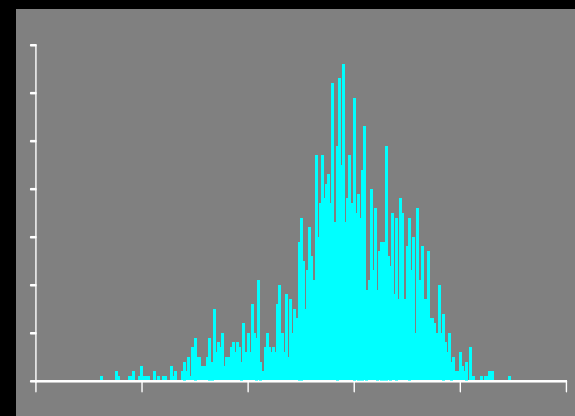


Not Just a Big Pipe...The Lower Willamette River and its Role in the Outmigration and Ecology of Juvenile Chinook Salmon



**Portland Harbor – Lower Willamette River
Cleanup and Restoration Conference**

May 4, 2012



Scope of the “Willamette Fish Study”



Migration



Diet



Habitat survey



Predation



Invertebrates



Habitat use



Chinook Outmigration and Ecology

- Timing and density
- Migration rate / residence time
- Habitat use
- Diet
- Growth and rearing



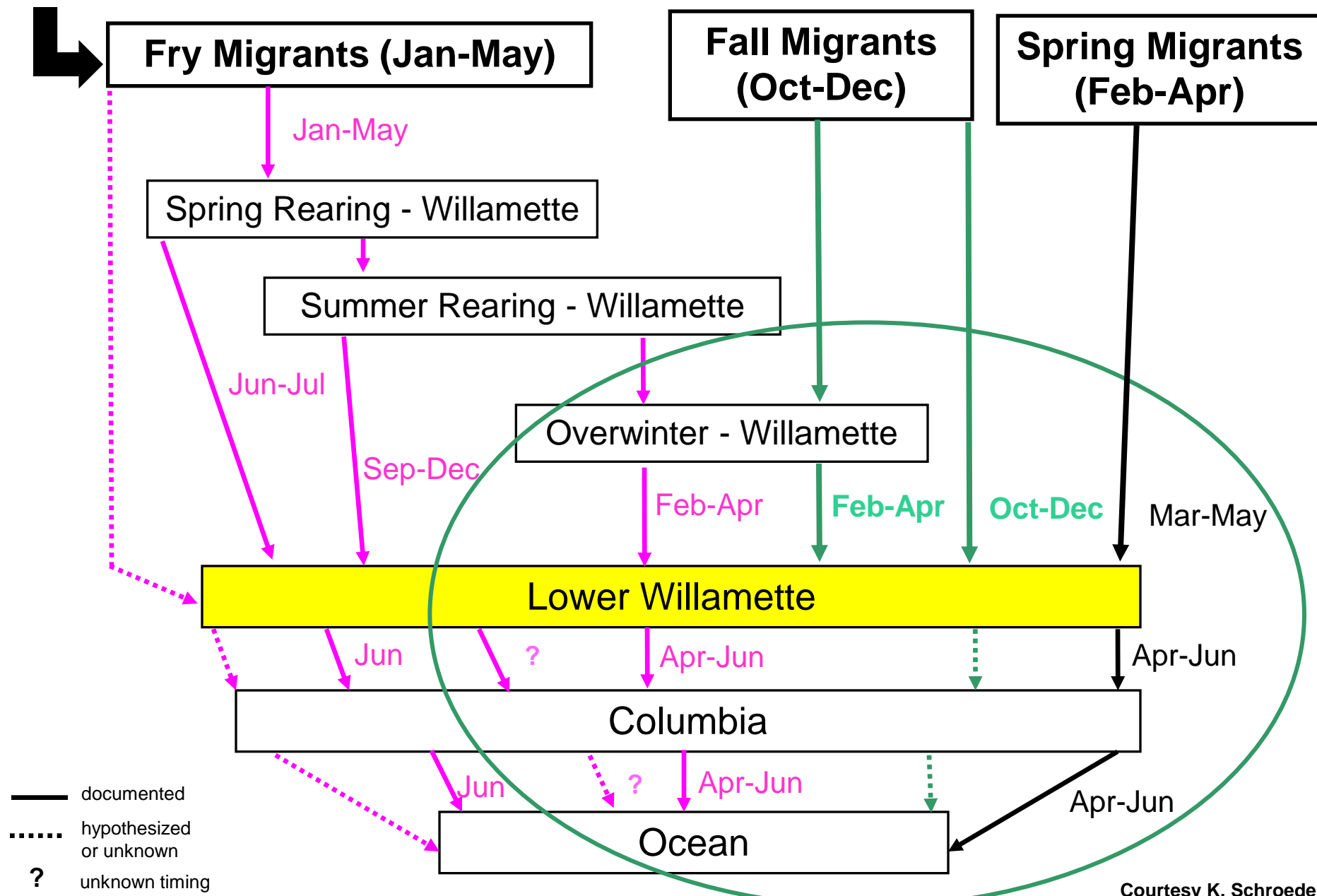
Methods and Fun Facts

- Duration – May 2000 to July 2003
- Electrofishing – 982 (900 sec.) runs
- Beach seining – 568 sets
- Radio telemetry – 95 fish >100 mm released
- Captured ~42,000 fish; 4,383 juvenile Chinook
- Unmarked Chinook = 92% of seine catch
- Hatchery Chinook = 81% of electrofishing catch
- Mean FL: 154 mm (hatchery); ~70 mm (unmarked)



