Enumeration and evaluation of adult Pacific lamprey escapement and behavior in underwater video at McNary and Ice Harbor dams with the application of computerized imaging software (AVEDac)

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Study Overview

- Video monitoring of picketed leads at McNary and Ice Harbor dams (2nd yr)
- Video monitoring of new lamprey orifices at Ice Harbor and Lower Monumental dams
- Completion of automated, video event detection and classification software (AVEDac)

Picketed Lead Monitoring Methods

McN S ladder: 4 cameras (94%)

McN N ladder: 2 cameras (80%)

IHR S ladder: 3 cameras + Count window (100%)

IHR N: 2 cameras + Count window (100%)

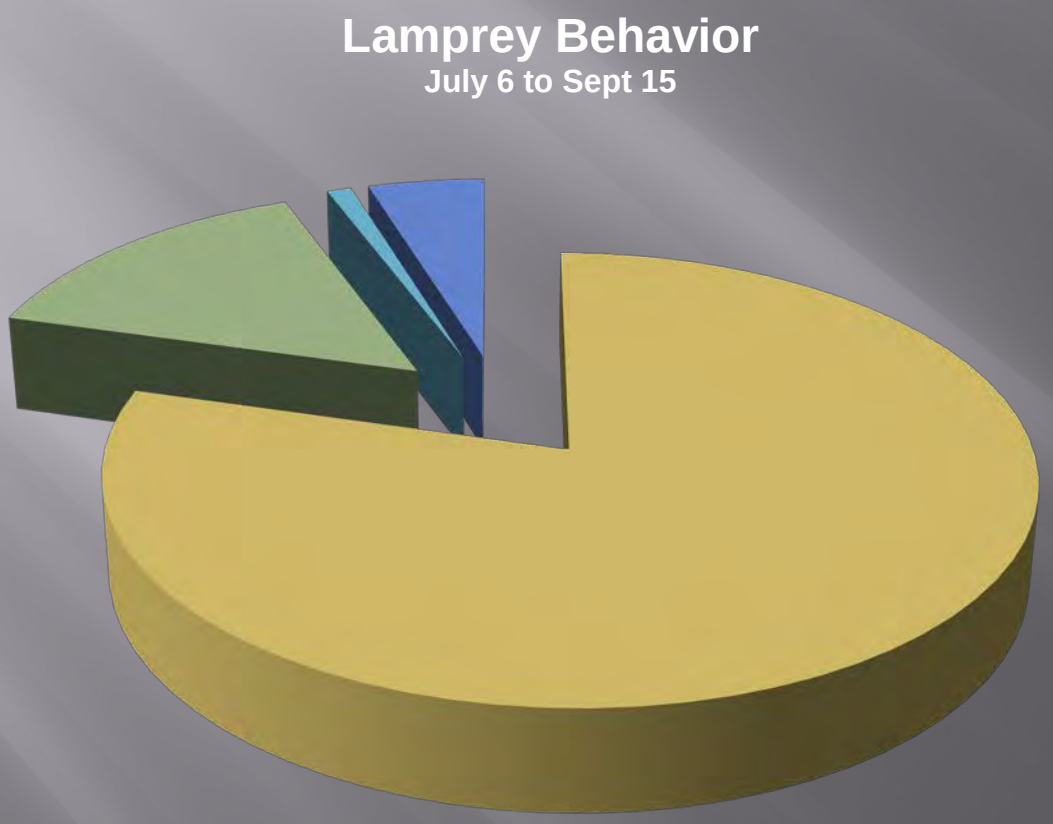
Picket video: 24/7 (July 7-Oct 15)
Count window : 21:00- 05:00

- ~ 36,000 hours of video collected
  - Transmitted via satellite
  - Processed with AVEDac

Lamprey Escapement

	McNary South	McNary North	Ice Harbor South	Ice Harbor North
Count Window Day	794	178	173	311
Count Window Night	457	324	466	227
Picket Video Day	569	6	1	21
Picket Video Night	257	4	0	4
TOTAL WINDOW	**1,251**	**502**	**639**	**538**
TOTAL PICKET VIDEO	**826**	**10**	**1**	**25**
ESCAPEMENT	***2,030***	***512***	***640***	***563***
% Window counts 2012	66.0%	2.0%	0.16%	4.6%
2011	71.4%	5.7%	3.0%	15.2%

Picketed Lead Video McNary South



	2011
Under 79.4%	65.5%
Lateral 14.8%	25.9%
Through 1.0%	0.8%
Downstream 4.8%	7.8%

Orifice Methods

- One lamprey orifice monitored per ladder
  - 07:00-13:00; 21:00-05:00 (May-Sept)
  - 5 days/week
- GOAL: Monitor 25% of salmonid runs during early and peak passage
  - Spring, Summer, Fall Chinook; Steelhead; Sockeye
- GOAL: Monitor lamprey behavior and passage

