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Corps of Engineers 2004 AFEP Preliminary Research Results

NPCC Meeting April 2005

Boise, ID

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Purpose of Briefing

- The ISRP recently reviewed the AFEP process, indicating a lack of transparency
  - We are sharing what the Corps is learning and to communicate this to the Council
  - Developing a research plan to better outline what research is being performed and why

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AFEP Program

- Purpose: To produce scientific information to assist the Corps in making engineering, design, and operations decisions to support safe, efficient passage of fish past the eight mainstem Columbia and Snake River hydroelectric projects.

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How Research Results Are Used

- Baseline Information
  - Collect data necessary for design of improvements
- Decision Support
  - Hydroproject Configuration, Prototype Development, Operations
- Monitoring
  - Support of Biological Opinions, Confirmation of Decisions

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Major 2004 Research Categories

- Juvenile Fish Project Passage
  - Post Construction Evaluations
  - Spillway evaluations
  - Bypass systems
- Transportation
- Predation

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Other 2004 Research

- Adult fish
  - Lamprey, Sturgeon, Salmon, Bull Trout, Kelts
- Estuary
- Turbine Survival
- Modeling
  - Numerical fish surrogate
  - Laboratory Evaluations (pressure)

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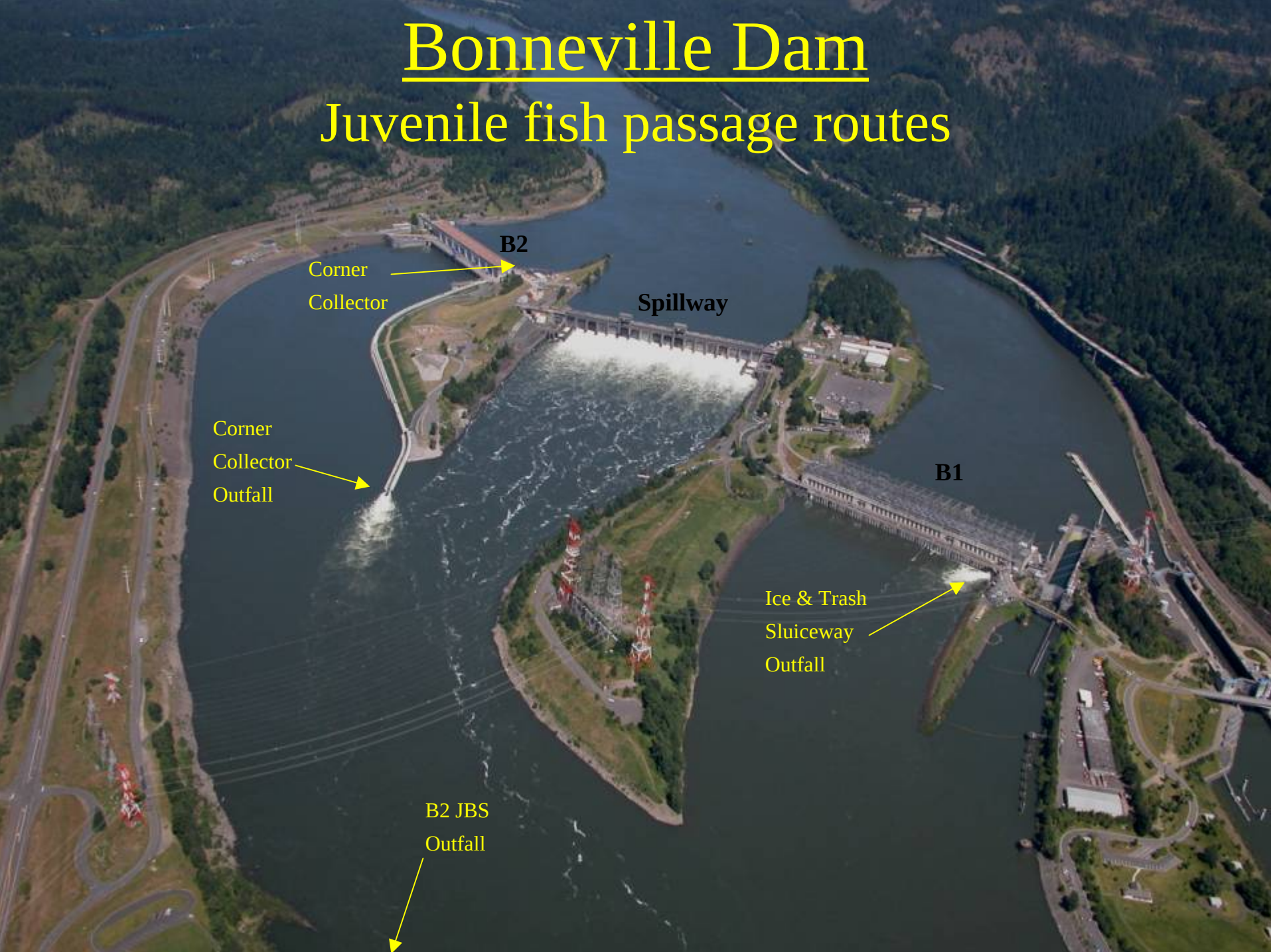
Adult Work