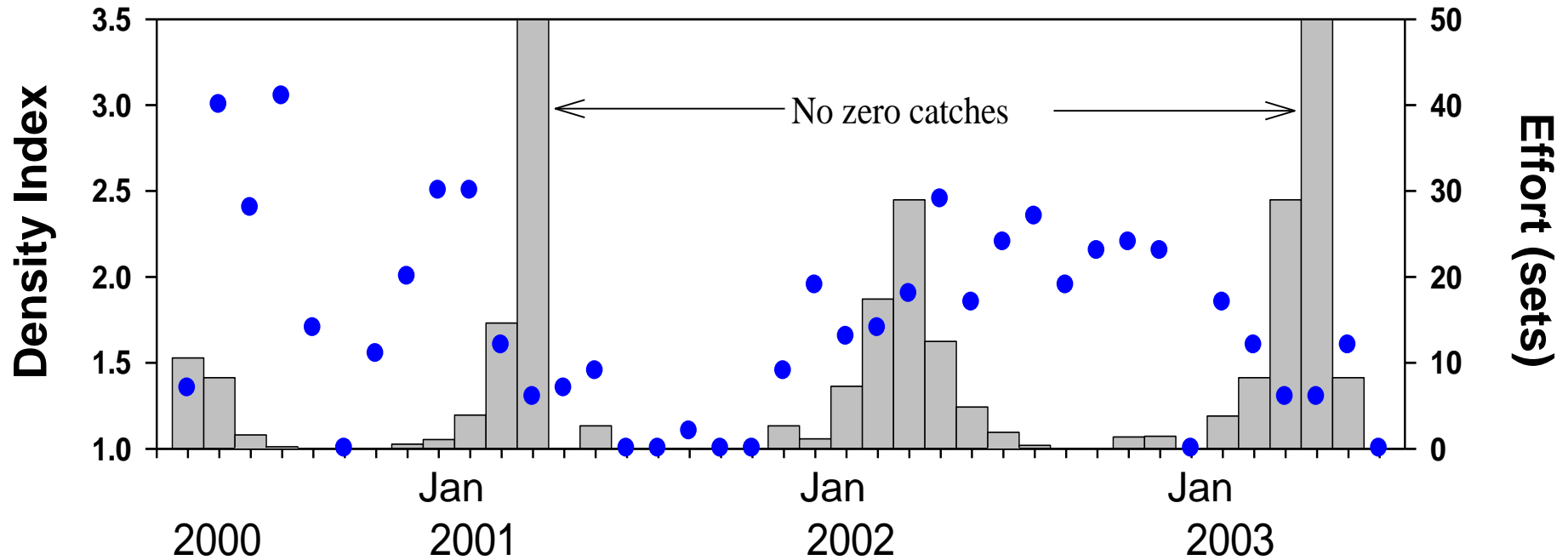
Spring Chinook Life-history Pathways

From spawning areas



— documented
 hypothesized or unknown
 ? unknown timing

Outmigration Timing (Unmarked Chinook) - LWR



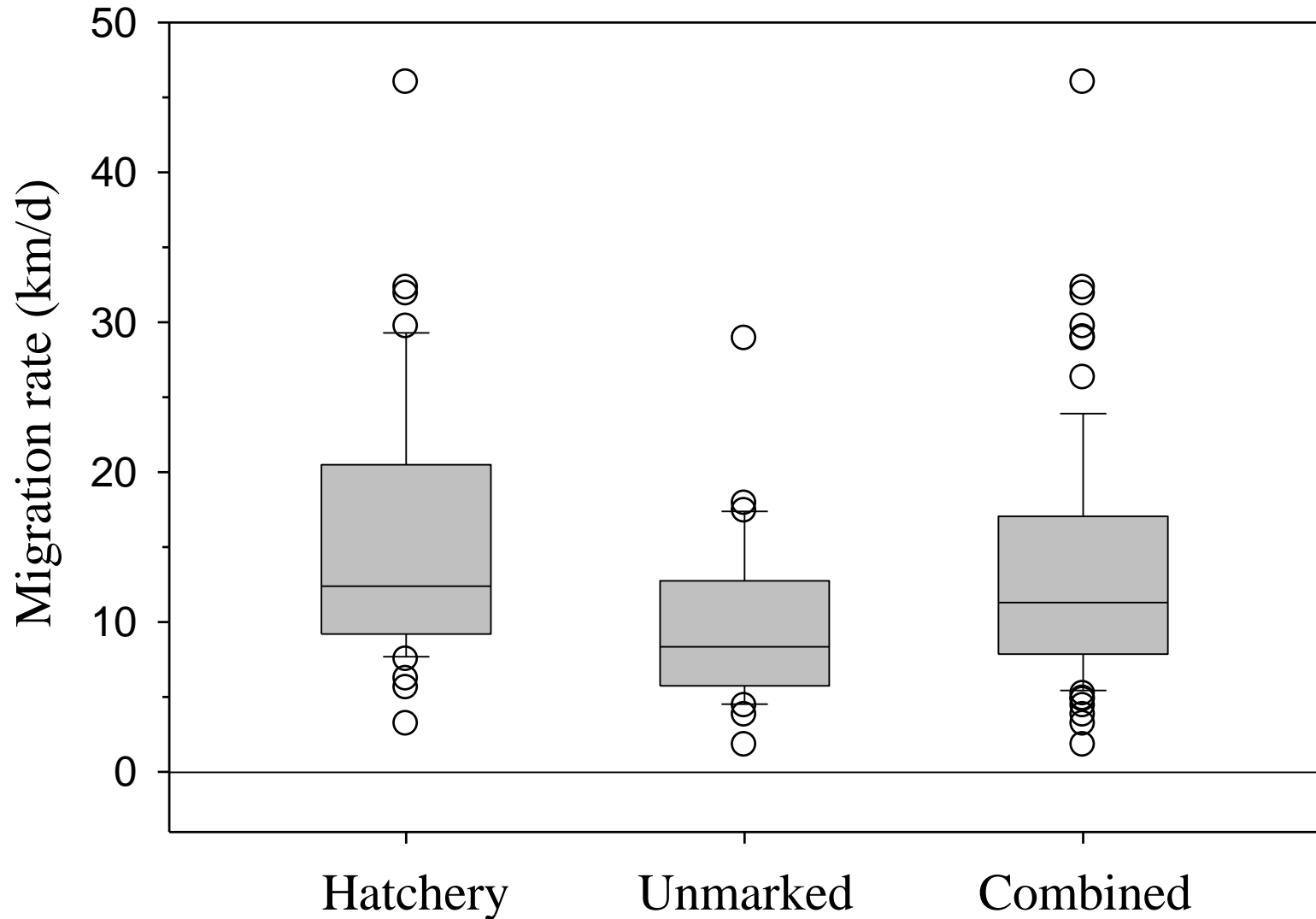


Results and Conclusions

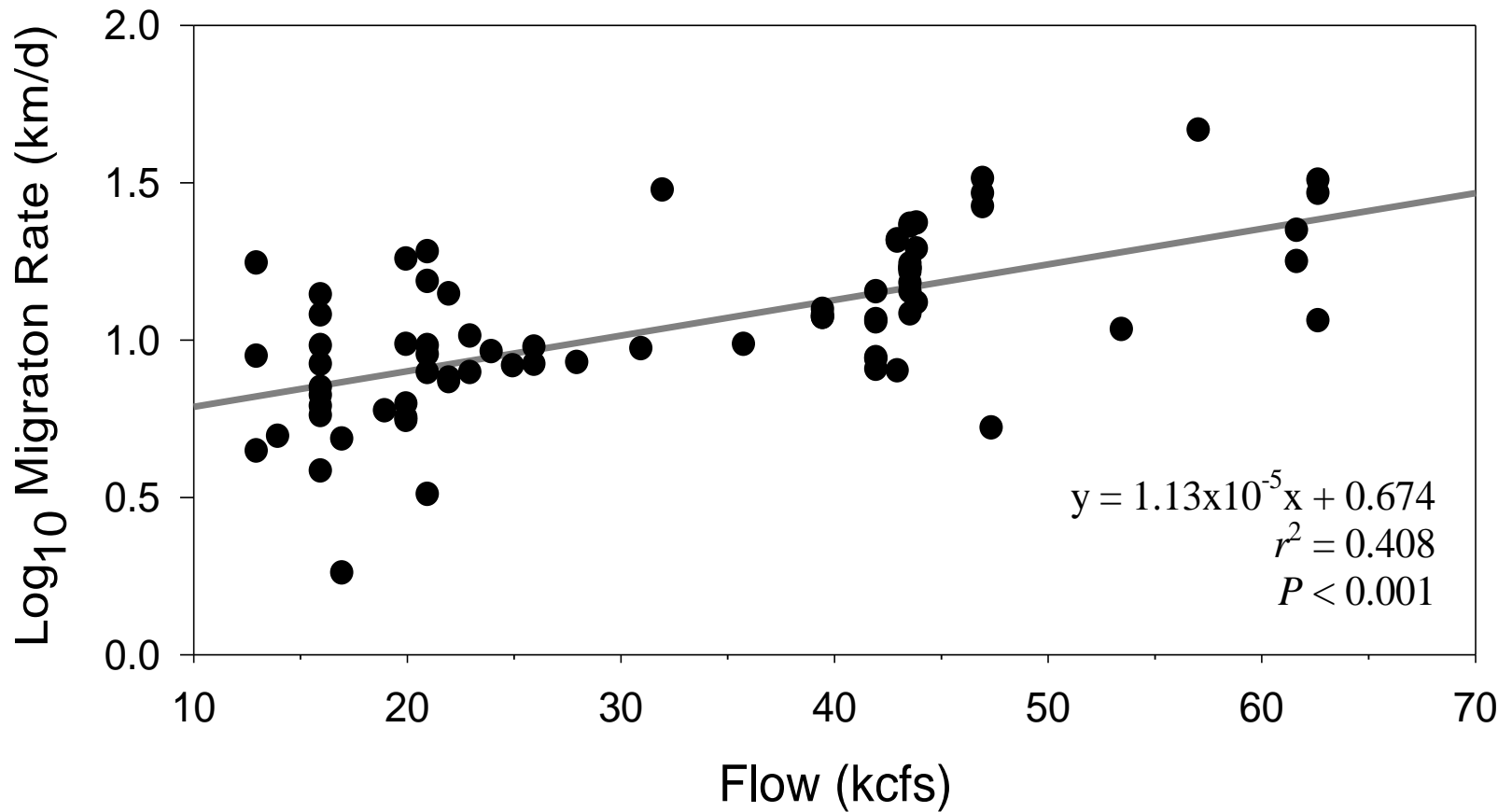
Migration Timing & Density

