

# Effects of hatchery rearing and release practices on olfactory imprinting and homing



THE NEW YORKER



"Face it—we're lost."

S. GROSS

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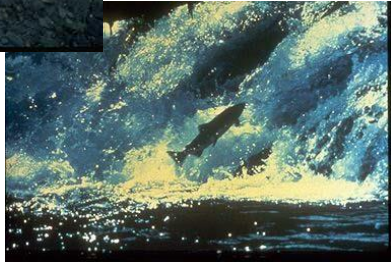
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# Olfactory imprinting and homing



Fall

Spring

Spring

Fall

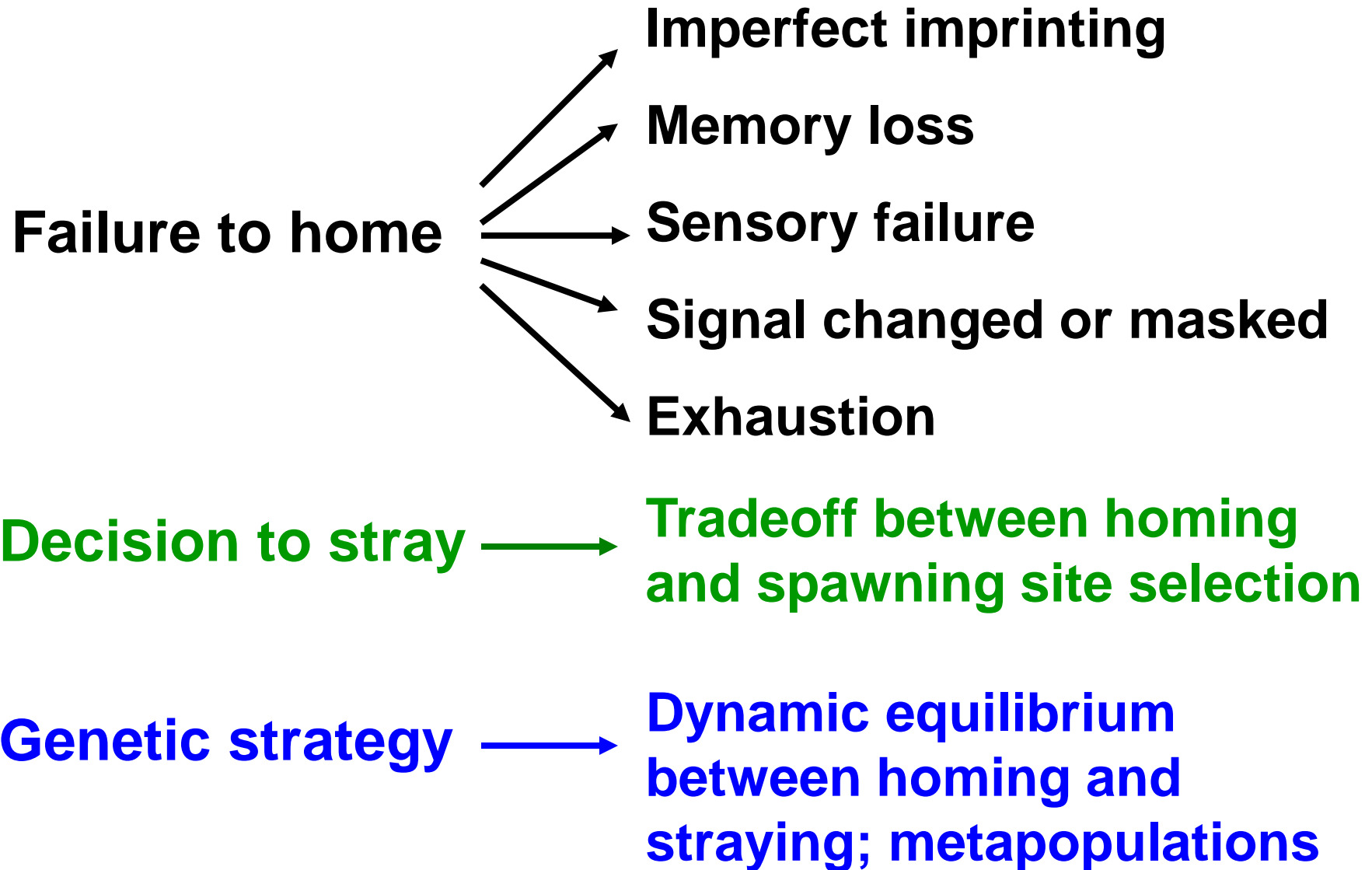
Fall

Spring

Ocean

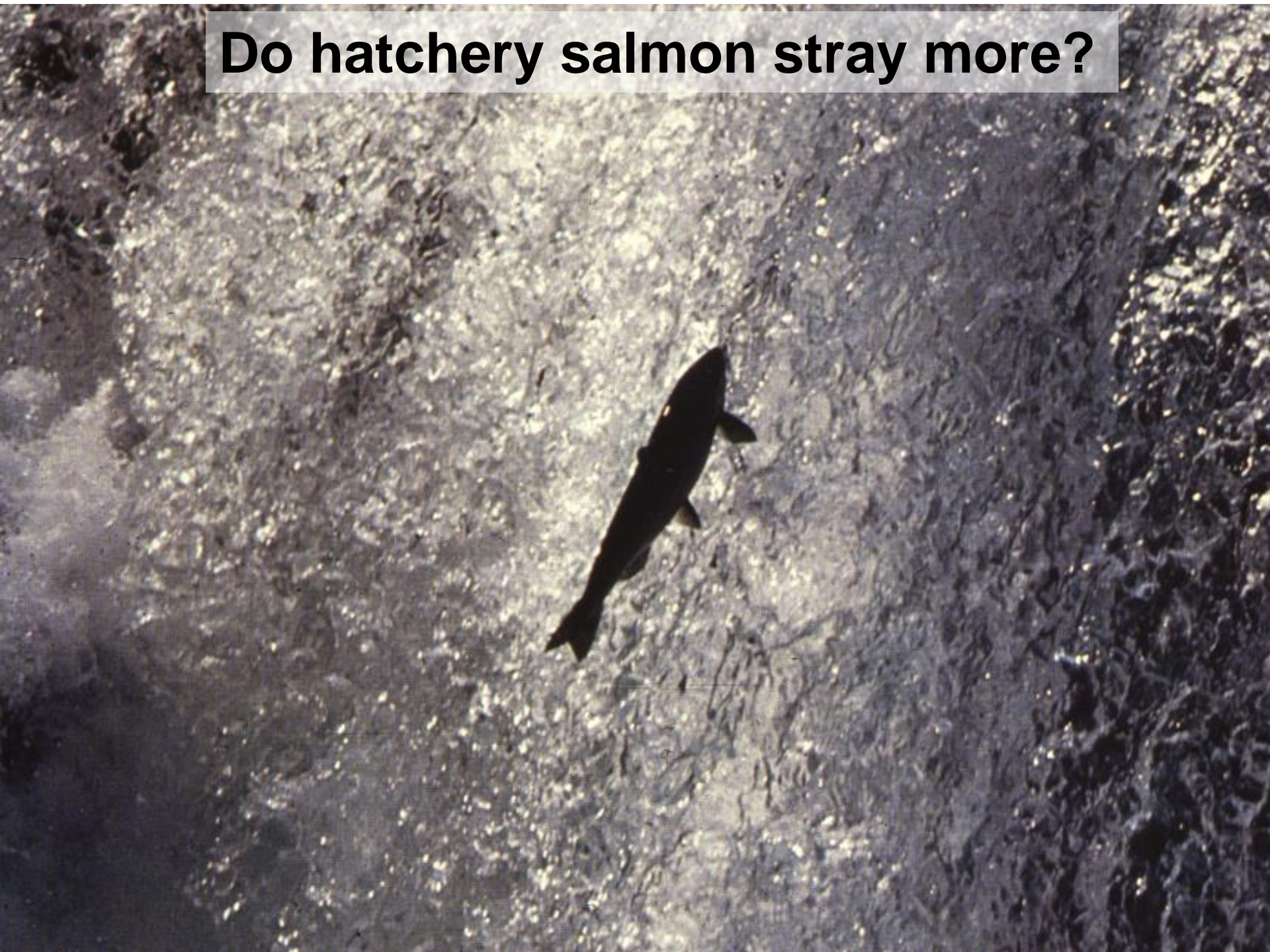


# Why do salmon stray?





**Do hatchery salmon stray more?**





# Do hatchery salmon stray more?

## Not necessarily



Species	Origin	UW returns	Issaquah returns
Coho	UW	3712	2
	Issaquah	1	737
Chinook	UW	5863	3
	Issaquah	1	542