- Reporting: summarizing all years of data collection
- BiOp Performance Monitoring: evaluating feasibility of using PIT system instead of radio telemetry
- Post-Construction Evaluations:
  - Bonneville 2 Corner Collector
  - The Dalles Spillwall

Bonneville Dam

Juvenile fish passage routes



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2004 Operations & Objectives

- BiOp Operation
  - 75kcfs day vs. gas cap night
  - Conducted summer spill test 50kcfs 24 hour vs BiOp
- Objectives
  - B2 Corner Collector Post Construction Performance
  - Summer Spill Evaluation
  - B1 Ice and Trash Sluiceway Survival
  - B1 MGR Survival

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2004 Yearling Chinook and Steelhead

Metric	Yearling Chinook	Steelhead
Project FPE	71%	86%
B2 FPE	57% (37%*)	84% (59%*)
B2 CC Survival	100%	100%
Spill Survival	91%	98%
Dam Survival	95%	99%

* = (2002 results)

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2004 Subyearling Chinook

Metric	BiOp spill	50 kcfs spill
Project FPE	79%	57%
B2 FPE	58% (47%*)	46%
B2 CC Survival	98%	96%
Spill Survival	88%	74%
Dam Survival	89%	85%

* = (2002 results)

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2004 Summary Results

- Survival through the B1 Ice & Trash Sluiceway during BiOp operations was second only to the B2 Corner Collector
  - Yearling chinook = 100%; Steelhead = 99%; Subyearling Chinook = 94%
- Survival through the MGR Turbine was high (95-96%)

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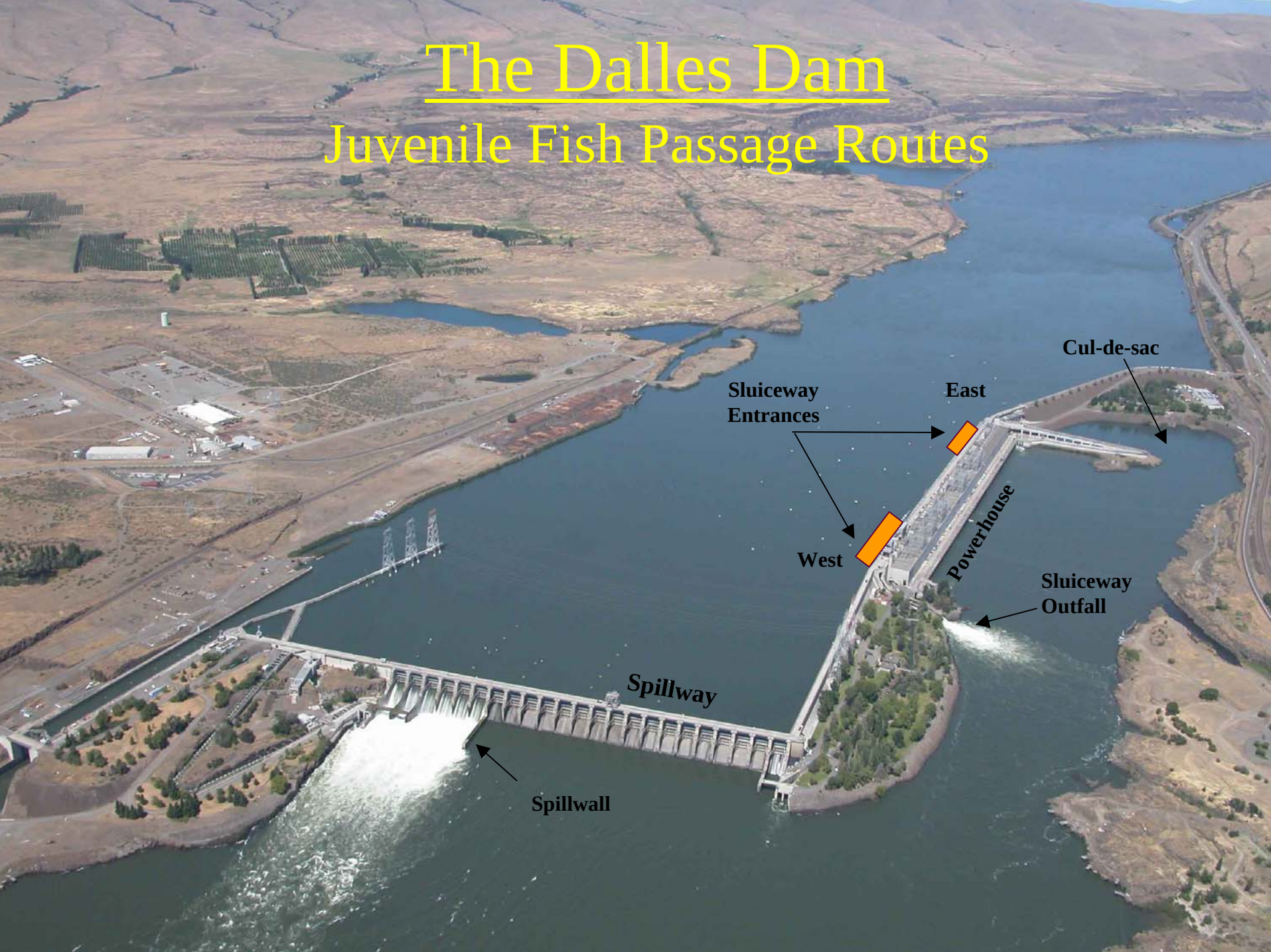
Adult Passage