- Chinook present virtually all year – 34 of 35 months sampled
- Average outmigration period – January to June
- Peak densities – April and May
- Hatchery fish timing and densities similar to unmarked
- Implications for in-water work timing (December & January)
- Perhaps ~10 M juvenile Chinook pass through the LWR

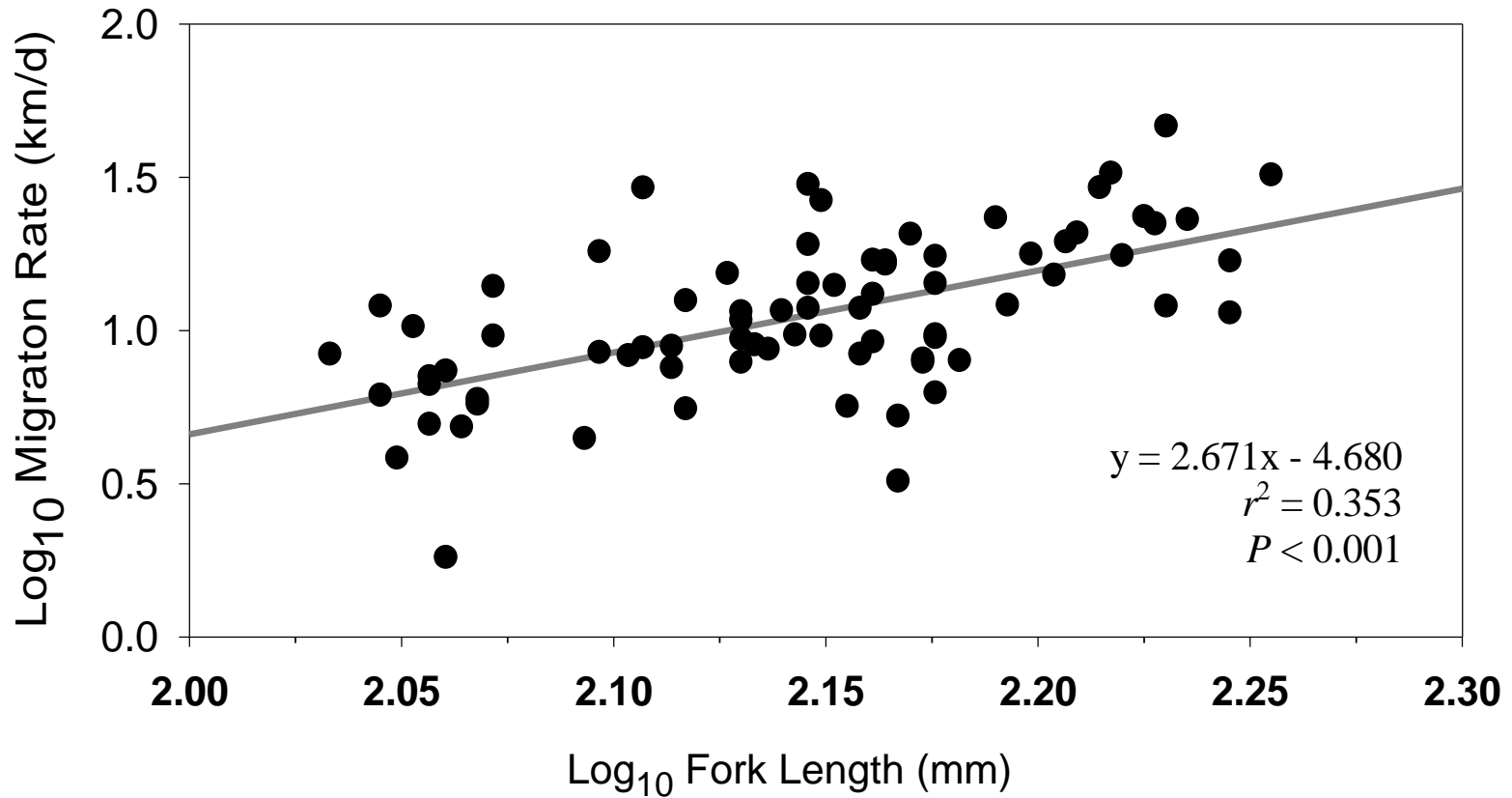
Chinook Migration Rate (>100 mm FL)



