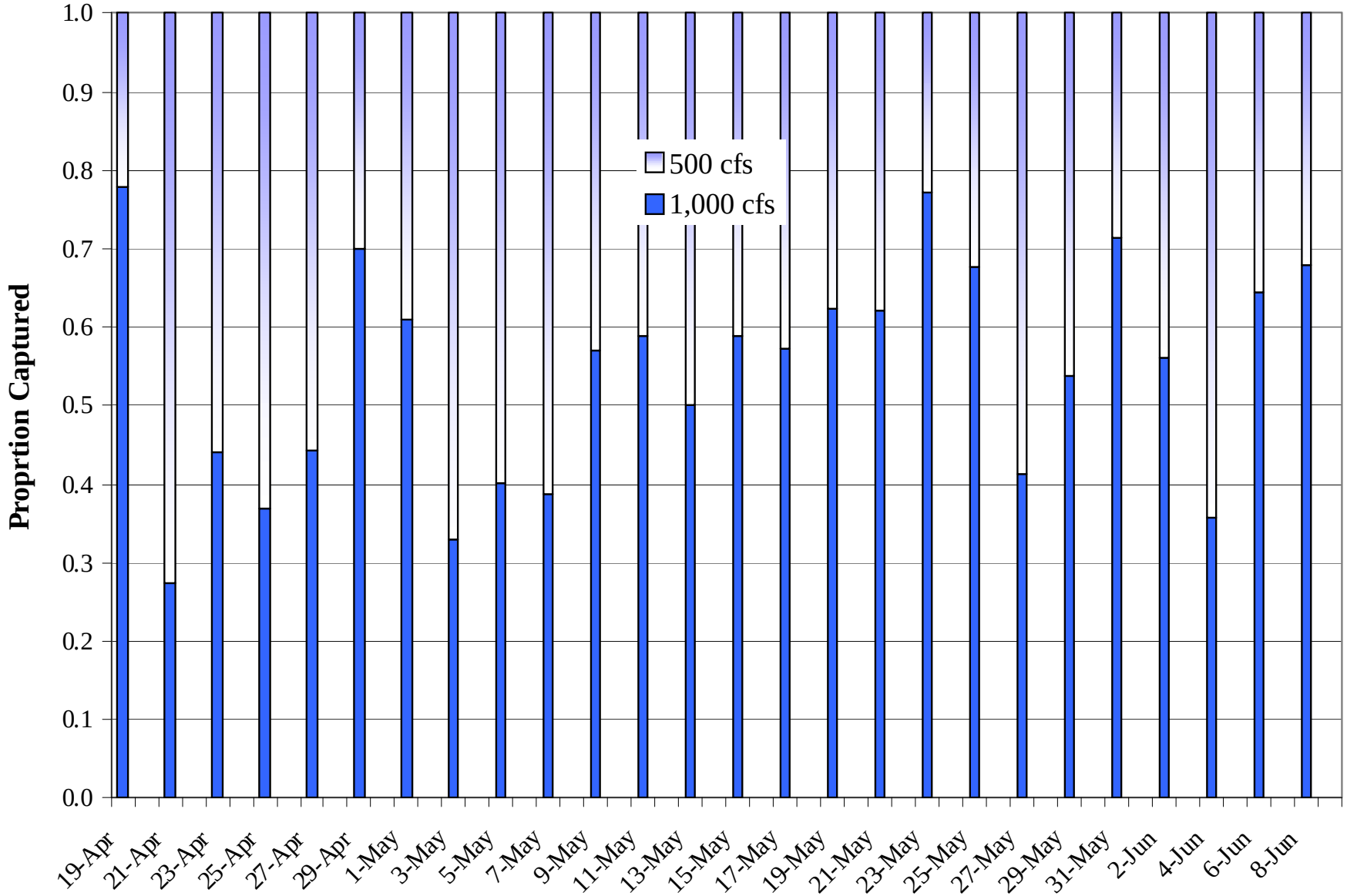
2008 FSC Coho