- B2 CC operation did not affect adult fish fallback
- B2CC operation significantly reduced turbine passage at B2 for steelhead kelts
  - B2 FPE increased from 62% in 2002 to 88% in 2004, Project FPE = 91%
- Forebay residence time for kelts was significantly reduced from 2002

The Dalles Dam

Juvenile Fish Passage Routes



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The Dalles Dam

2004 Operations & Objectives

- BiOp operation
  - 24 hour spill 40% of total flow
- Study Objectives
  - Evaluate post-construction performance of the spillwall and new spill pattern
  - Evaluate fish behavior in the forebay to provide design information for a behavioral guidance structure

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The Dalles Dam

Spillwall Post-construction Results

- Direct survival rates were high for all conditions and all release points at bays 2 and 4 (range 98.1-99.8%) but low (85%) for fish hand-tossed into a vortex at Bay 6
- Spill passage efficiency was high for yearling (84%) and subyearling (78%) Chinook
- 2004 Spillway survival estimates were slightly higher for yearling Chinook (91% vs. 88%) but lower for subyearling Chinook (91% vs. 86%) when compared to 2002
- New spill configuration had no negative effect on adult passage or kelts

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The Dalles Dam

Fish Behavior Results

- Yearling Chinook and steelhead that approached near the powerhouse at the upstream end were most likely to pass through turbines.

- Yearling Chinook and steelhead that approached the dam mid-river and north of mid river were most likely to pass the dam via the spillway.

