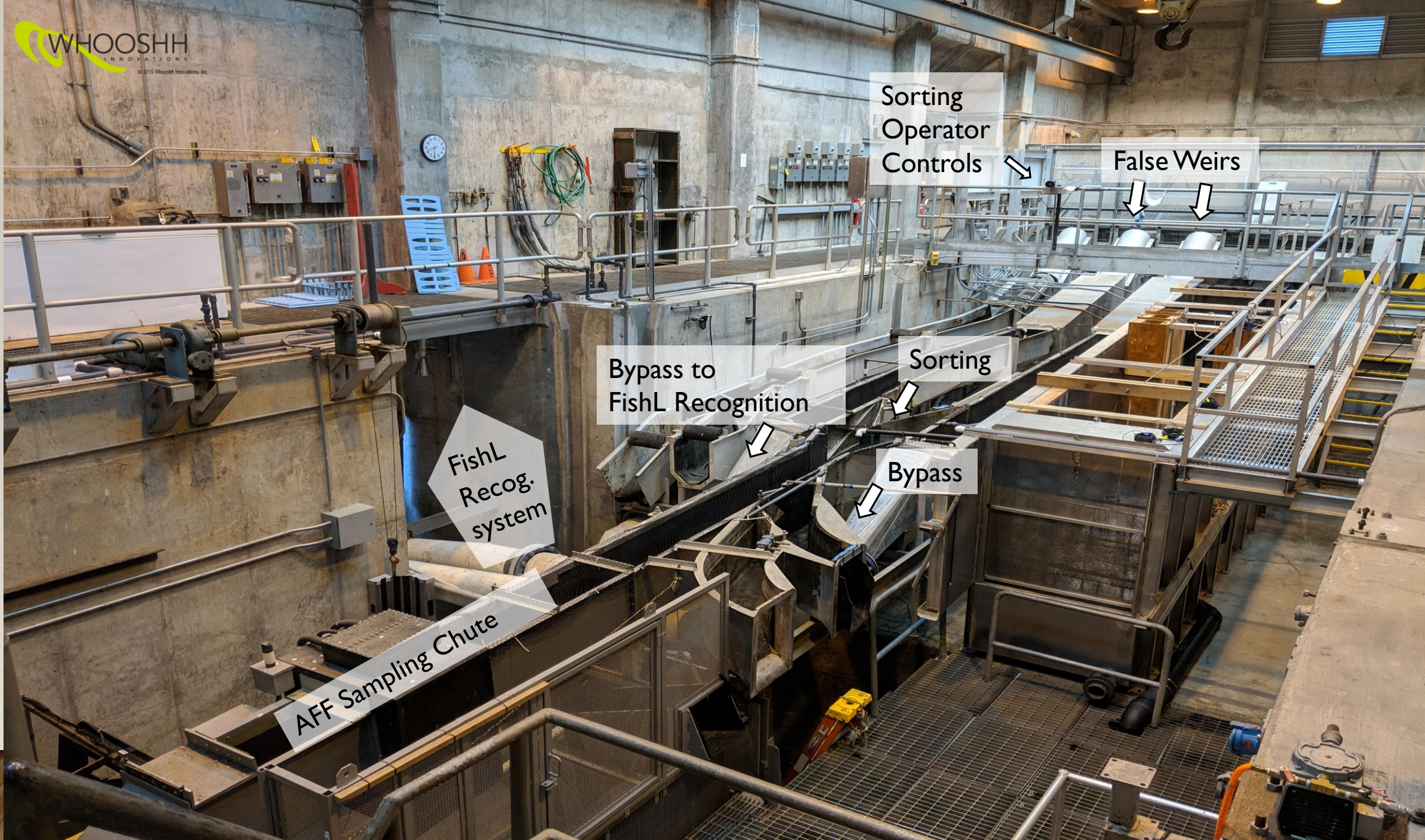




FISHL™ Recognition System Whooshh Installation at Bonneville AFF

Species Counts, Fork Length Distributions By
Species, Adipose Status, Injury Assessment
Bonneville AFF Whooshh FishL™ Recognition
Image Data