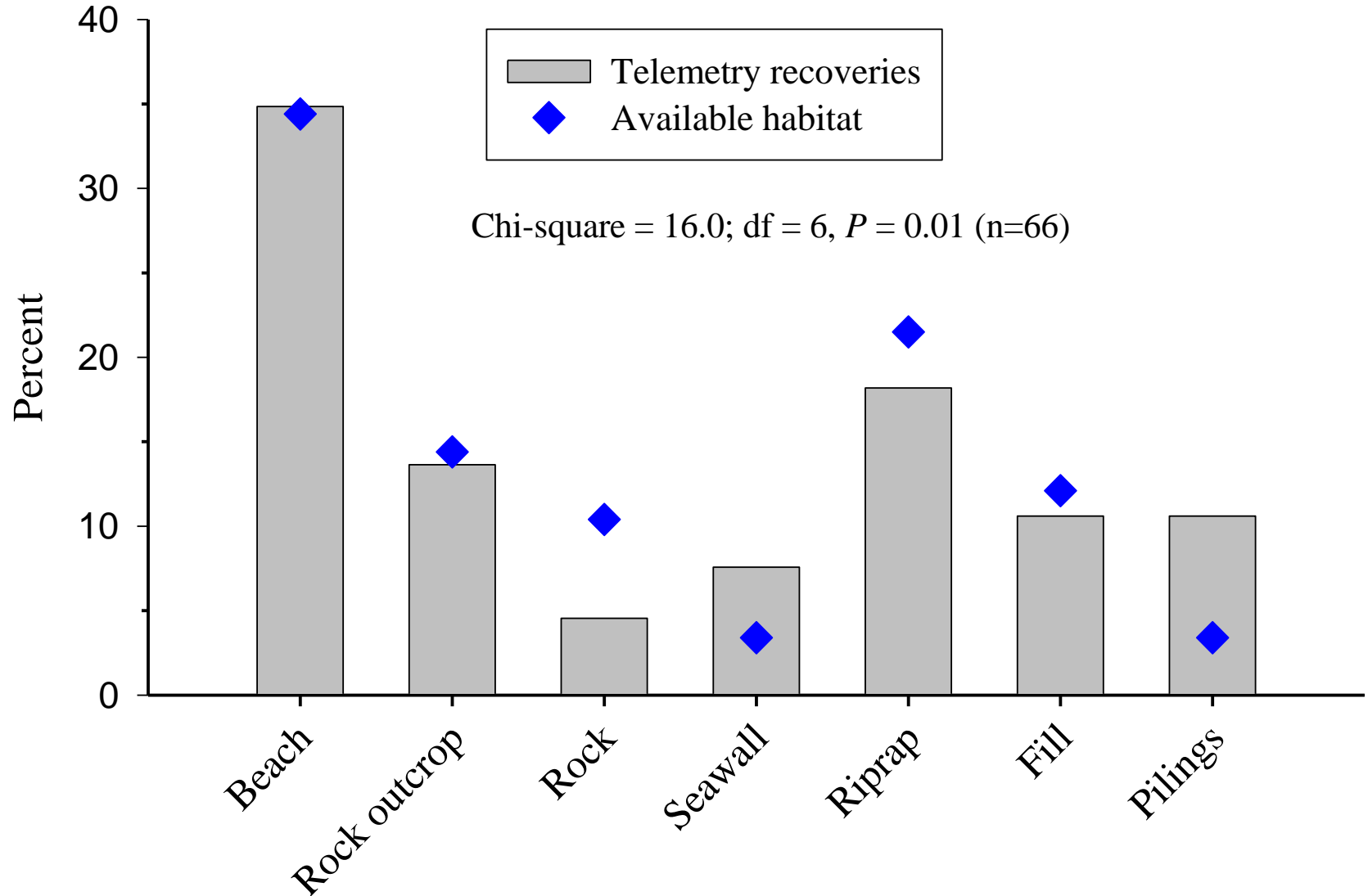
Effect of River Flow on Migration Rate



Effect of Fork Length on Migration Rate



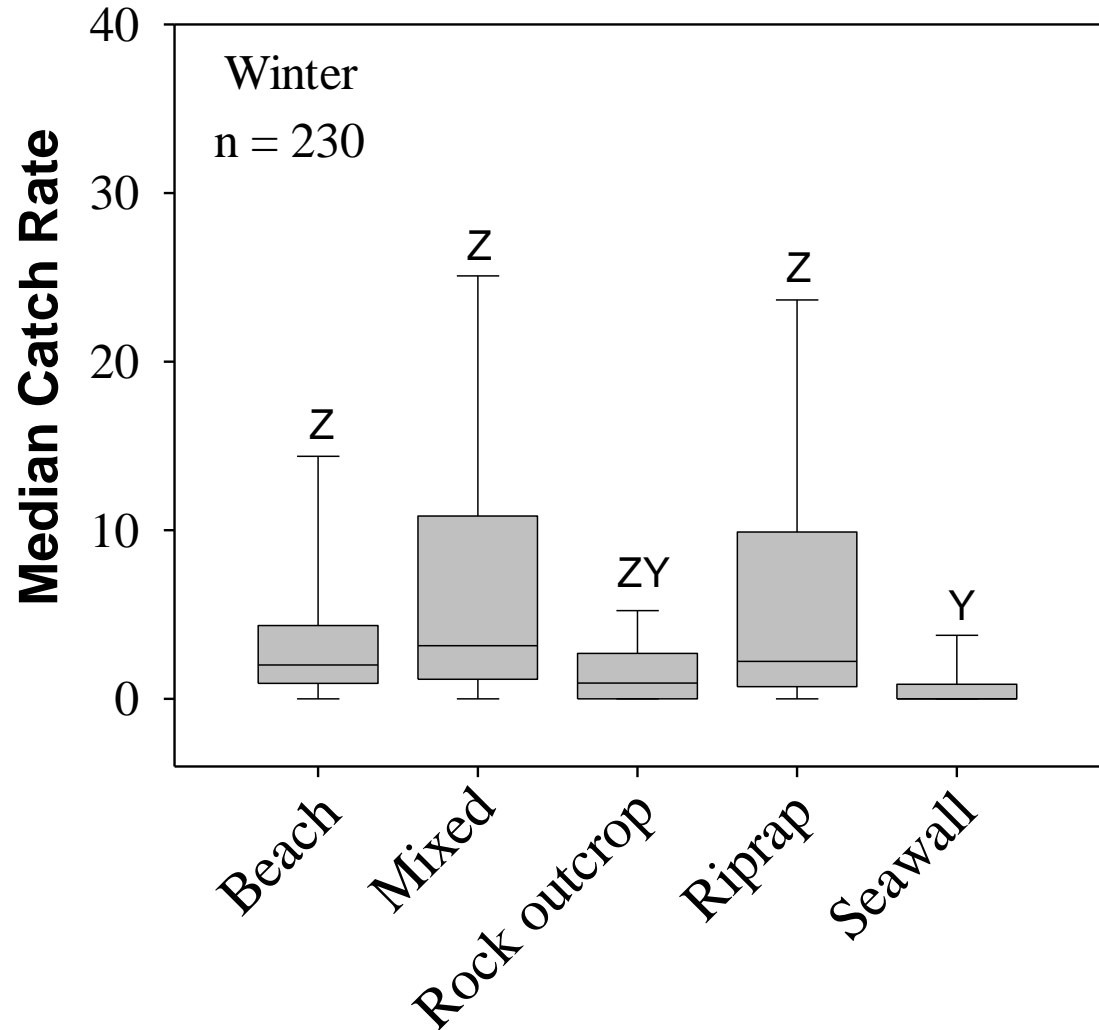
Chinook Habitat Use (telemetry)



Chinook Habitat Use (electrofishing)

Multiple Analyses:

- Qualitative habitat
- Habitat clusters
- Season
- Size class
- Hatchery vs. unmarked





Results and Conclusions

Migration & Habitat Use

(biotelemetry)

- Chinook >100 mm FL generally move quickly through the LWR (median residence time 3.4 days)
- Some remain as long as 34 days
- Little evidence for habitat “selection”
- No apparent association with littoral areas
- Migration rates related to river flow and fork length

