# 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)

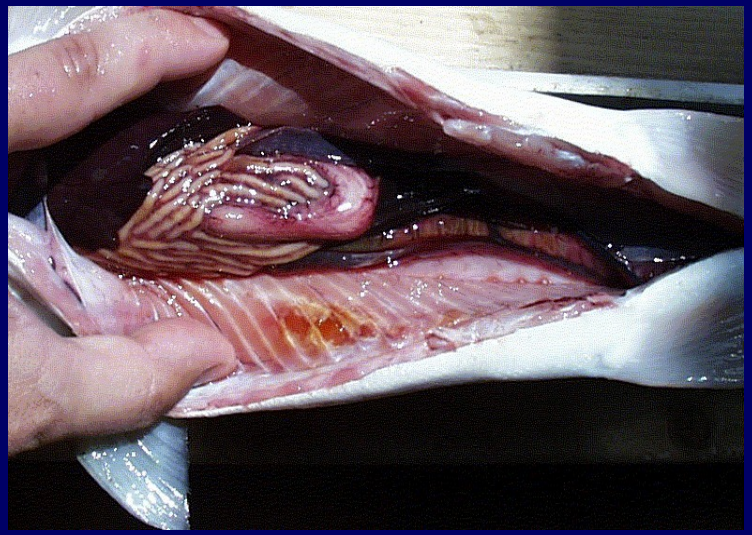
| River | Iteroparity | Dams (rkm) | Reference |
|---|---|---|---|
| Kalama | >17% & >21% | 0 (118) | Leider |
| Hood | > 9% & >13% | 1 (273) | Olsen |
| Yakima | 2% | 4 (539) | Hockersmith |
| *Snake | 2% | 4-8 (520-1,500) | Whitt |