2019 NOAA Update



Sorting
Operator
Controls

False Weirs

Bypass to
FishL Recognition

Sorting

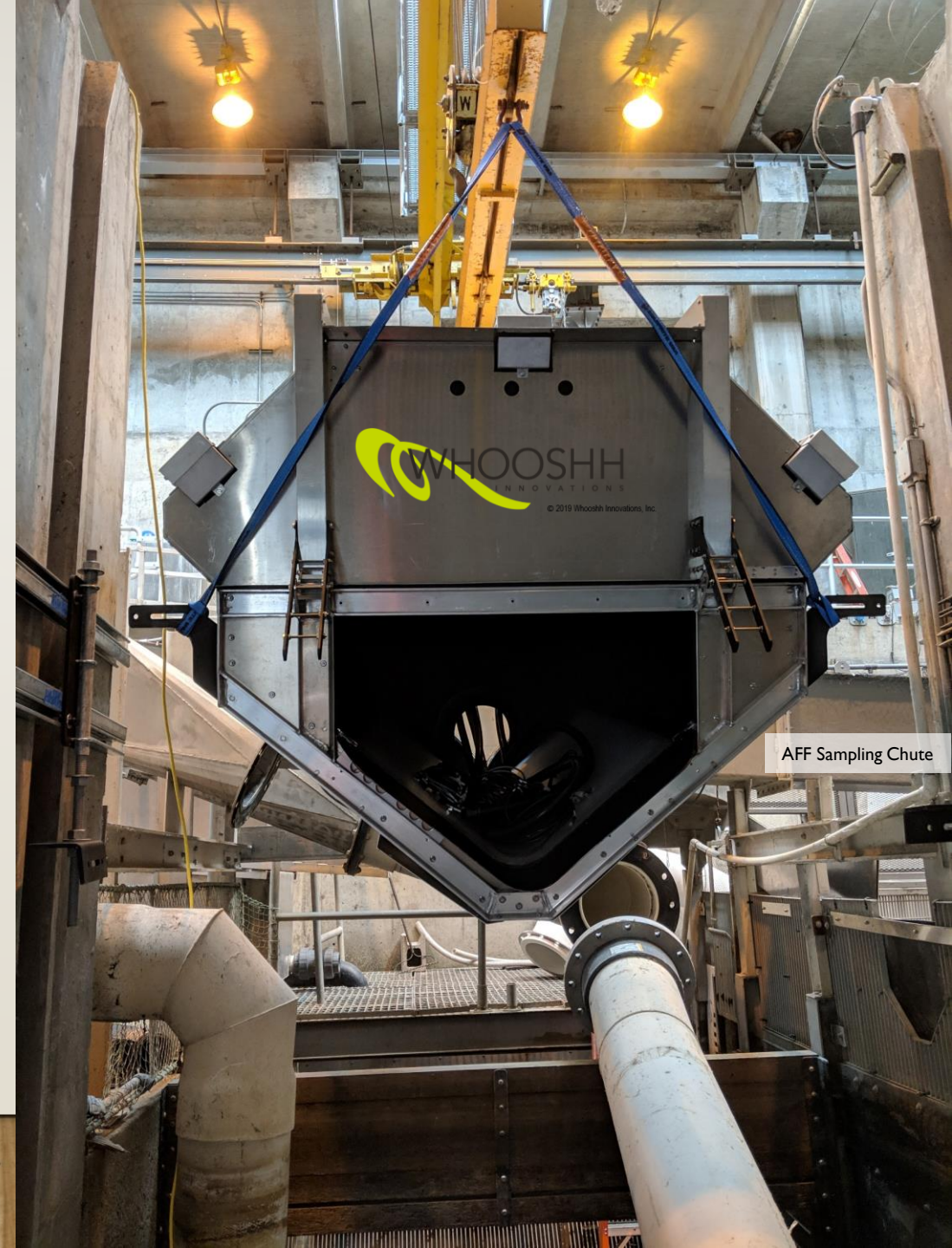
Bypass

FishL
Recog.
system

AFF Sampling Chute



AFF Sampling Chute



AFF Sampling Chute

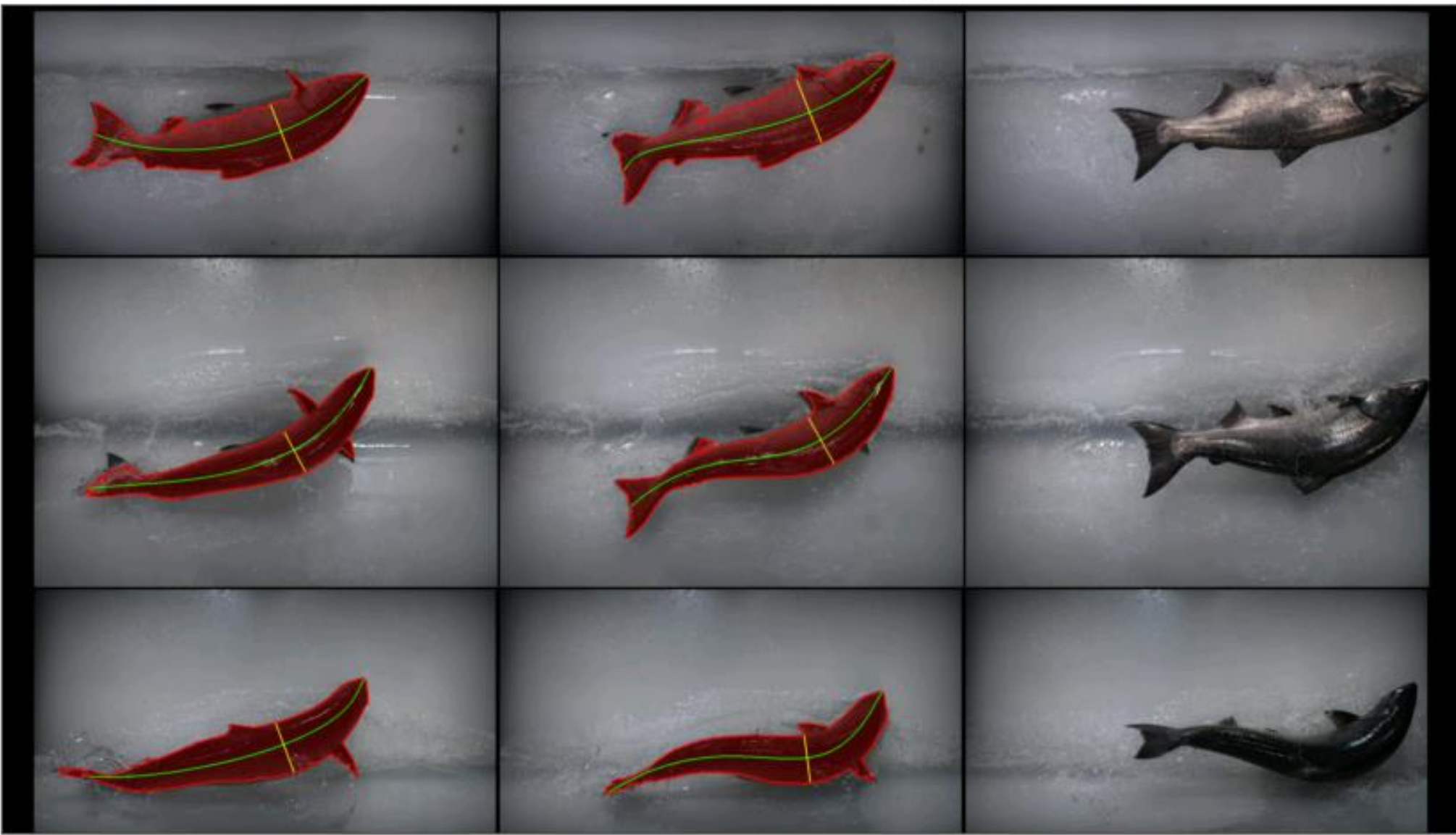


AFF Sampling Chute

ADAPTING TO THE CONDITIONS OF THE BONNEVILLE AFF

- Calibration Parameters Modified to address:
 - Increased fish speed over typical Whooshh False Weir Design (speeds up to 5 m/s)
 - Excess Water
 - Erratic Behavior
 - Spiders





Column	Result
Circumference	491.9 mm
Length	830.4 mm
PercentageAdipose...	
PercentageNotAdip...	
Reversed	0
Speed	3.66 m/s
TotalImagesSent	
TotalImagesTimeout	

- Show native resolution
- Show corrected image
- Show NIR image
- Show Raw Foreground
- Show Fish

Gamma

Pen

Inference Server Status : OK

1x Zoom

Fit



April 25-Aug 1, 2019 FishL™ Recognition System Operational 2520 hr but fish passed through only 210 hr

# of Weeks	Week # of yr	Days Sampled/wk	% of day/wk	Hrs Sampled/ wk	% of hr/wk
1	17	2	29%	2.75	2%
2	18	5	71%	13	8%
3	19	5	71%	15.5	9%
4	20	4	57%	12.75	8%
5	21	5	71%	14.5	9%
6	22	4	57%	10	6%
7	23	5	71%	15.5	9%
8	24	5	71%	17.5	10%
9	25	4	57%	13	8%
10	26	5	71%	19	11%
11	27	4	57%	13.5	8%
12	28	5	71%	17	10%
13	29	5	71%	17	10%
14	30	4	57%	13	8%
15	31	4	57%	16	10%
Total		66	63%	210	8%