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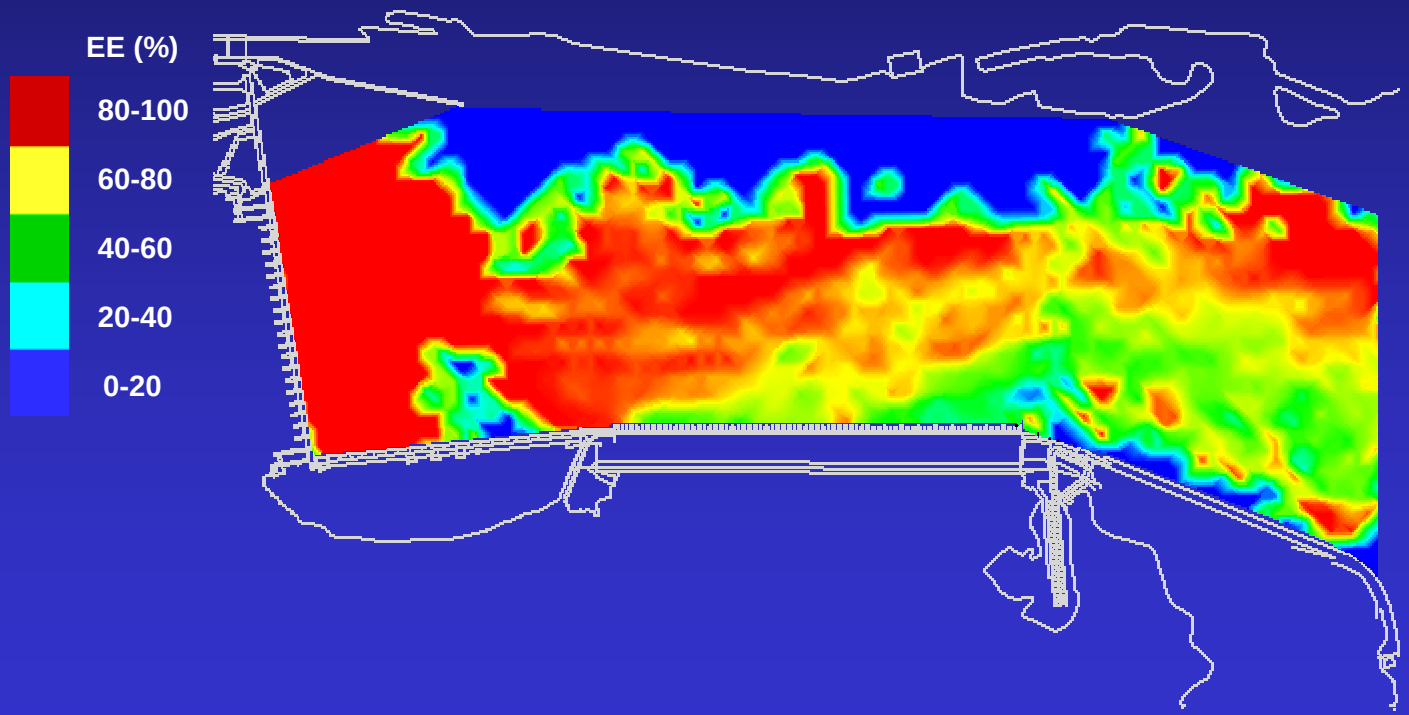
Fish Behavior Results

Yearling Chinook Salmon: Spillway Passage



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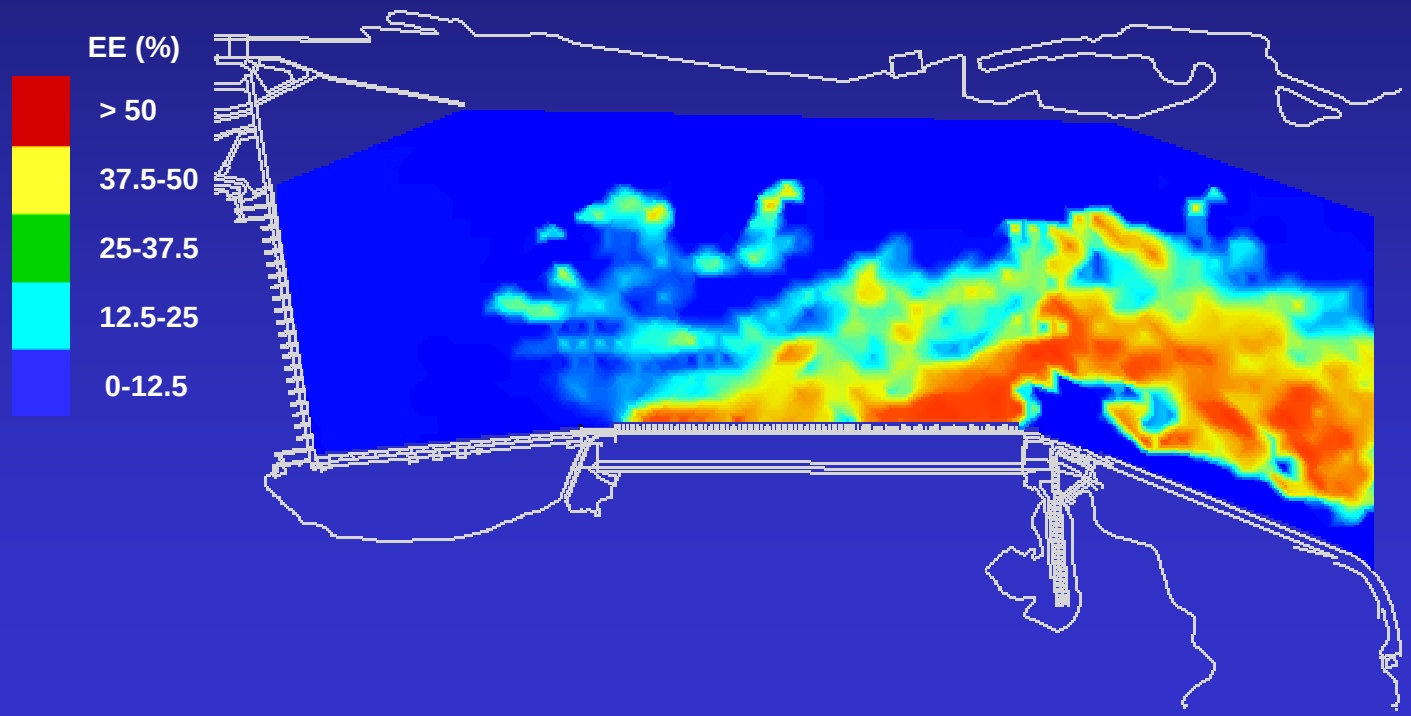
Fish Behavior Results