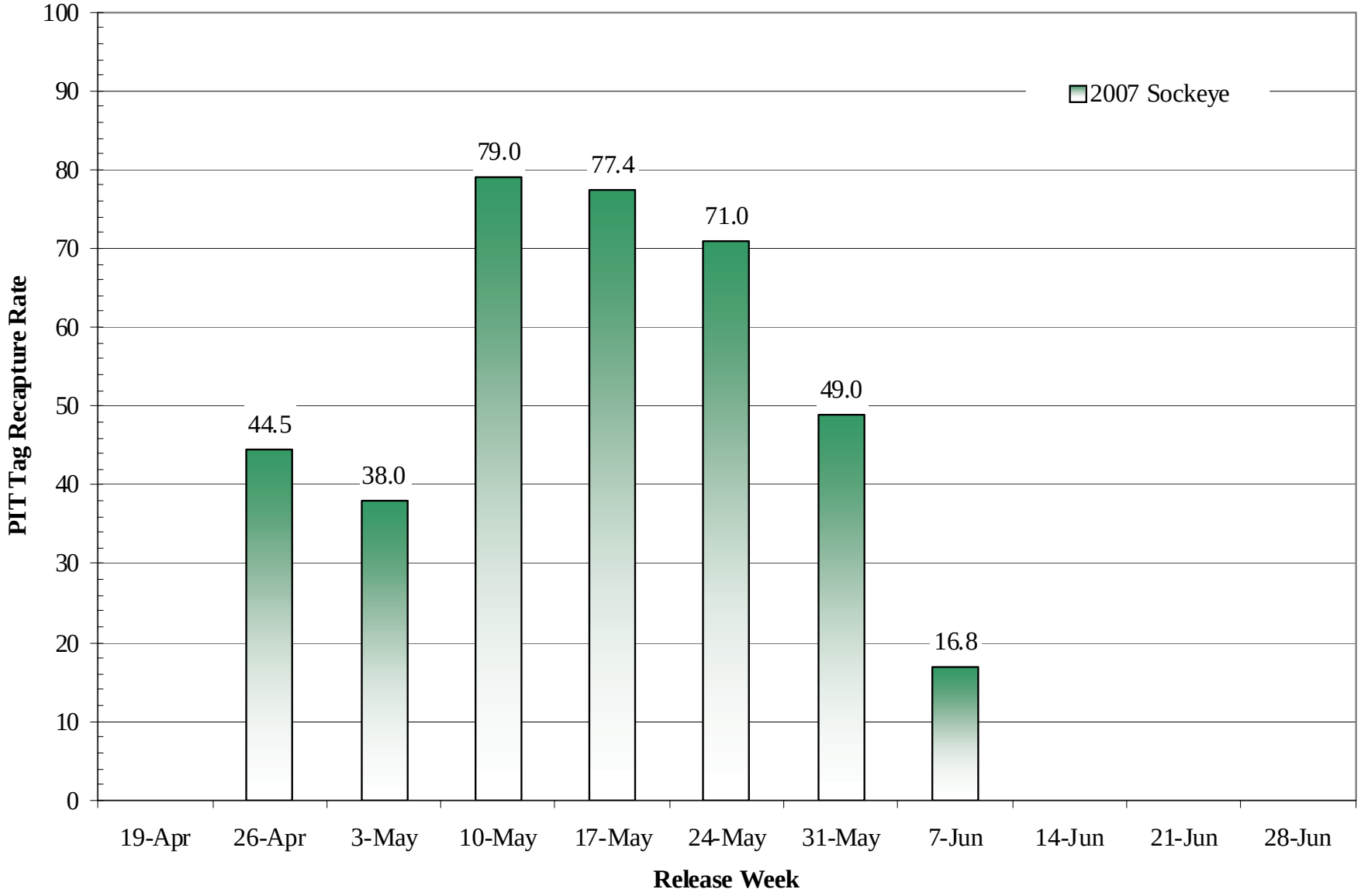
2009 FSC Coho