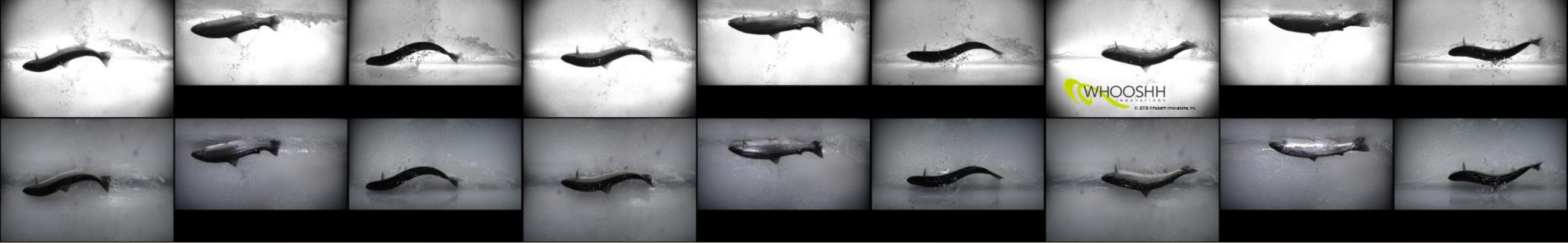
Species through Sept 4	Count	Percentage
American Shad	818	10.3%
Chinook	2899	36.7%
Coho	157	2.0%
Large Scale Sucker	22	0.3%
Mini jack	1286	16.3%
Northern Pikeminnow	4	0.1%
Pacific Lamprey	12	0.2%
Peamouth Chub	1133	14.3%
Pink	18	0.2%
Small Mouth Bass	2	0.0%
Sockeye	1266	16.0%
Steelhead	290	3.7%
Whitefish	1	0.0%
Total	7908	100.0%



12 species Classified

Current status ~12000 scans, over 200,000 images

* Non-Native Species to Bonneville Reach: Small Mouth Bass, American Shad, Whitefish



