

Environmental Effects on Smolt Quality in Spring Chinook Salmon

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BPA





Talk Outline

- Background & Objectives
- Study Design & Sampling
- Data
- Results Explanation
- Why should we care



Hood River Background

➤ Native populations

- Coho, spring & fall chinook, summer & winter steelhead, cutthroat, bull trout, & lamprey

➤ Anthropogenic Disturbances

- Migration barriers, road construction, agricultural and forest management practices, water withdrawals etc.

➤ Hood River Production Program (HRPP)

- BPA

- Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO)

- Oregon Department of Fish and Wildlife (ODFW)



Big Picture Goals For The HRPP



- **Re-establish and/or accelerate the recovery of native populations**
- **Provide consistent annual harvest opportunities**
- **Maintain genetic integrity of native fish populations**
- **Protect and restore fish habitat**



Achieving Those Goals

- Accelerate recovery of native populations
 - Provide consistent annual harvest opportunities
 - Maintain genetic integrity of native fish populations
 - Protect and restore fish habitat
-
- **Develop a spring Chinook Salmon supplementation program for the Hood River**



Challenge #1

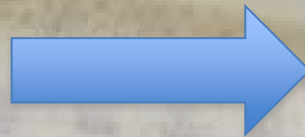
- **Can only rear some fish in-basin**
 - Parkdale Hatchery ~75,000 Fish**
- **Need to look at supplemental rearing options out of basin ~75,000 Fish**

Solution:

- **Test raise fish at 2 other hatcheries (Round Butte & Carson)**
- **Assess which hatchery will yield highest returns of adults**
- **Raise fish at hatchery with highest yields**

Challenge #2

Waiting for adults return rates takes years!!!!



Need a surrogate for adult return rate....

One Possible Solution

**Use smolt quality as a surrogate
for adult return rate**

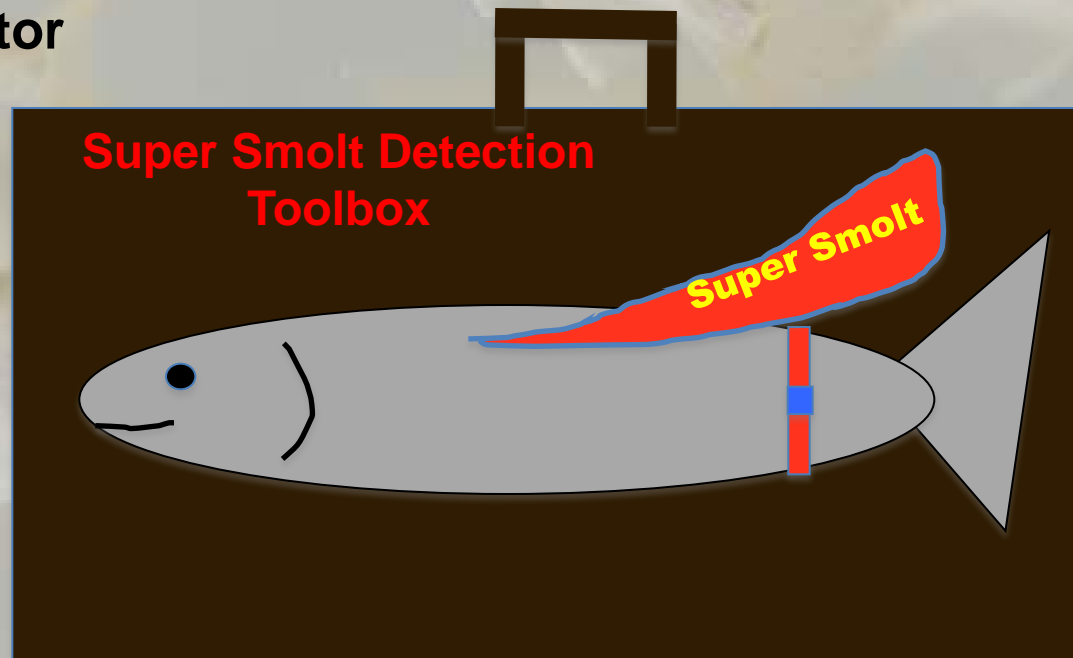


**Assess & compare the smolt quality of
fish reared at the different hatcheries**

Super Smolt Detection Toolbox

Size
Lengths & weights
Condition factor

Lipid
Nutritional
status &
Smolt
development



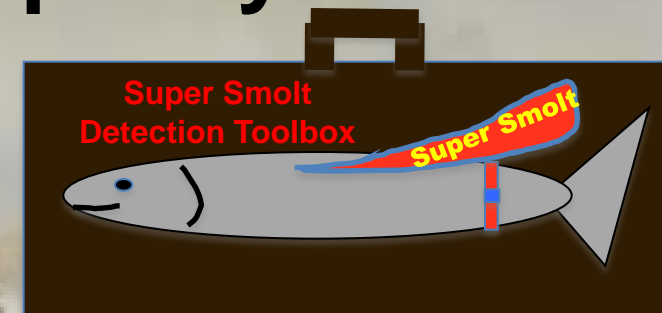
Na/K ATPase
Smolt development

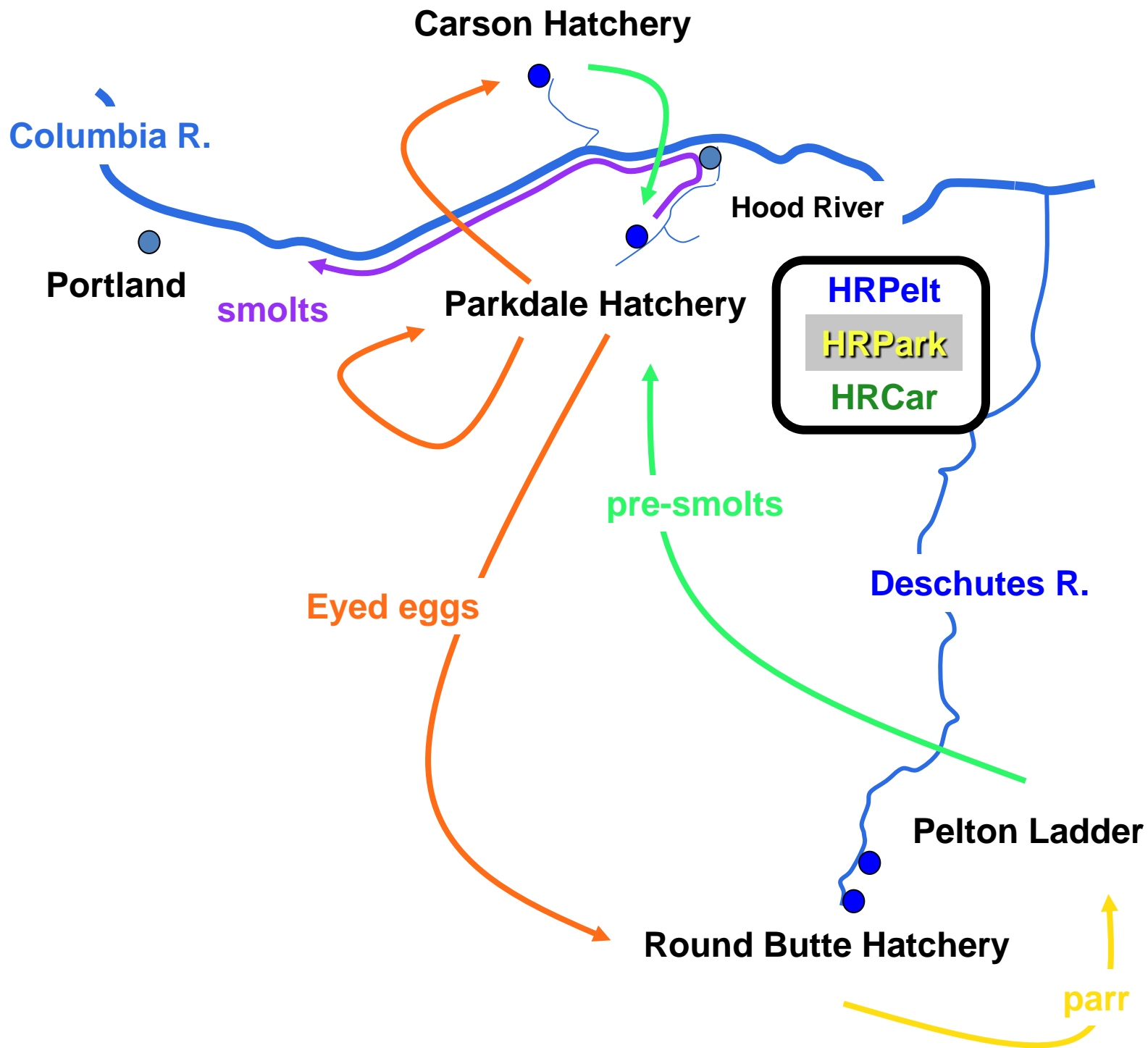
IGF
Growth

11-Ketotestosterone
(11-KT)
Early male maturation

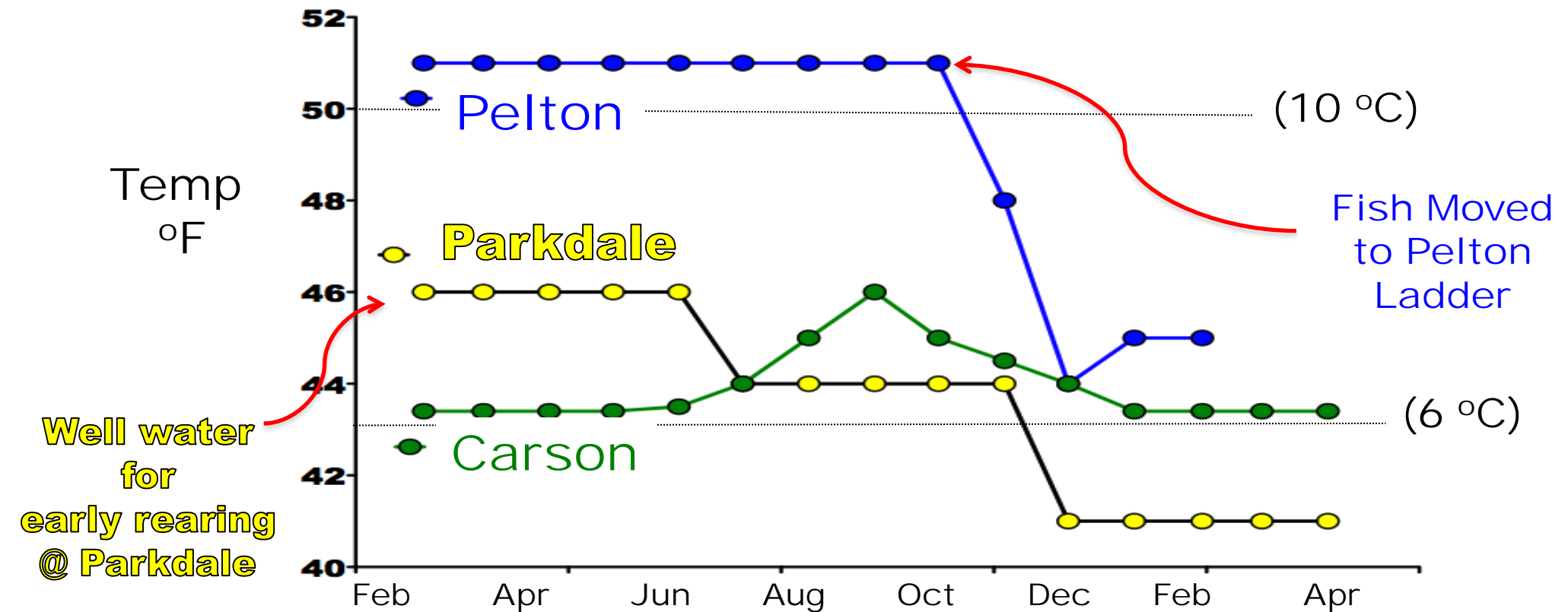
Study Design

- Raise Hood River stock fish at:
 - Parkdale – **HR Park**
 - Round Butte/Pelton – **HR Pelt**
 - Carson – **HR Car**
- Assess & compare smolt quality
 - Size
 - Lipid
 - Growth (IGF)
 - Smolt development (ATPase)
 - Rates of early male maturation (11-KT)