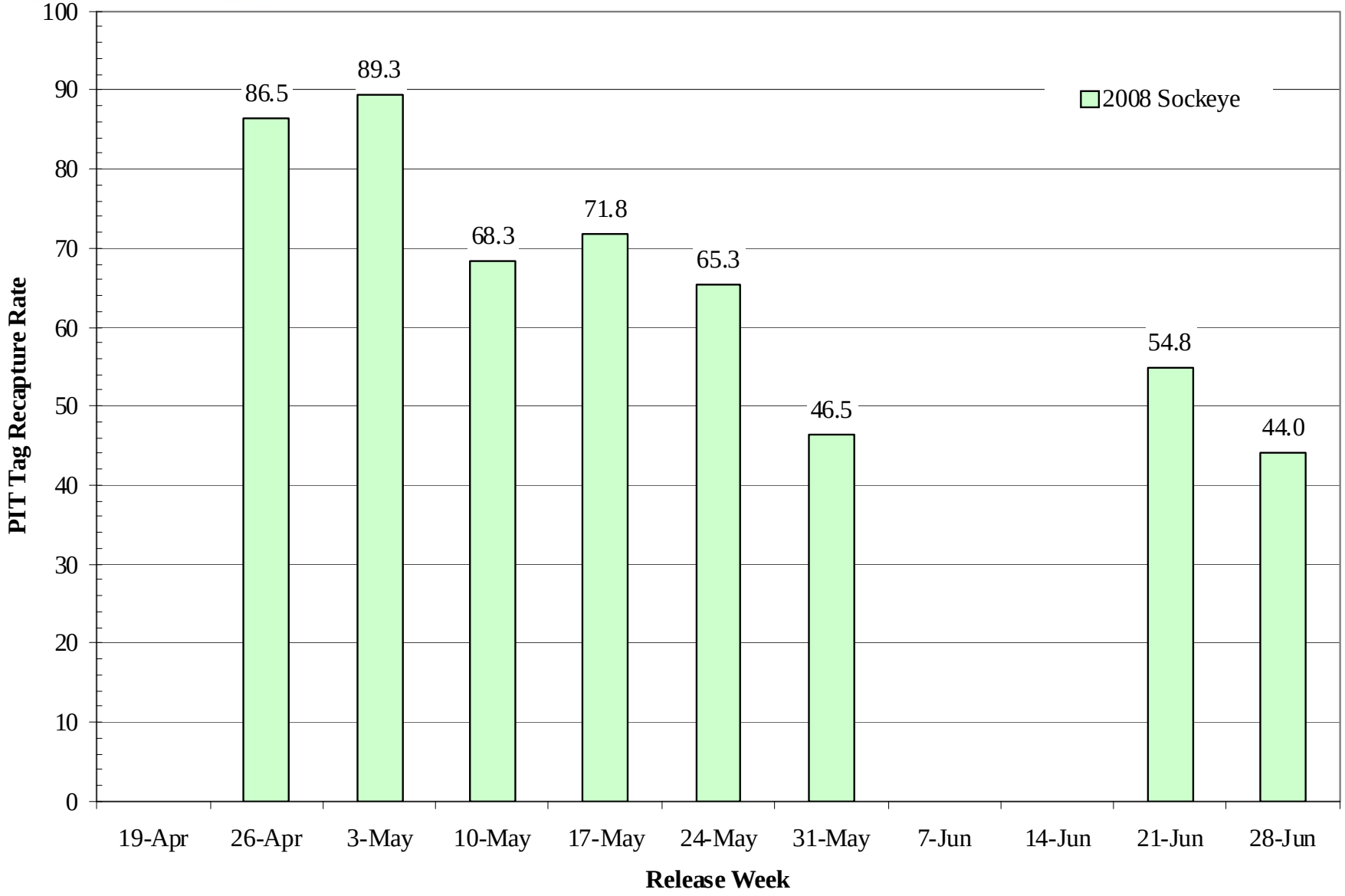
2010 Coho Preference (46:54)



