Iteroparity in Columbia River summer steelhead: Implications for FCRPS dams

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Introduction

- Iteroparity (repeat spawning) provides genetic and demographic benefits
- Increasing iteroparity rates is a potential steelhead recovery tool
  - Kelt reconditioning
  - Kelt transportation
  - In-river passage
- Very little is known about historic or potential COLR steelhead iteroparity

Study Objectives

- Collect baseline iteroparity data for Snake and Columbia populations
  - Return rates
  - Life history (migration timing, breeding interval)
- Monitor downstream migration
- Manage adaptively

Background: Repeat Spawning in the Columbia Basin

- Up to four repeat spawning events documented
- Consecutive and skip-spawners present
- Female dominated life history
- Many hatchery kelts are present
- High repeat spawning variation

  - Differences in run types (Ocean vs. Stream maturing)
  - Geographic differences (Coast vs. Inland)
  - Annual differences

Life History: Columbia Basin

Repeat rates range from < 1% to 17%

- Differences in run types (Winter vs. Summer)
- Geographic differences (Coast vs. Inland)

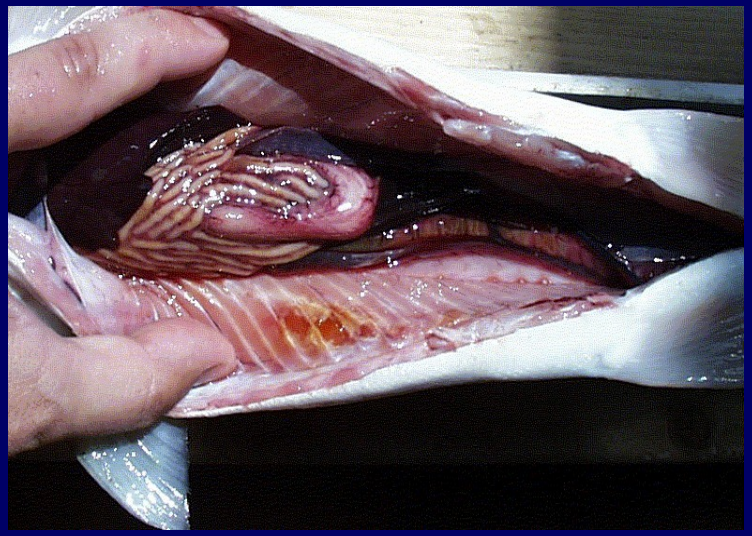
River	Iteroparity	Dams (rkm)	Reference
Kalama	>17% & >21%	0 (118)	Leider
Hood	> 9% & >13%	1 (273)	Olsen
Yakima	2%	4 (539)	Hockersmith
*Snake	2%	4-8 (520-1,500)	Whitt

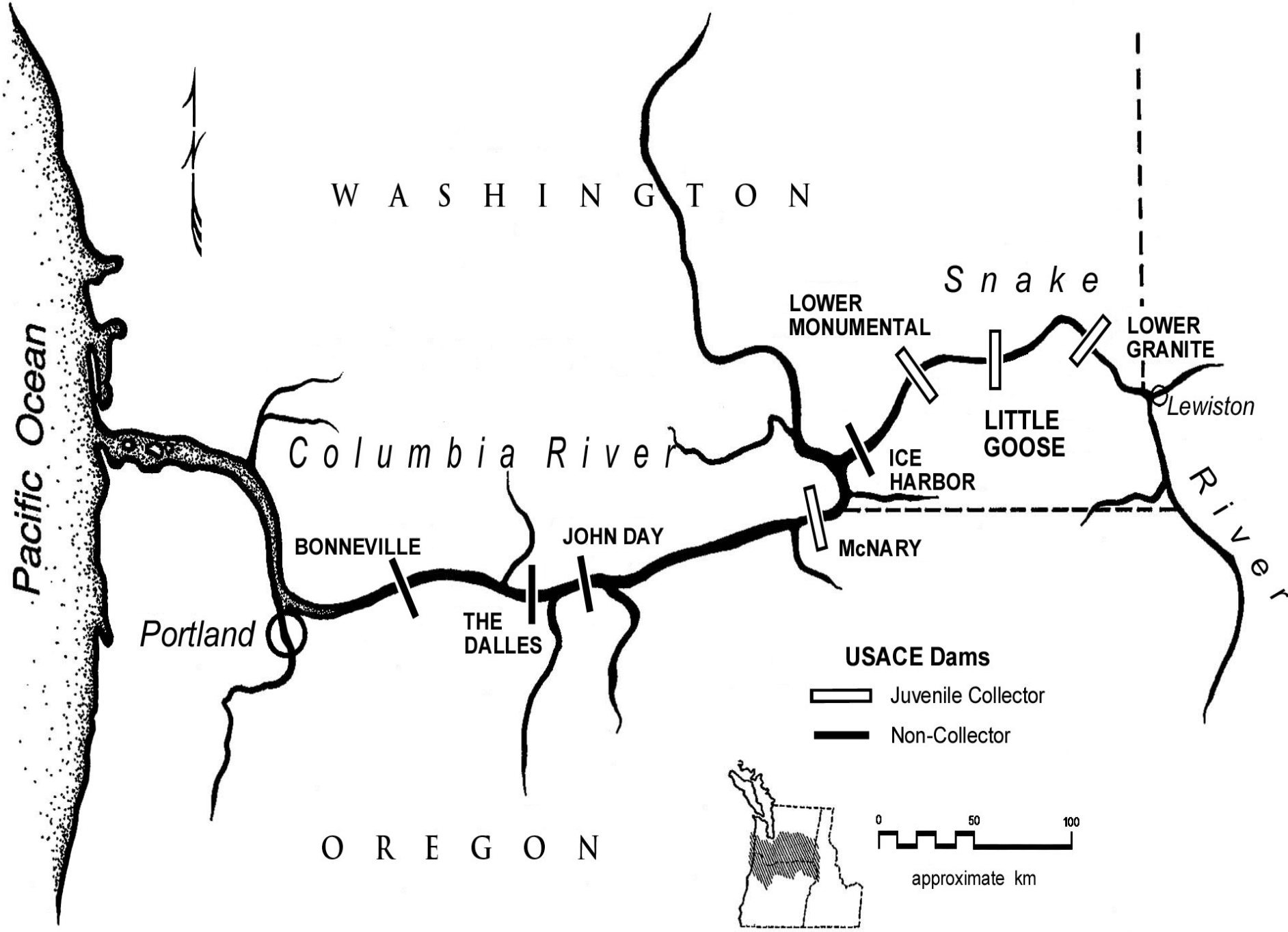
*** Current rates to be discussed**

Methods

- Collect adult steelhead in bypass systems
- Use ultrasound to identify kelts
- PIT and/or radio tag kelts
- Assign to in-river or transport treatments
- Monitor behaviors and return rates