Hatchery Rearing Conditions Differ



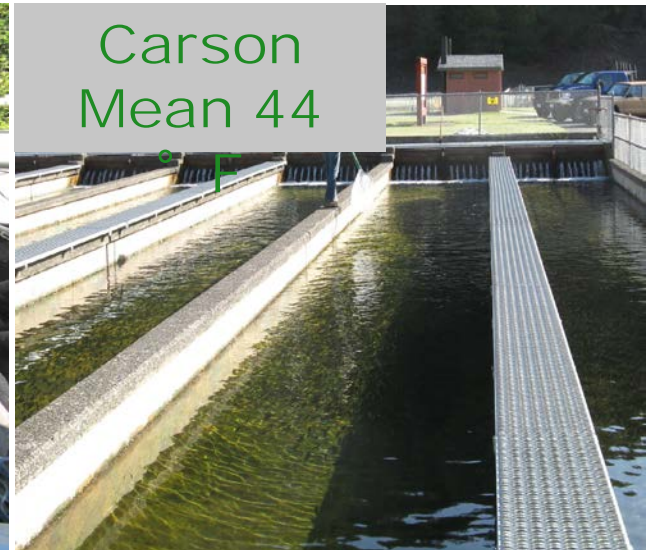
RB/Pelton Ladder
Mean 50 ° F



Parkdale
Mean 44 ° F



Carson
Mean 44 ° F



Sampling

October- 300 fish/Treatment

- ◆ Lengths & weights
- ◆ Bodies (25) for Lipids
- ◆ Check for Precocious Parr

Jan-April- 25 fish/Treatment

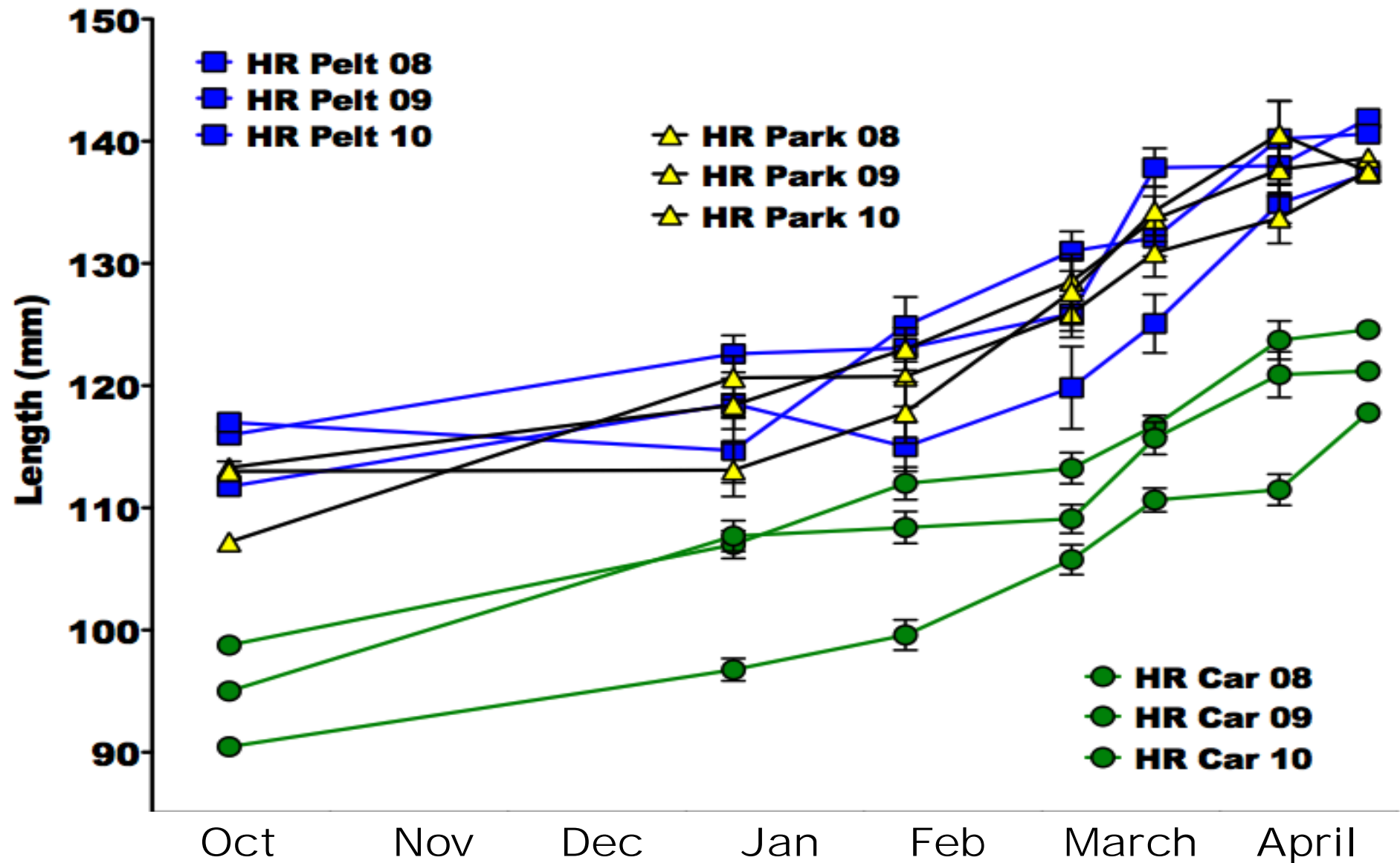
- ◆ Lengths & weights
- ◆ Bodies for Lipids
- ◆ Gender
- ◆ Plasma for IGF (growth)
- ◆ Gill for ATPase (smolt development)

April Pre-Release-
300 fish/Treatment

- ◆ Lengths & weights
- ◆ Bodies (25) for Lipids
- ◆ Gender
- ◆ Gill for ATPase (smolt development)
- ◆ Plasma for IGF & 11KT (early male maturation)



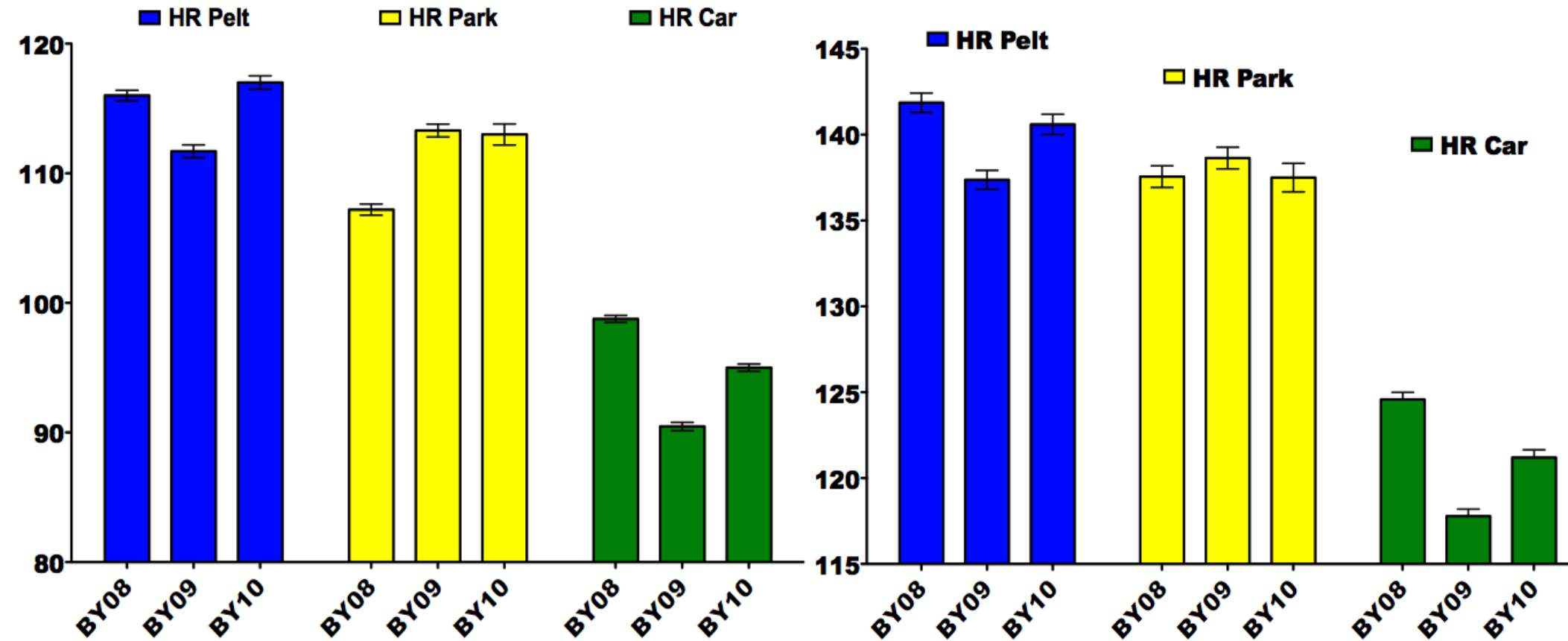
Fish Were Different Sizes & Had Different Growth Patterns