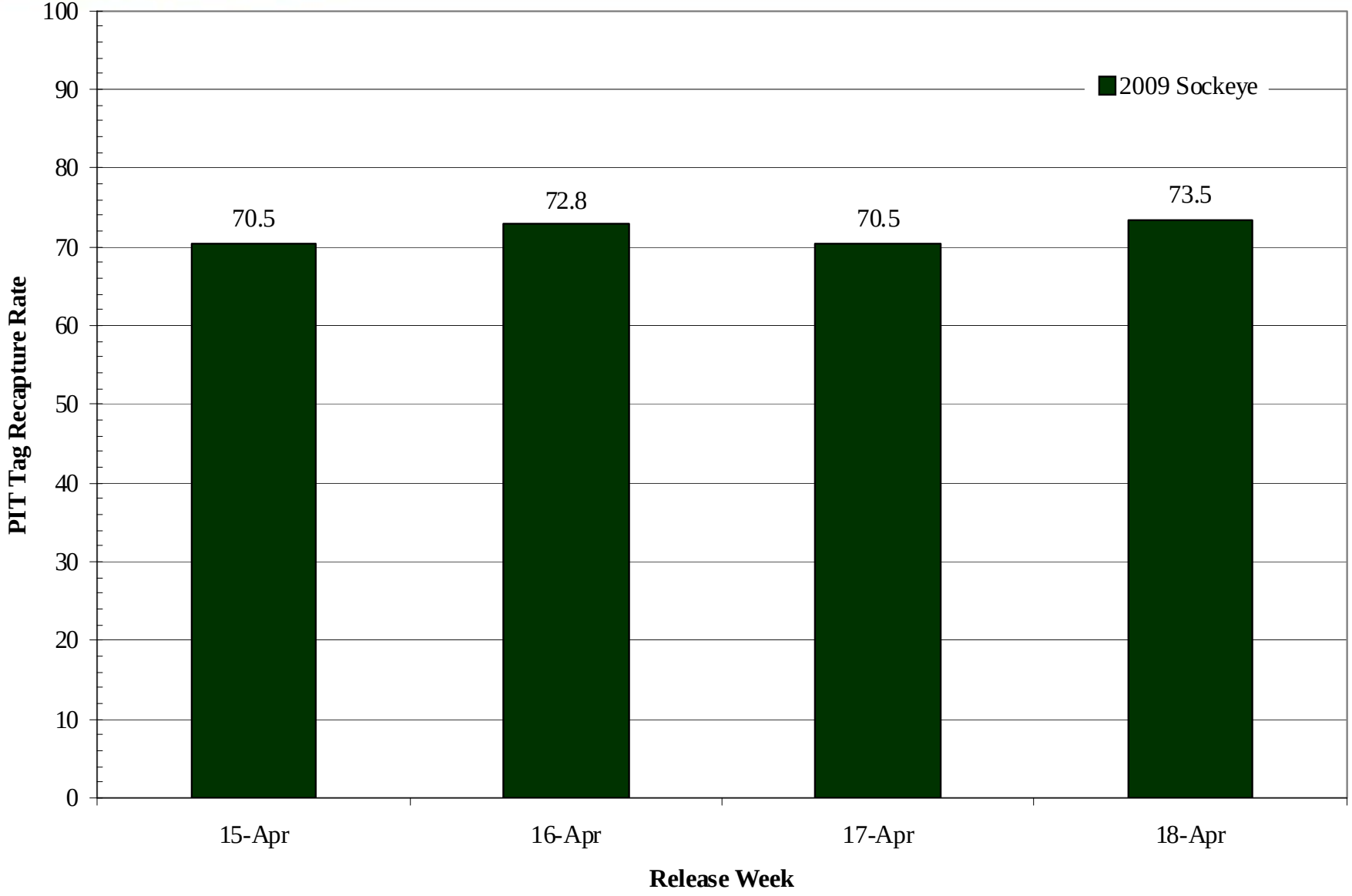
2007 Gulper Sockeye



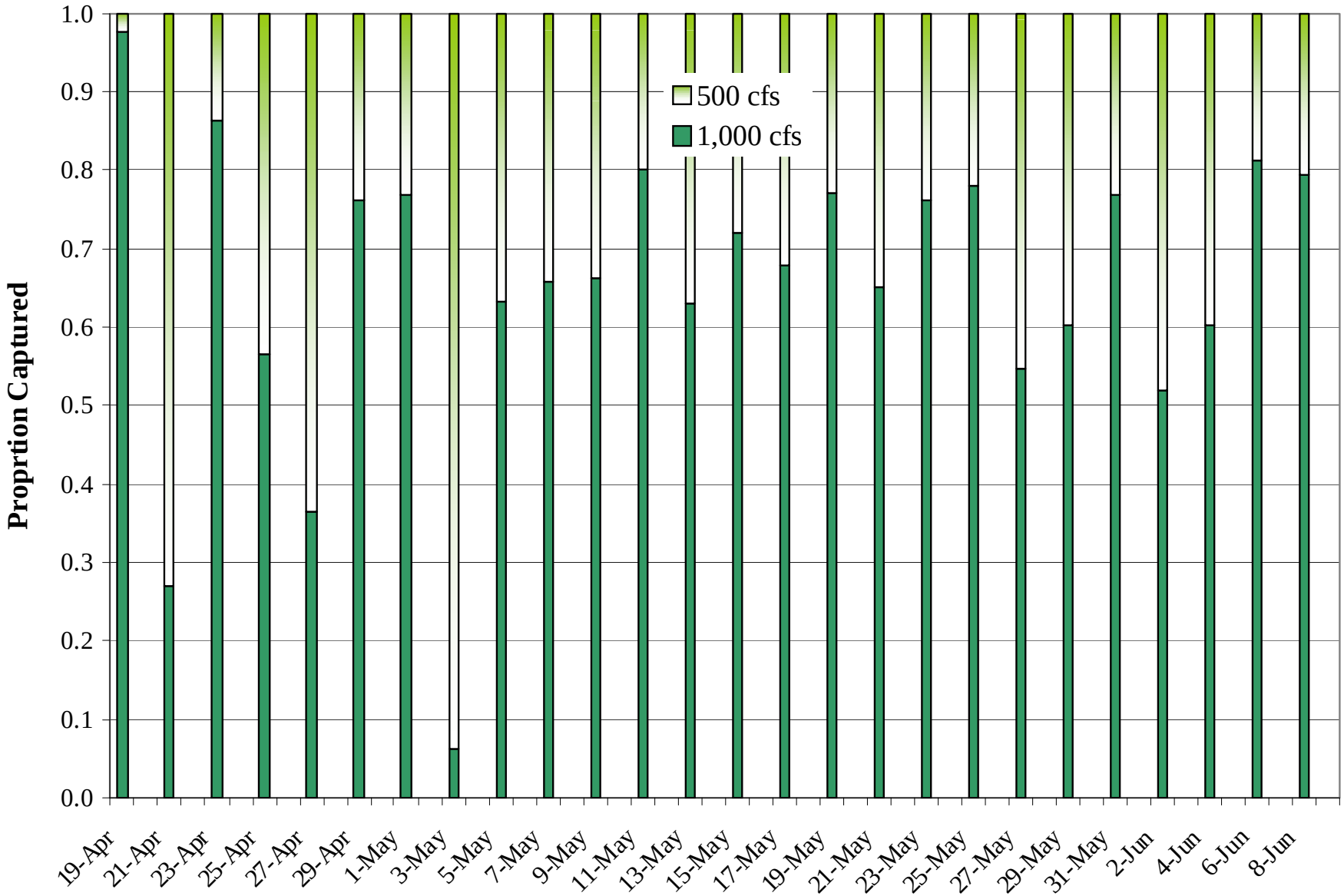
2008 FSC Sockeye