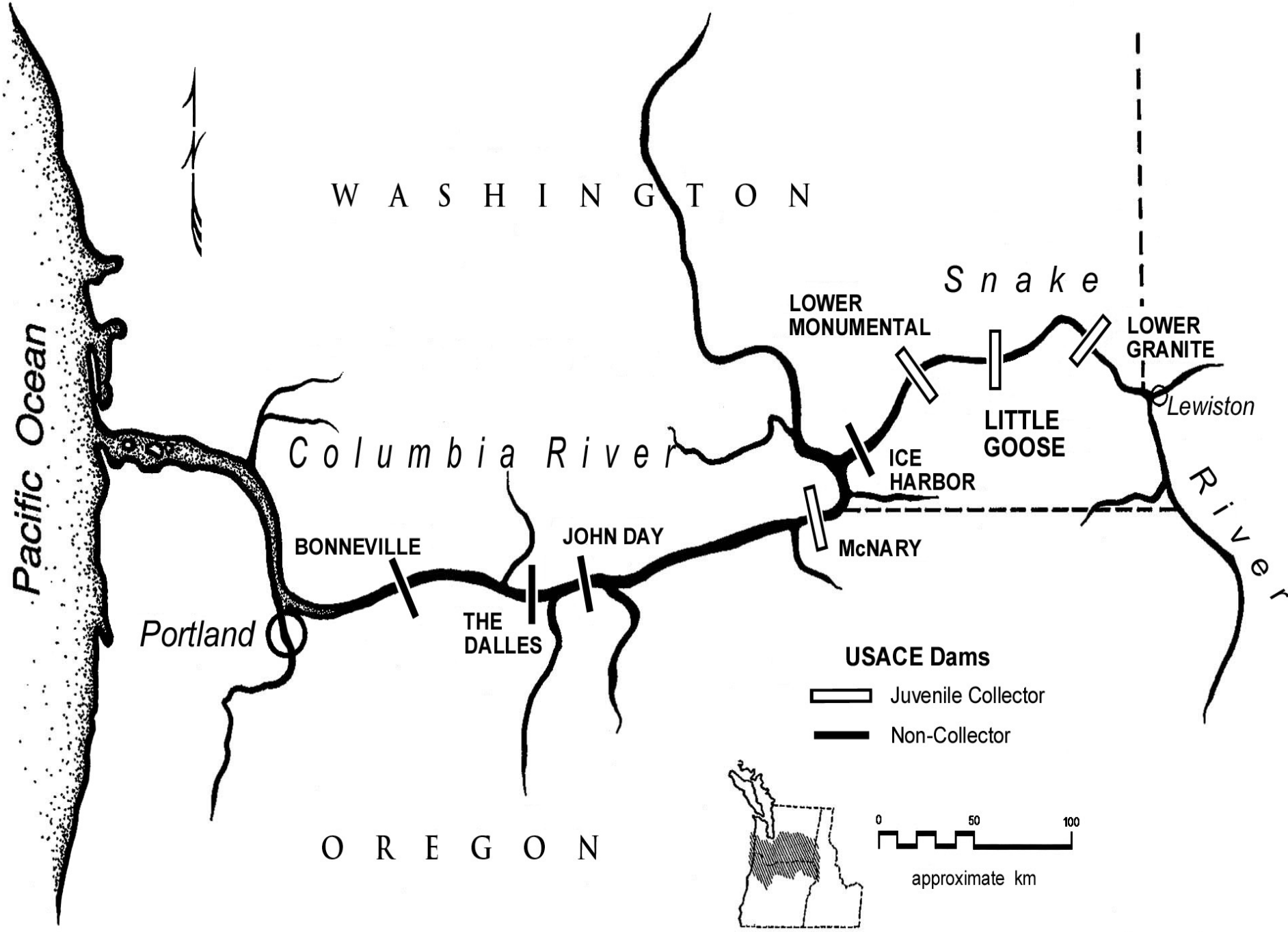
*** Current rates to be discussed**

# 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

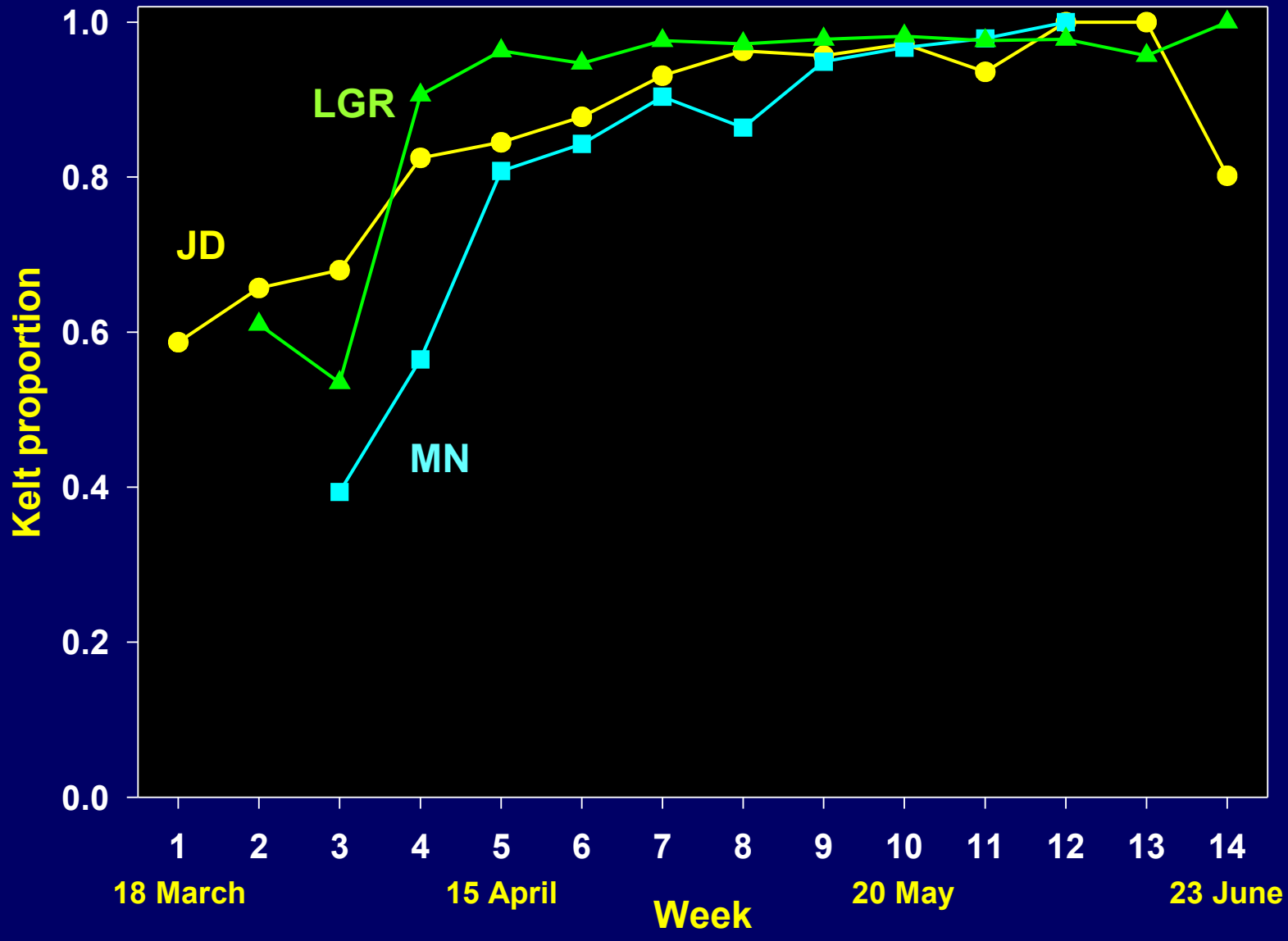
# Kelt Sampling

| 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 | | | | | |