Yearling Chinook Salmon: Turbine Passage



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McNary Dam

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McNary Dam

2004 Operations and Objectives

- BiOp Operation
  - Spring = No Spill day, Gas Cap at Night
  - Summer = Maximize transportation
  - Powerhouse capacity typically causes forced spill above ~170 kcfs

- Objectives
  - Examine fish condition as related to McNary Modernization activities
  - Establish baseline survival information for evaluating surface bypass improvements

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McNary Dam

2004 Research Results

- McNary Modernization
  - Turbine loading similar to proposed higher turbine discharges caused greater descaling and mortality to bypassed fish

	Yearling Descaling		Subyearling Descaling	
	Shallow	Full Depth	Shallow	Full Depth
60MW	0.4%	1.6%-2.8%	0 - 5.6%	2.6%
80MW	0.9%	5.5-6.5%	-	-

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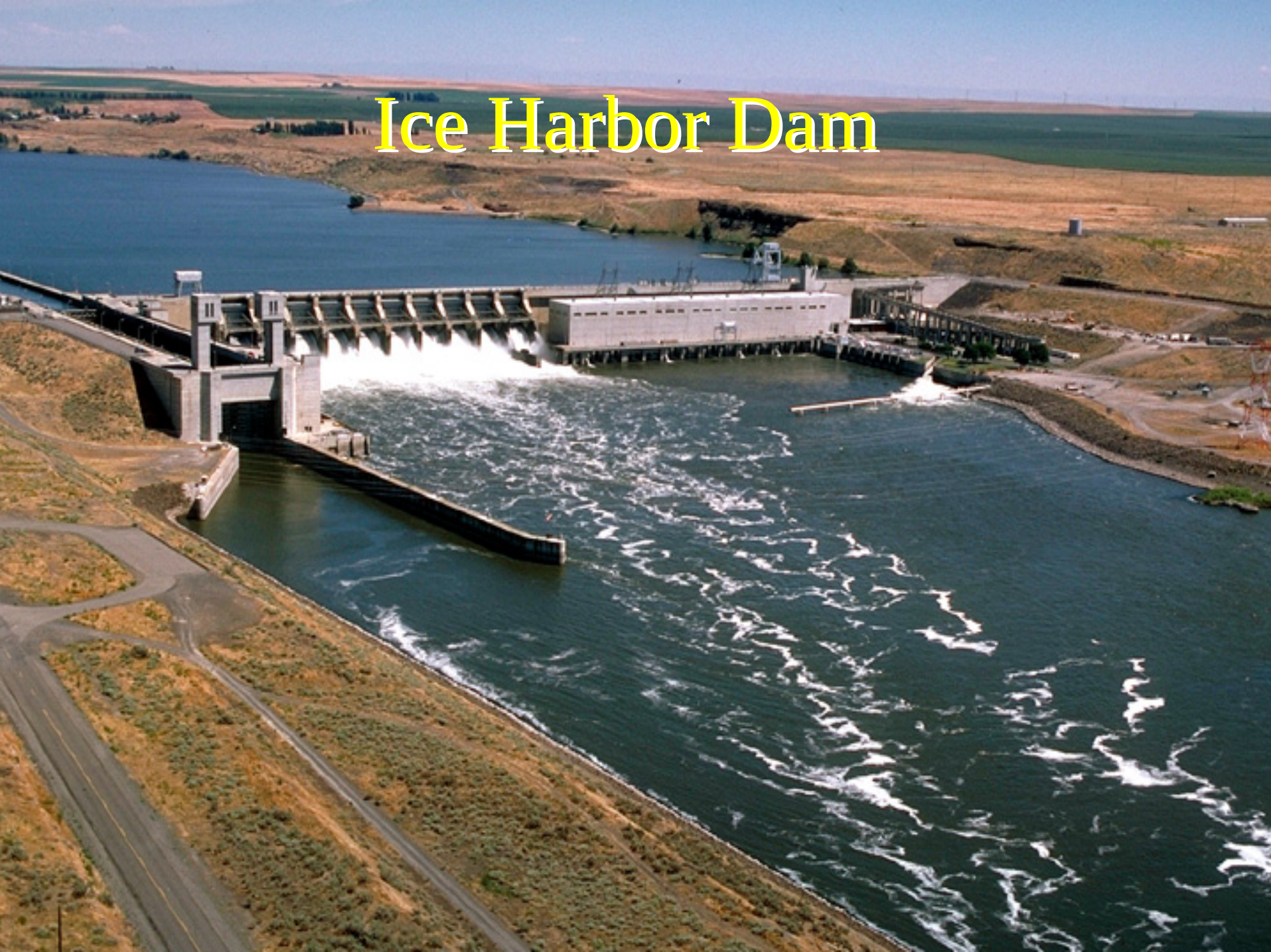
McNary Dam