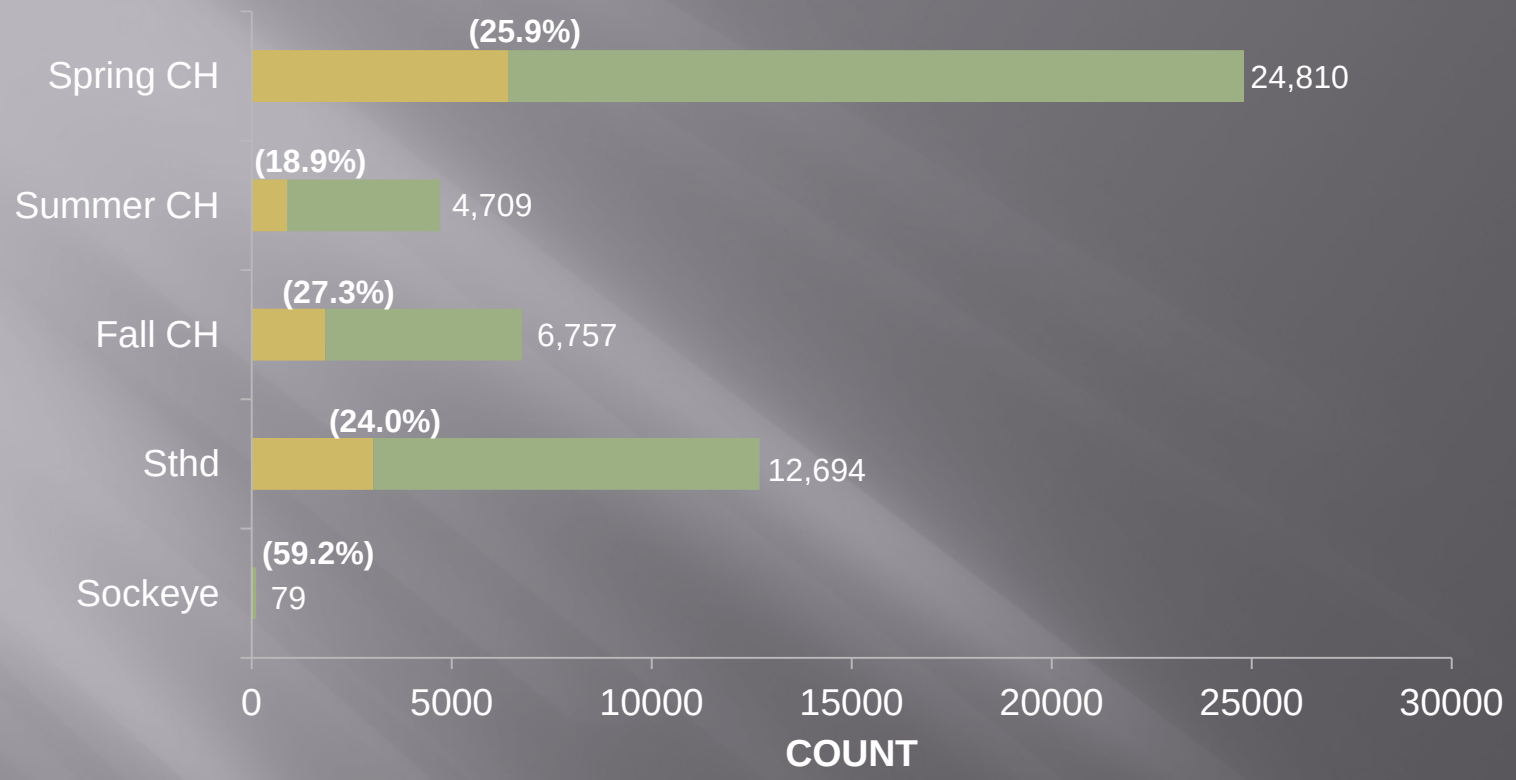
Approach

Interaction

- Video reviewed within 72 hrs and clips sent to USACE

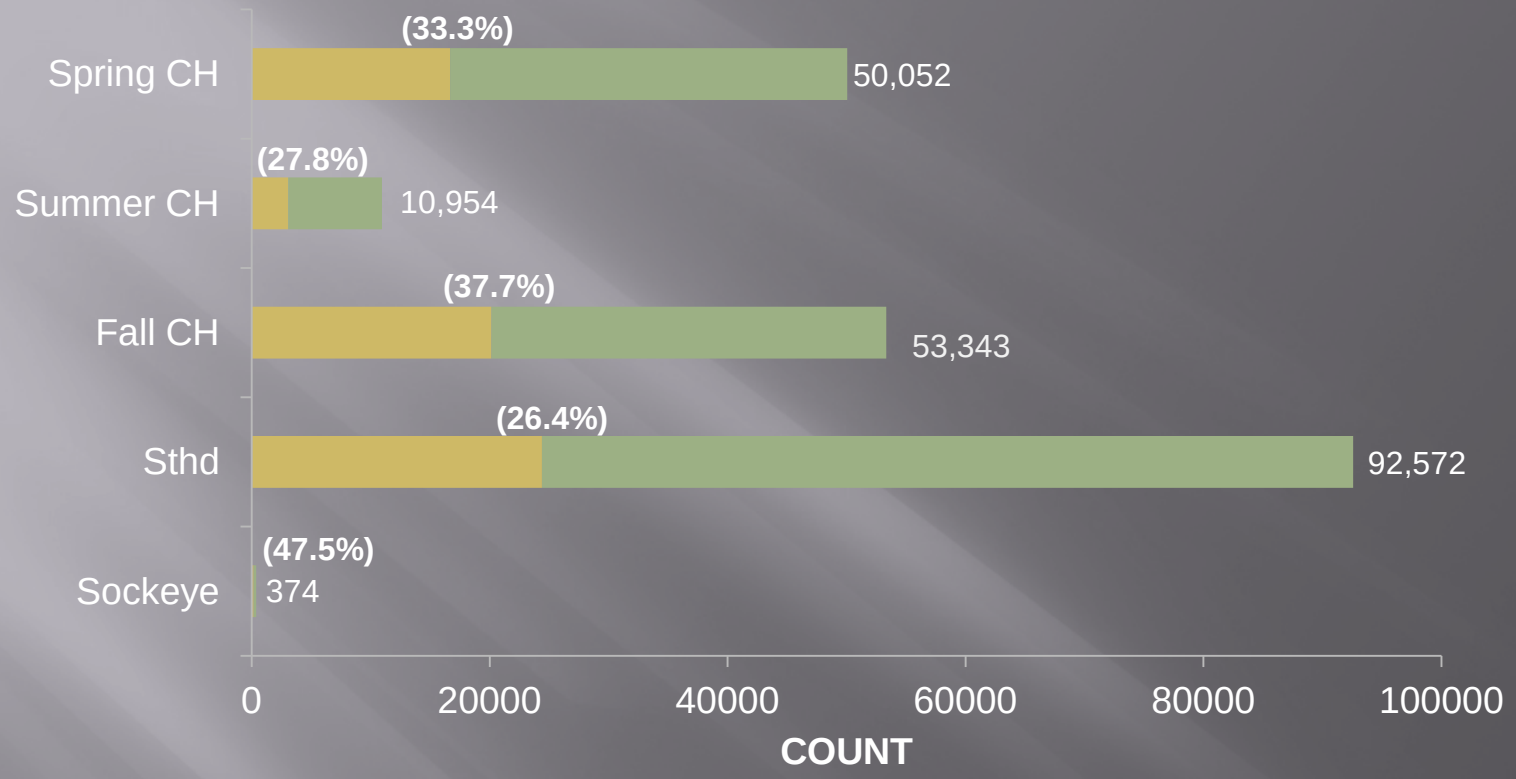
~ 6,000 hours of video collected and processed