April – Aug 1, 2019

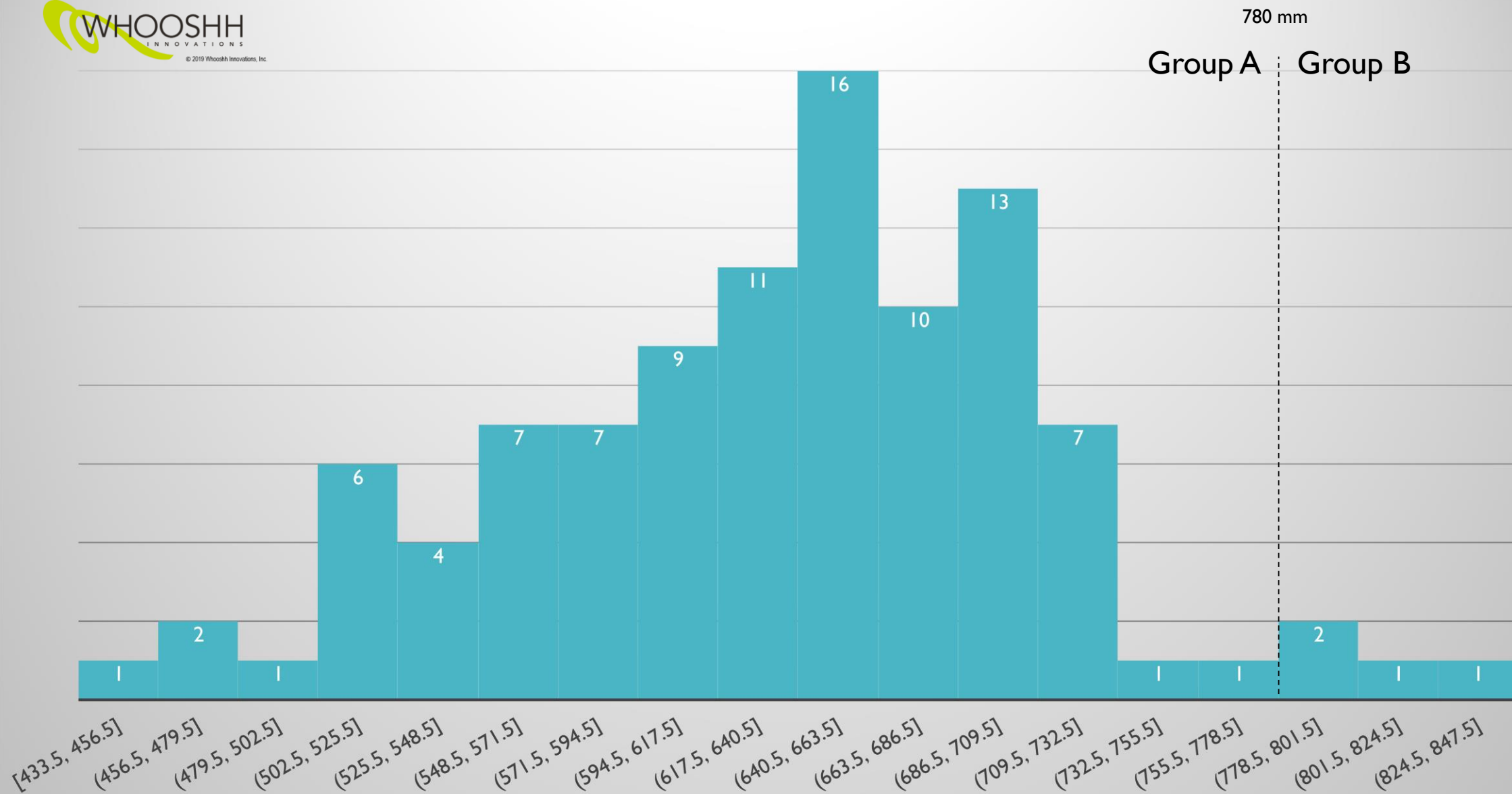
103 Steelhead

April – Sept 6

290 Steelhead Total

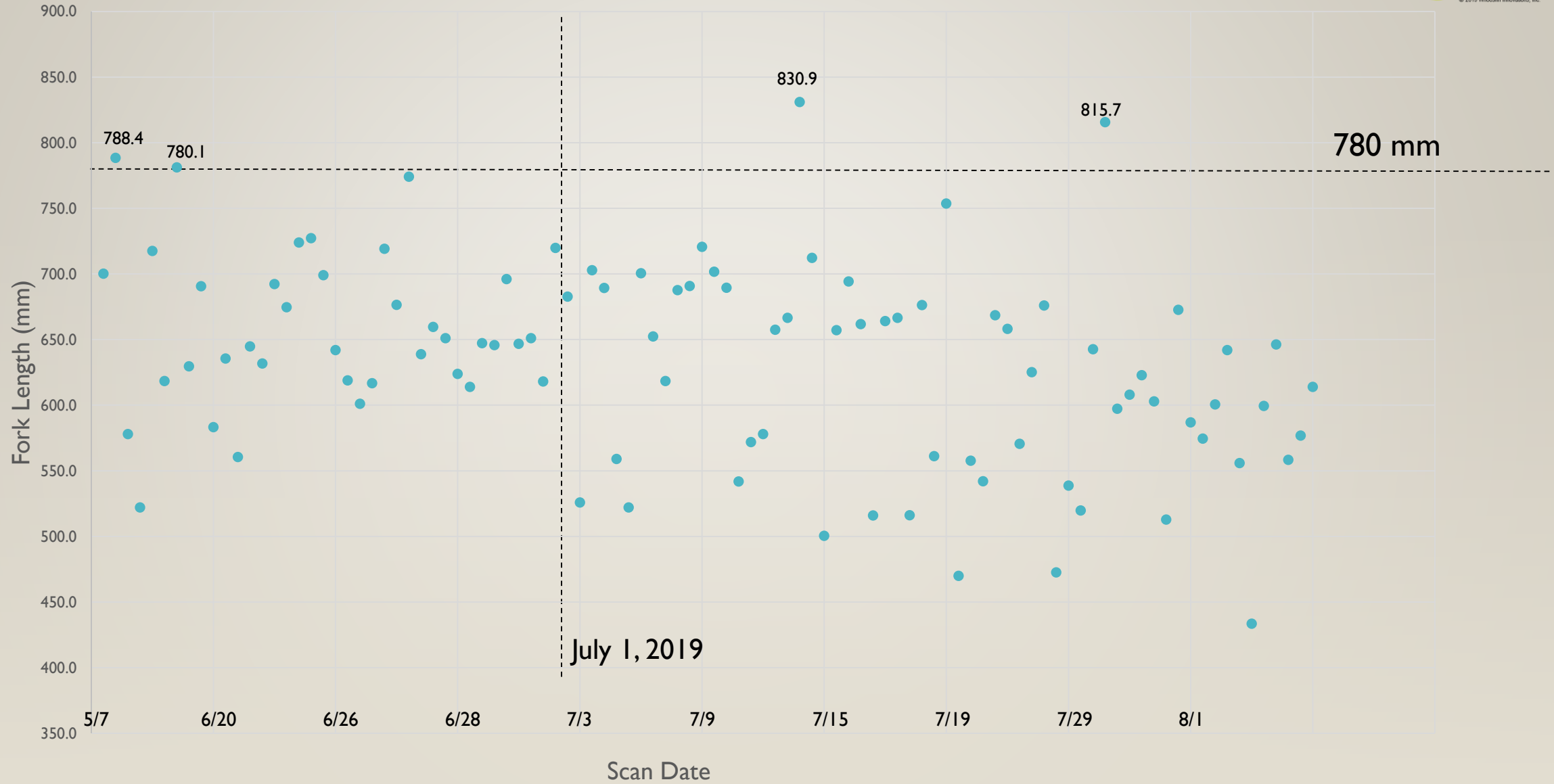
(Aug 2-Aug 31 sampling on only 9 days)

Steelhead Fork Length Distribution (mm)



April through Aug | 103 Steelhead – add to AFF sampling counts => Steelhead data set increase 142%

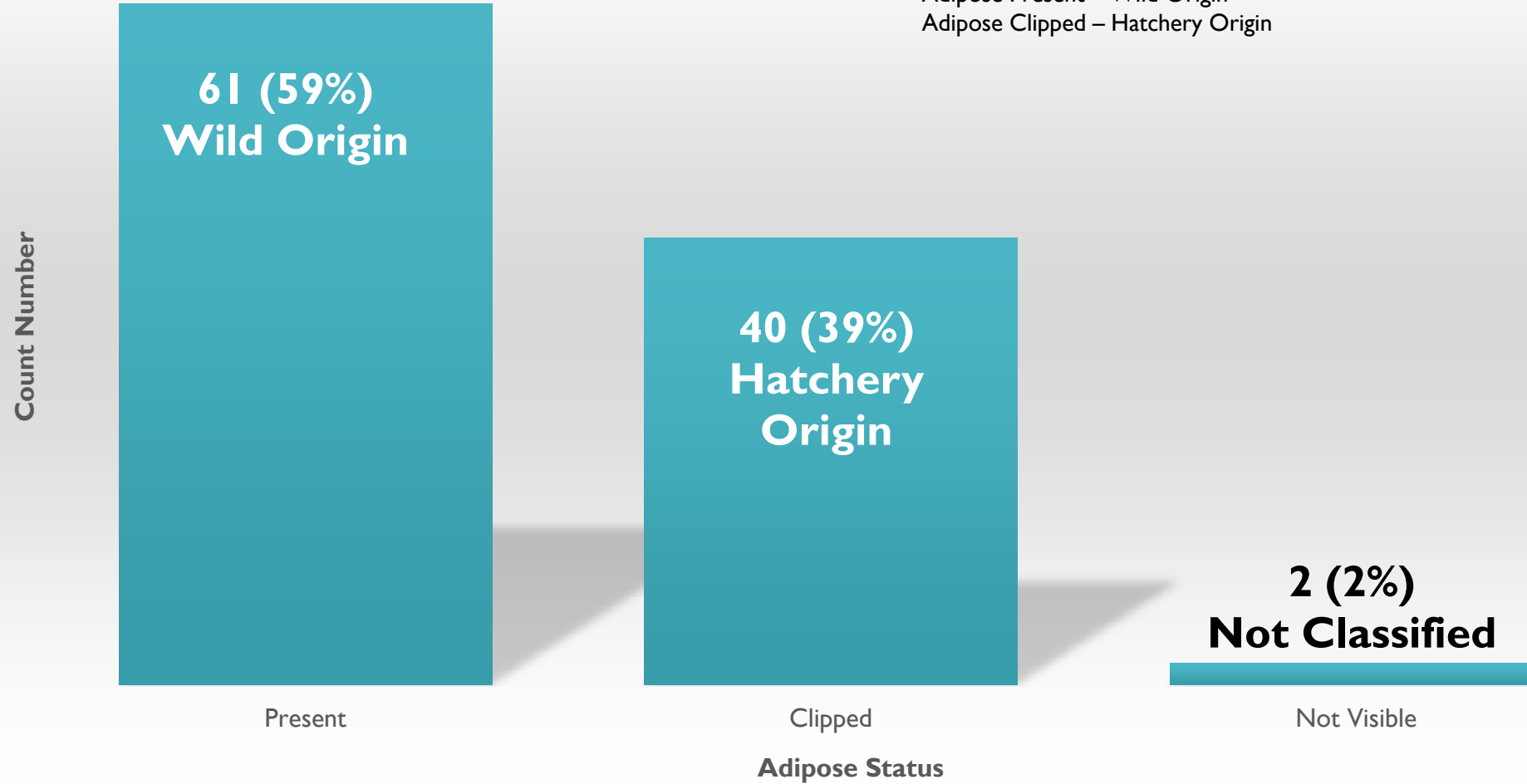
Steelhead Fork Length by Count Number



Steelhead Adipose Status



Adipose Present – Wild Origin
Adipose Clipped – Hatchery Origin





Steelhead sampled or scanned at Bonneville AFF April – Aug 1, 2019 (Wk17-31)