Obj. 1 Results: Female anatomy and ultrasound images




WASHINGTON
OREGON
Pacific Ocean
Columbia River
Snake River
Portland
BONNEVILLE
THE DALLES
JOHN DAY
McNARY
ICE HARBOR
LOWER MONUMENTAL
LITTLE GOOSE
LOWER GRANITE
Lewiston
USACE Dams
Juvenile Collector
Non-Collector
0
50
100
approximate km

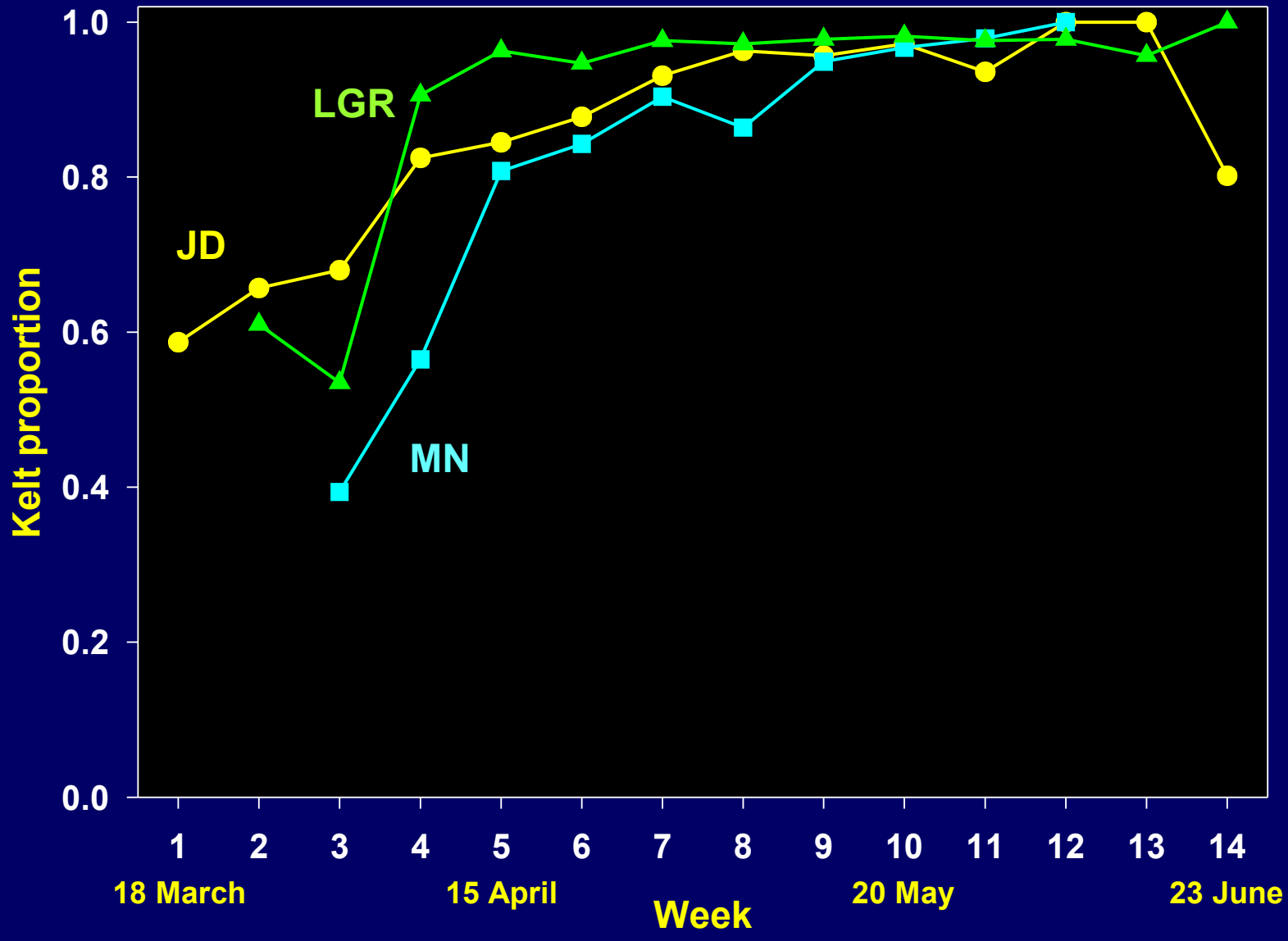
Kelt Sampling

Dam	Adults Examined	Kelts	% Kelts	Sampling years 2001	2002	2003	2004
John Day	4,394	3,560	81%	x	x	x	x
McNary	1,390	1,141	82%	x	x		x
L. Granite	7,409	7,068	95%		x	x	x
Total	13,193	11,769					