# Do hatchery salmon stray more?

## Not necessarily

But the things we do can definitely increase straying

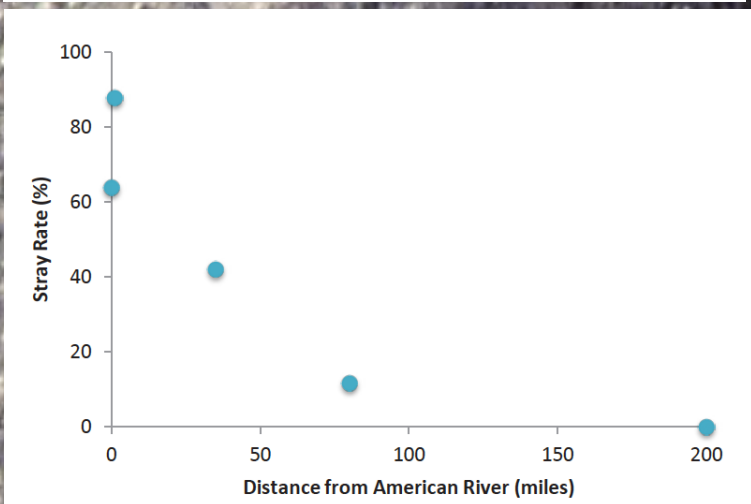
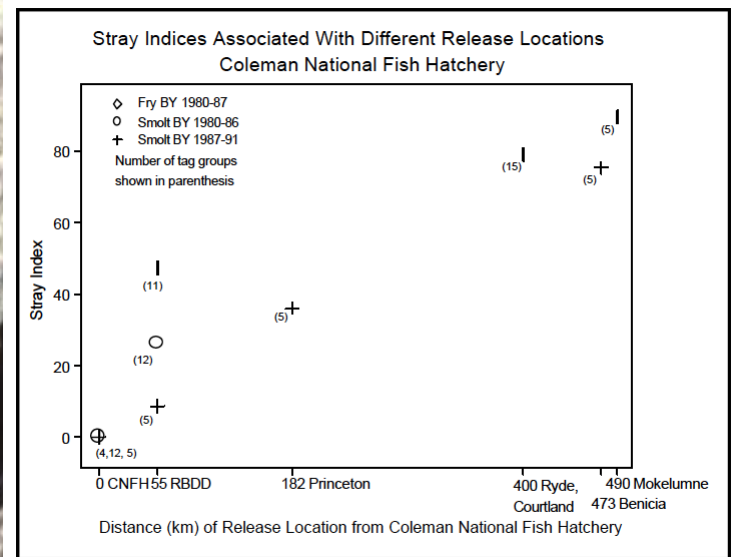
- Transport and release away from the natal hatchery
- Release at inappropriate developmental stages
- Acclimation strategies
- Release into inappropriate habitat
- Rearing environment
  - Environmental complexity
  - Developmental/epigenetic processes



# Do hatchery salmon stray more?

Not necessarily, but.....