2004 Research Results

- Spillway survival high for spring migrants
- Spill passed a large proportion of fish
- Dam survival has not been confirmed
  - Still analyzing turbine information

	Yearling CH	Steelhead	Subyearling CH
FPE	79%	94%	42%
SPE	51%	72%	-
Spill Survival	97%	99%	-


Ice Harbor Dam

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Ice Harbor Dam

2004 Operations and Objectives

- BiOp Operation
  - 45 kcfs day, gas cap night
  - Tested Bulk 24 hrs to gas cap and flat 24 hrs at 45kcfs
- Study objectives
  - Assess dam passage survival
    - Assess spillway survival for spring and summer migrants
    - Compare bulk versus flat spill
  - Assess passage timing

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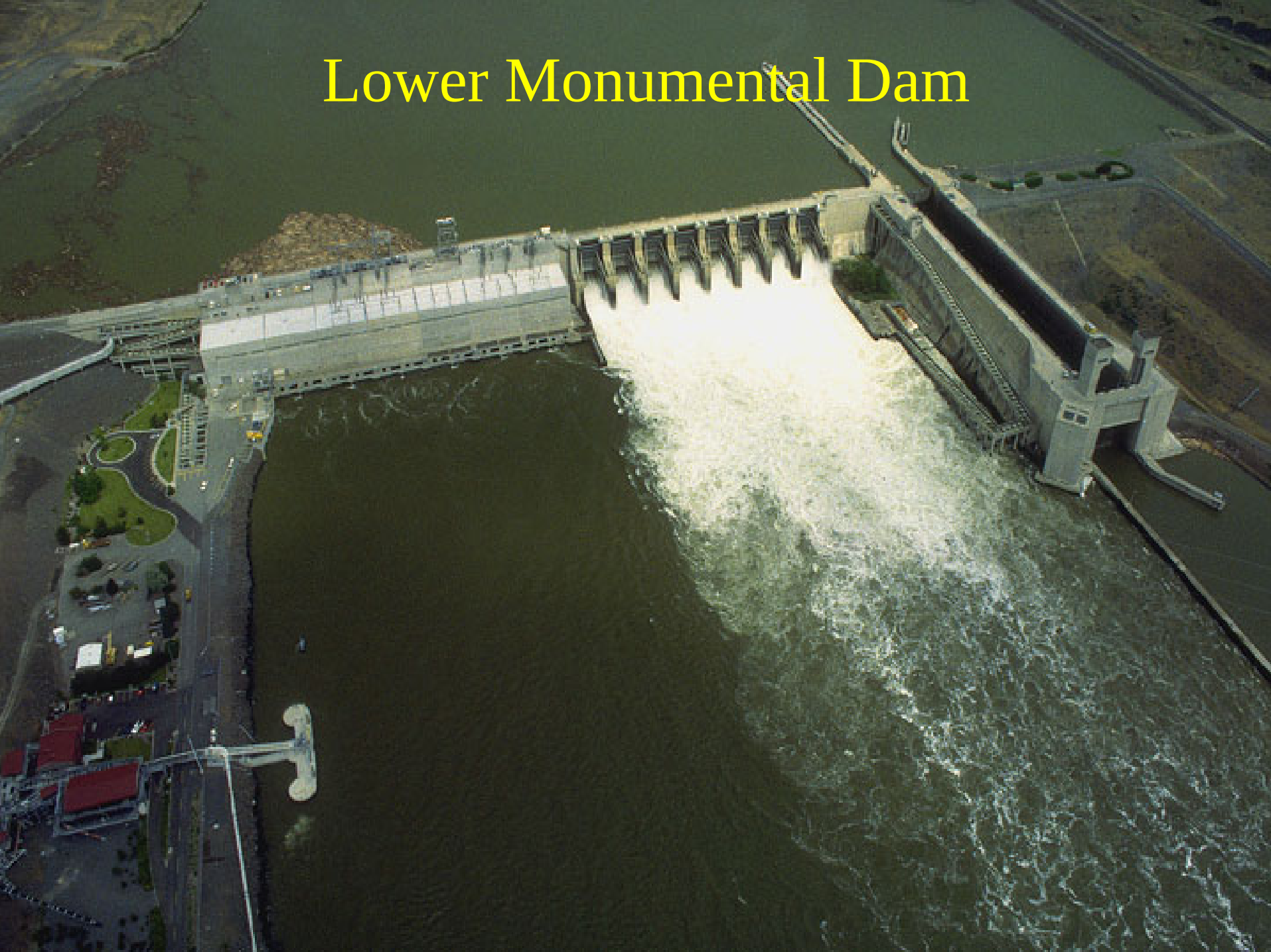
Ice Harbor Dam