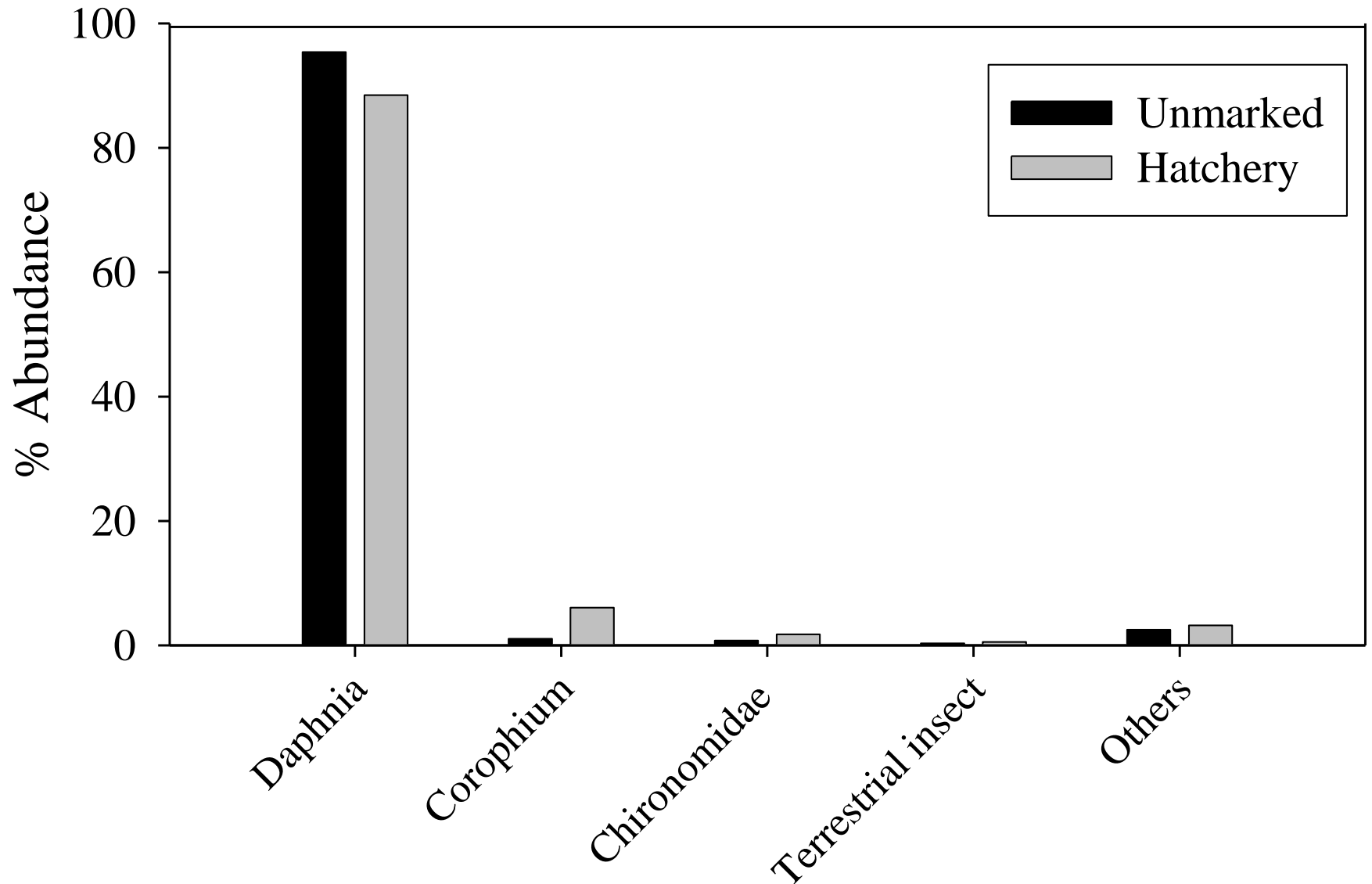


Results and Conclusions

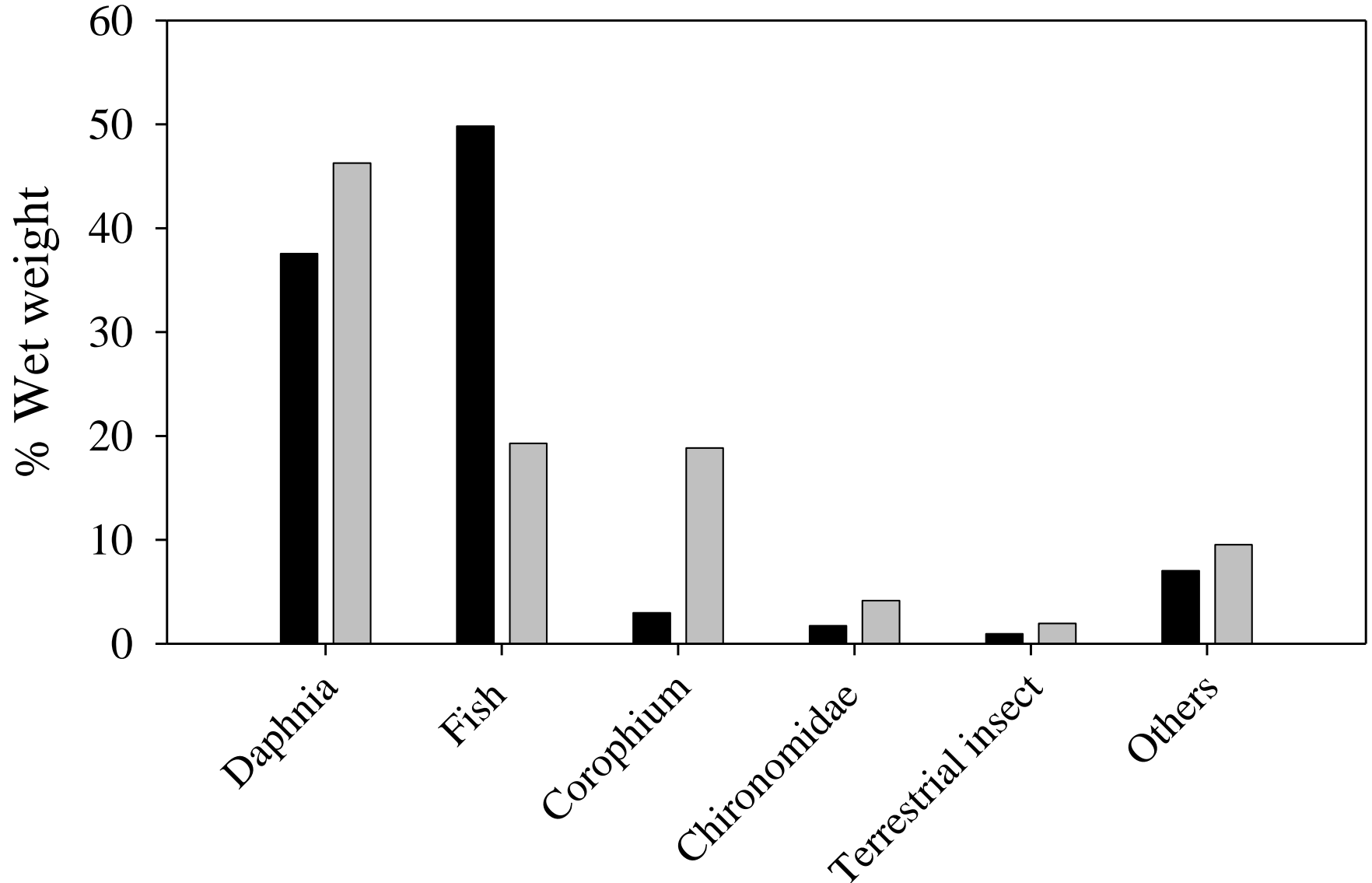
Habitat Use (direct sampling)

- Generally supported telemetry results – Chinook >100 mm FL did not exhibit selection for or avoidance of habitat types
- Exception: seawalls