Transport and release away from the natal hatchery



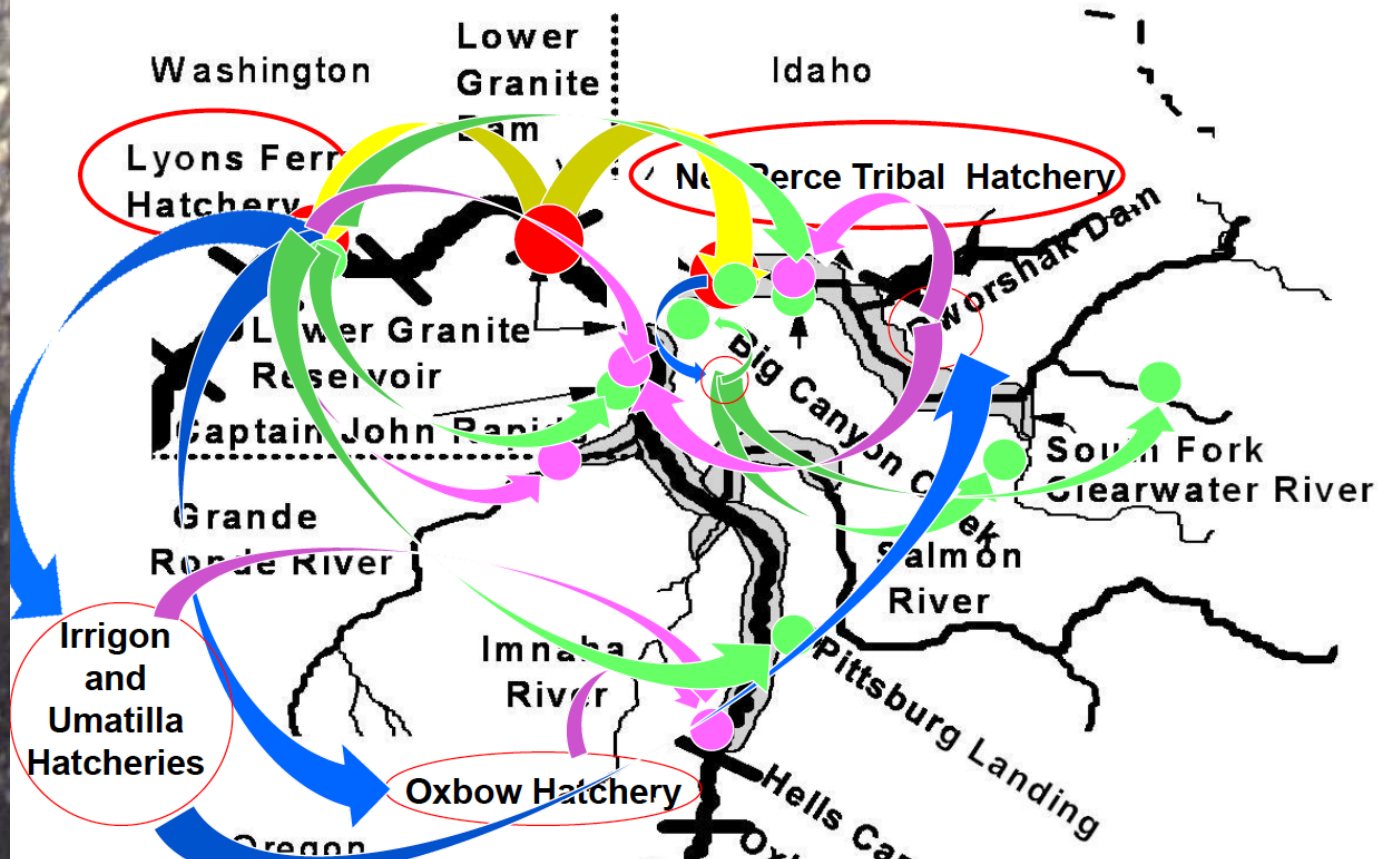


# Do hatchery salmon stray more?

Not necessarily, but.....