Week	Sample Size	
	AFF	Whooshh
17	2	
19	1	2
20	2	1
21	2	1
22	2	1
23	4	
24	2	1
25	5	8
26	8	25
27	15	12
28	30	10
29	61	13
30	42	9
31	70	20
Total	246	103

- Steelhead volitionally enter 1 of 2 chutes via 2 false weirs
- AFF selects steelhead for sampling from both chutes
- Whooshh scans non-selected, bypassed fish, from only the right-side chute

- AFF sampling plus Whooshh scanning gave positive increase in Steelhead data collected during the 2019 15 wk period.

Combined => **142% of AFF sample set**

- Combined Total sample: 349

Chinook

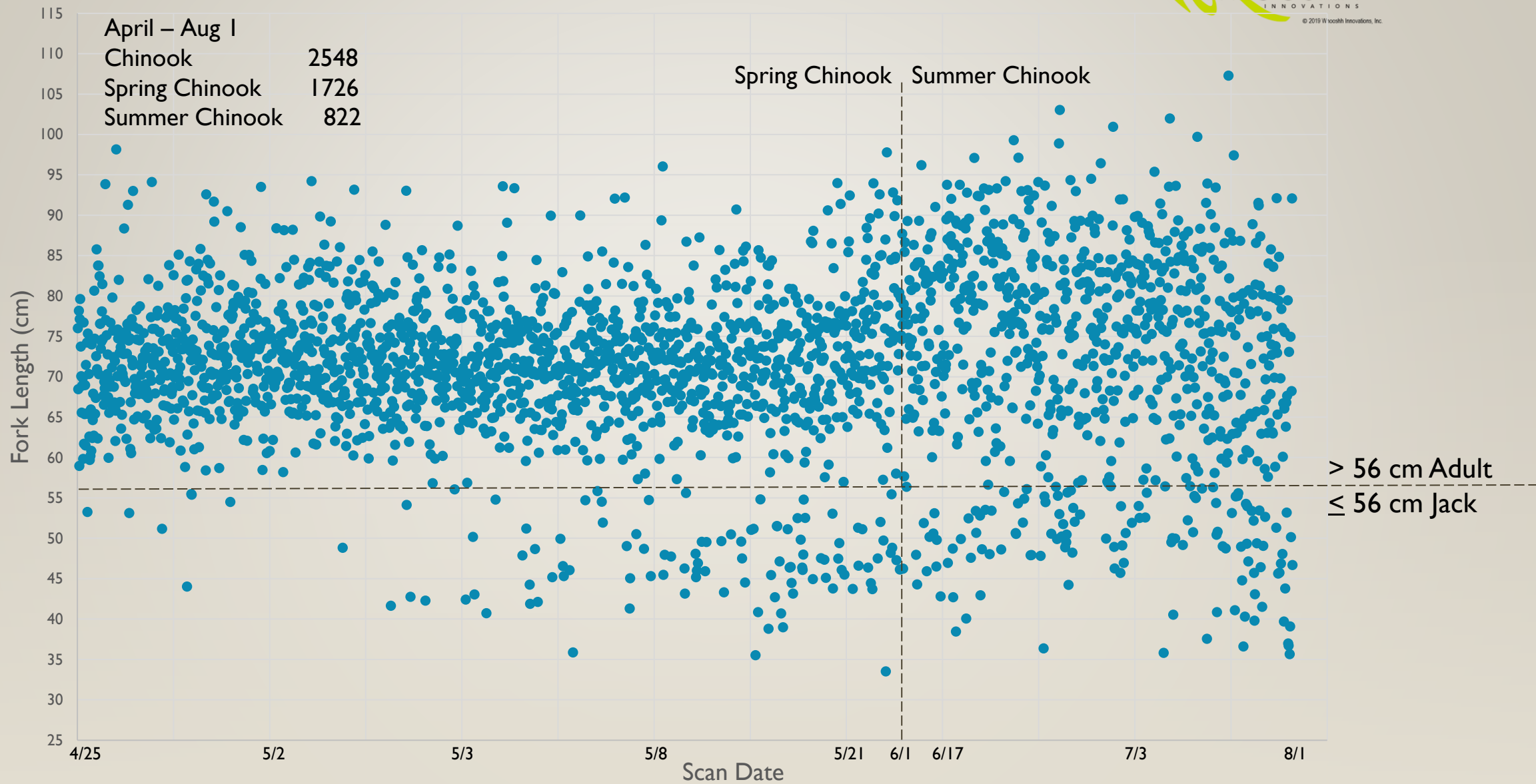
FishL™ Recognition System Image



April – Aug 1, 2019 2548 Chinook
By week 36 AFF sampled 2757 Chinook and FishL 2899 Chinook = Total 5656

Chinook data set increase 205%

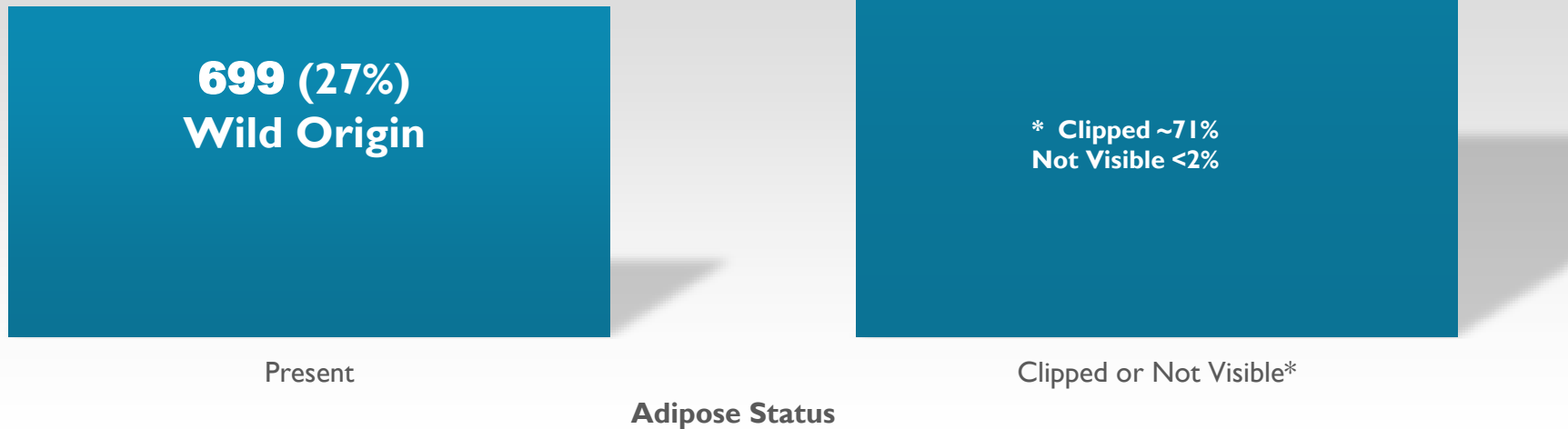
Chinook Fork Length per Count Number Logged