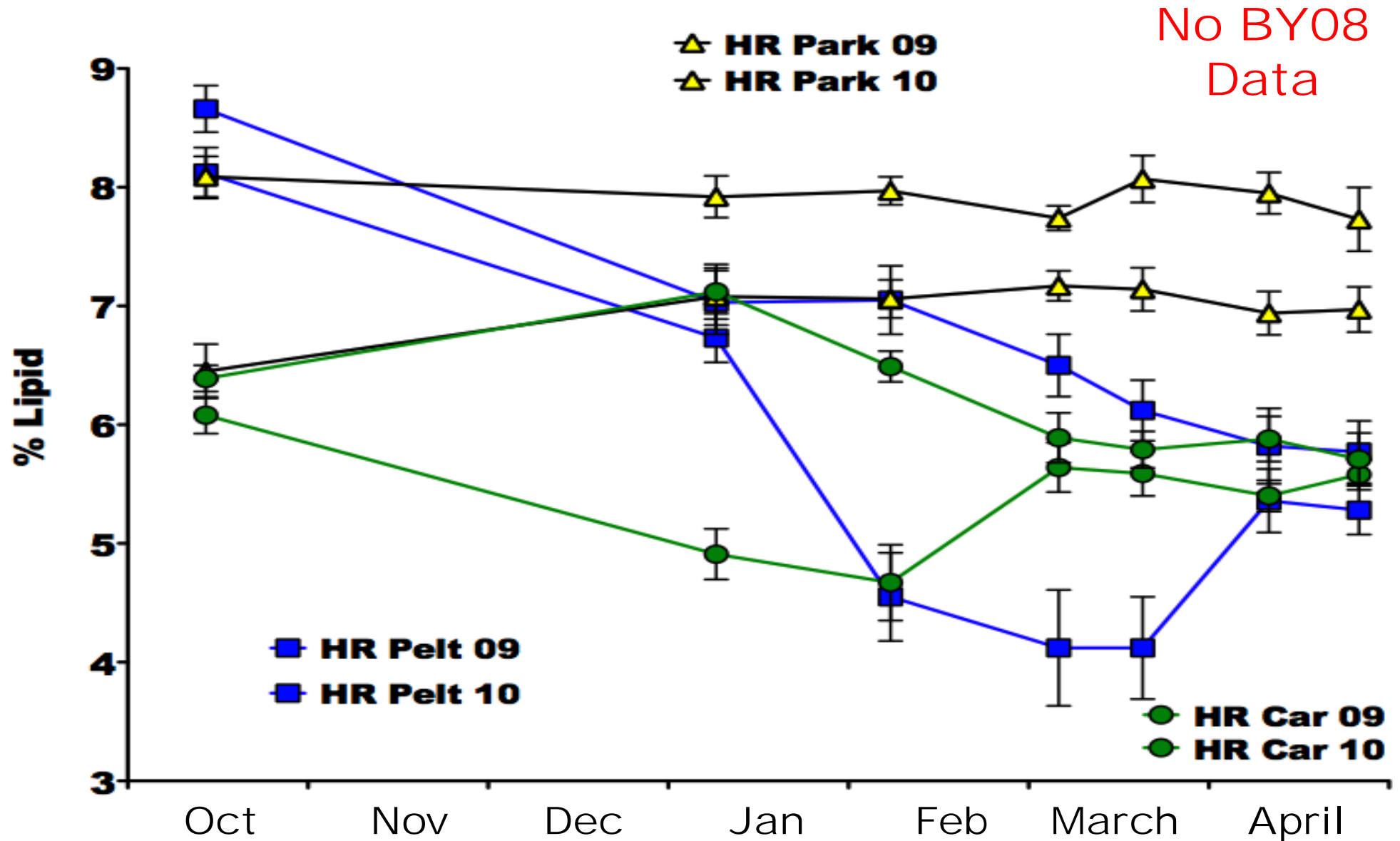
Every Year Pelton Fish Are Consistently Larger

October Length
(mm)

April Length
(mm)