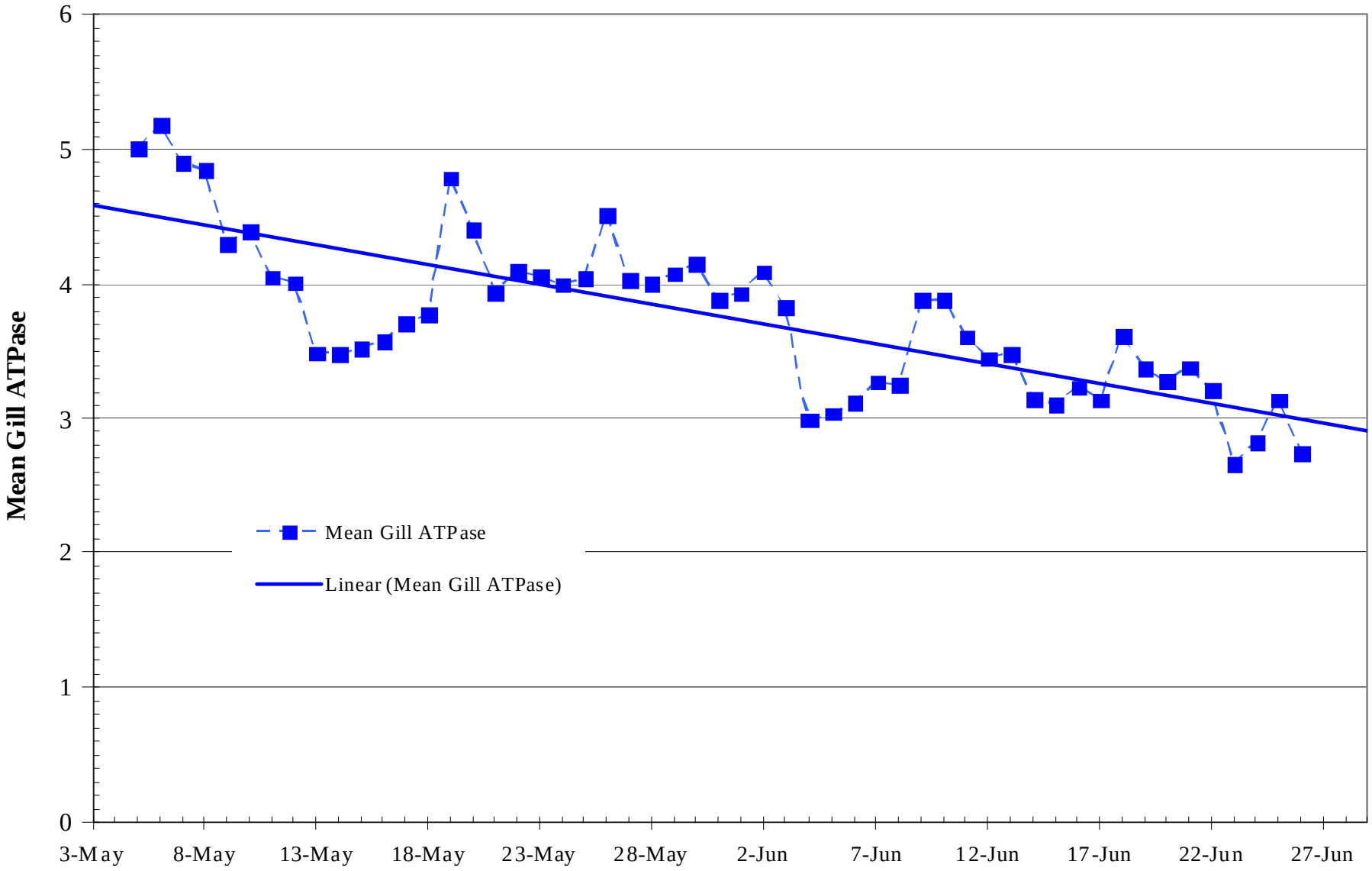
2009 FSC Sockeye

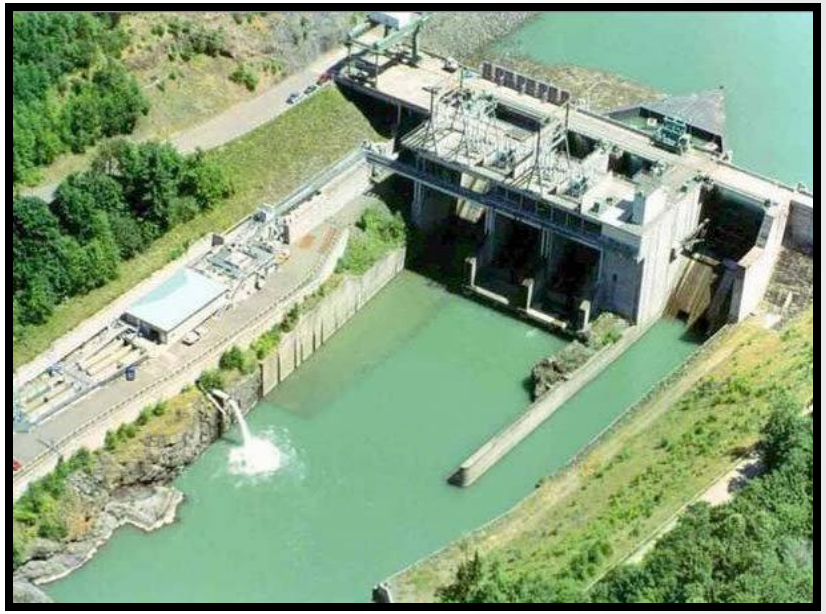


2010 Sockeye Preference (65:35)



2006 Gulper Coho