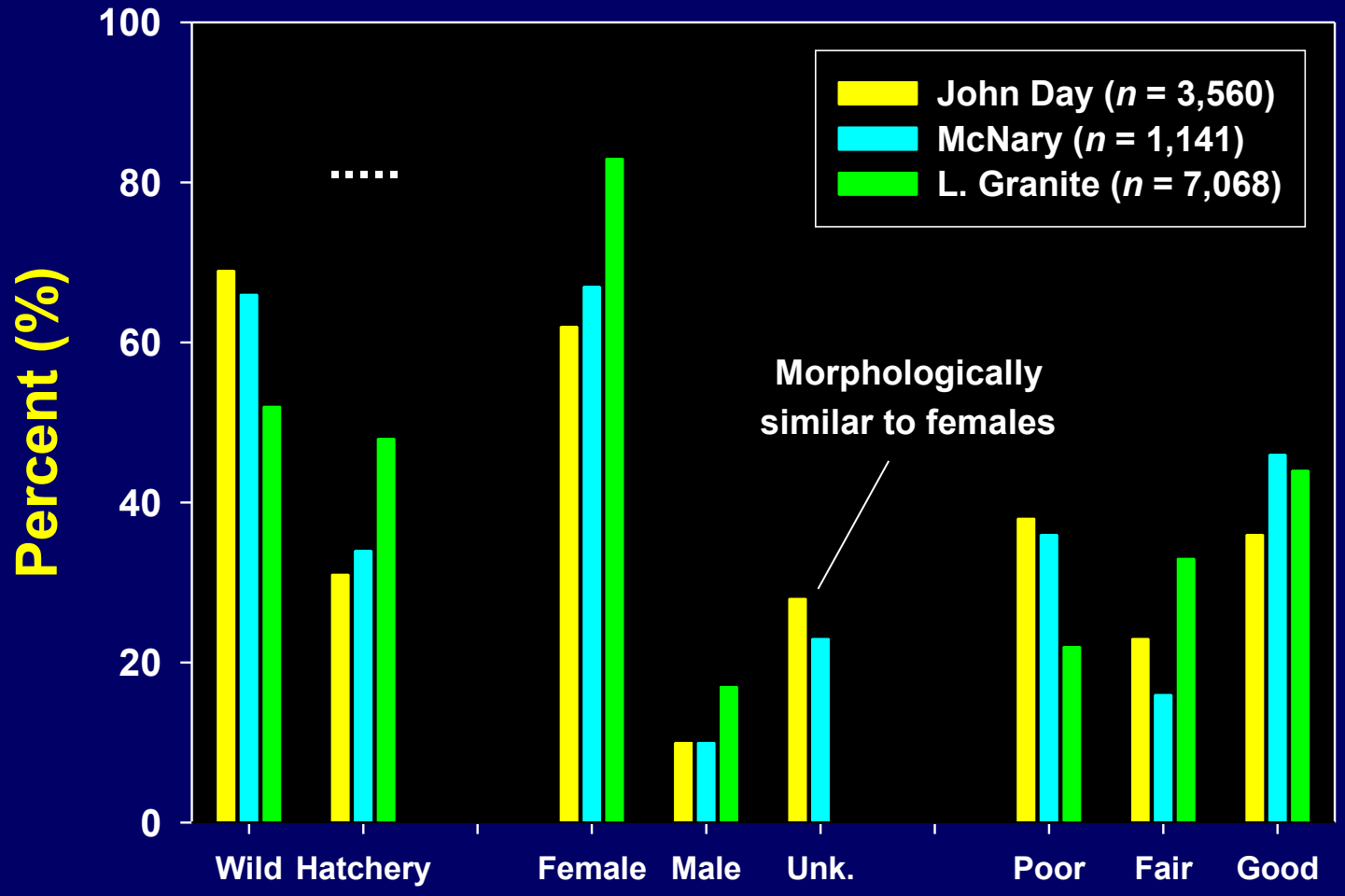
‘Good’ condition kelt

. . . not so good

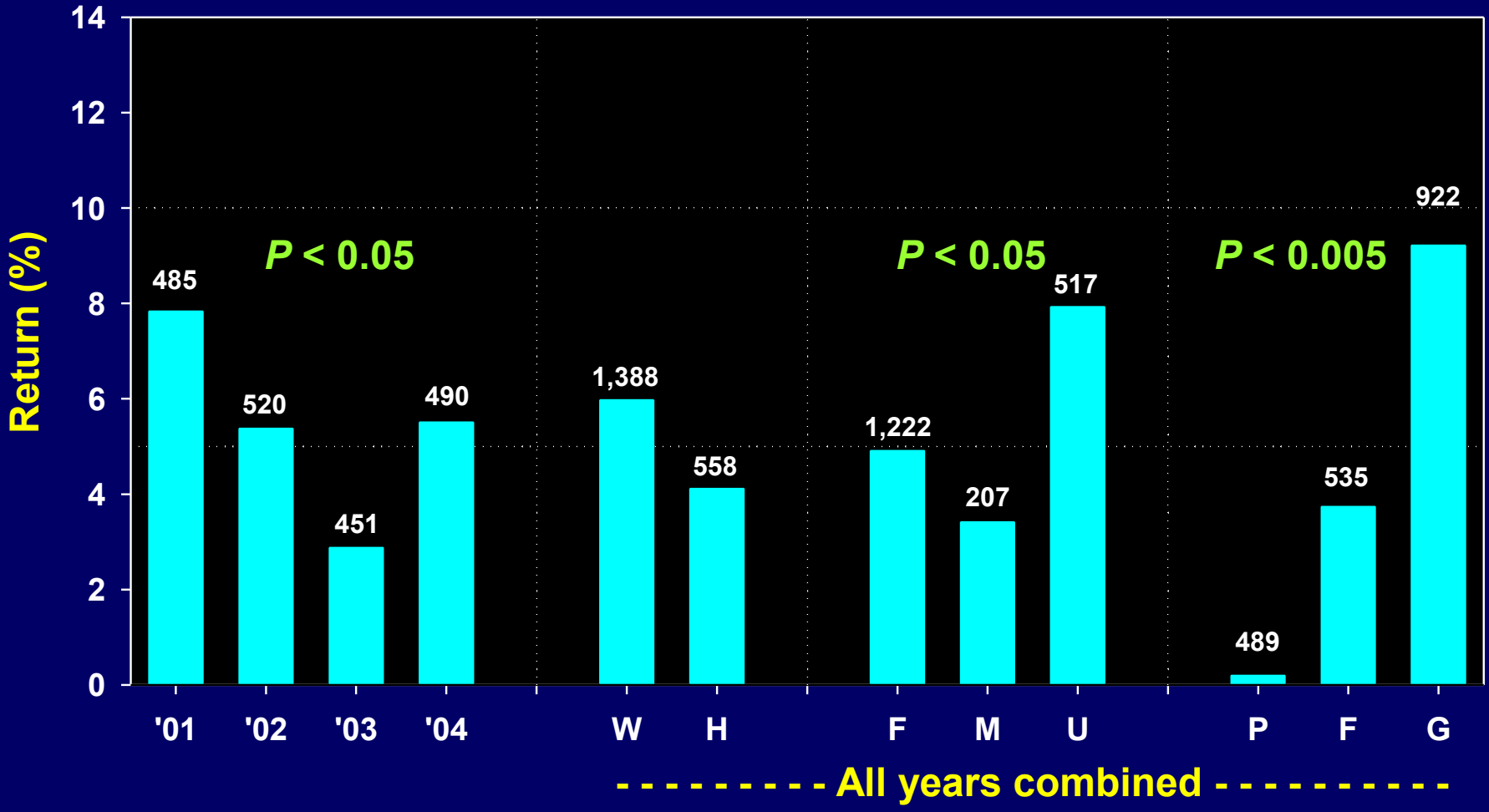
Kelt Sampling



Kelt Sampling (*n* = 11,769)