ICE HARBOR NORTH LADDER SALMON



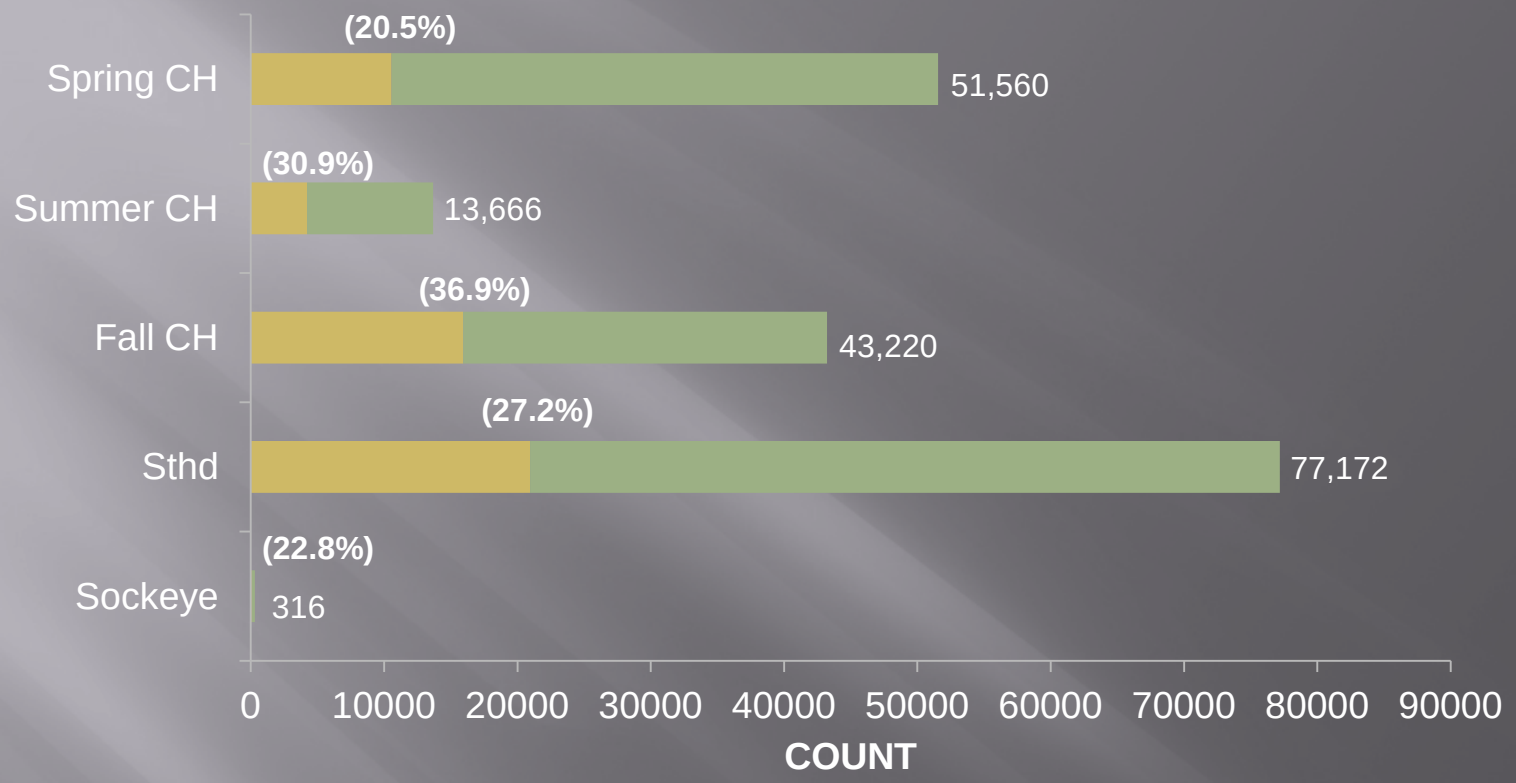
	Approach during monitoring period (%)	Interaction during monitoring period (%)
Spring CH	6.4	-
Summer CH	4.7	0.1 (N=1)
Fall CH	1.1	-
Sthd	5.4	0.5 (N=14)
Sockeye	19.2	2.1 (N=2)