Chinook Adipose Status: Wild vs Hatchery April – Aug 1, 2019



Count Number



* Lack of adipose visibility in images due to water obstructing clear view or the position/ behavior of the fish in the scanner. Water impact to visualization was size related with smaller fish more occluded. The Chinook **Not Visible Rate is estimated to be <2%** based upon general size relationship to Steelhead, Steelhead no visible rate of 2% and unrecorded observations of less Chinook visualization challenges related to position in comparison to Steelhead.

Chinook First Pass Injury Observations

Number of Chinook

Major Injury:

Open wounds,
punctures, gashes, bites,
large scratches, large scrapes,
>20% descale, or torn fins

298 (12%)

2250 (88%)

Normal / Minor Injury:

Generally normal +/-
small sores, small cuts,
≤20% descale, split fin,
net abrasions, or cuts,
hook injuries

Condition of Chinook

Sockeye

FishL™ Recognition System Image



© 2019 Whooshh Innovations, Inc.

April – Aug 1, 2019

1256 Sockeye

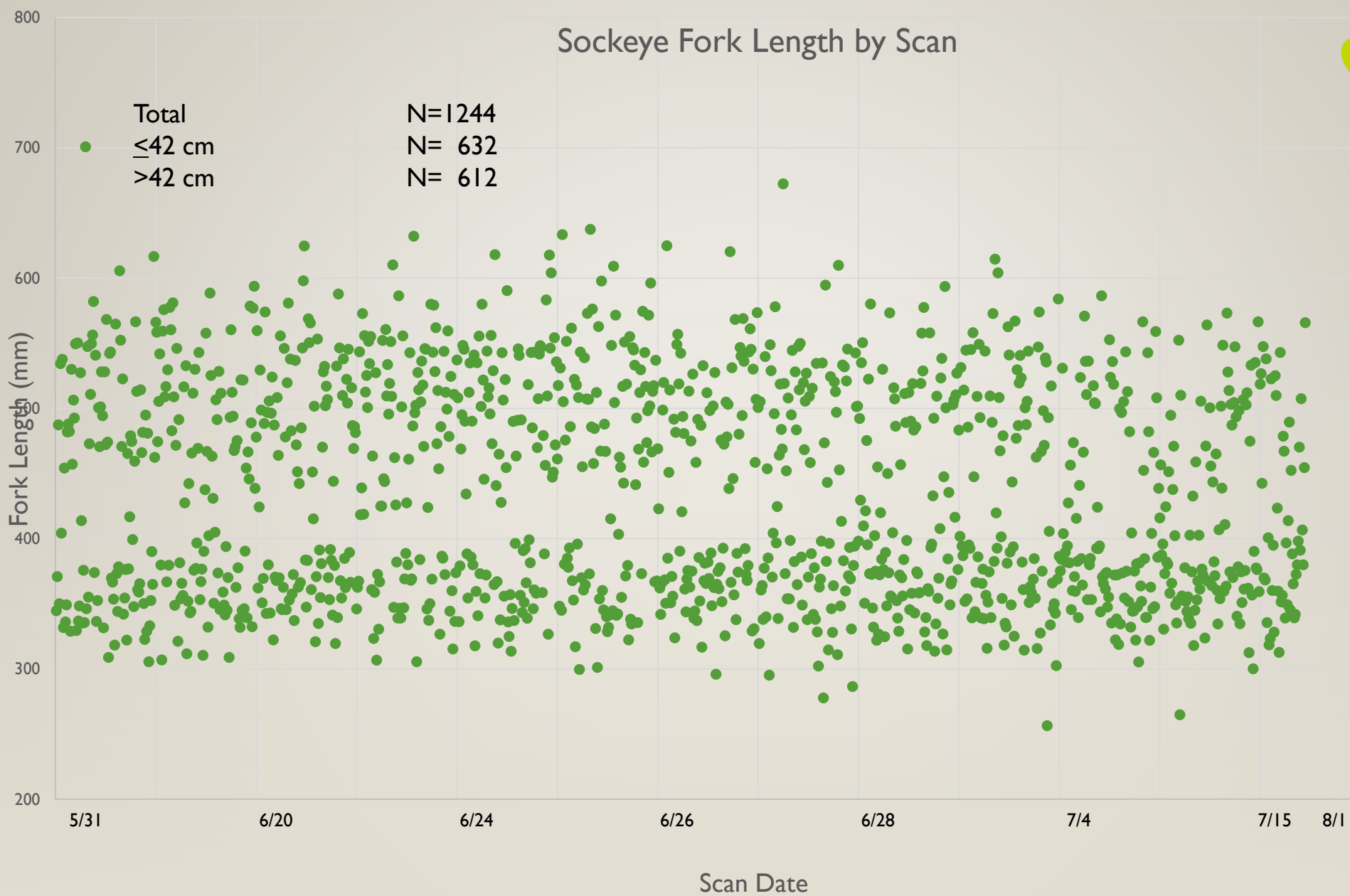
Sockeye

	Mean		Mean	
Week ▼	AFF FL (mm) ▼	AFF N ▼	Whooshh FL (mm) ▼	Whooshh N ▼
23	485	15	440.9	6
24	453	66	452.3	66
25	464	139	441.4	258
26	458	289	446.9	491
27	432	209	423.5	247
28	424	148	408.8	135
29	434	67	416.3	41
30	452	28	398.7	10
31	443	20	510.2	2
Weighted	450	981	437	1256

Combined sample set= 2237, Increase, total sample set size 228%

Difference in weighted sample set fork length means just 1.4 cm across 2237 sockeye