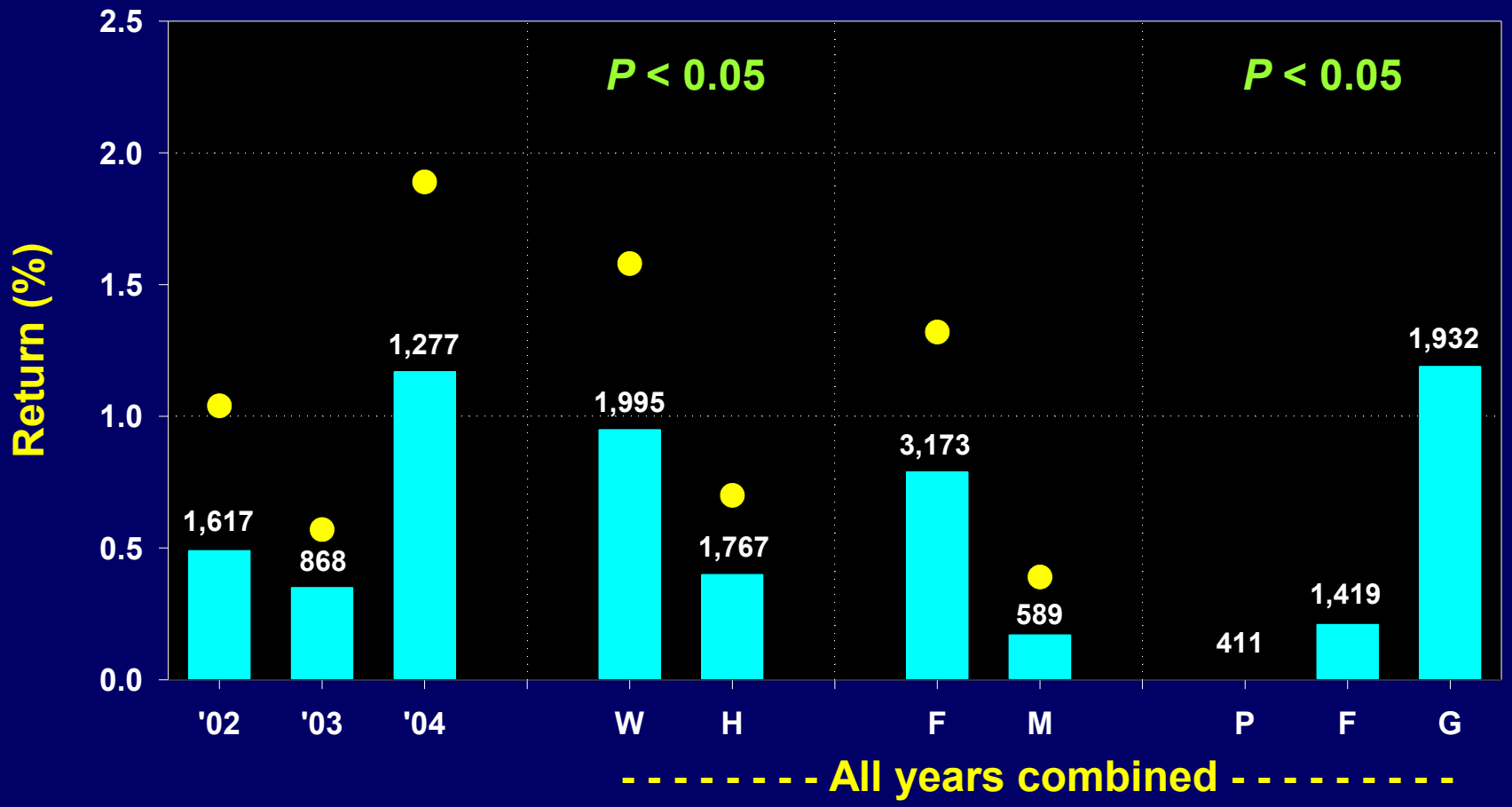


Repeat spawner returns: John Day (In-River)



► 1 poor condition kelt returned (*2002, wild, female*)

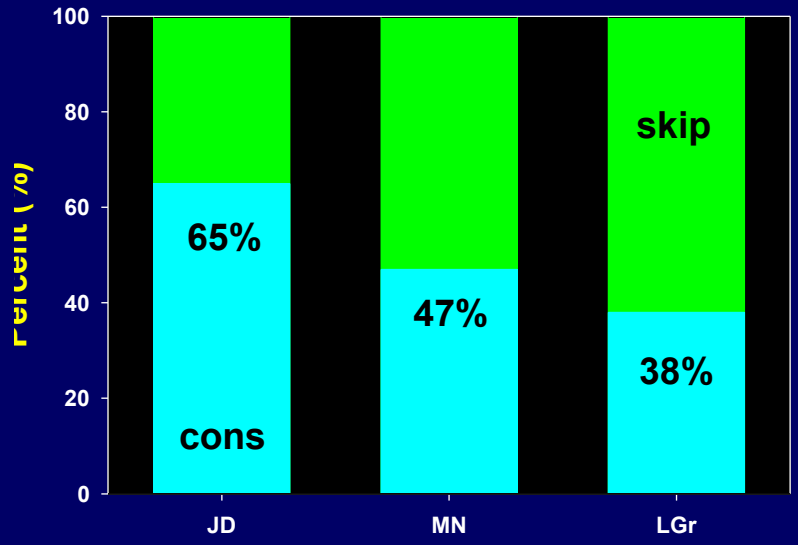
Repeat spawner returns: L. Granite (In-River)



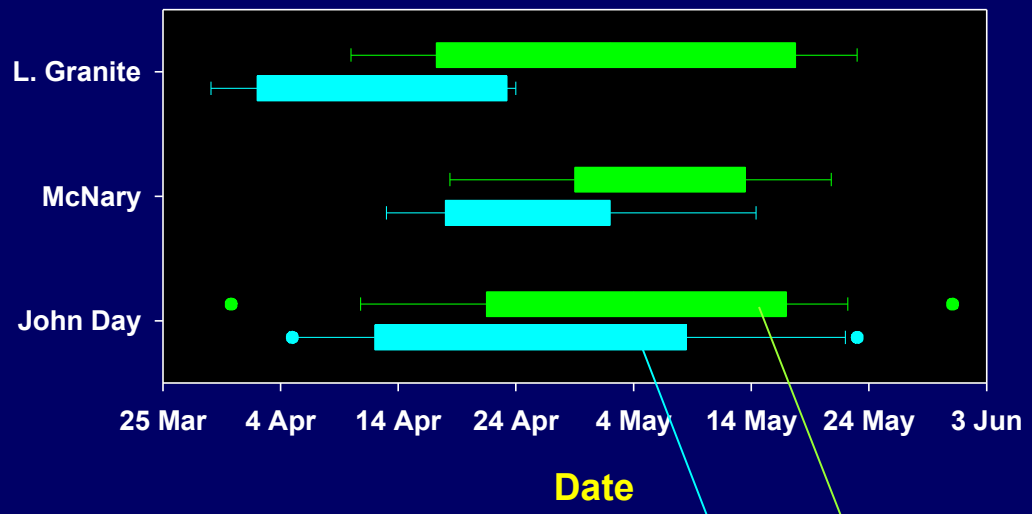
► 1 male kelt returned (*2004, wild, good condition*)