Ice Harbor South Ladder Salmon



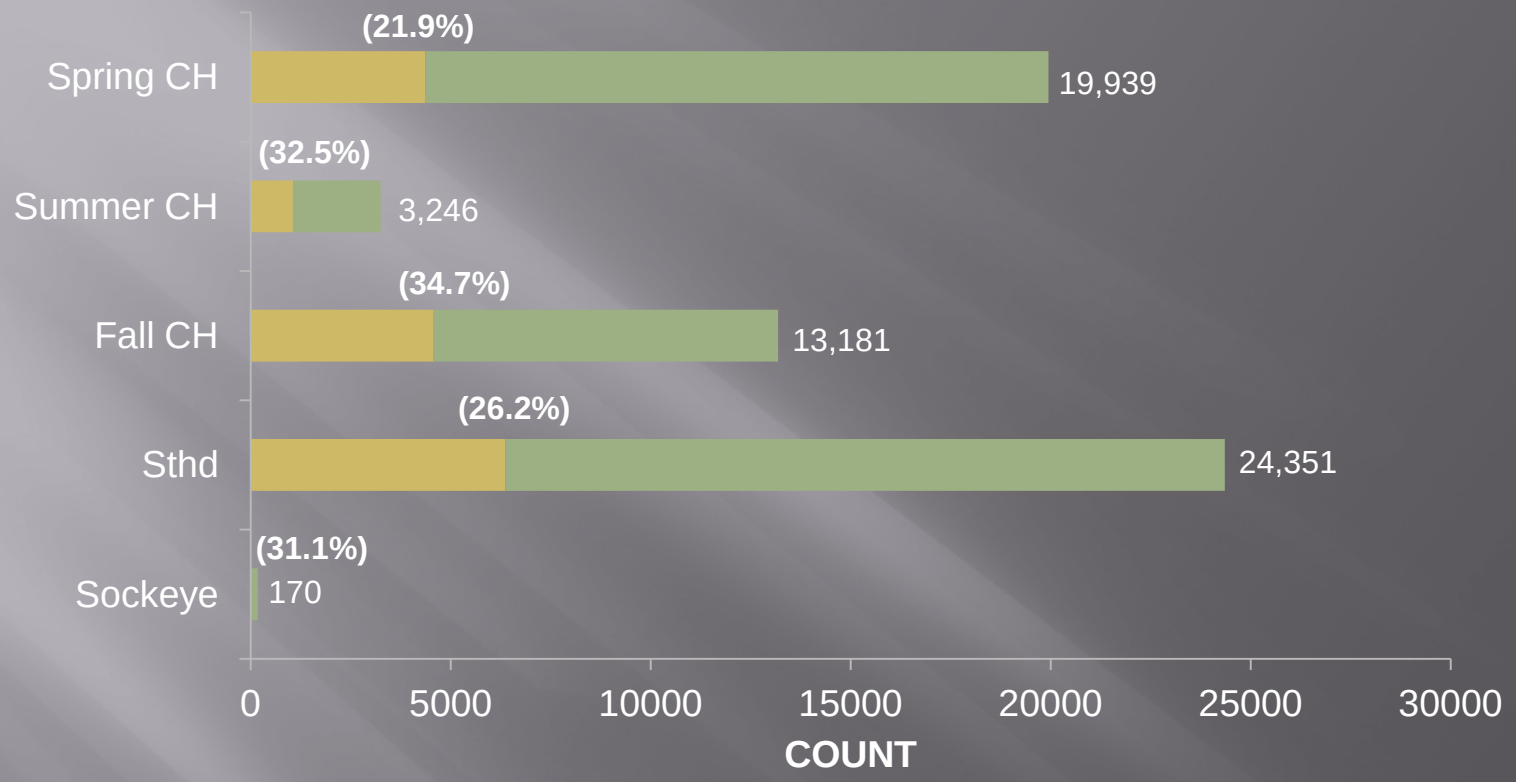
	Approach during monitoring period (%)	Interaction during monitoring period (%)
Spring CH	0.6	-
Summer CH	1.0	-
Fall CH	-	-
Sthd	1.1	0.02 (N=4)
Sockeye	7.3	-