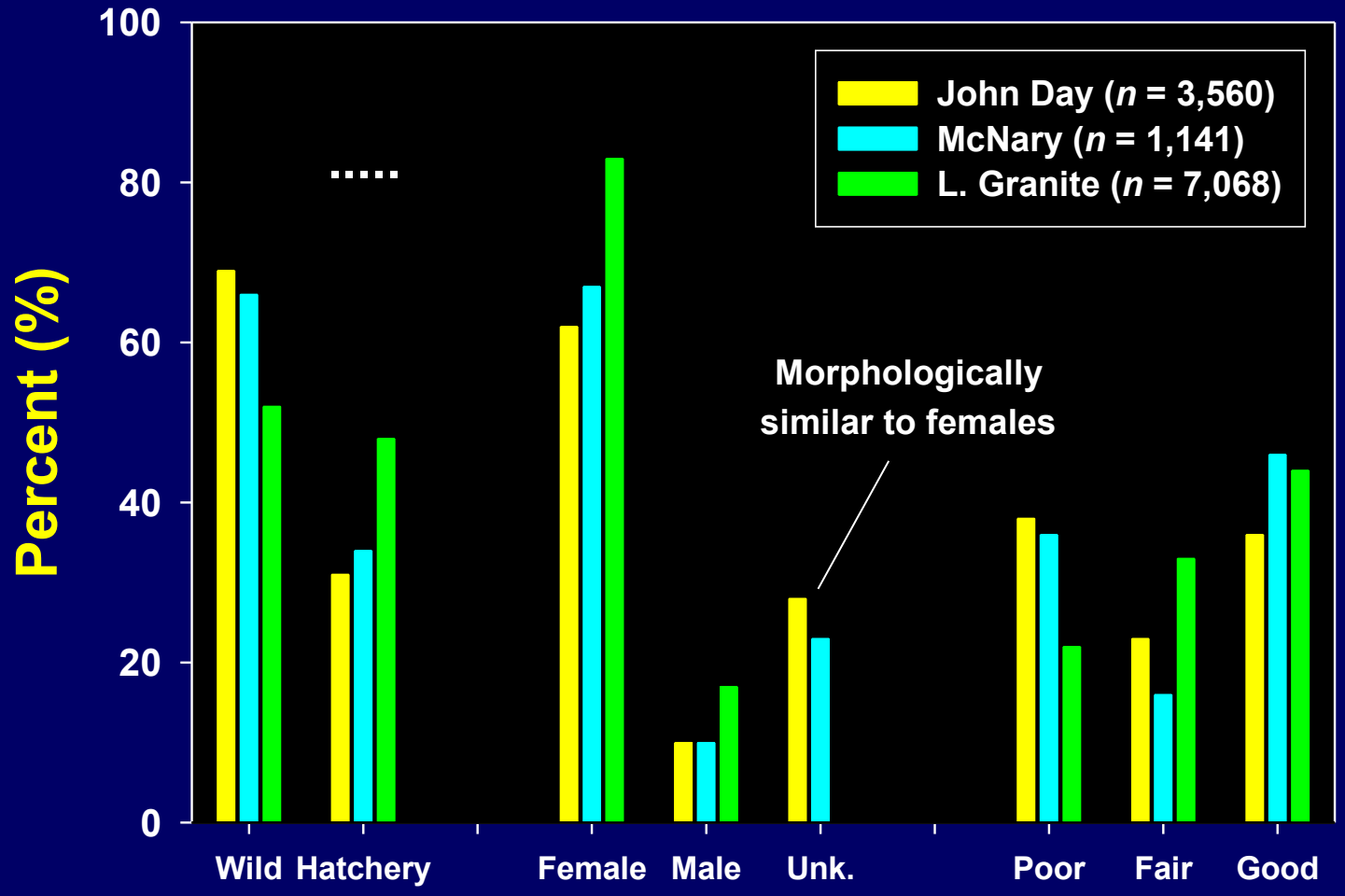
‘Good’ condition kelt

. . . not so good

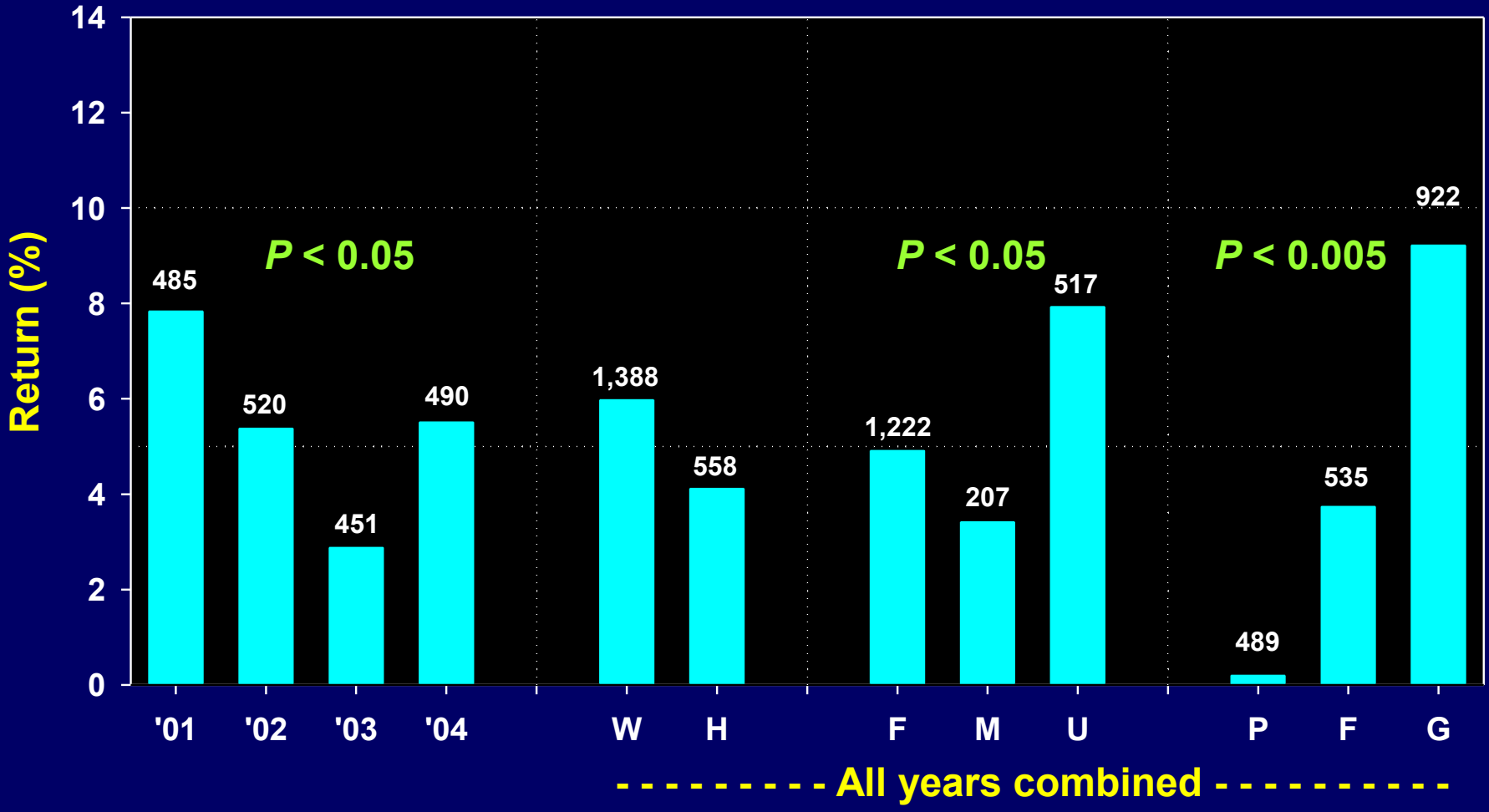
# Kelt Sampling



# Kelt Sampling (*n* = 11,769)

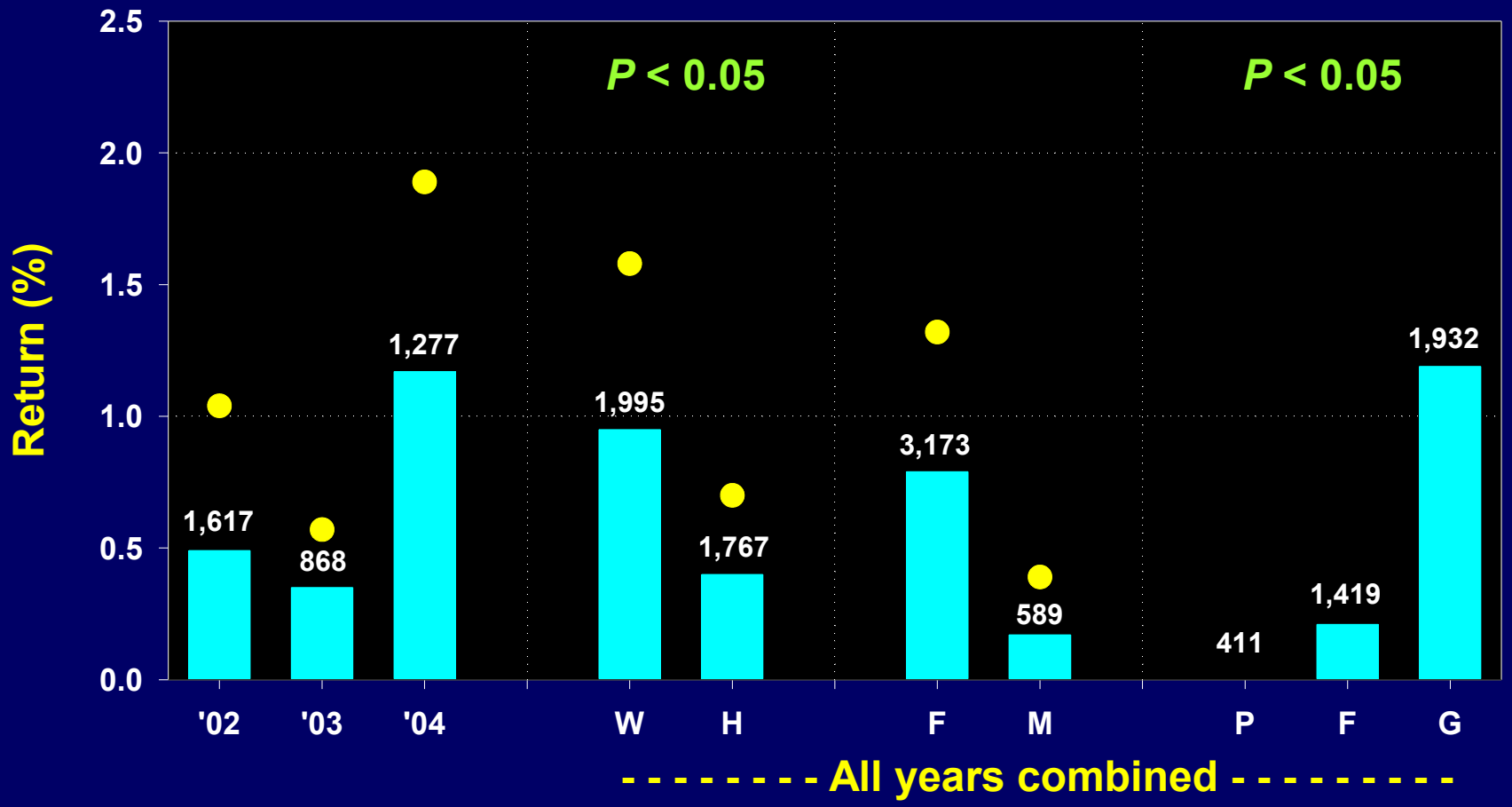