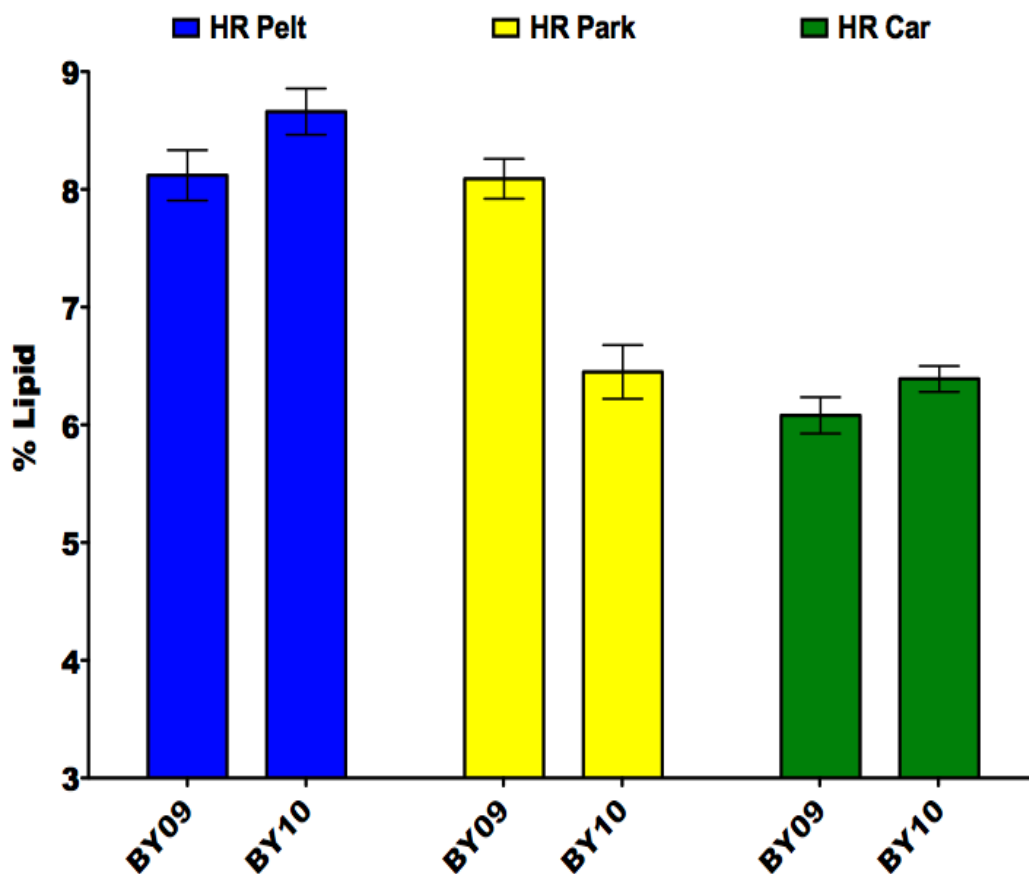


HR Pelt Fish Have a Greater Seasonal Decline In Lipid

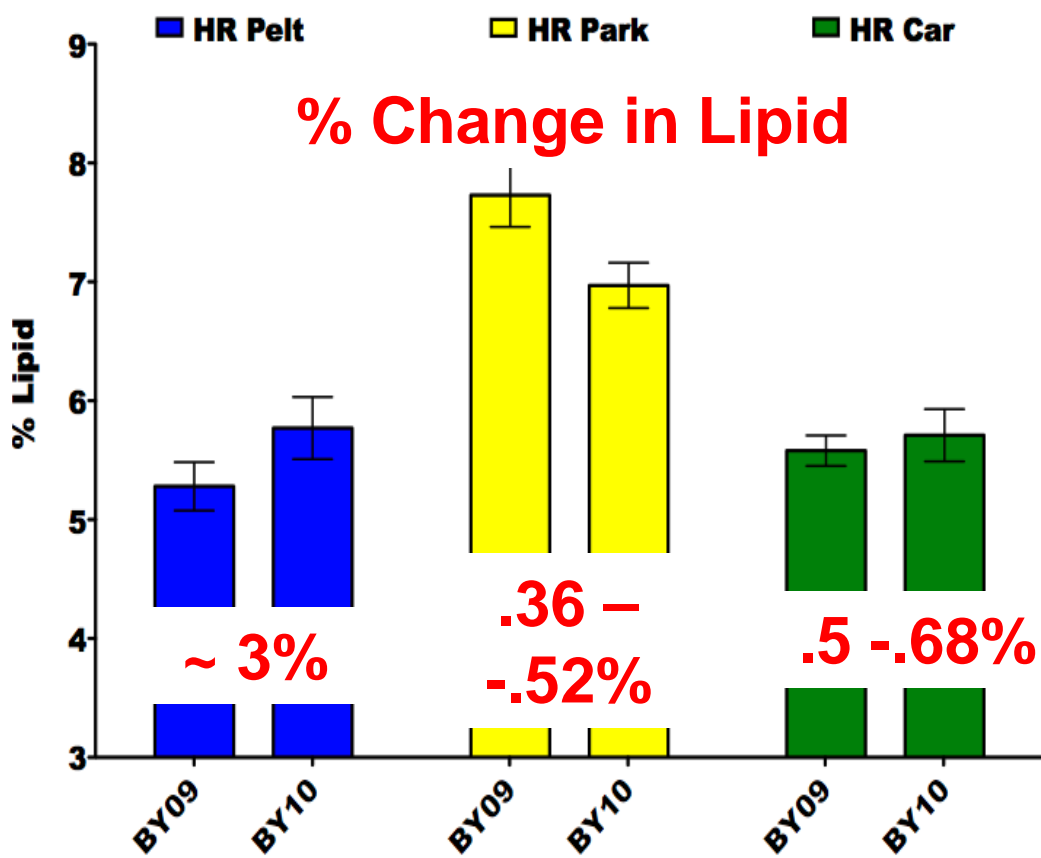


Lipid is Higher in HR Pelt Fish in Oct but Declines Over Time

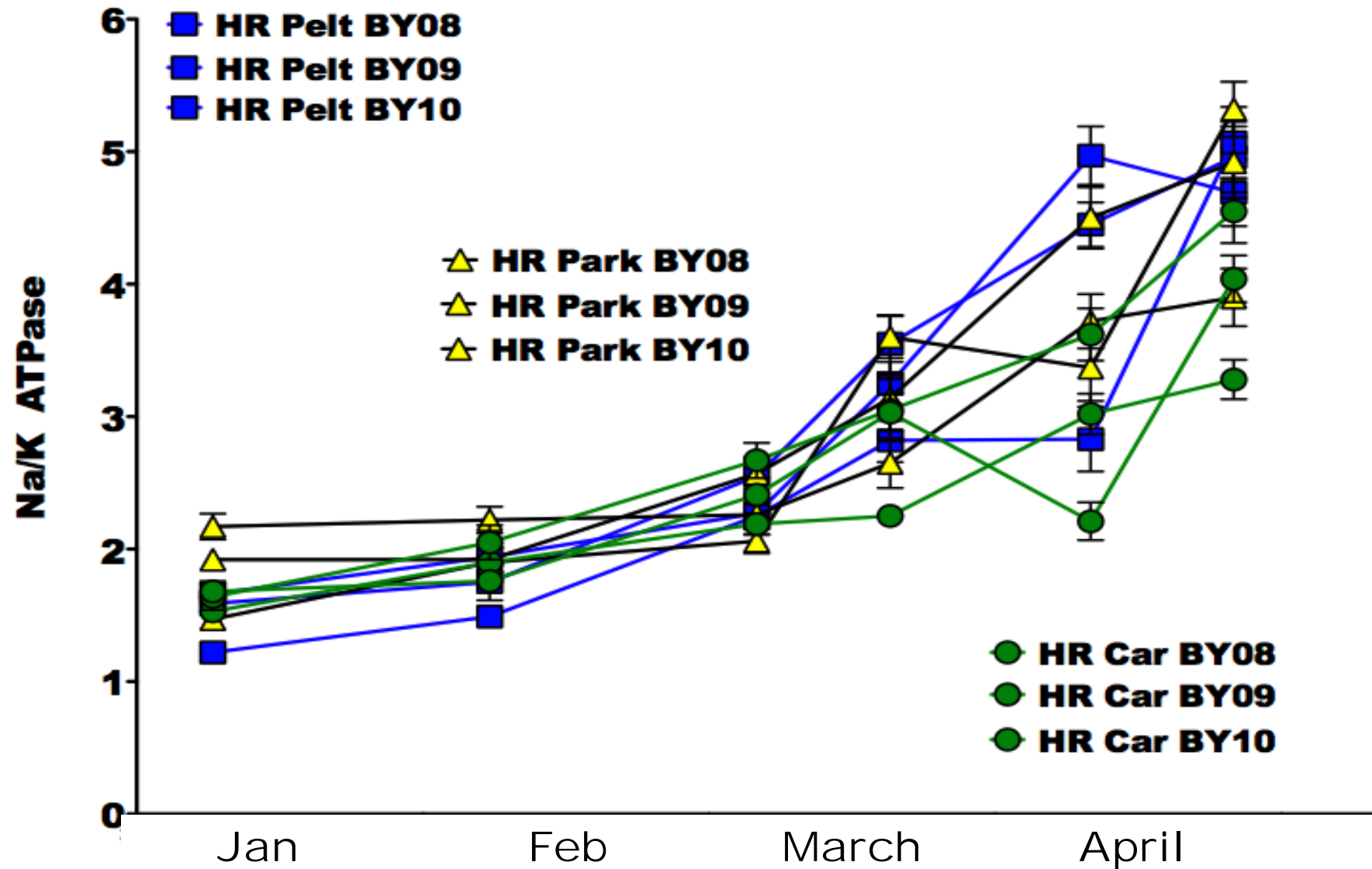
October
% Lipid



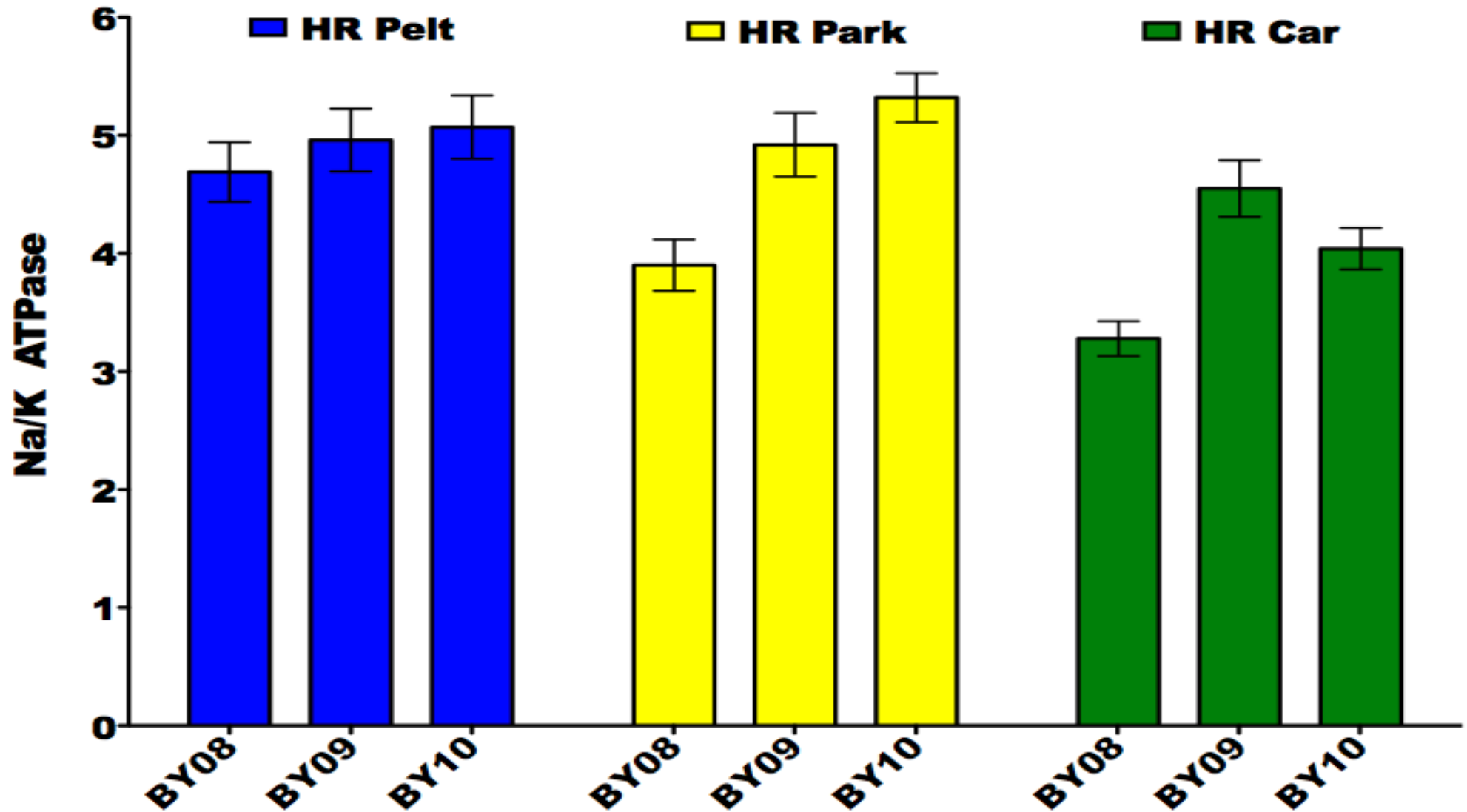
April
% Lipid



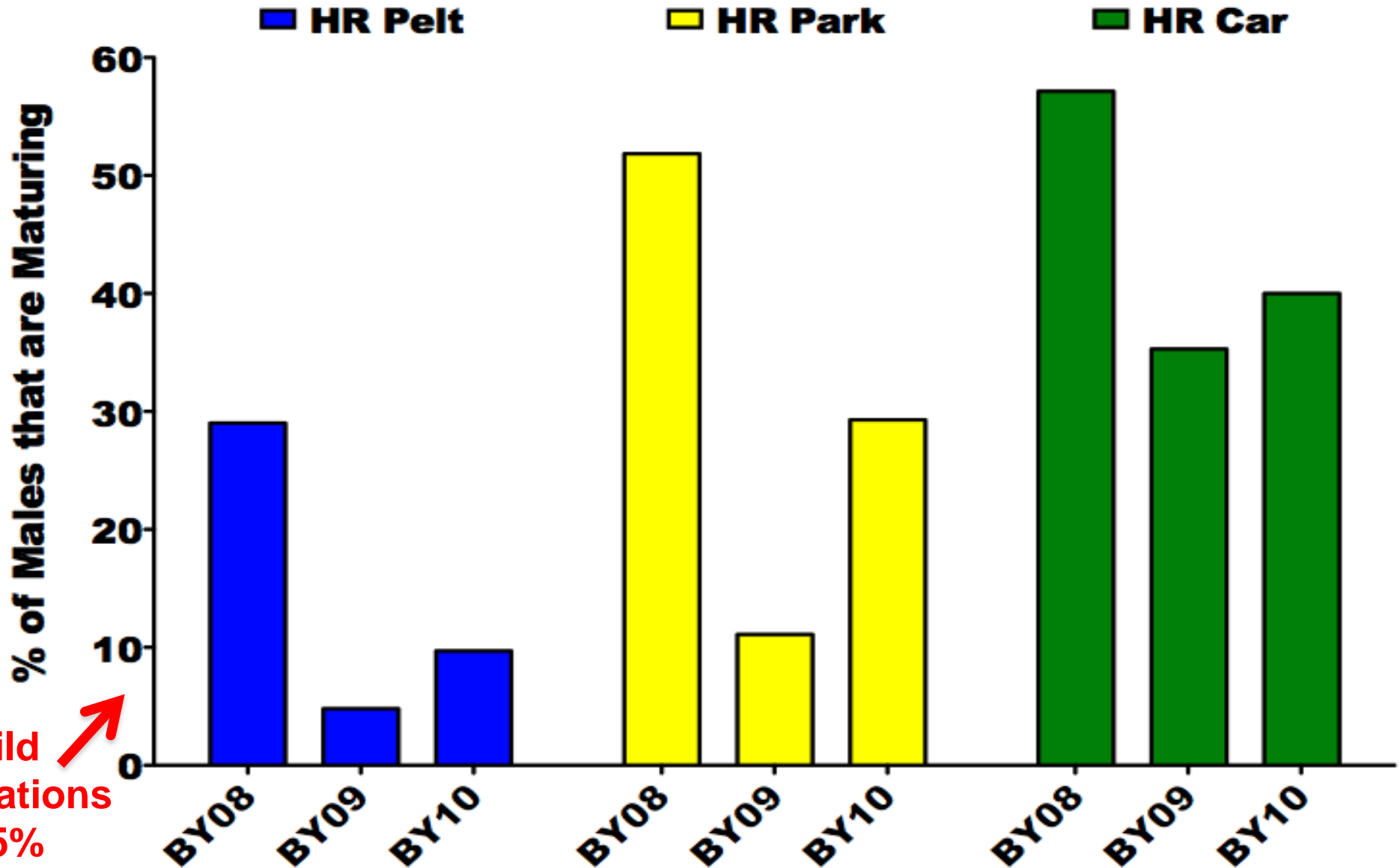
Winter ATPase Levels Start Out Low but Increase Over Time



At Release ATPase in HR Pelt Fish is More Consistent & Usually Higher than HR Car



HR Pelt Fish have Lower Rates of Early Male Maturation

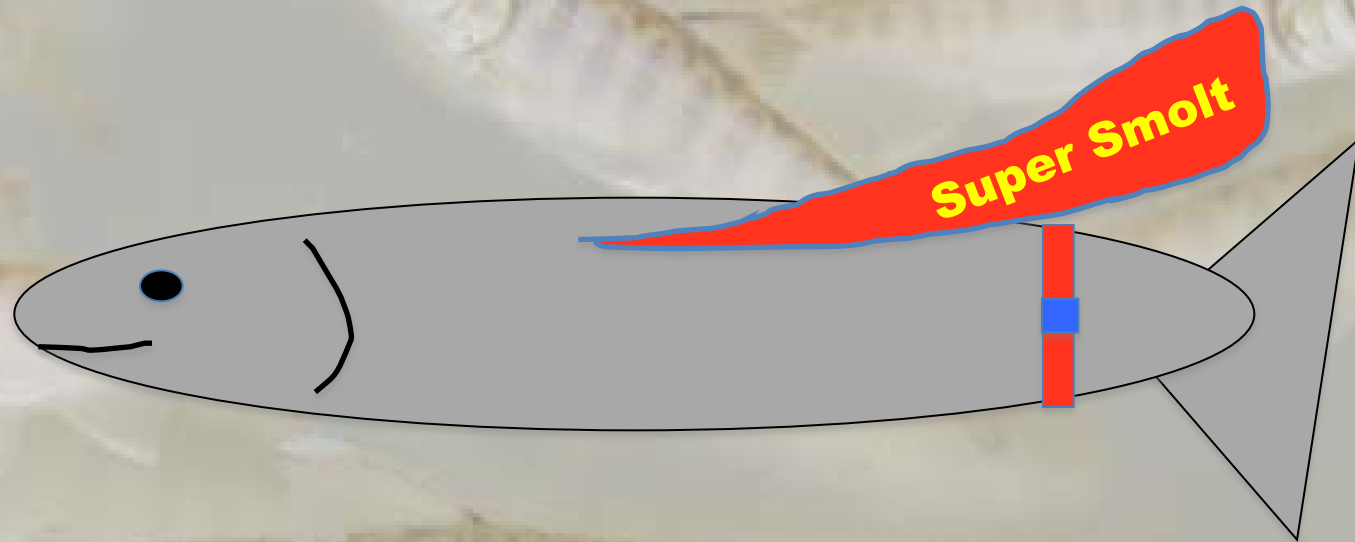


Wild

Populations

< 5%

What makes a good smolt?