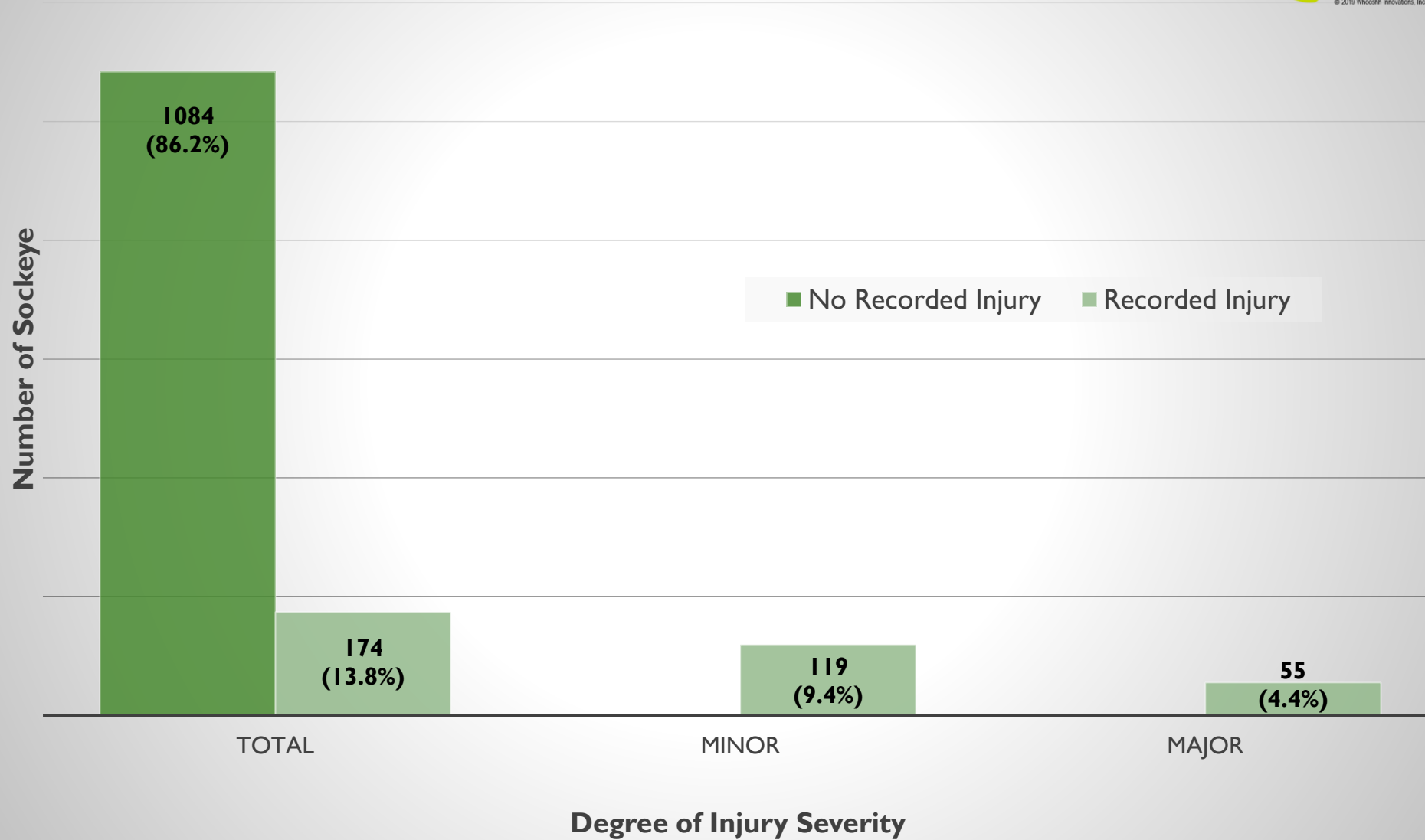
Sockeye Fork Length by Scan



Two Populations Distinguished by Size



Sockeye Recorded Injuries



Minor Injury – Descaling \leq 20%, scrapes, split fins, small sores
Major Injury - Open wounds, gashes, pinniped bites, long scratches

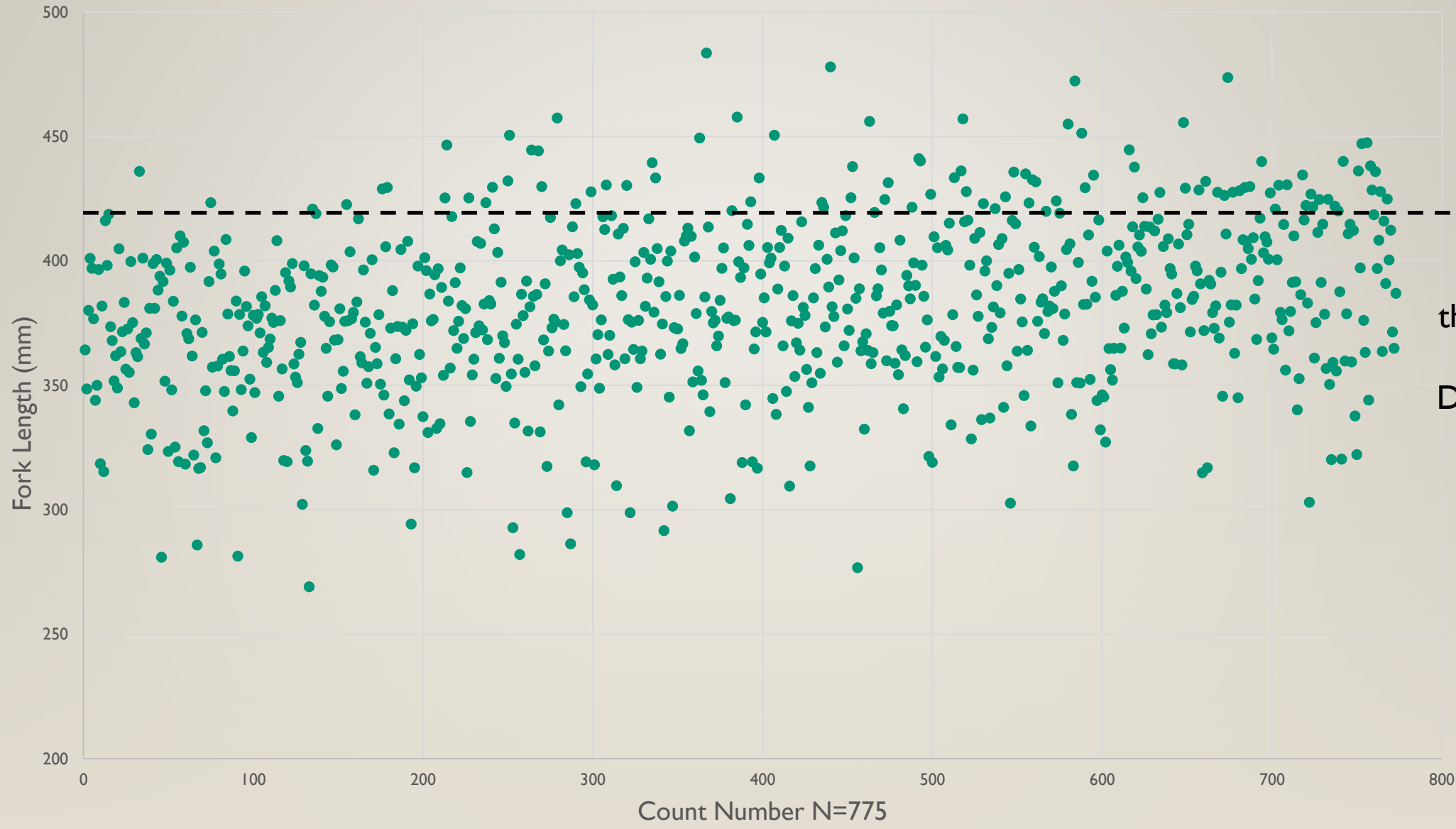


American Shad

FishL™ Recognition System Image

April – Aug 1, 2019 779 American Shad (2 multiple fish images)
Fork Length Recorded 775 with Average Fork Length 381 mm (15 in)