# Repeat spawner returns: John Day (In-River)




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

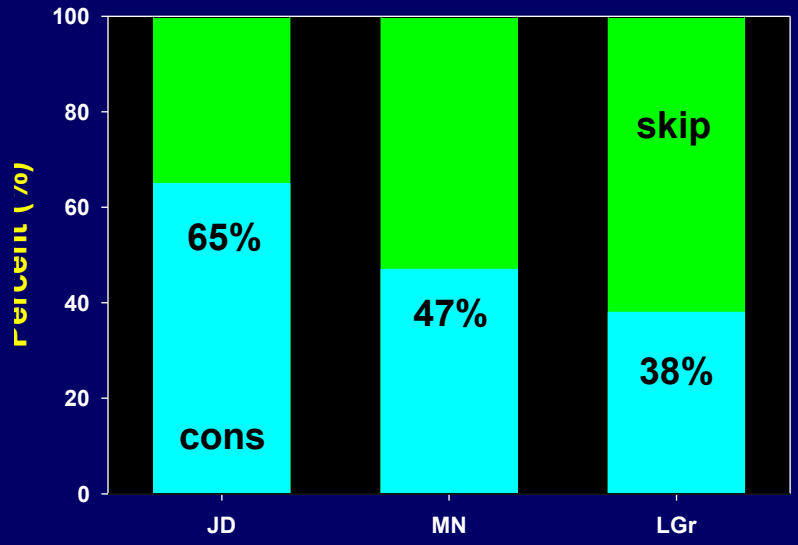
# Repeat spawner returns: L. Granite (In-River)



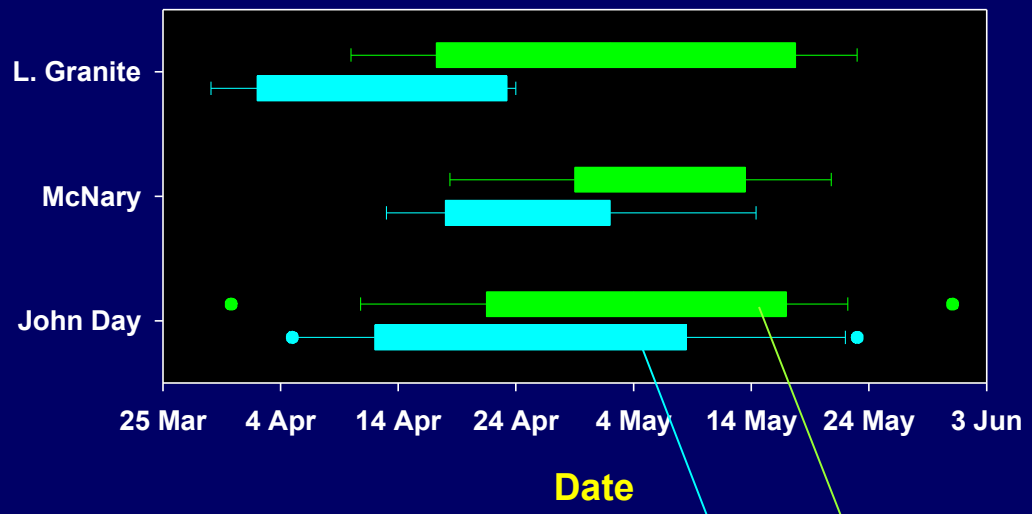

► 1 male kelt returned (*2004, wild, good condition*)