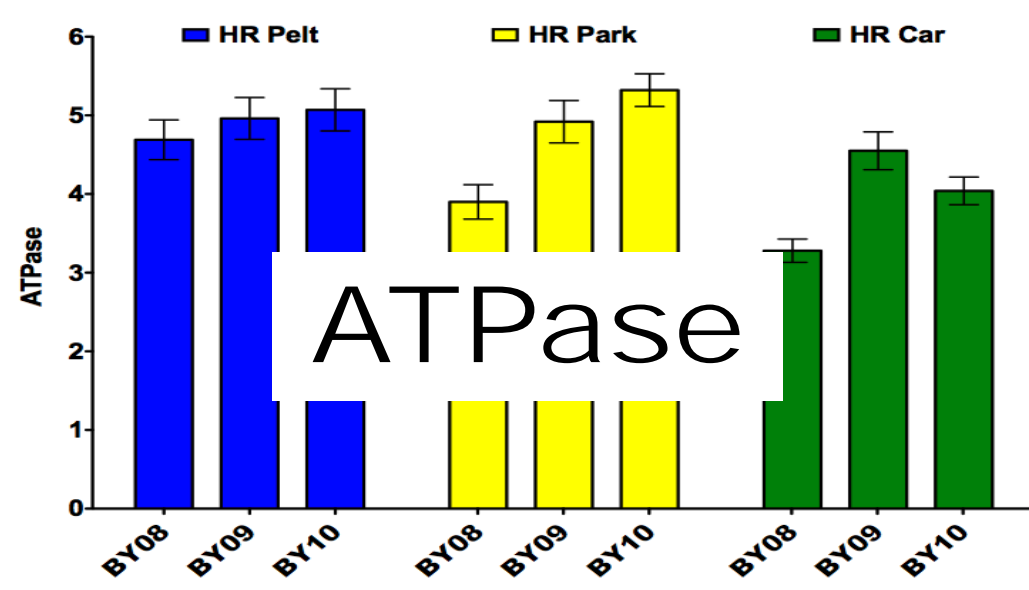
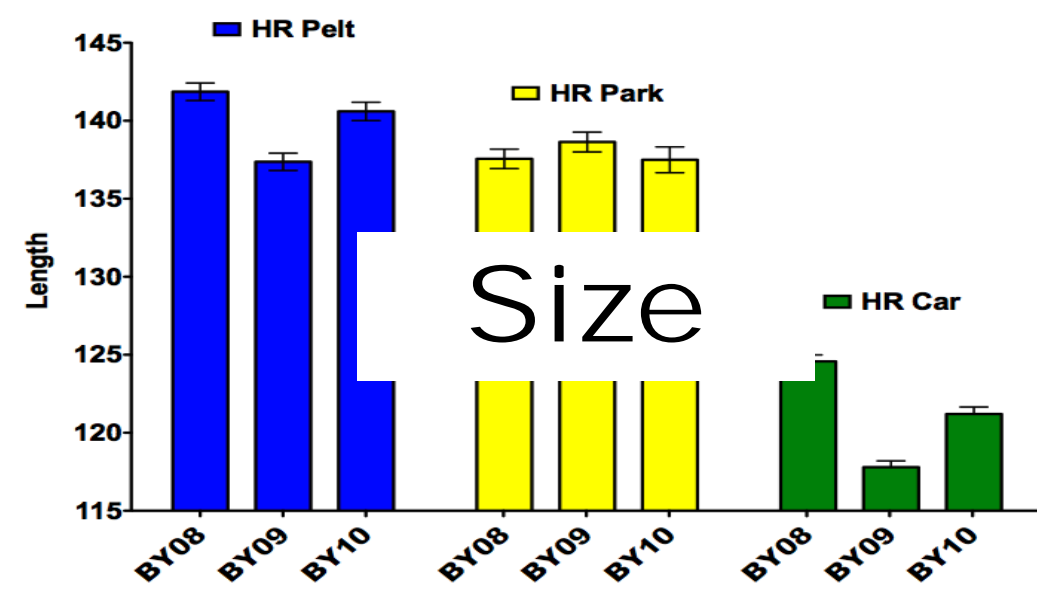


Size = Large

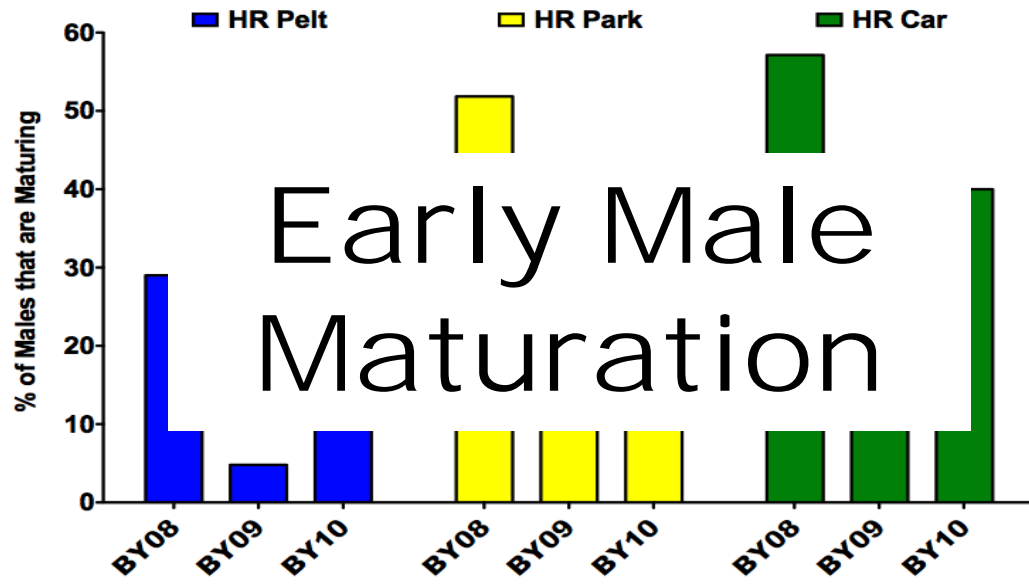
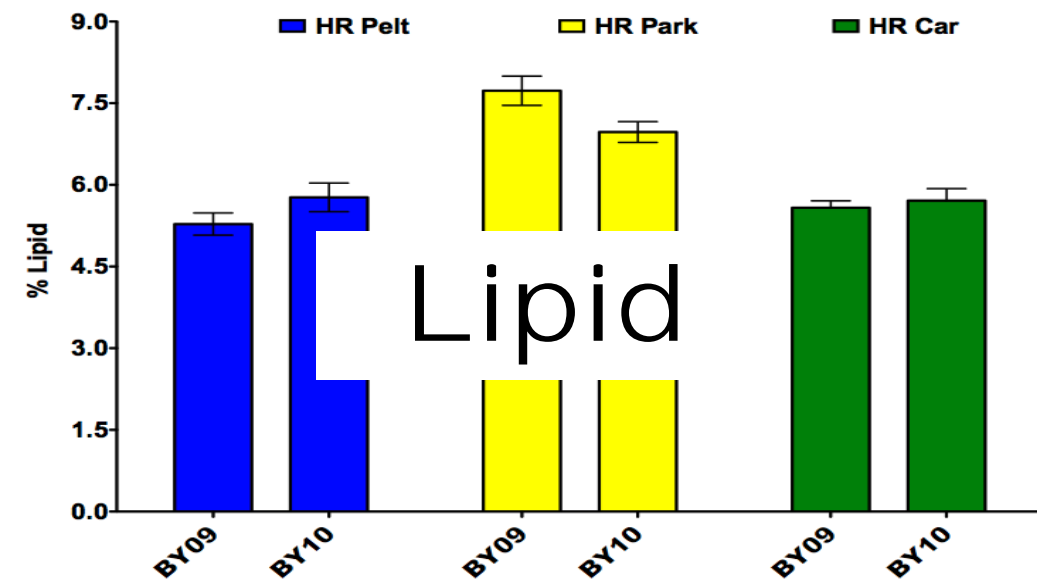
ATPase = High

Lipid = High w/ some Seasonal
Variation

Minijack = Rate Low



Pelton > Parkdale > Carson

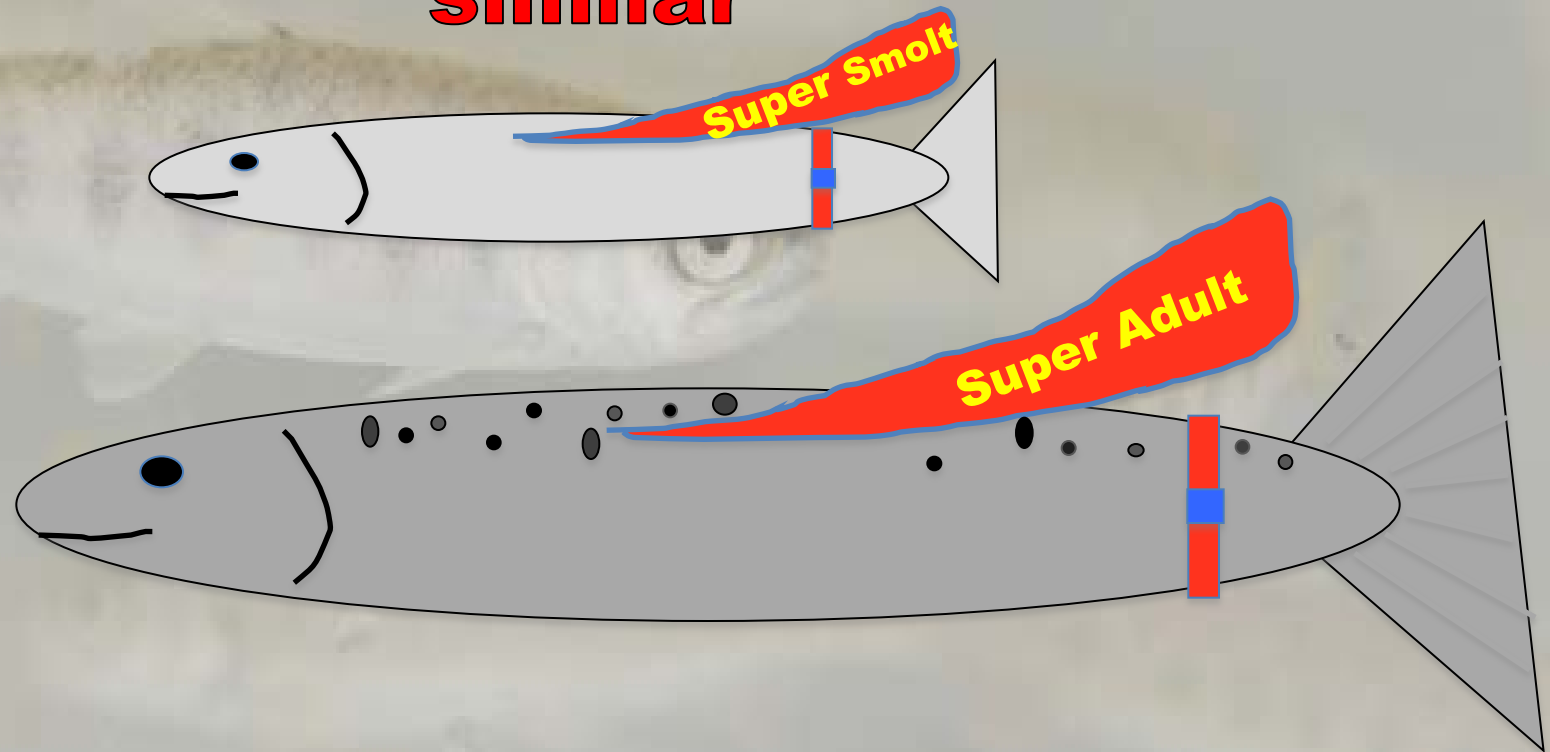


What We Learned

Smolt quality varied among HR stock fish reared at different sites.