FERC FISH PASSAGE WORKSHOP 2011

Steve Fischer & Keith Underwood
TACOMA POWER

TACOMA POWER
TACOMA PUBLIC UTILITIES

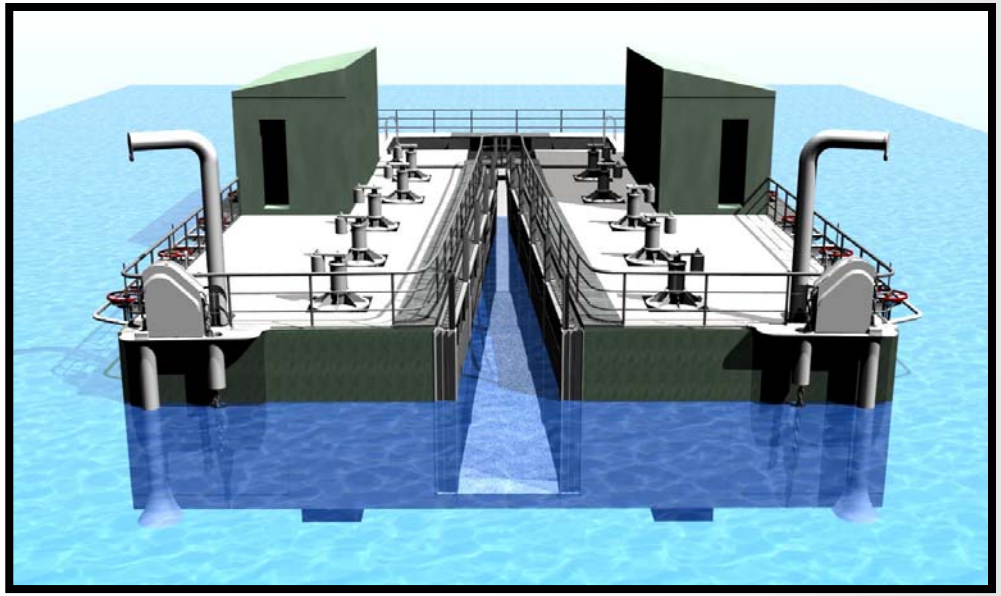