- Some high catches in off-channel areas, but not significantly different from main channel
- Unmarked subyearling Chinook abundant at beaches; corroborated by literature; use of other habitats unknown

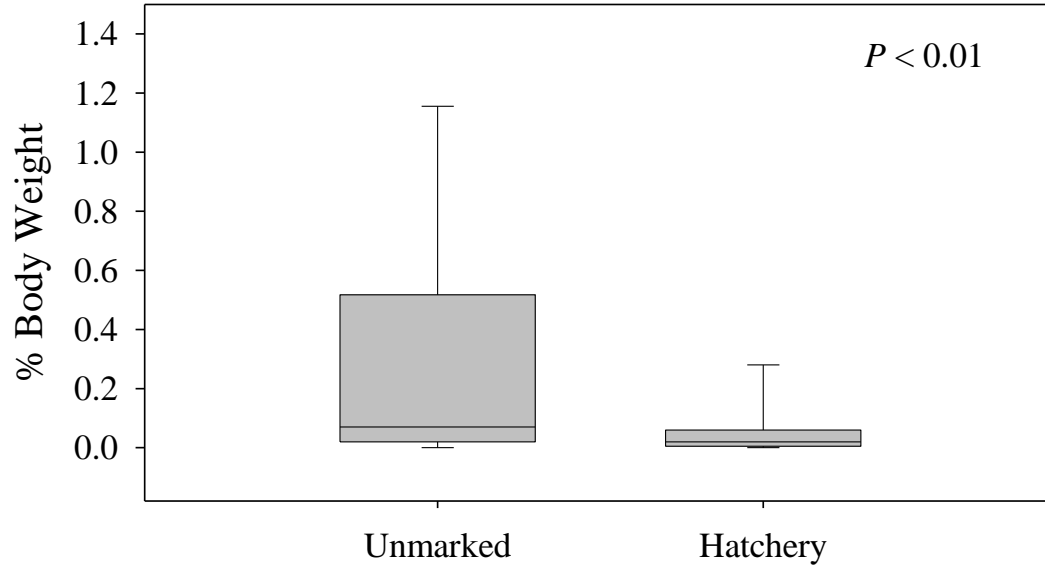
Chinook Diet (by number of prey items)