Repeat Spawner Life History

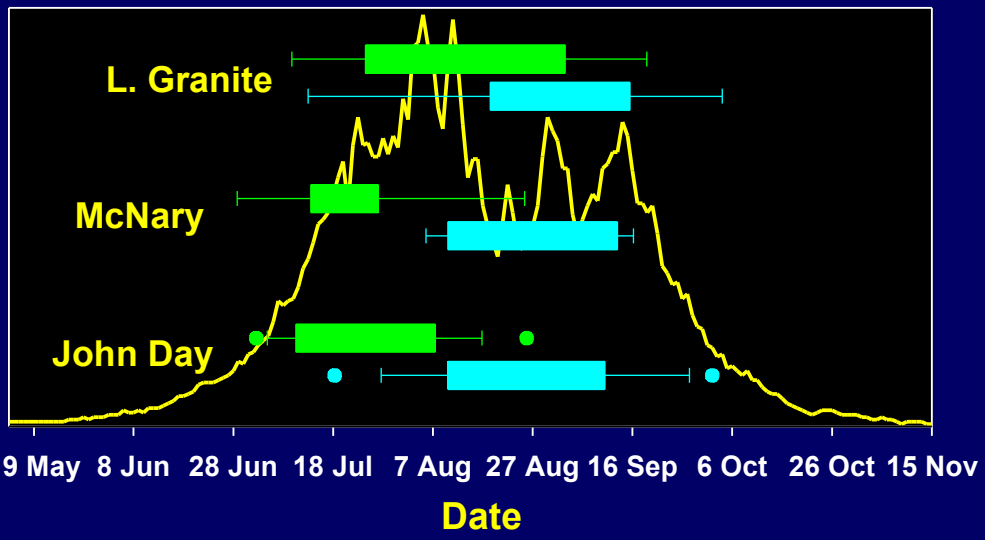
Consecutive vs skip spawners



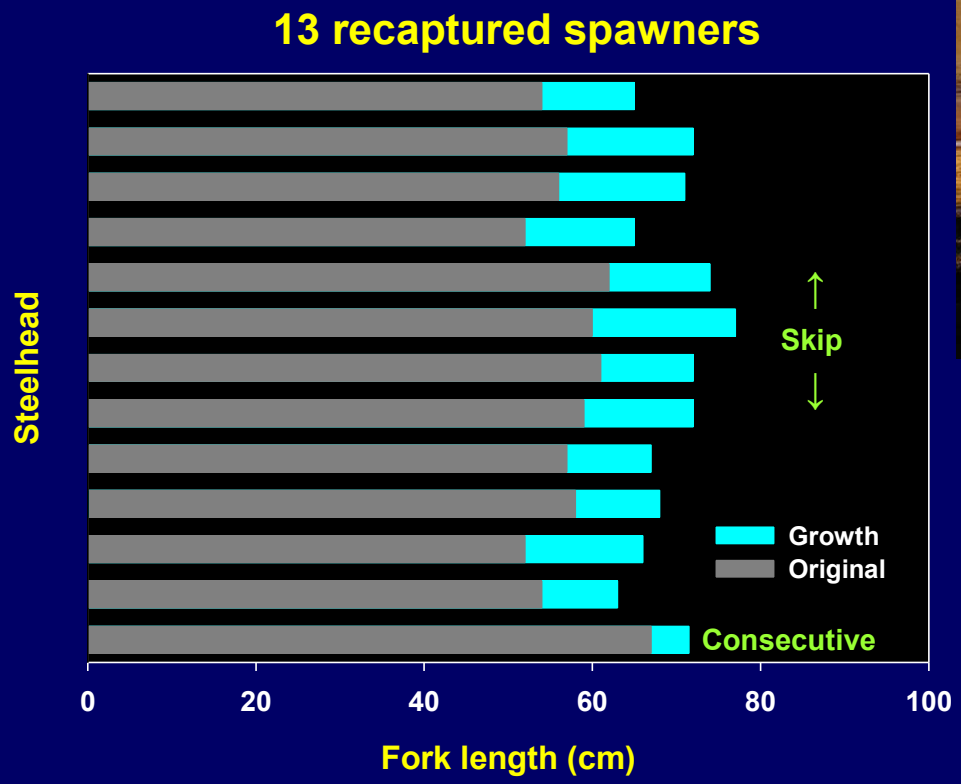
Outmigration timing



Return migration timing



Repeat Spawner Life History



◄ Mean growth = 12 cm (skips) (22%)