# Repeat Spawner Life History

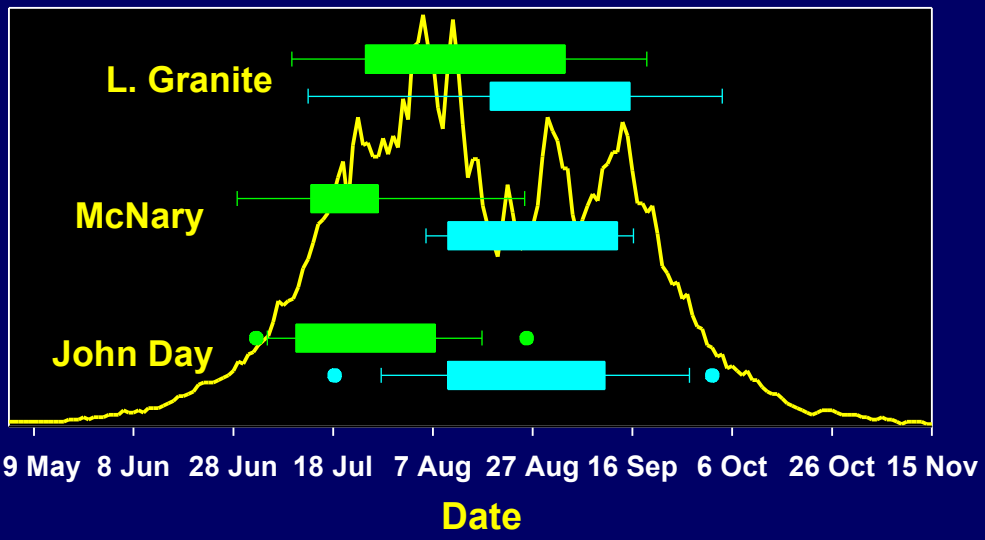
## Consecutive vs skip spawners



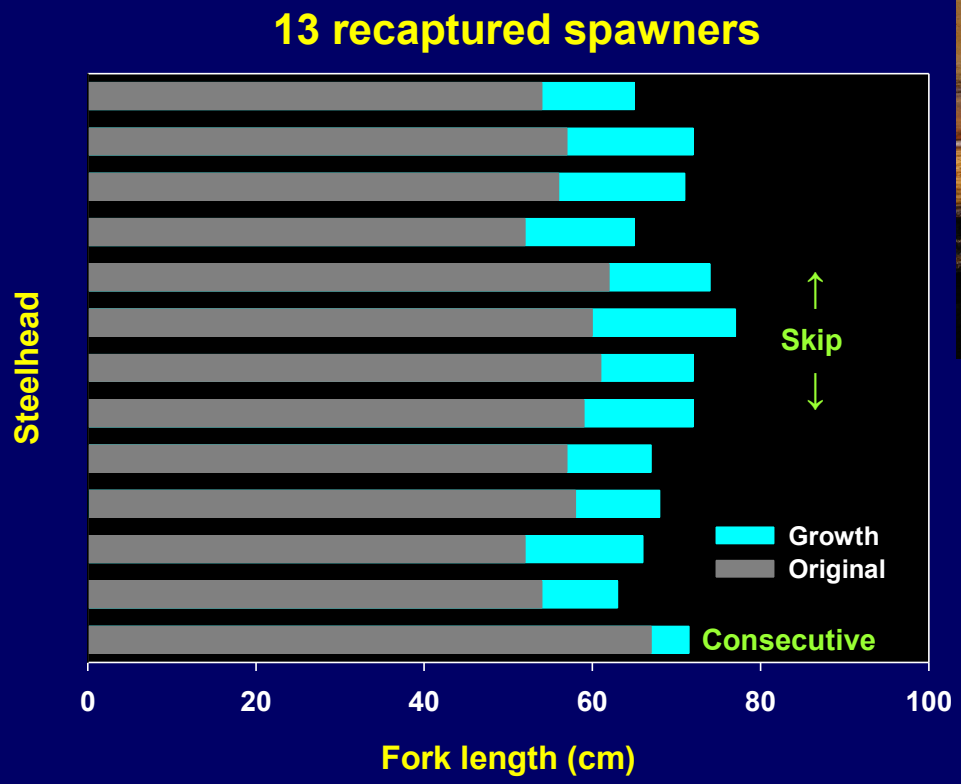

## Outmigration timing




## Return migration timing



# Repeat Spawner Life History





◄ Mean growth = 12 cm (skips)
(22%)