Lower Monumental North Ladder Salmon



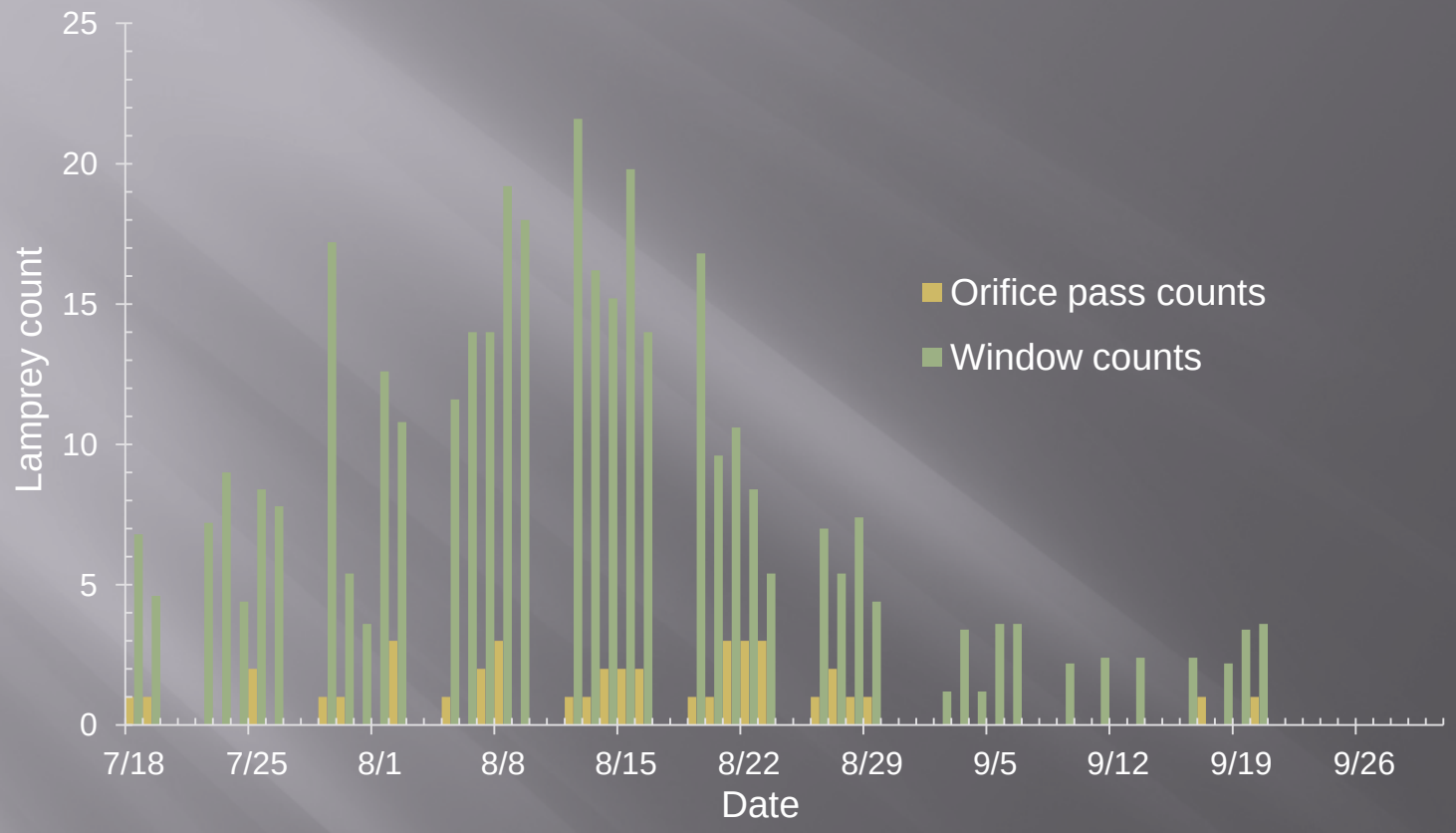
	Approach during monitoring period (%)	Interaction during monitoring period (%)
Spring CH	1.2	-
Summer CH	1.3	-
Fall CH	0.01	-
Sthd	0.7	0.005 (N=1)
Sockeye	8.3	1.4 (N=1)