2004 Research Results

- Bulk spill provided higher dam survival *
- Egress was similar but forebay delay decreased for yearling Chinook (Bulk = 1.4 vs. 2.4 hours)
- Other metrics for subyearlings did not change

	Yearling CH		Steelhead		Subyearling	
	Bulk	Flat	Bulk	Flat	Bulk	Flat
FPE	100.0%	98.0%			94.6%	97.0%
SPE	99.0%	90.0%			93.2%	93.3%
Spill Survival	97.4%	95.2%	97.7%	97.7%	97.5%	93.5%
Dam Survival	93.0%	89.8%	87.0%	87.0%	88.3%	86.4%


Lower Monumental Dam

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Lower Monumental Dam

2004 Operations and Objectives

- BiOp Operation
  - No spill required
  - Bulk spill, 13 days, 24 hours ~28kcfs
- Research Objectives
  - Evaluate passage behavior
  - Estimate project survival
    - Dam and Route Specific
    - Bulk spill versus no spill condition

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Lower Monumental Spill

- Most fish approached the dam at same location (Spillbays 7&8) regardless of spill
- Most mortality occurred in the forebay
- 2003 flat spill = 83%, 2004 Bulk Spill = 97%

	Yearling CH	
	Bulk	No
FPE	98.4%	72.1%
SPE	89.3%	-
Spill Survival	96.1%	-
Dam Survival	91.9%	75.0%
Powerhouse Surv	na	91.1%

Avian Predation

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Avian – Estuary

Good News!

- Population of Caspian Terns is flat @ 15,000 adults
- Overall drop in juvenile salmonid predation rate
  - 45% of diet (1999) 17% of diet (2004)
  - 15 Million (1999) 3 Million (2004)
  - Management actions and prey availability
- Tern management Final EIS
  - redistribute 2/3 colony to alternate sites in WA, OR, CA.

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Avian – Estuary

Bad News!

- Population of Double Crested Cormorants appears to be increasing
  - 100 (1989) 18,000 (2004)
  - Composition of diet is about 5% salmonids
  - Total consumption estimated at 6.4 Million
- Management actions are being considered

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Avian - McNary Reservoir

- Crescent Island Tern Population was stable, 530 pr
- Salmonids composed 70% of tern diet or an estimated 1 Million salmonid smolts (2004)
- Estimates of take on SR steelhead was about 35%
- 18% all PIT tagged steelhead leaving Lower Monumental were detected on Crescent Island.
- Variable survival of steelhead through each reach


94.4% (0.6)
76.0% (1.2)
84.0% (1.3)

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Marine Mammal Predation

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Marine Mammal Predation at Bonneville Dam

- Species, Numbers, & residency are up
  - Steller's SL, California SL and Harbor seals