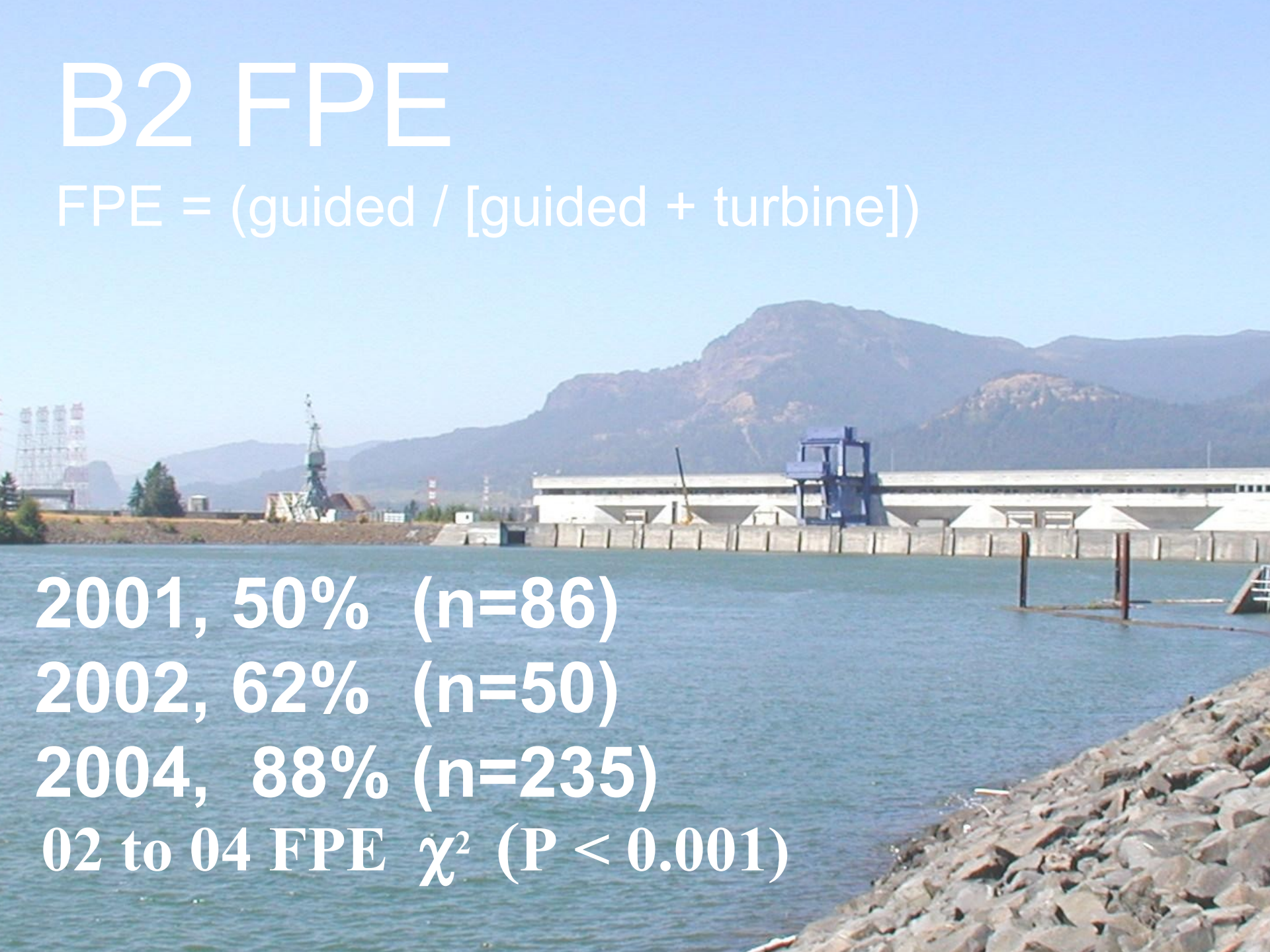
► 3-time spawners

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

# Bonneville Dam

# B2 FPE

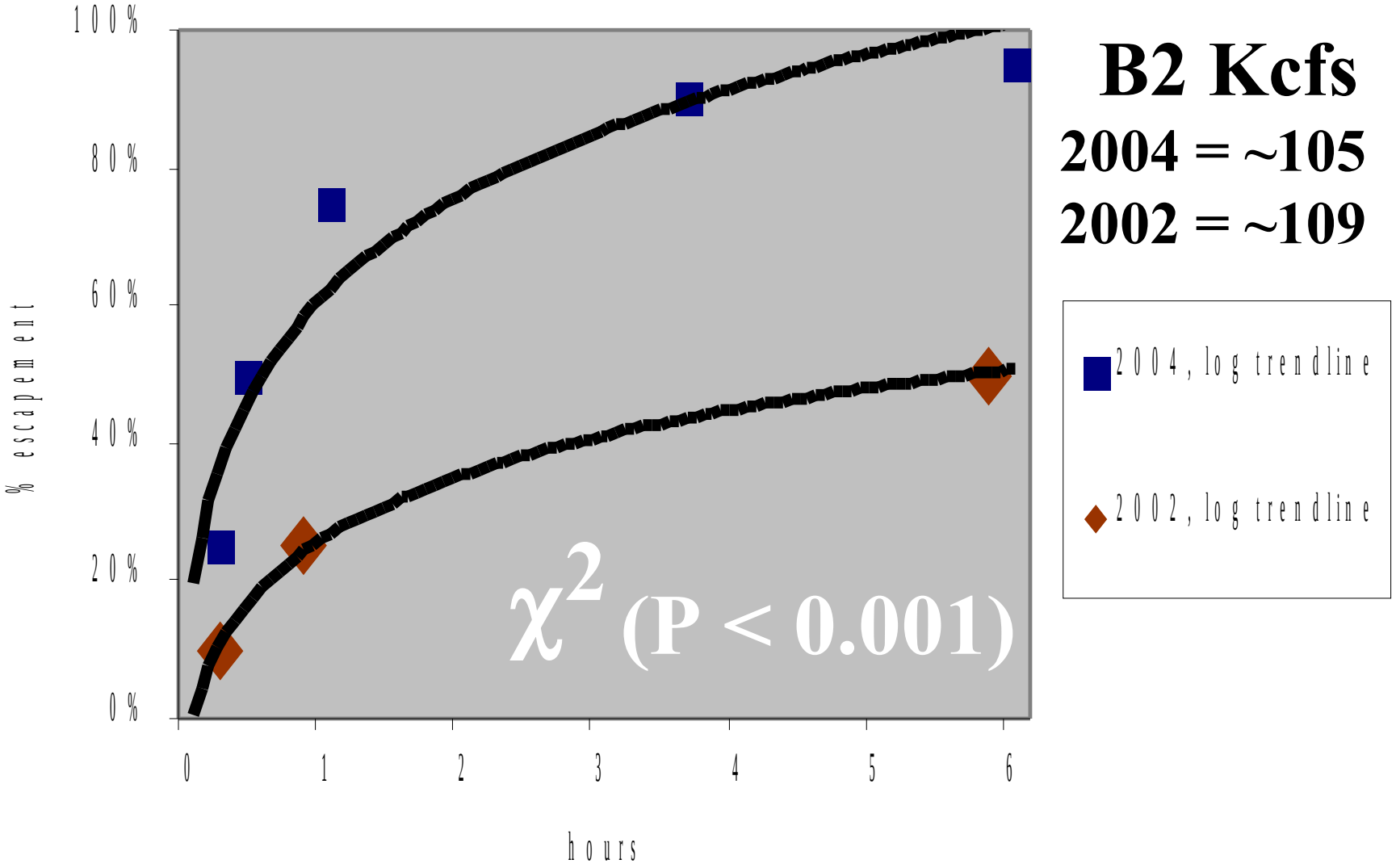
FPE = (guided / [guided + turbine])