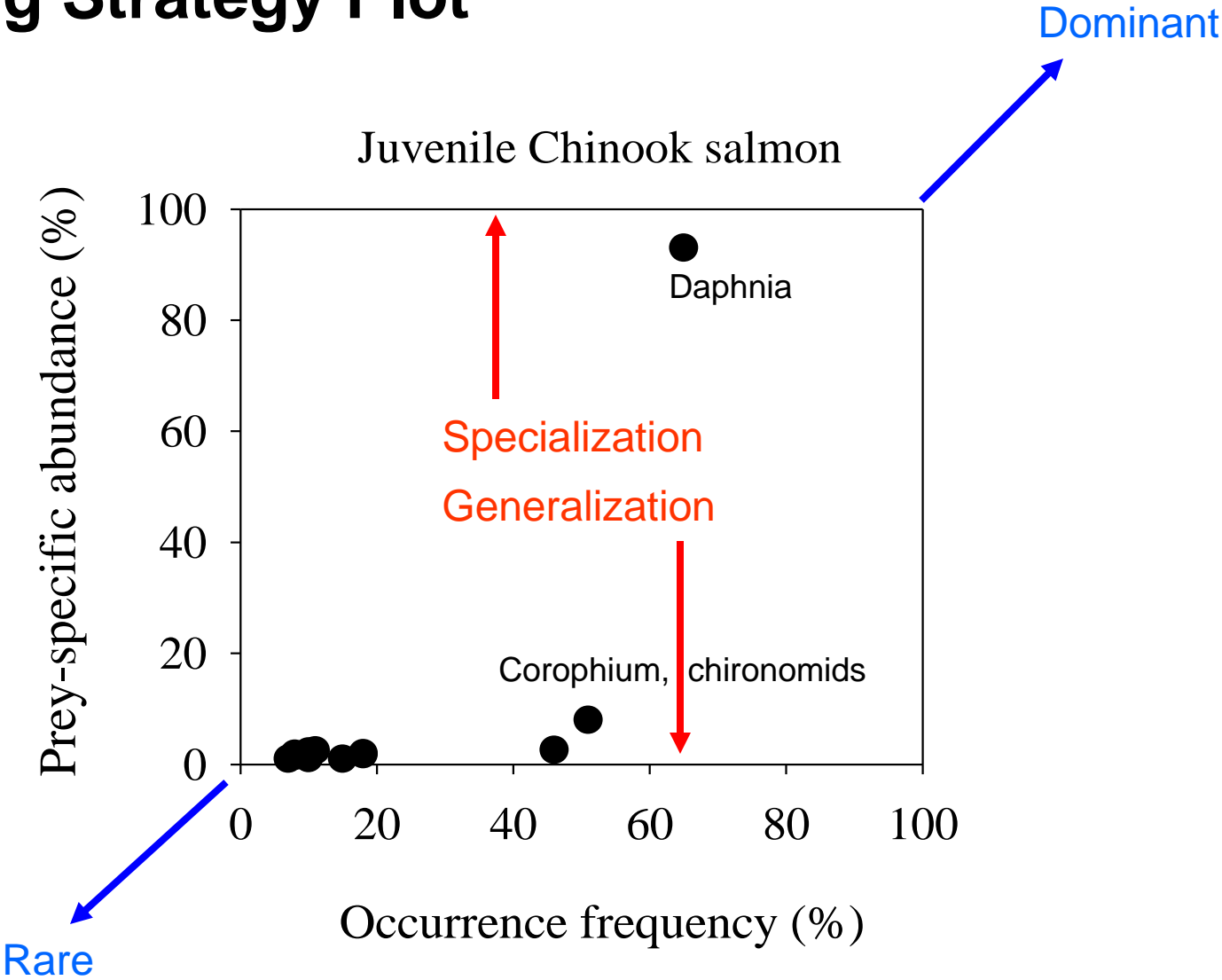
Chinook Diet (by weight of prey items)



Chinook Diet (“fullness” index)



Feeding Strategy Plot



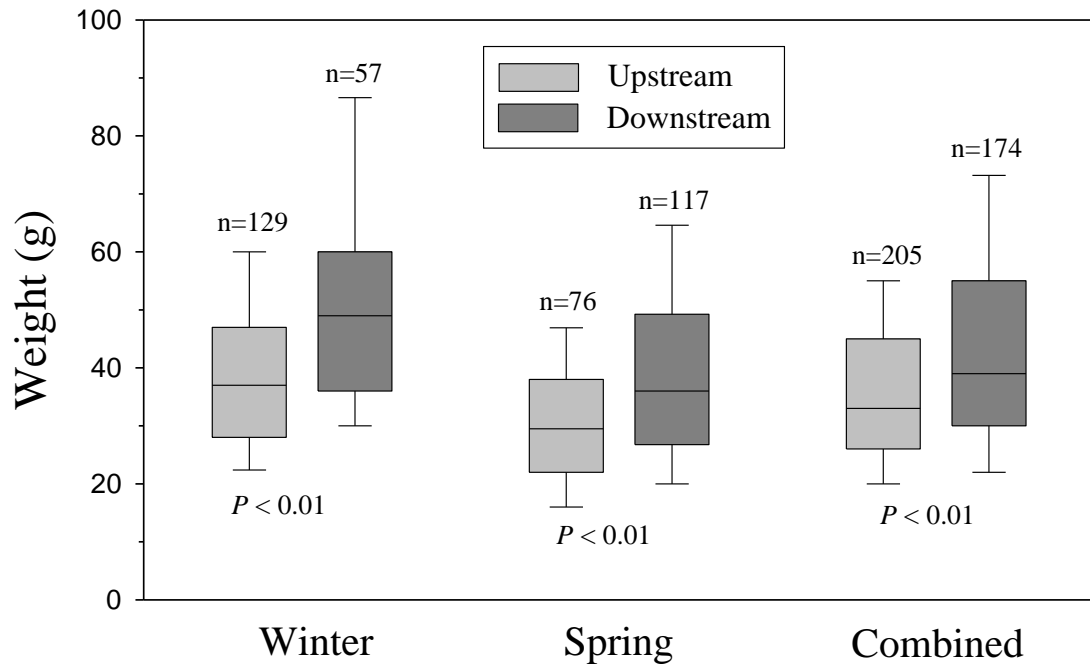
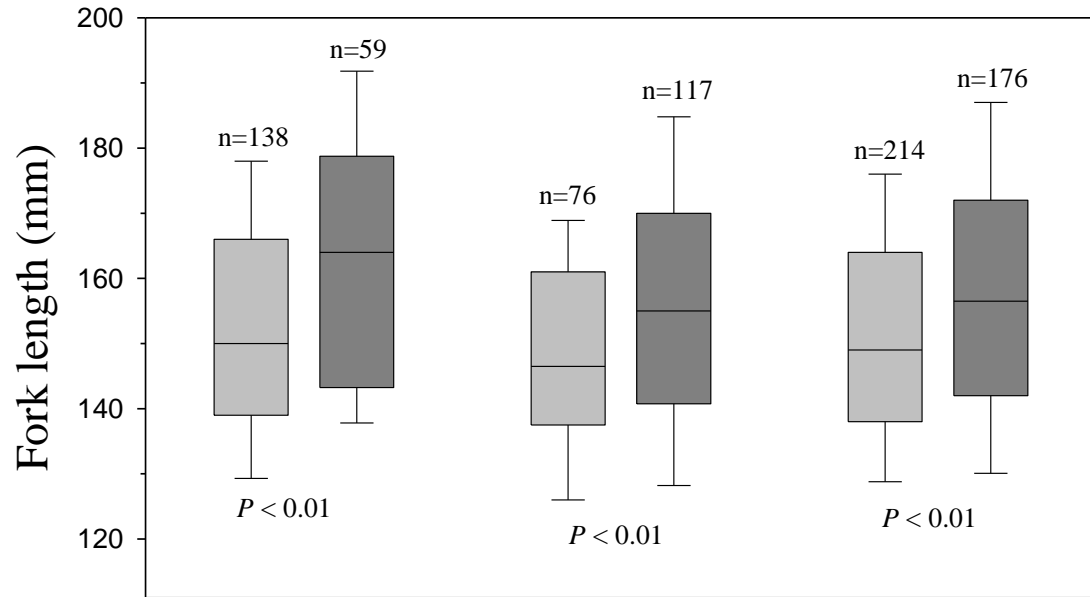