Transport and release away from the natal hatchery

## Hatchery Facilities and Release Locations

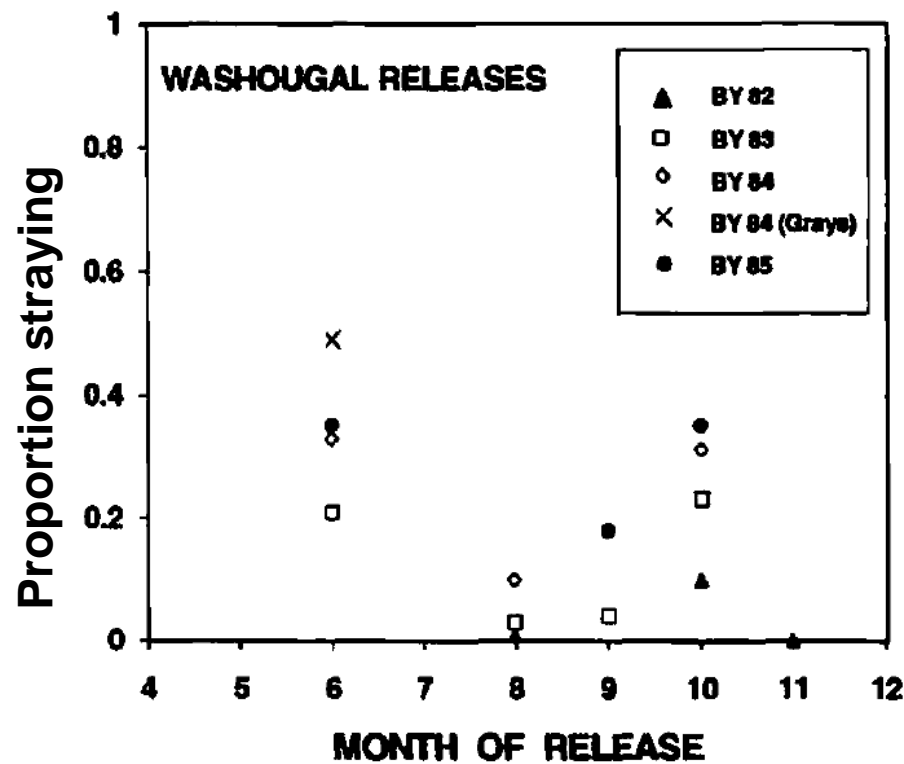




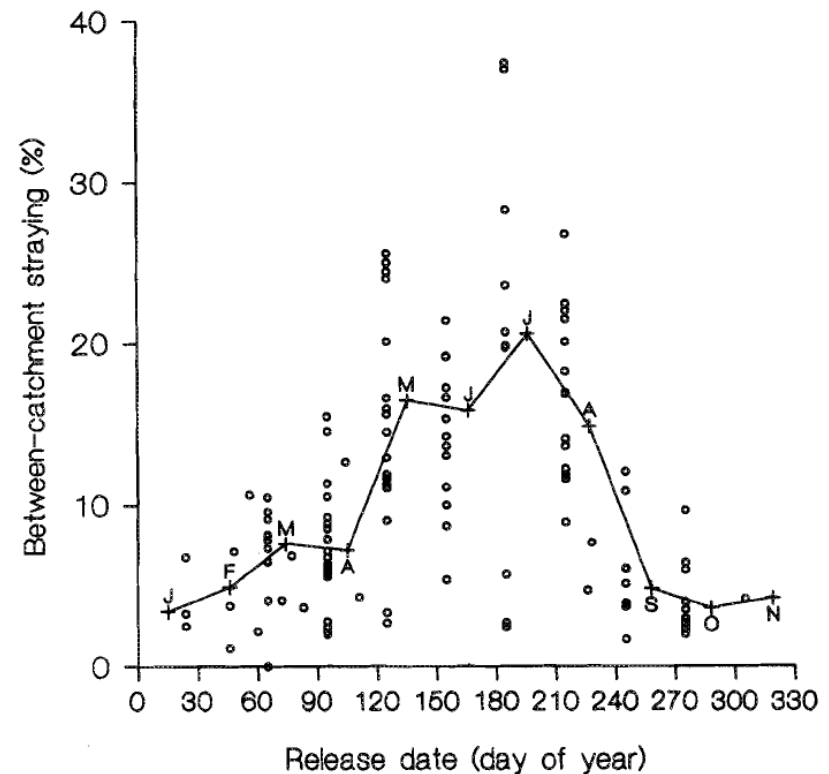
# Do hatchery salmon stray more?

Not necessarily, but.....

Release at inappropriate developmental stages



Pascual et al. 1995



Unwin and Quinn. 1993



# Do hatchery salmon stray more?

Not necessarily, but.....

Acclimation strategies/Release into inappropriate habitat

Acclimation: location, timing, duration





IF YOU BUILD IT,  
THEY WILL COME.





IF YOU BUILD IT,  
THEY MAY OR MAY NOT COME.