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

**02 to 04 FPE $\chi^2$ ($P < 0.001$)**

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

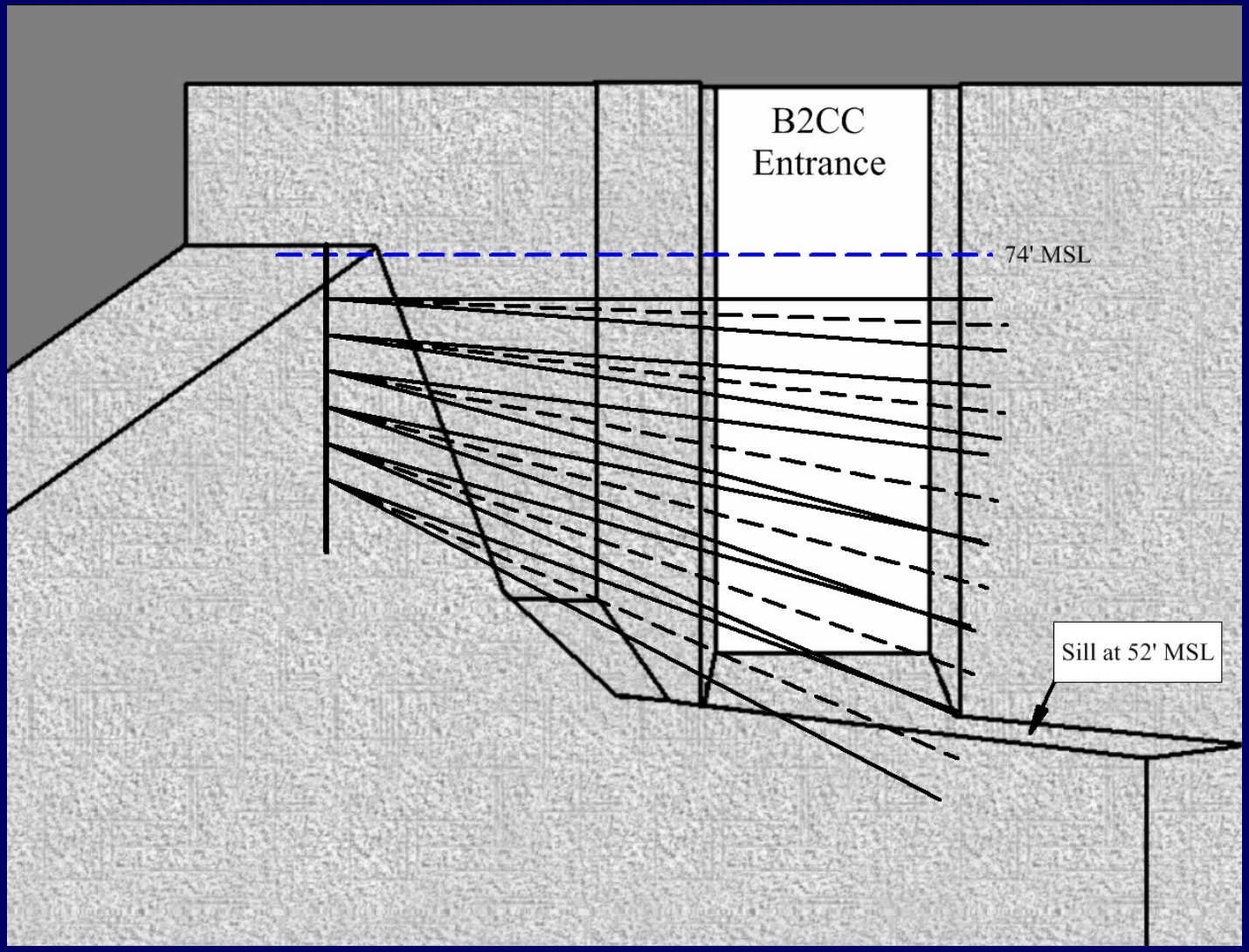



**B2 Kcfs**

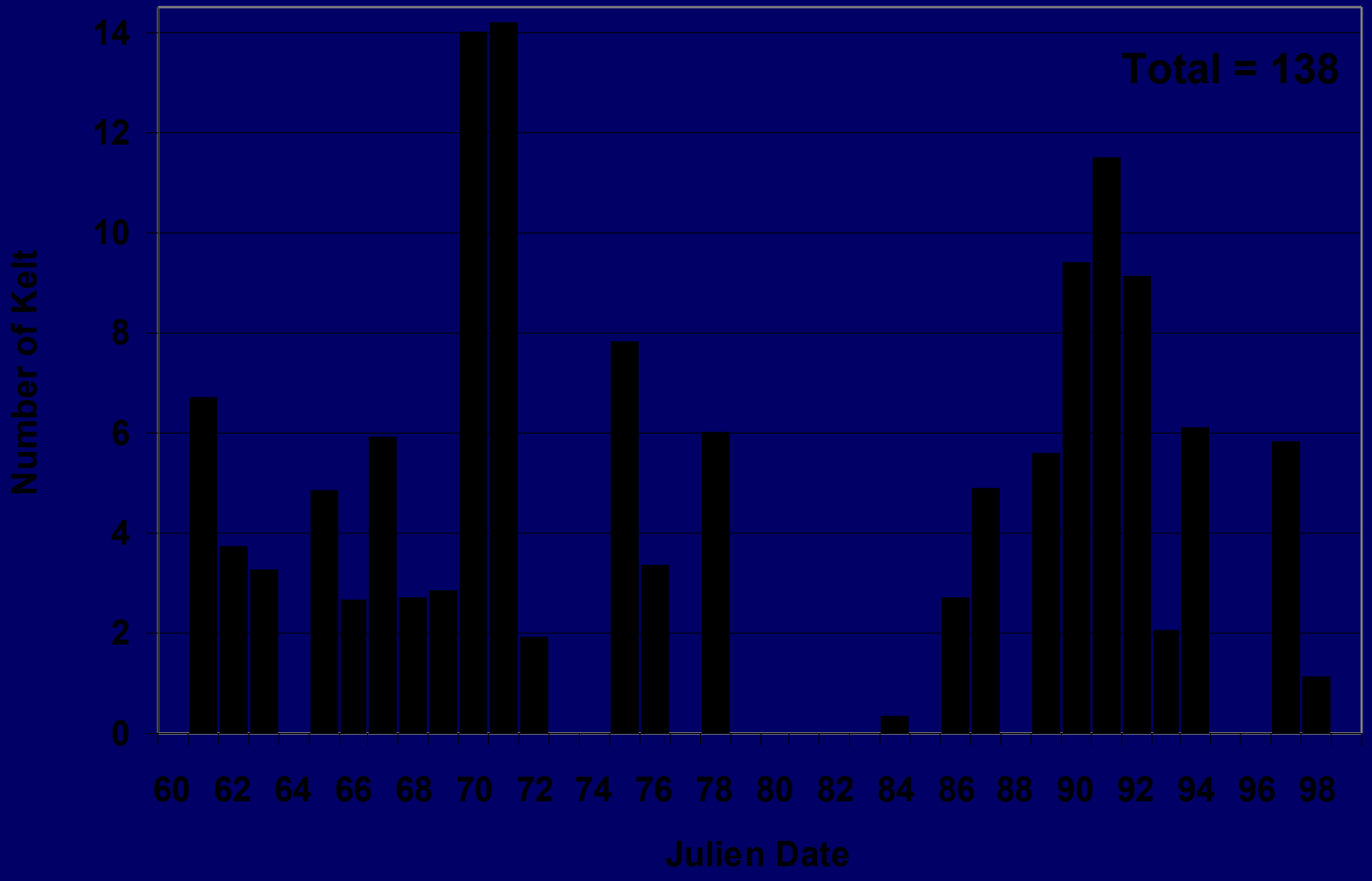