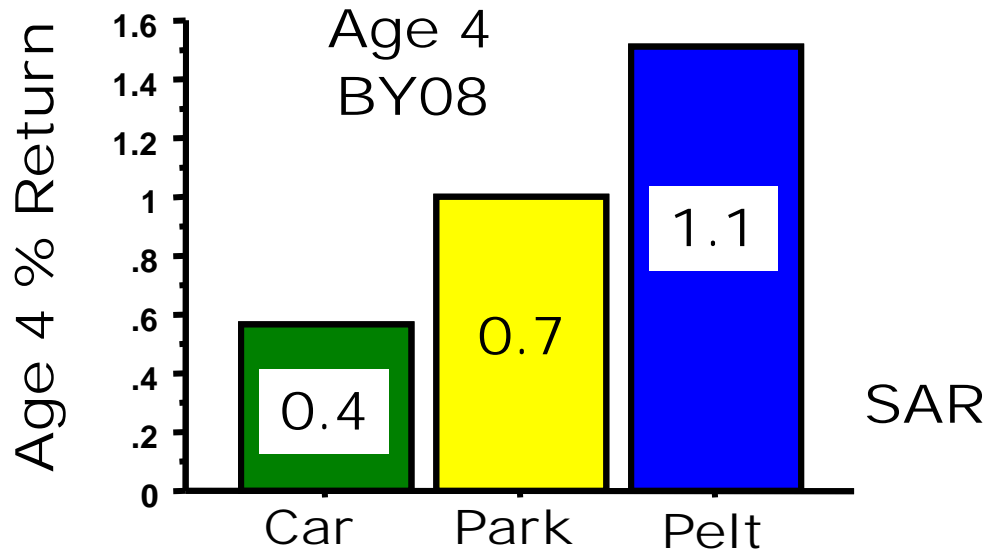
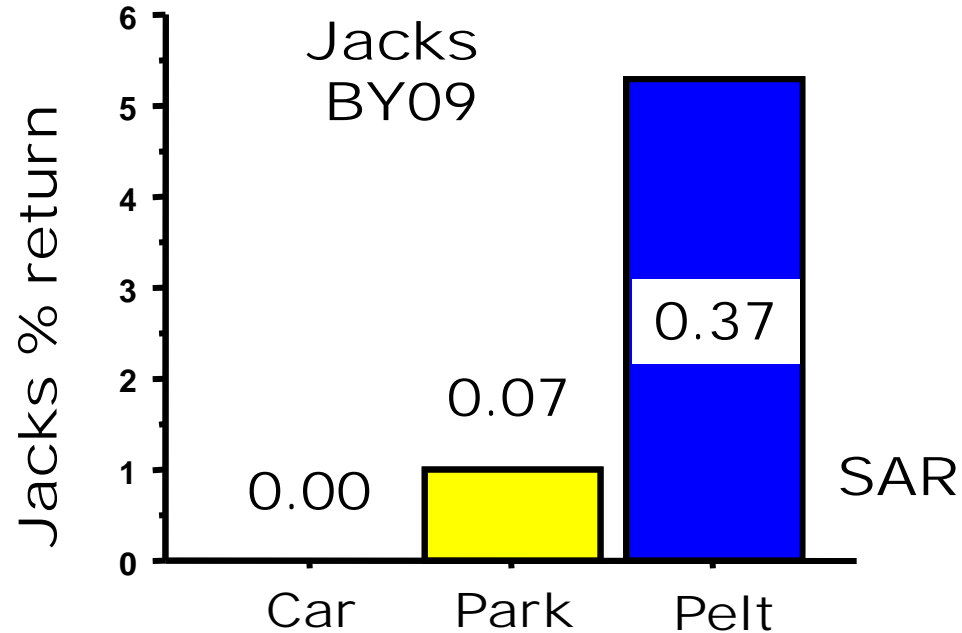
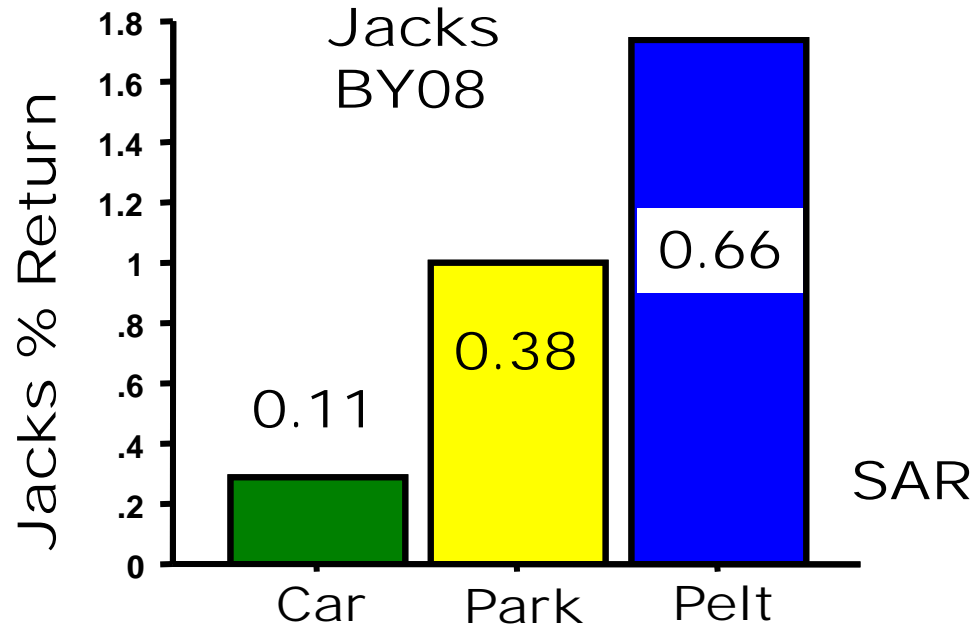
The rearing environment does affect smolt quality even if fish are genetically similar

Does a
Super
Smolt
=
Super
Adult?





Returns by Rearing Site Relative to Parkdale (Parkdale = 1)



**So Far
HR Pelt Has a
Higher SAR**

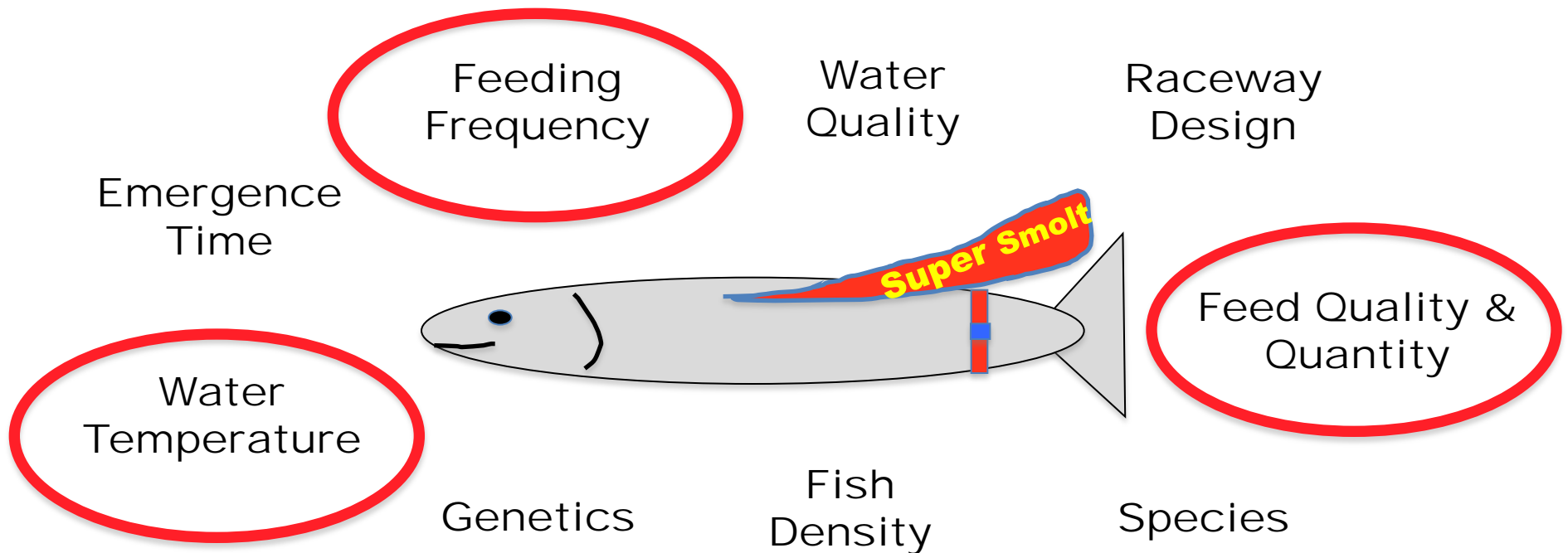
What We Learned

- ✓ Smolt quality varied among HR stock fish reared at different sites.
- ✓ **The Rearing Environment Does Affect Smolt Quality Even if Fish are Genetically Similar**
- ✓ Super Smolt = Super Adult

Why?

Similar Genetics
= Different Smolts

Rearing Environments Differ





Previous Studies Linking Size, Seasonal Growth Rates, & Lipid to Early Male Maturation

- **Higher Growth In The Fall/Winter Is Related To
Increases In Early Male Maturation
(Yakima River spring Chinook)**