American Shad Fork Length by Count Number



42 cm
Reference
Point to
the Sockeye
Size
Distribution



Post Imaging Analysis – Many possible assessments:

Injury Reports

Pinniped

Net

Hook

Other

Visual Characterization Reports or Reference/Education Guide

Photo Examples of Defining Species Characteristics

ie., Anal ray number in Steelhead (8-12)

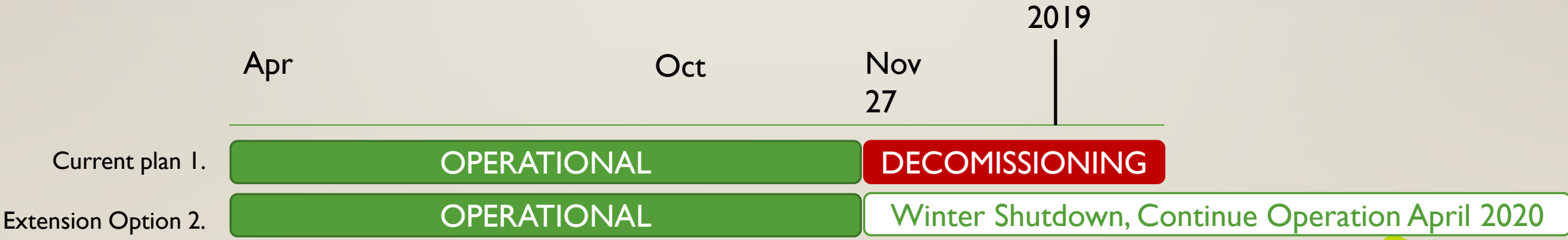
Representative Sampling: Model the Comparisons

-AFF species run timing and distribution vs Dam counts

-AFF species count distributions vs environmental factors:
temperature, weather, etc.

TIMELINE: REMOVAL VS. 2020 CONTINUATION

- Current plan if no action is taken is for removal in Dec 2019
 - Current agreements expire at end of 2019 season
- FPOM update and consideration of extending installation for another year October 2019
- Funding Agreement in Place by Nov 27 for continued operation in the AFF





Pinniped Predation Report – visual confirmation of consumption

Post imaging analysis of Whooshh FishL scans can provide supplemental, additional data: **Pinniped Injury Estimates** relative to fish species and dates of observation, injury data could be correlated with assessments of pinniped mitigation actions

















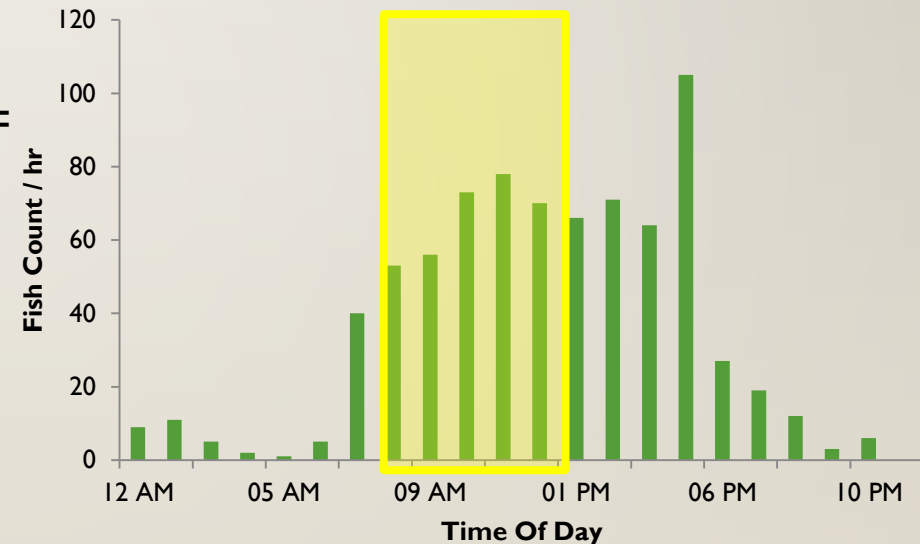
FISHL™ RECOGNITION DATA:VALUE ADD HIGHLIGHTS

- 1) Addition more than **doubled** AFF sampling output data
 - 1) species counts, forklength and adipose status
- 2) Provides a **more complete estimate** of AFF fish counts
- 3) Provides data on **all species** bypassed through the AFF
- 4) Fork lengths **correlate well** with manual measurements
- 5) **Rapid fish evaluation**, a fraction of a second, no handling or delay
- 6) Operational 24/7, rapid **automated data output**
- 7) **Permanent record**, scan image files, expand fisheries possibilities:
 - 1) Data confirmation
 - 2) Data mining
 - 3) Educational tools
 - 4) Outreach messaging

RECOMMENDATIONS FOR GOING FORWARD (NEAR TERM) IF OPERATION CONTINUED IN 2020

- Continue Species Classification and Counting
- Continue Adipose Classification and Counting
- Post Imaging Analysis for Value-Add Datasets
- Conduct Length Evaluation Direct Comparison Study at AFF
 - Whooshh vs AFF hand measure of same fish
- Potentially Conduct an Expanded Day Bypass Count Study
 - ? If there is value and interest ?
 - AFF watered up and bypass open to log who and what come through during an extended operation day
 - Identify if, what, when and how well the current sampling process represents the fish runs

**Feather River Hatchery Ladder
11/7/18 24hr Run**



WHOOSH PASSAGE PORTAL : CHIEF JOSEPH DAM

<https://www.youtube.com/watch?v=I7qyh6IlaA>

THANK YOU!





Steelhead
A FishL™ Recognition System Image





Chinook
A FishL™ Recognition System Image



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Sockeye
A FishL™ Recognition System Image





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Pacific Lamprey
A FishL™ Recognition Image



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American Shad
A FishL™ Recognition System Image