**2004 = ~105**

**2002 = ~109**

# Methods



# Results – Daily Passage



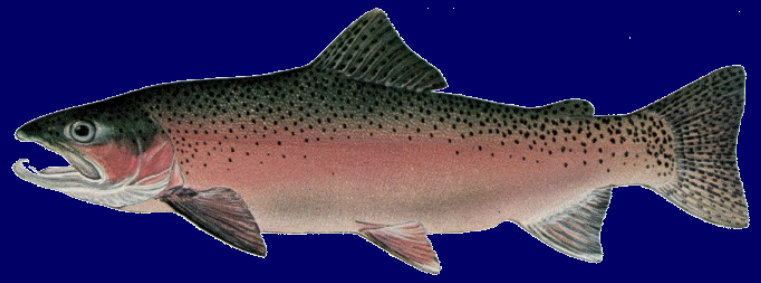
# Methods

- 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

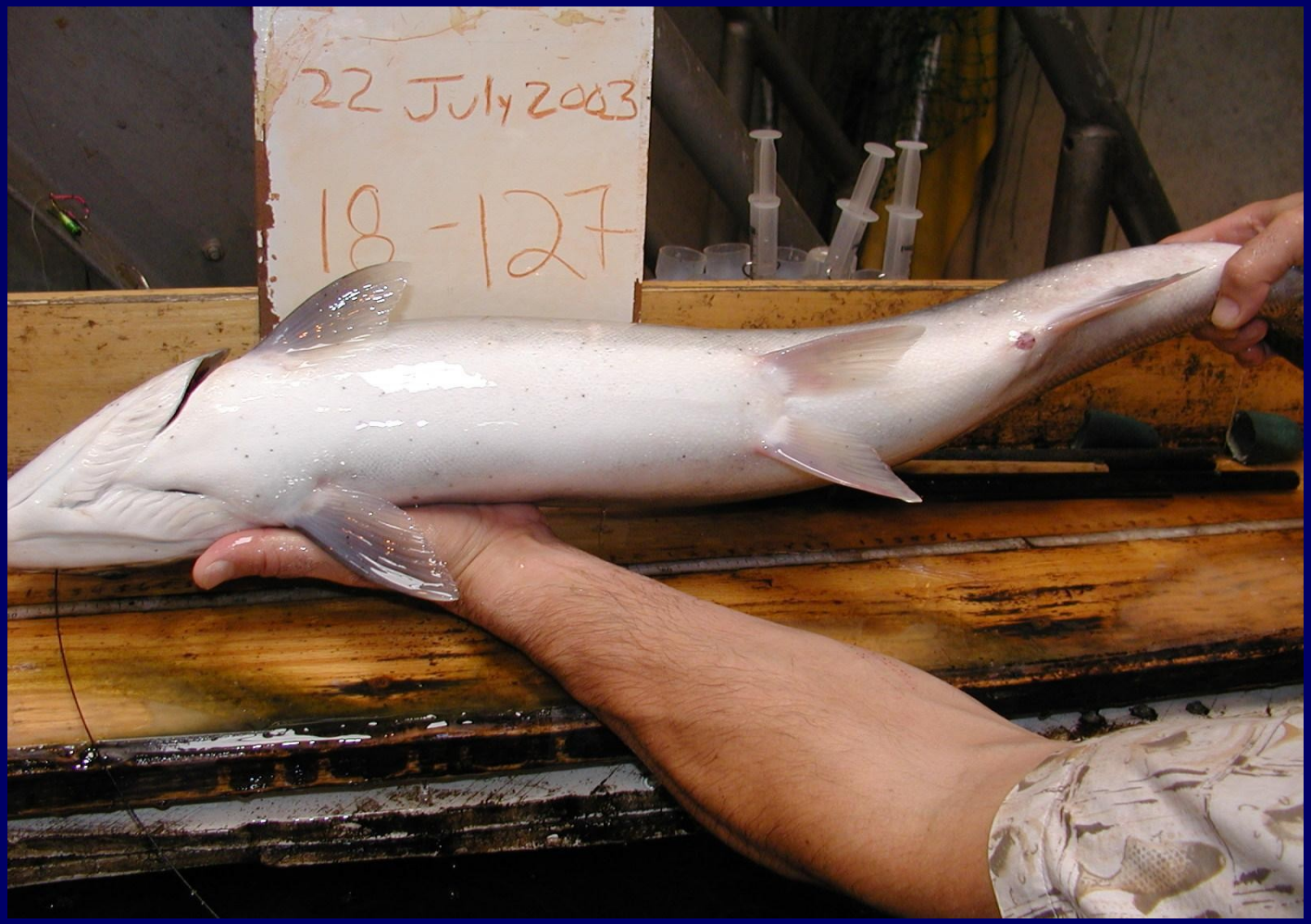
# Summary

- ► 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!