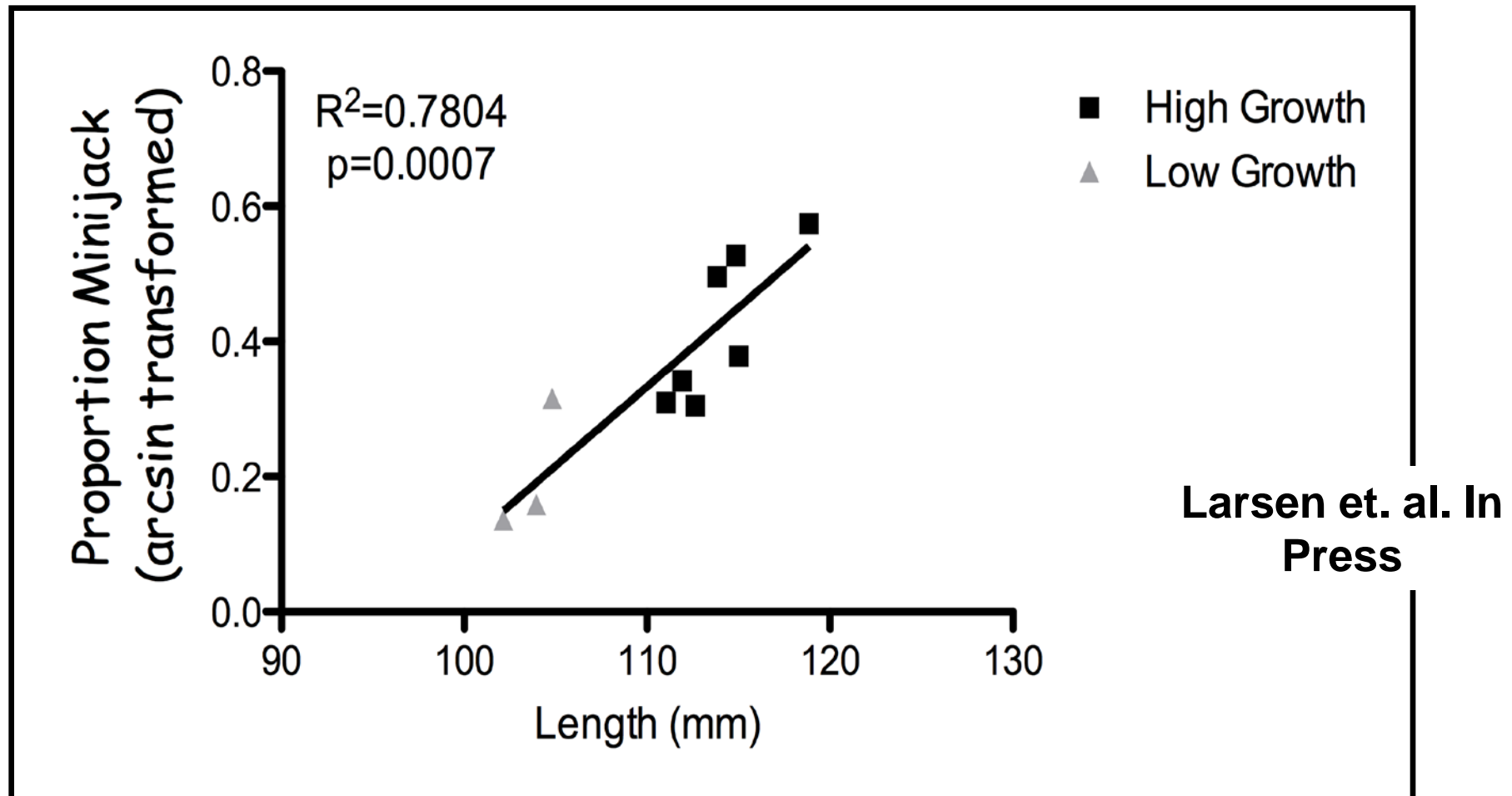
Donald A. Larsen & Brian R. Beckman

- **The Effect of Whole Body Lipid on Early
Sexual Maturation of 1+ Age Male Chinook
Salmon (*Onchohynchus tshawytscha*)**

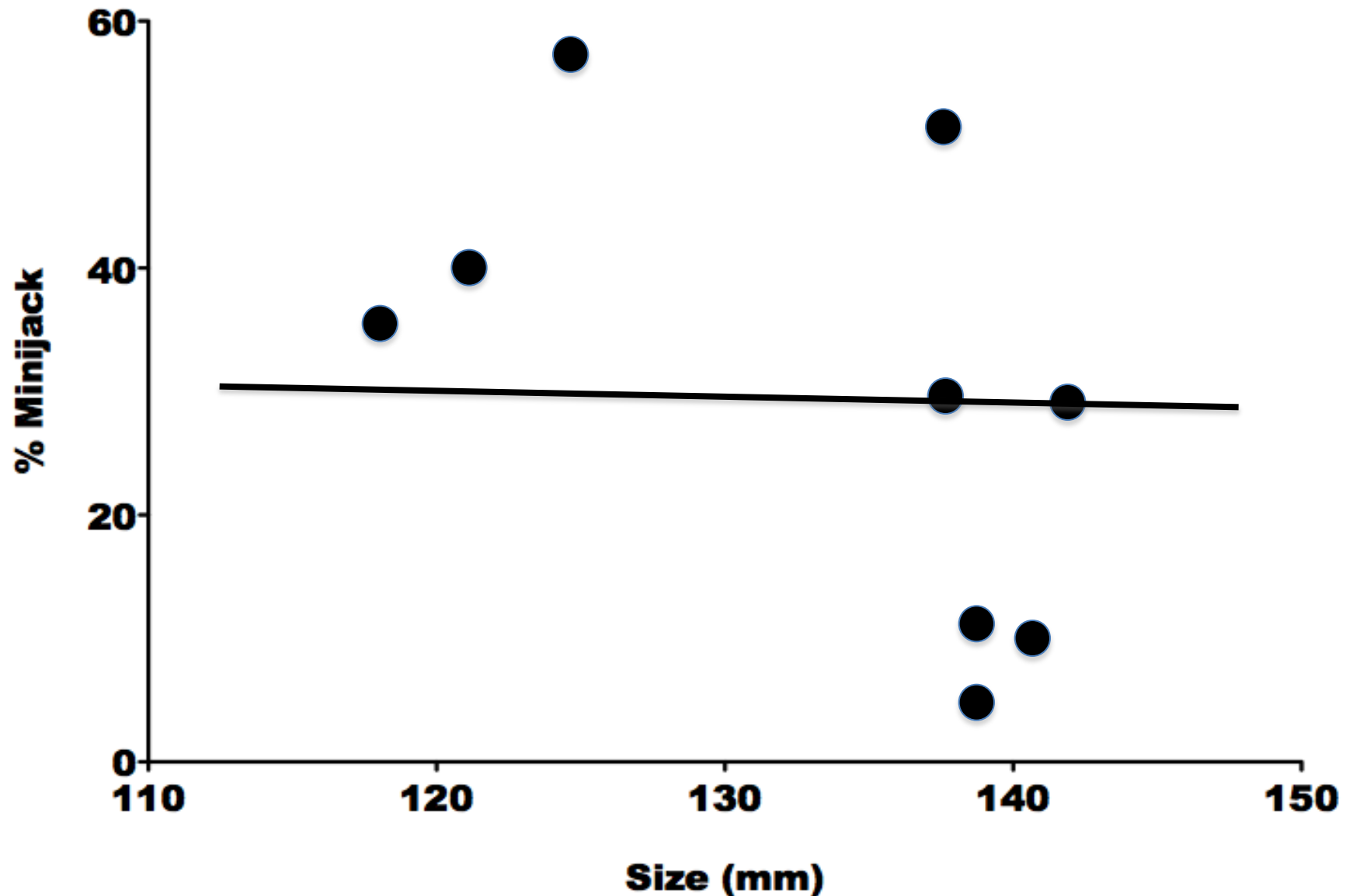
Karl D. Shearer & Penny Swanson



Data From The Yakima Shows a Strong Positive Relation Between Release Length and % MiniJack



Hood River Not Following Usual Size/Minijack Trend



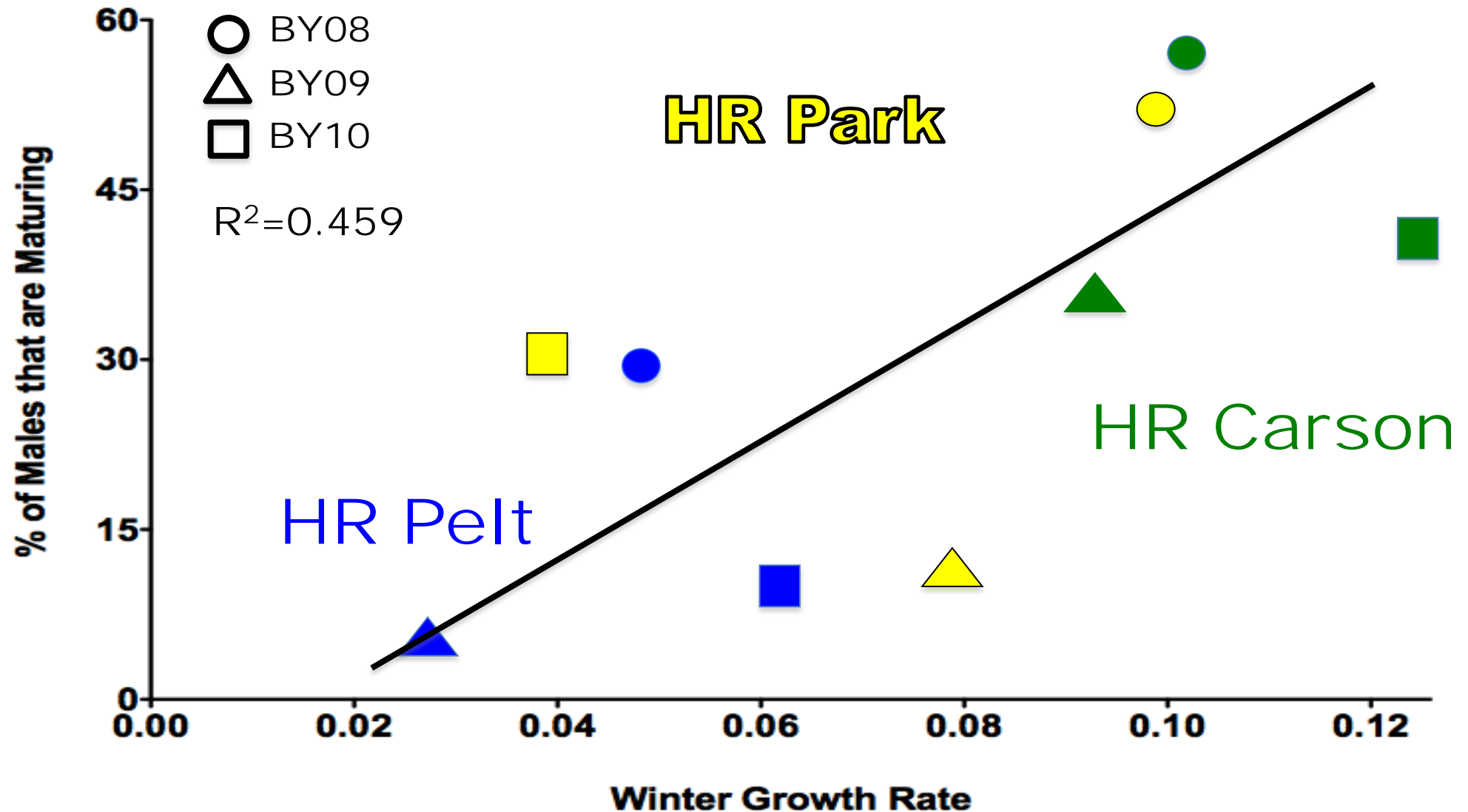
Within Groups, Early Maturing Males Are Still the Biggest Fish

Brood Year	Group	Immature Males (mm)	Mature Males (mm)	Size Difference (mm)
BY08	HR Pelt	140	155	16