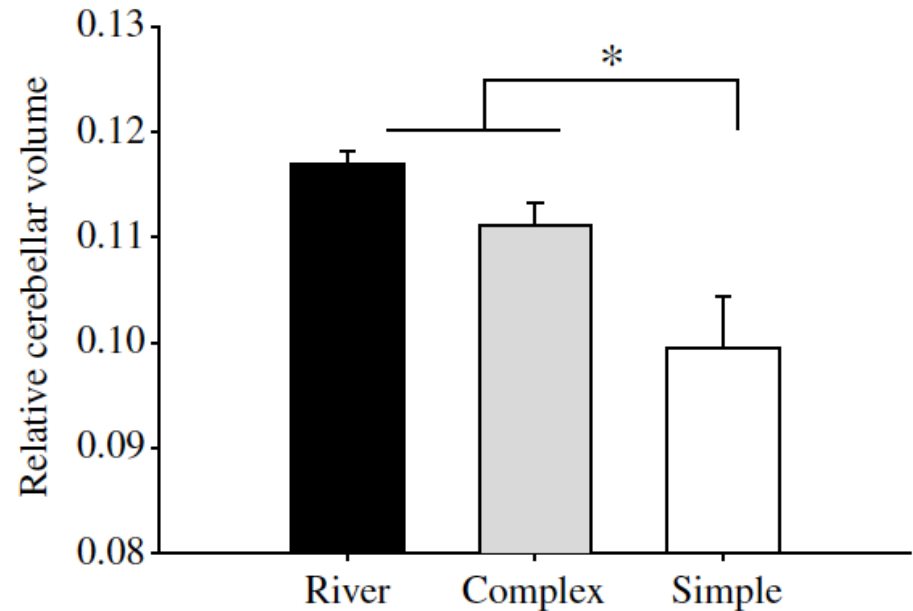
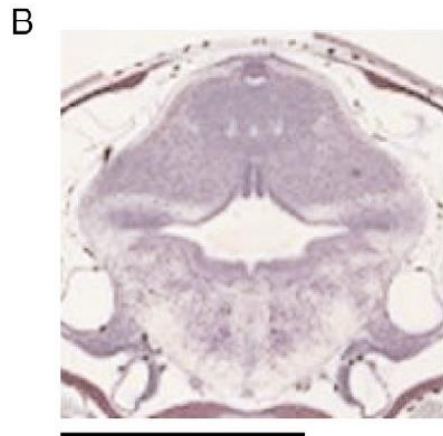
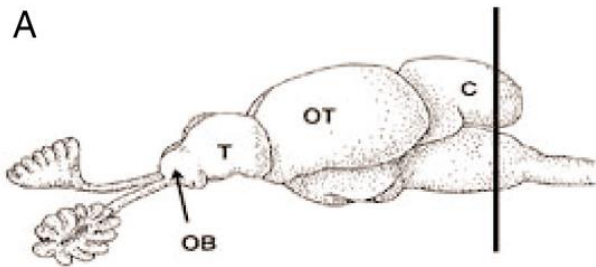
# Do hatchery salmon stray more?

## Not necessarily, but.....

Rearing environment:

Environmental complexity/developmental/epigenetic processes

## Does hatchery rearing affect the olfactory system?

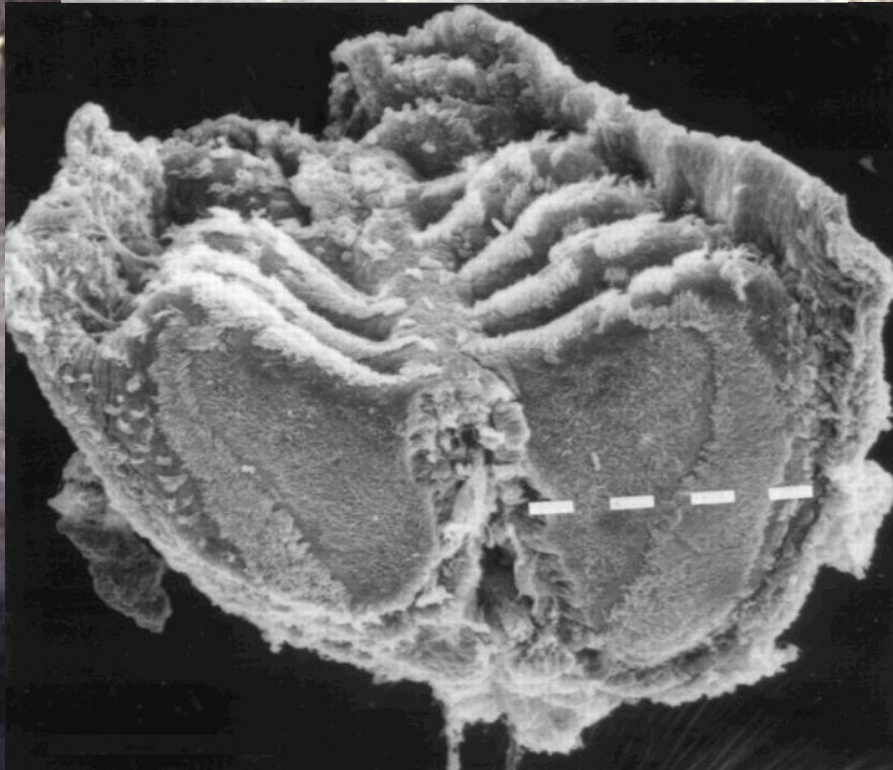


Kihlslinger and Nevitt 2006



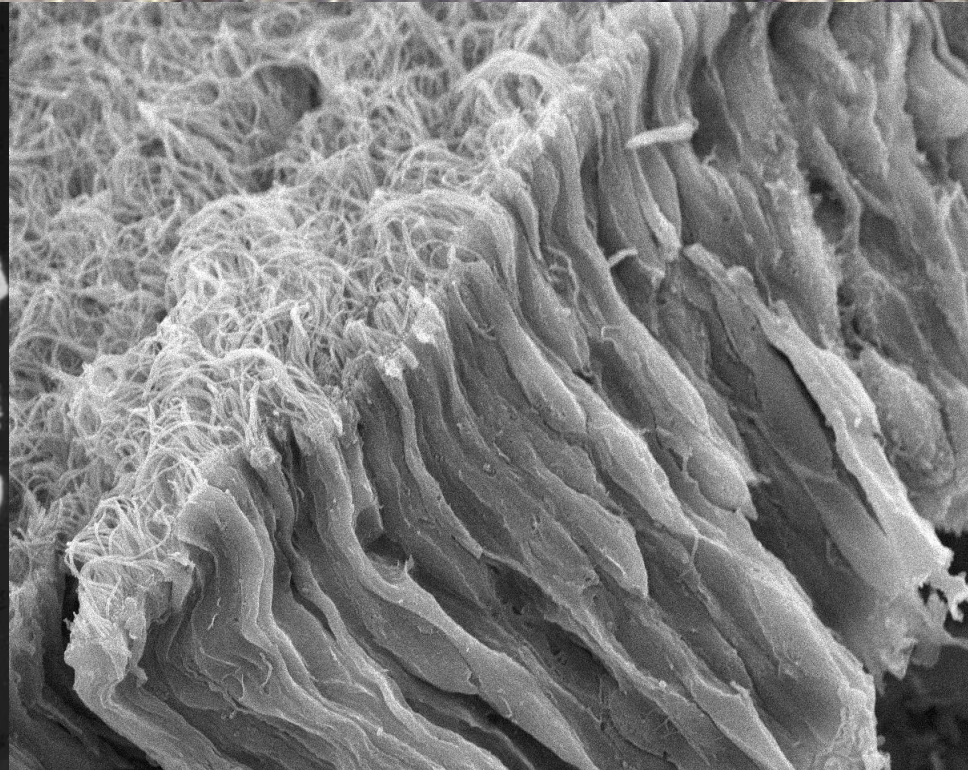
# Does hatchery rearing affect the olfactory system?