OVERVIEW

STEVE FISCHER

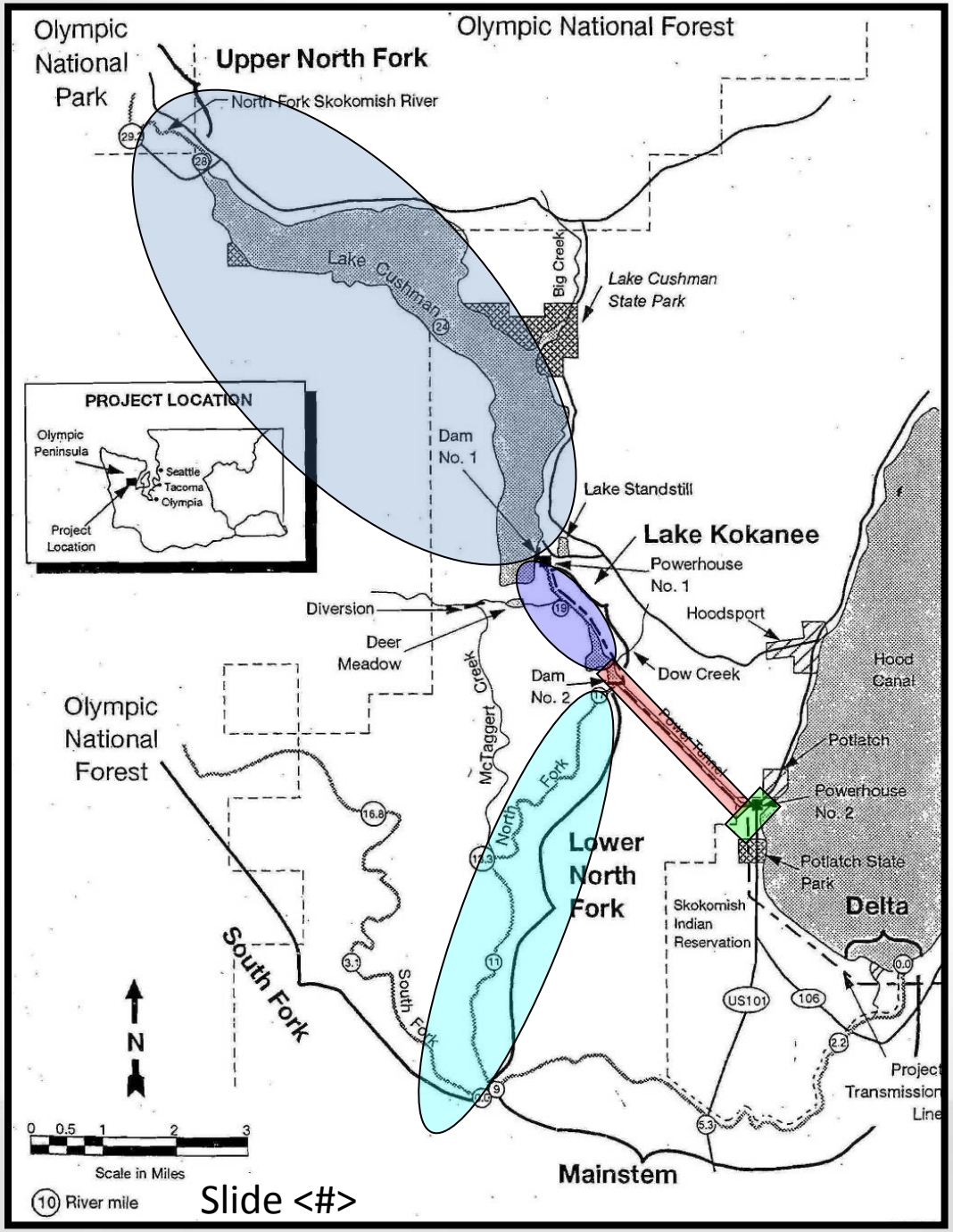
- **Cushman Project**
  - **Downstream**
  - **Upstream**