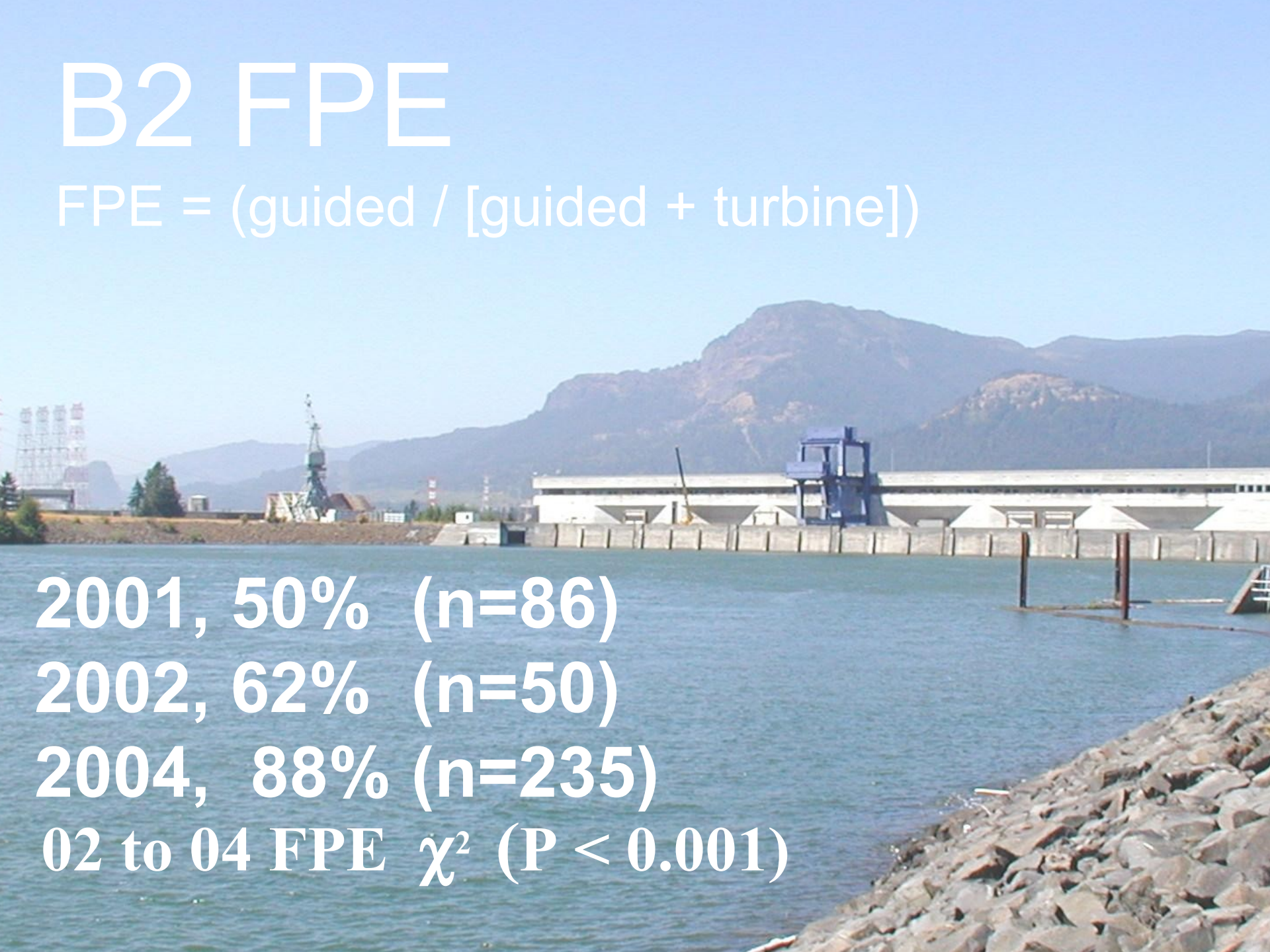
► 3-time spawners

n = 3 (0.03% of full sample; 0.10% of John Day sample)

Bonneville Dam

B2 FPE

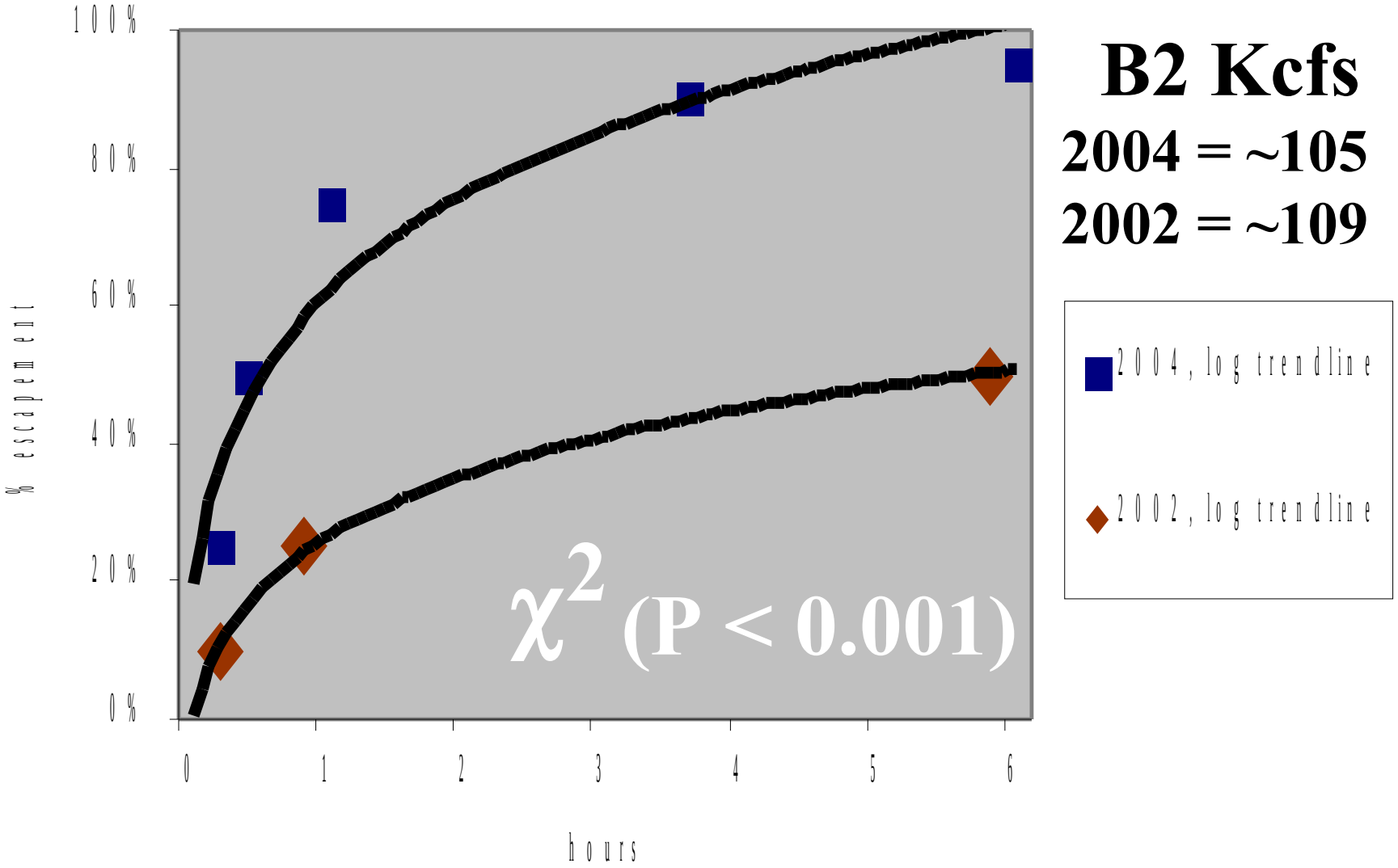
FPE = (guided / [guided + turbine])



2001, 50% (n=86)
2002, 62% (n=50)
2004, 88% (n=235)

02 to 04 FPE χ^2 ($P < 0.001$)

Kelt Escapement From the PH 2 Forebay at Bonneville Dam in Spring 2004 and Spring 2002