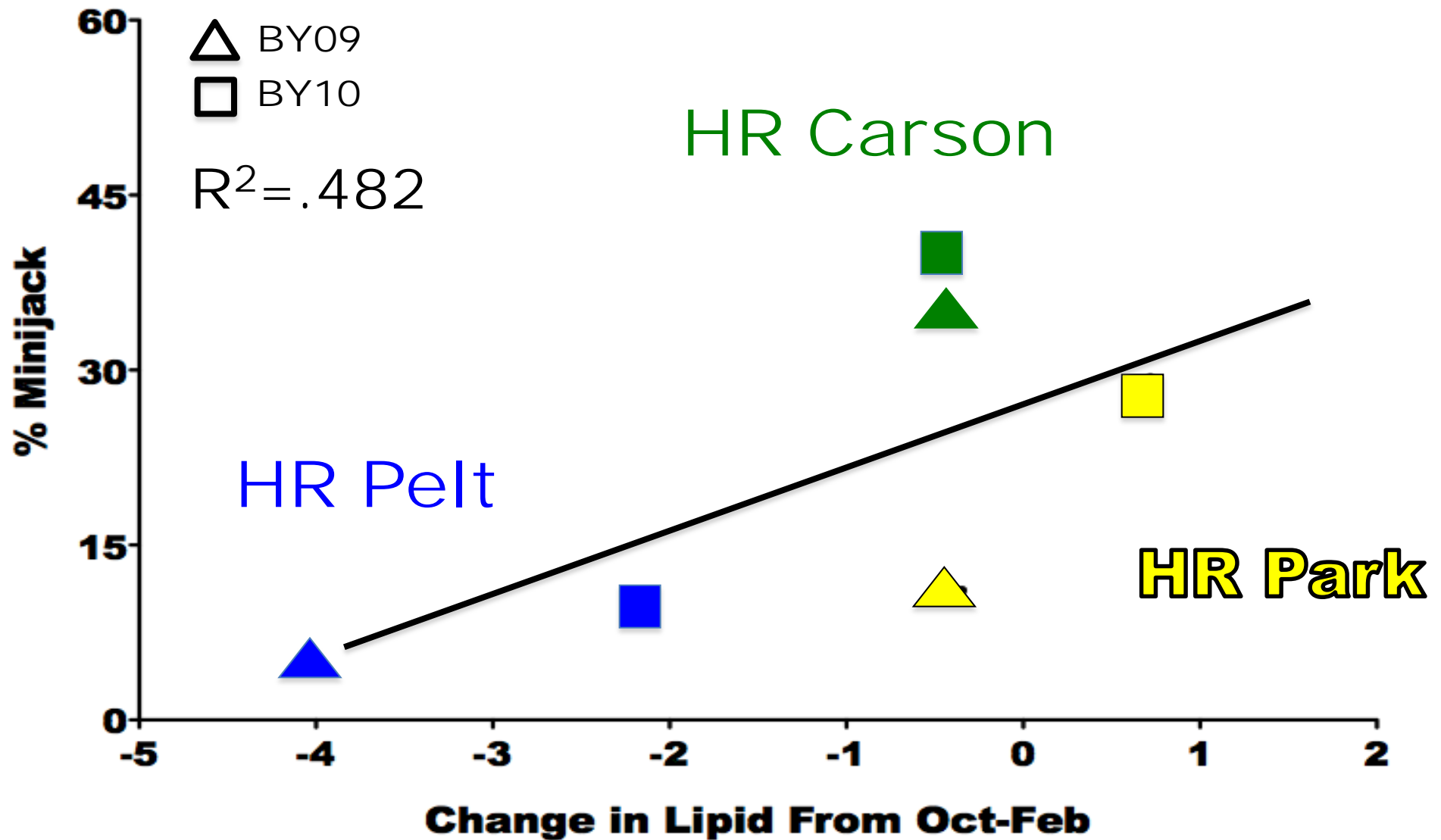
Ave. Length 132 mm 145mm
Difference 13 mm

	HR Park	138	154	16
	HR Car	117	126	10
BY10	HR Pelt	139	158	19
	HR Park	135	155	20
	HR Car	120	130	10

Winter Grow Rate May Influence Early Male Maturation



HR Pelt Fish Have a Greater Change in Lipid from Oct to Feb



Current Hatchery Experiments Looking at Feed Type and Ration

BPA Project

Umatilla

➤ Fall Chinook

- High Fat/ High Ration
- High Fat/ Low Ration
- Low Fat/ High Ration
- Low Fat/ Low Ration

Don Larsen

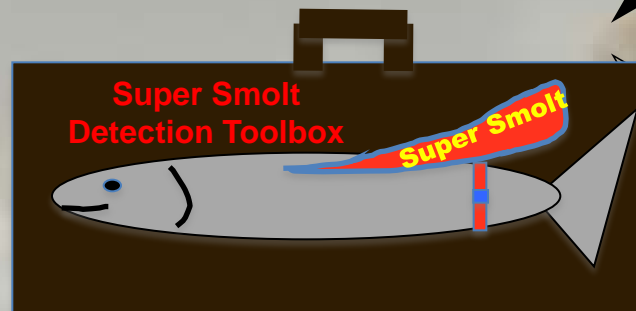
Grant Co. PUD

White River

➤ Spring Chinook

- Low Fat/ 18 FPP
- High Fat/ 20 FPP
- Low Fat/ 22 FPP
- High Fat/ 24 FPP

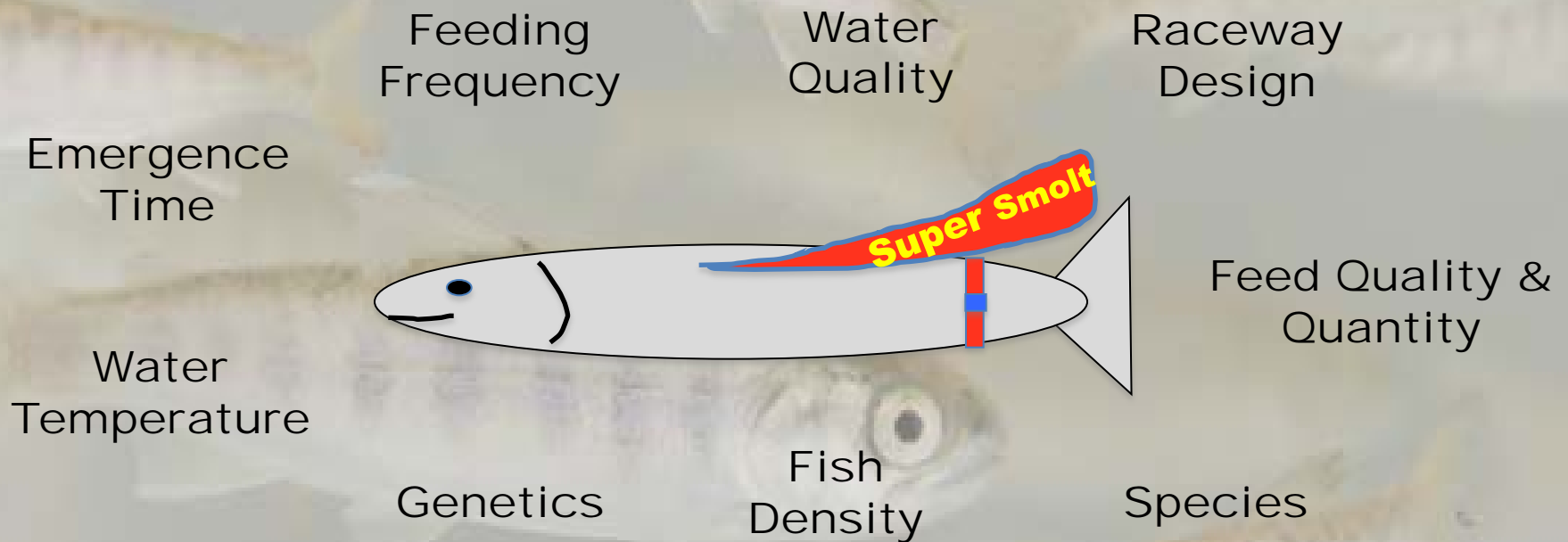
Eric Lauver



Why Should We Care?

Fish = Fish

Bigger Fish = Better Fish



Trade-offs between size & early male maturation

Acknowledgements

Parkdale Hatchery- Jim Gidley &
Albert Santos

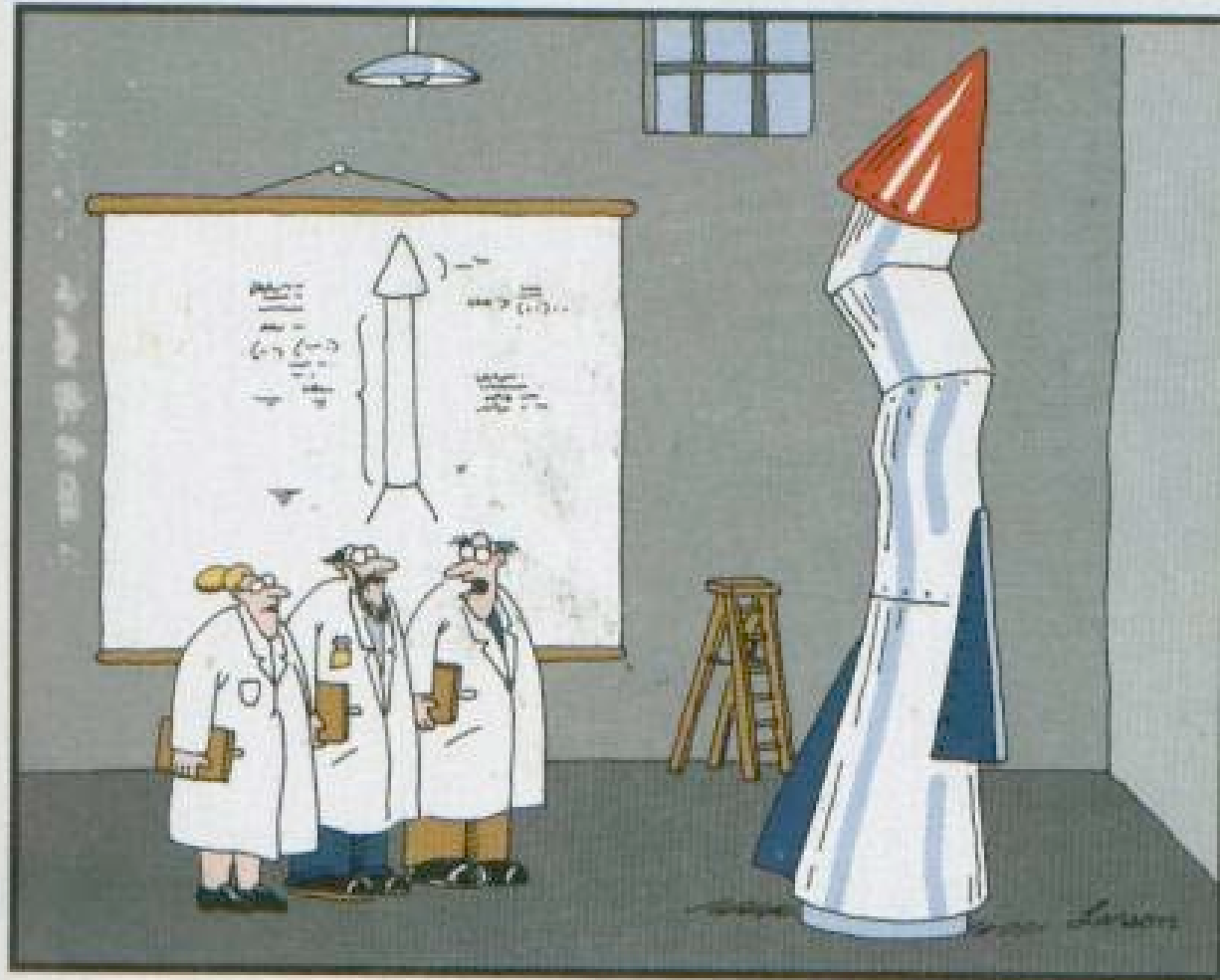
ODFW- Jack Palmer and Crew

USFWS- John Hitron, Thomas
Hogan & Crew

NOAA- Larissa Felli, Deb Harstad,
Shelly Nance

BPA- Richard Golden COTR

Questions



**"It's time we face reality, my friends. ...
We're not exactly rocket scientists."**