Results and Conclusions

Diet

- Chinook actively feeding throughout LWR (~ 5% empty stomachs and 123 food items / fish)
- *Daphnia*: recommended by 9 out of 10 growing salmon (> 90% of diet by number, > 40% by weight); specialized, selective diet
- Seasonal shift to *Corophium*
- Potential competition with hatchery Chinook, coho, smallmouth bass

Length and Weight of Hatchery Chinook, Upstream vs. Downstream



The Oregonian



Science

WEDNESDAY • APRIL 28, 2004

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B12

2M

Around the globe: A strong windstorm blowing across South Florida causes the large but shallow Lake Okeechobee to slosh back and forth and raises the water level in a lopsided manner normally seen on the Great Lakes.

Page B10



Research notebook

Study links dental X-rays to low infant birth weights

A study shows that women who have dental X-rays during pregnancy are three times as likely to have a low birth-weight baby as women who do not.

Dr. Philippe Hujoel, a professor at the University of Washington School of Dentistry, and his colleagues report their findings today in the *Journal of the American Medical Association*.

Hujoel said the reasons for the low birth weights — less than 5 pounds 8 ounces — are unclear, and more study is needed. The study found an association between the low birth weights in full-term babies and diagnostic X-rays performed during routine dental care.

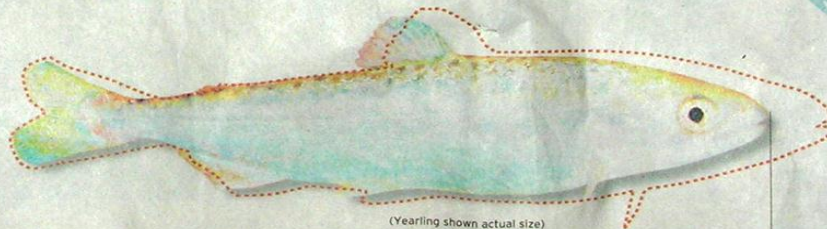
"We don't know whether radiation affects neurohormonal mechanisms in the head and neck region, such as thyroid function, or whether factors unrelated to the X-rays are to blame," Hujoel said. The results should not prevent pregnant women from having X-rays if they are suffering from a dental problem, he said.

The study linked dental data from the Washington Dental Service, a non-profit insurance company, and Washington birth certificates between 1993 and 2000. About 4,500 women who were enrolled with the insurance company and had a baby during that period were included in the study.

High-powered shrimp kicks caught on video at Berkeley

The lowly mantis shrimp may be the world's most powerful kick-boxer. The small crustacean packs a blow that can smash its prey's shell under-

DESPITE THE ODDS IN THE LOWER WILLAMETTE, YOUNG SALMON GROW



GROWING CHINOOK

Chinook yearling measured near West Linn averaged 5.5 inches. Reaching Sauvie Island, the average yearling fish has grown to 6 inches

Sauvie Island

Willamette River

Columbia River

St. Johns Bridge

Ross Island Bridge

Average chinook salmon yearling size: 154 mm (6 inches)

● Sampling sites
Ⓡ Radio tracking station

Salmon linger in the Willamette

Despite a legacy of industrial pollution and urban development, the lower Willamette River supports a surprisingly robust ecosystem, including the nearly year-round presence of young salmon, according to a recently completed four-year study. Among the findings:

DAPHNIA: SALMON FOOD SOURCE



▲ CRUSTACEAN DIET: Daphnia, a free-swimming crustacean about the size of a sesame seed, supply most of the food salmon eat as they move through the lower Willamette, scientists found by examining stomach contents. Daphnia filter feed on suspended algae, bacteria and bits of organic matter abundant in slow-moving waters.

10 PERCENT GROWTH: Yearling chinook salmon caught at the upriver end of the study area near Willamette Falls averaged about 5 1/2 inches in length. They grew an average of 10 percent by the time they reached sampling sites 26 miles downriver near the Willamette's mouth on the Columbia River.

NATURALLY SPAWNED: More than 90 percent of young chinook salmon caught in hatch pens were naturally spawned



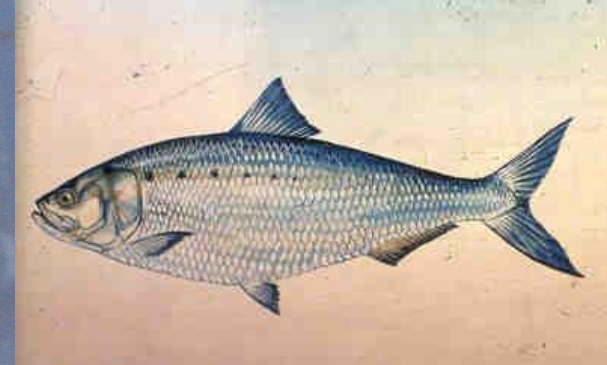
Results and Conclusions

Growth / Rearing

- Significant (positive) differences in length and weight between upstream and downstream sites
- Observed FL increases of 1-14 mm realistic to high, based on known growth rates and estimated migration rates
- Multiple explanations: growth, estuary-type rearing, Columbia outmigrants
- Differential mortality & other factors...?

Unanswered Questions (and Concerns)

- Subyearling behavior and habitat use
- Predation
- Introduced species
- Habitat modification, conservation
- Contributions of life-history types



Questions?