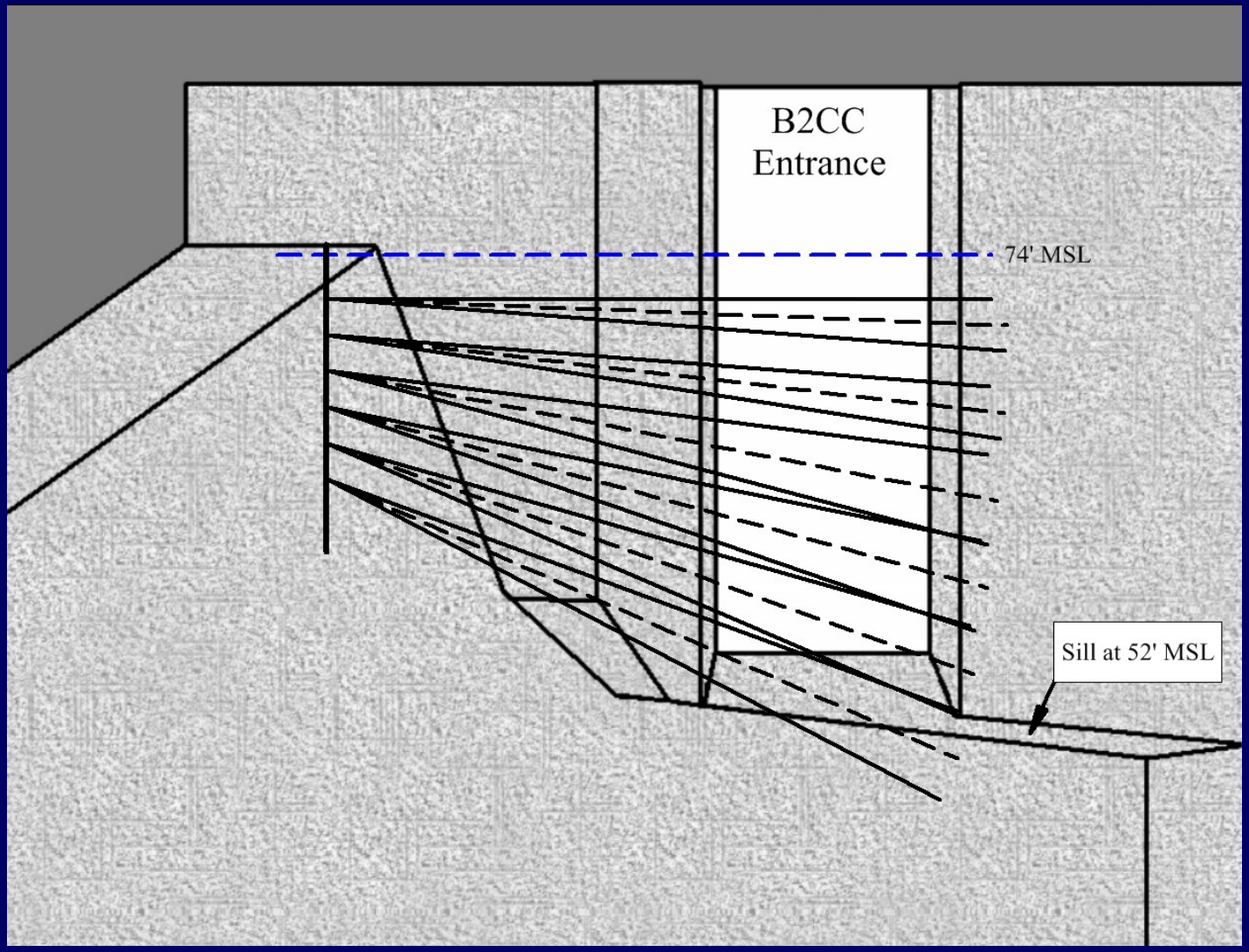


B2 Kcfs

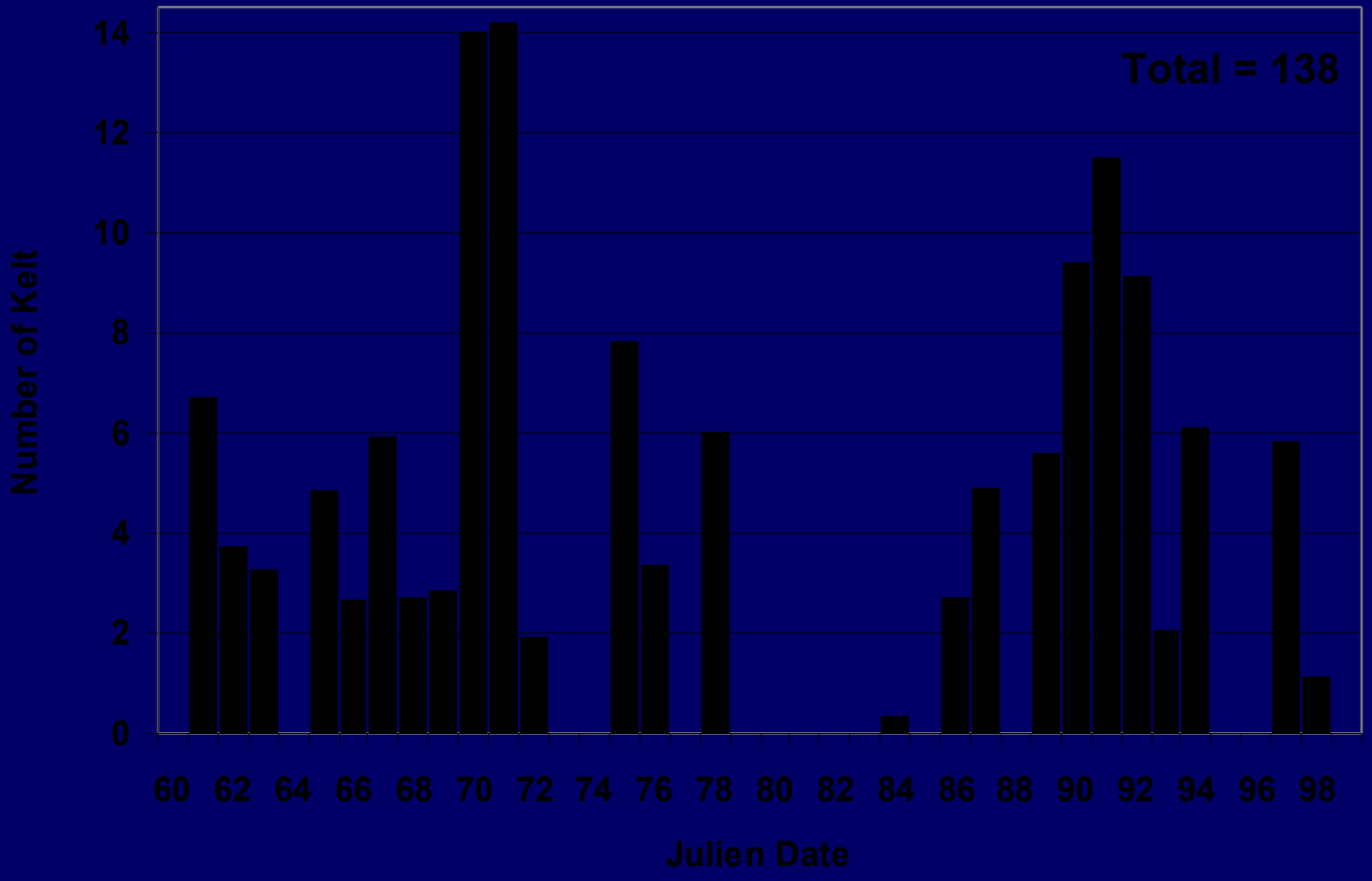
2004 = ~105

2002 = ~109

Methods



Results – Daily Passage



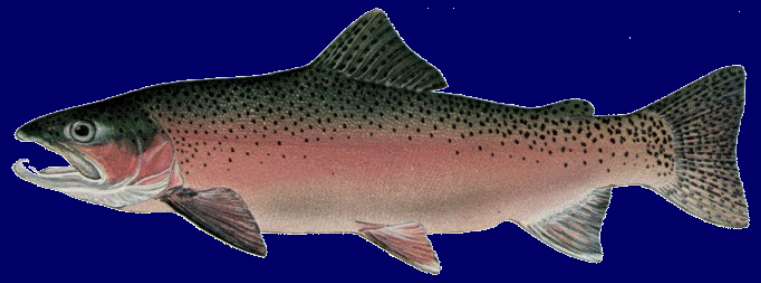
Methods

- Data quite “noisy”
- Vortices at the same target strength as kelt sized targets
- Suite of filters used on the data to remove noise but retain targets of interest

Sampled female mortality w/ immature oocytes

Summary

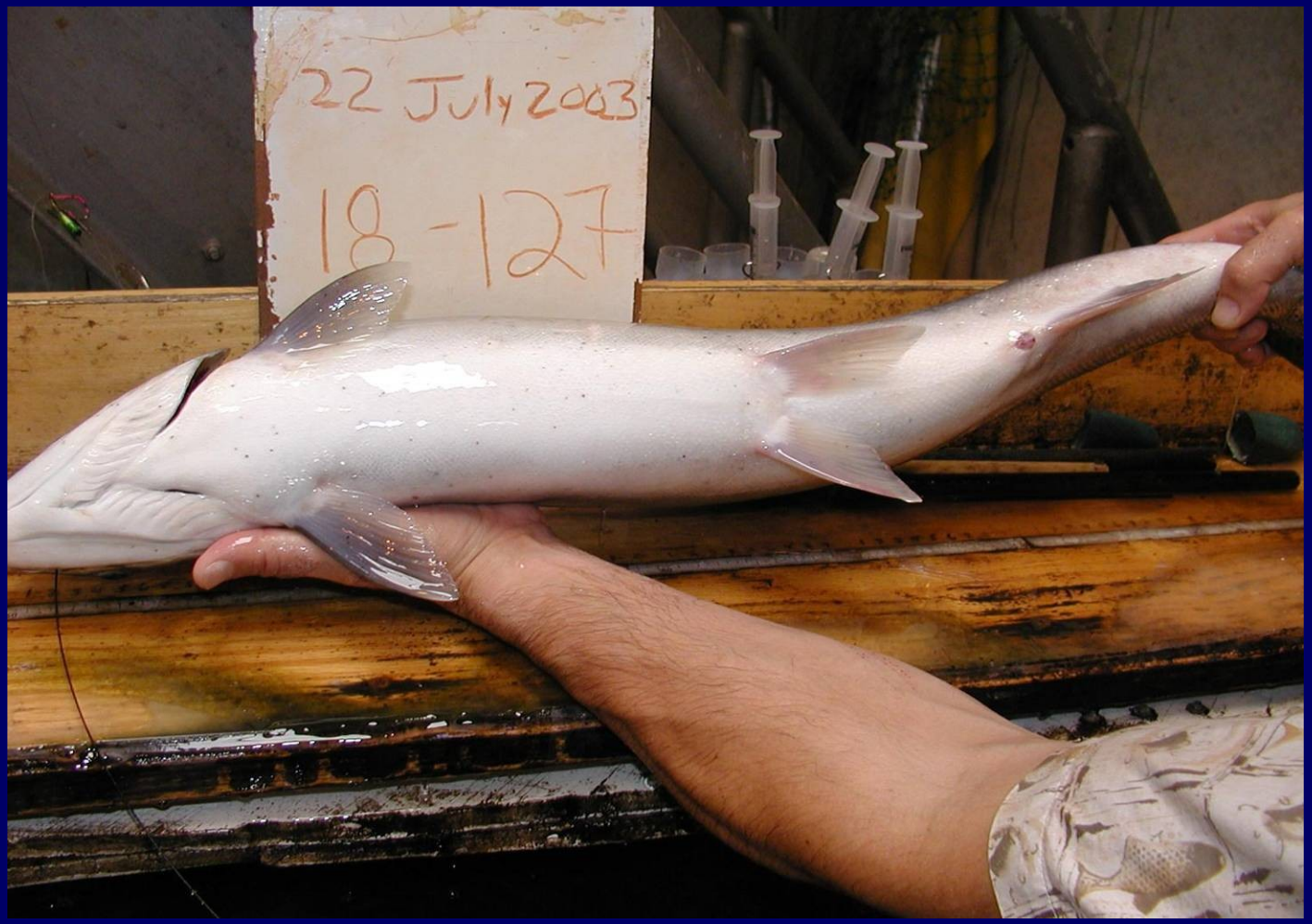
- ► Aggregate iteroparity estimates for in-river samples:
  - All fish: 5.5% (John Day), 5.4% (McNary), 0.7% (L. Granite)
  - 'Good' fish: 9.2% (John Day), 7.2% (McNary), 1.2% (L. Granite)
- ► Most likely to return:
  - Wild, female, good condition
  - Early outmigrants, relatively smaller
- ► Improved understanding of life history
- ► Contributions of repeat spawners
  - 10s – 100s of Snake River fish
  - 100s – 1000s of Columbia River fish



- ► Continuing analyses:

1) Seasonal operations to enhance return rates
2) Effects of river and ocean conditions

Questions ?



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J. Dalen, P. Madson, M. Jonas, B. Nagy - And many others!