	2002	2003	2004
Individuals	31	111	105
Avg per day	4.4	13.3	13.7
Days	58	71	97

- Behavior has changed
  - Observed hauling out at the spillway
  - Observed in the fish ladders
  - Observed sleeping around the dam

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Marine Mammal Predation at Bonneville Dam

- Success rate on Spring Chinook appears to be increasing
  - 2002 = (.3%)
  - 2003 = (1%)
  - 2004 = (2%)


Transport

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Transport

2004 Research Objectives

- Continue to improve the transport process
- Continue comparisons to refine operations
  - McNary for Mid Columbia Stocks
  - Finalizing Snake River spring migrants
  - Working on developing Fall Chinook Studies

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Transport

2004 Research Results

- T/Is and SARs vary considerably in relation to seasonal timing of juvenile migration
- Wild steelhead and spring Chinook SARs

	Transported	Inriver
2001 - (WSpCH)	0.96	-
2001 - (WST)	2.33	-

- WSSCH CSS study = 1.3, .14 or a T:I = 9:1
- HSSCH CSS study = 1.0, .04 or a T:1 = 25:1

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Transport

2004 Research Results

- Studied behavior of fish after release
  - Resulted in a proposed new barge release site in the estuary to increase post release survival

- Historic data analysis study suggested a "better" transport initiation date
  - Initiate at 9.26C or April 22 for Spring Chinook
  - Initiate at 8.90C or April 19 for Steelhead

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Transport

2004 Research Results

- Fish transported as juveniles have higher stray rates, fallback rates and unaccounted loss as adults*

	Pemanent Stray		Fallback		Unaccounted Loss	
	Transp	Not Transp	Transp	Not Transp	Transp	Not Transp
Sp/Su Chinook	3.6%	0.8%	17.3%	7.9%	14.7%	6.2%
Steelhead	7.0%	3.9%	14.8%	9.3%	16.1%	8.4%

* - However we still typically see TIRs to Lower Granite of greater than 1

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FY05 Focus

- Research
  - Transport evaluations
  - Project survival studies for improvements
  - Other research
- Work on developing strategic plans for out year construction and research

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Acknowledgements

- Researchers:
  - Federal — USGS, NOAA, Corps, DOE
  - Universities — OSU, U of I, UW
  - Organizations — Real Time Research, Normandeau Associates, PNNL, Biomark, etc…
- District Staff
- Cooperating Agencies, States and Tribes

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Pacific Lamprey

Management and Research Program

- 2004 Results
  - Volitional LAPS at B1 pass > 8,000 lamprey out of AWS cul-de-sac
- 2004 Lamprey Summit
  - Regional mangers brought together to here status of management and research and begin focus on prioritizing critical uncertainties.
  - Supported COE efforts and focus on passage improvements
- 2005 Management and Research Focus
  - Passage improvements
    - Development of LAPS at WA shore ladder (identified as major passage problem area)
    - Improve passage monitoring with lamprey specific PIT system
    - Improve dewatering procedures to reduce stranding and mortality
  - Raise regional awareness of importance of Pacific Lamprey
  - Development of Lamprey Passage Management Plan

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Sturgeon Behavior

- To date, 127 sturgeon have been radio-tagged in The Dalles tailrace
  - A minimum of 9 were subsequently harvested
- Preliminary results indicate substantial movement occurs in the tailrace
  - Some fish ascended the ladder to the forebay and then fellback (likely through the spillway) to the tailrace multiple times
  - Some fish have exhibited extensive movements, upstream to John Day Dam and downstream to the tailrace of Bonneville Dam
  - Additional antennas have been installed to better define fallback events and movement within the tailrace

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2004 Summary Results

			Chin-0 Spill treatment	
Metric	Chin-1	Steelhead	BiOp	50 kcfs
Spill efficiency	33%	26%	50%	21%
Project FPE	71%	86%	79%	57%
B2 FPE	57%	84%	58%	46%
B2CC Survival	102%	103%	98%	96%
B2 JBS Survival	97%	95%	93%	96%
Spillway Survival	91%	98%	88%	74%
B1 Survival	91%	97%	85%	83%
Dam Passage Survival	95%	99%	89%	85%
B1 ITS Survival	100%	99%	94%	96%
B1 MGR Survival	96%	95%	---	---

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Avian – McNary Reservoir

- Foundation Island
  - Cormorant population @ under 400 pairs
  - 8% of diet estimated as smolts
- Badger Island
  - White Pelican Colony possibly increasing
  - Only 300 tags/yr detected on the island