KEITH UNDERWOOD

- **Cowlitz Project**
  - **Downstream**



TACOMA POWER
TACOMA PUBLIC UTILITIES



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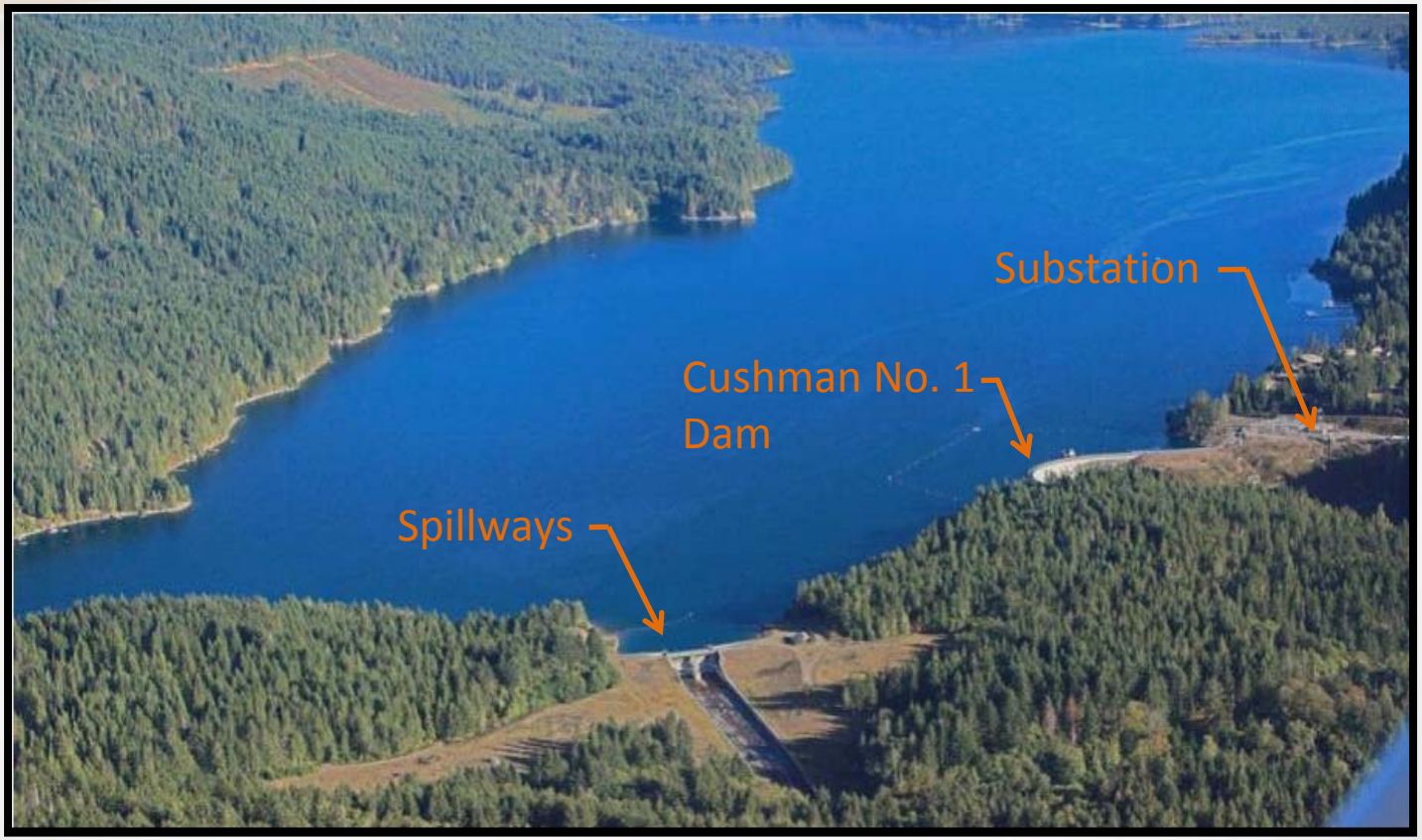
TACOMA POWER
TACOMA PUBLIC UTILITIES

LAKE CUSHMAN RESERVOIR



TACOMA POWER
TACOMA PUBLIC UTILITIES

CUSHMAN NO. 1 DAM

LOCATION OF DOWNSTREAM COLLECTOR

TACOMA POWER
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