Lower Monumental South Ladder Salmon



	Approach during monitoring period (%)	Interaction during monitoring period (%)
Spring CH	1.5	-
Summer CH	0.9	-
Fall CH	-	-
Sthd	0.5	0.03 (N=2)
Sockeye	1.9	-

Ice Harbor North Ladder Lamprey

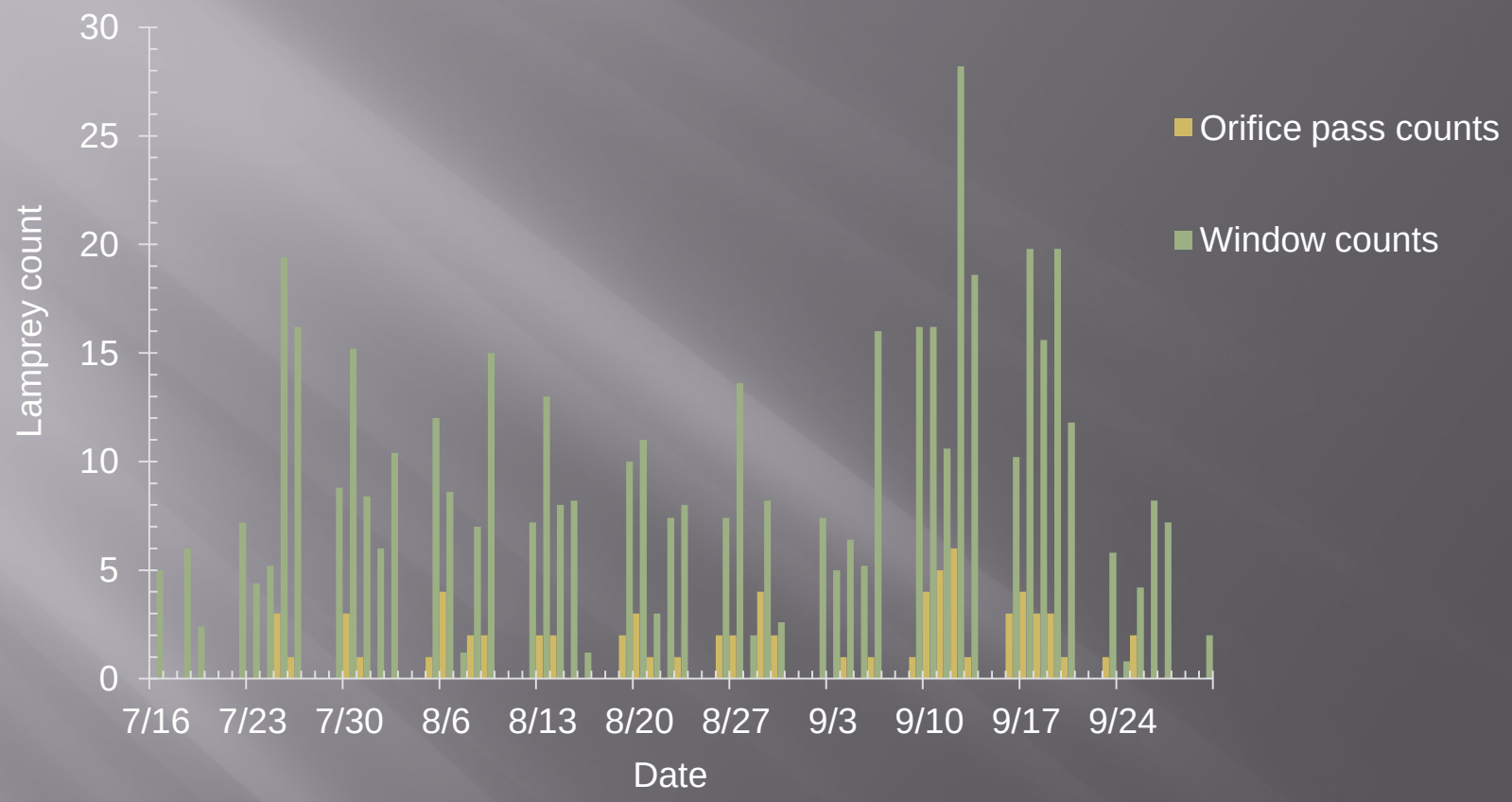


Window counts (day & night) = 368

Orifice pass counts = 41 → 11.1% lamprey passage

Total obs. at orifice = 95 → 43.2% orifice use

Ice Harbor South Ladder Lamprey

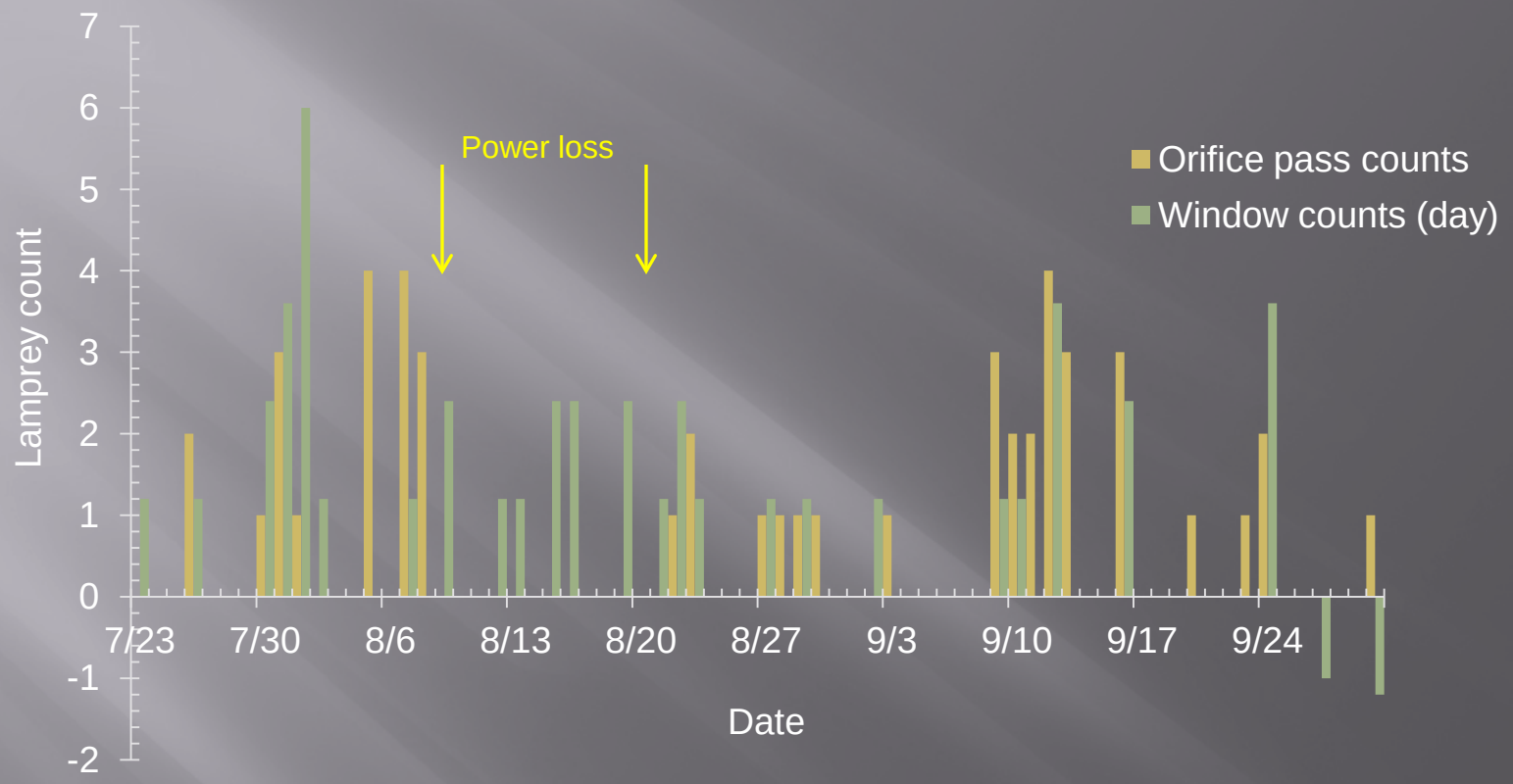


Window counts (day & night) = 508

Orifice pass counts = 74 → 14.6% lamprey passage

Total obs. at orifice = 179 → 41.3% orifice use

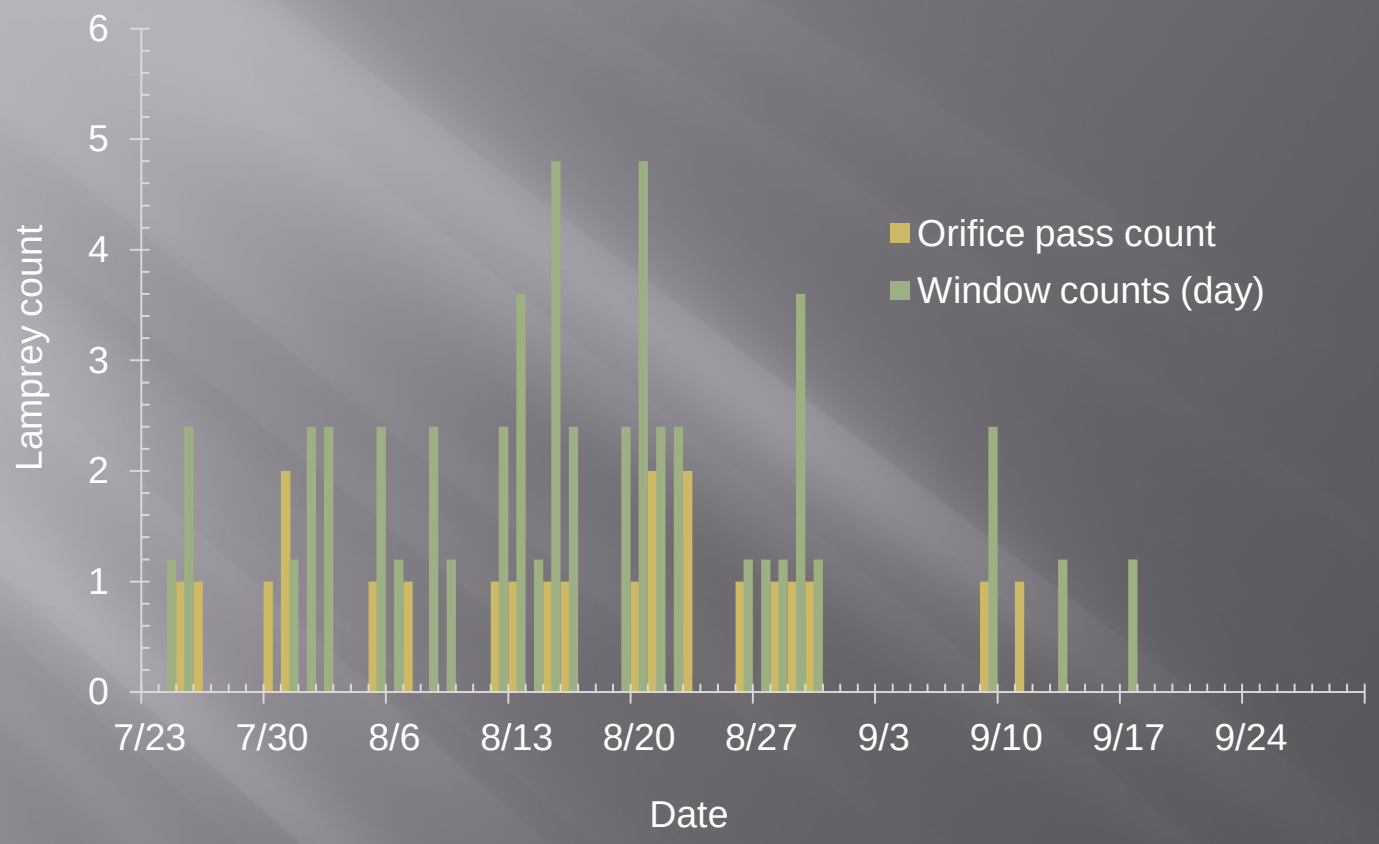
Lower Monumental North Ladder Lamprey



Window counts (day) = 39
Orifice pass counts = 48 → 123% lamprey passage

Total obs. at orifice = 95 → 49% orifice use

Lower Monumental South Ladder Lamprey



Window counts (day) = 56
Orifice pass counts = 22 → 39.3% lamprey passage

Total obs. at orifice = 57 → 38.6% orifice use

Automated Visual Event Detection and Classification: CyborgVision (AVEDac)

- 3 Modules:
  1) *Video acquisition*
  2) *Detection and Tracking*
  3) *Event Classifier*

- Modules 1 and 2 used for all video

- Detection and tracking module reduced video length by 75% on average

- Maintenance of cameras and stability important

CBVision

Modules 2 and 3 preliminary results

<u>Count Window</u>
Precision = 99%
Accuracy = 85-95%

<u>Picketed Leads</u>
Precision = 98%
Accuracy = 80-90%

Classifier in action

Conclusions

- PICKETED LEAD MONITORING
  - As in 2011, variable passage; site-specific
  - Window + picket = escapement
- LAMPREY ORIFICE MONITORING
  - Small runs = expand monitoring period
  - Negligible effect on most runs
  - Sockeye most interested (2010 also)
  - Lamprey use: 10-15%
- CBVision VIDEO PROCESSING
  - Reliance on video requires automated processing
  - Classification possible
  - Automated counting

Acknowledgments

We wish to thank the following people for their help and assistance:

U of Idaho: Charles Boggs and Travis Dick; USACE: John Dalen (fish counts), Derek Fryer and Steve Juhnke; Chelsea Santos, Stephanie Klein, and Jessica Huang at UCD for many hours spent looking for lamprey.