**Olfactory Rosette**



from Weth et al. 1996

**Olfactory Epithelium**



Carla Stehr



# Does it matter what water source salmon are reared in?





# Smolting-associated changes in odorant receptor expression

**Walla Walla Hatchery steelhead**



**Reared to yearling stage at Big Beef Creek hatchery in well water**



**Initiate surface water experiment Jan. 20**  
**2 tanks well water**  
**2 tanks surface water**



**Sample fish for olfactory tissue every 3 weeks**

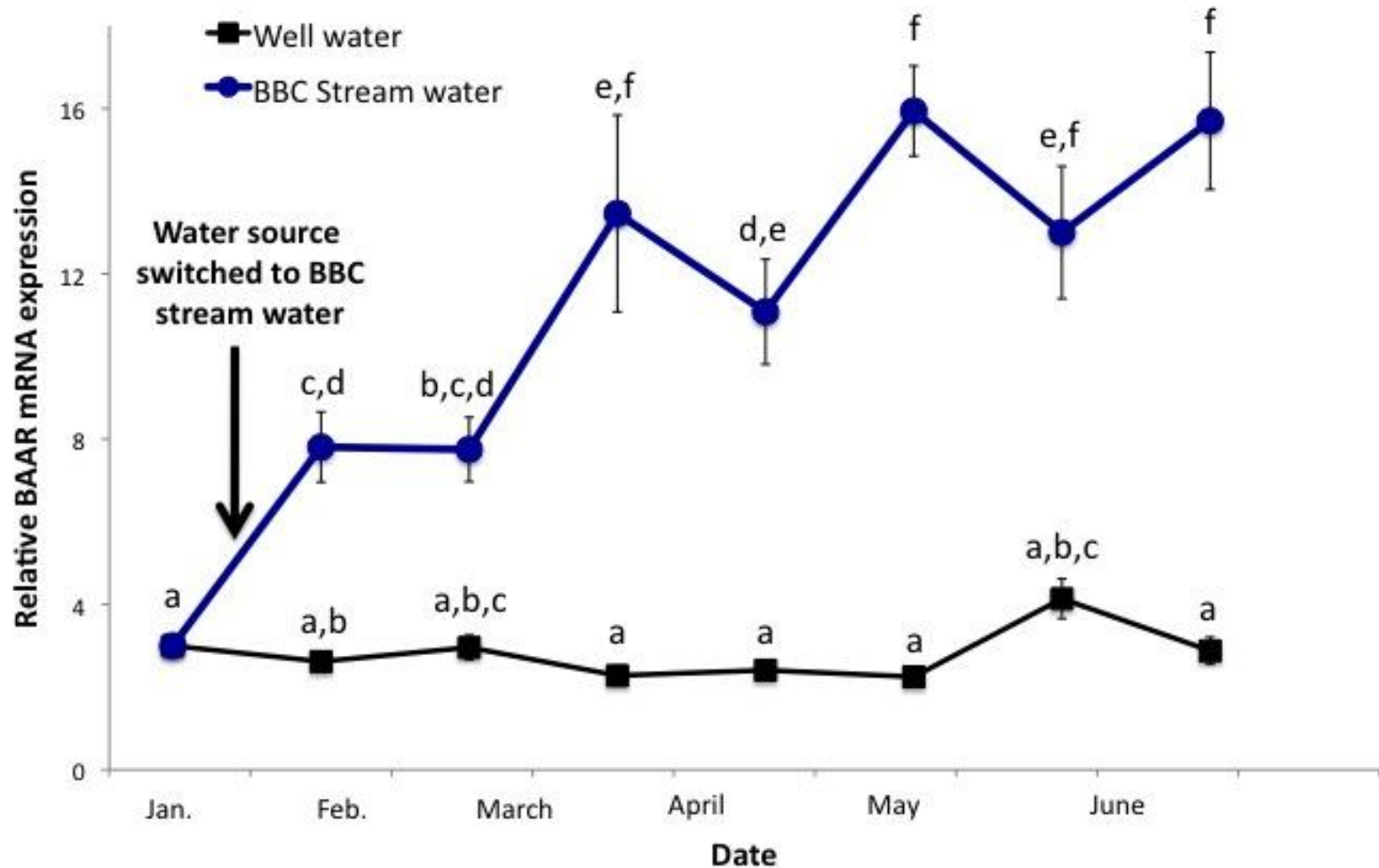


**Analyze olfactory development (OR expression)**



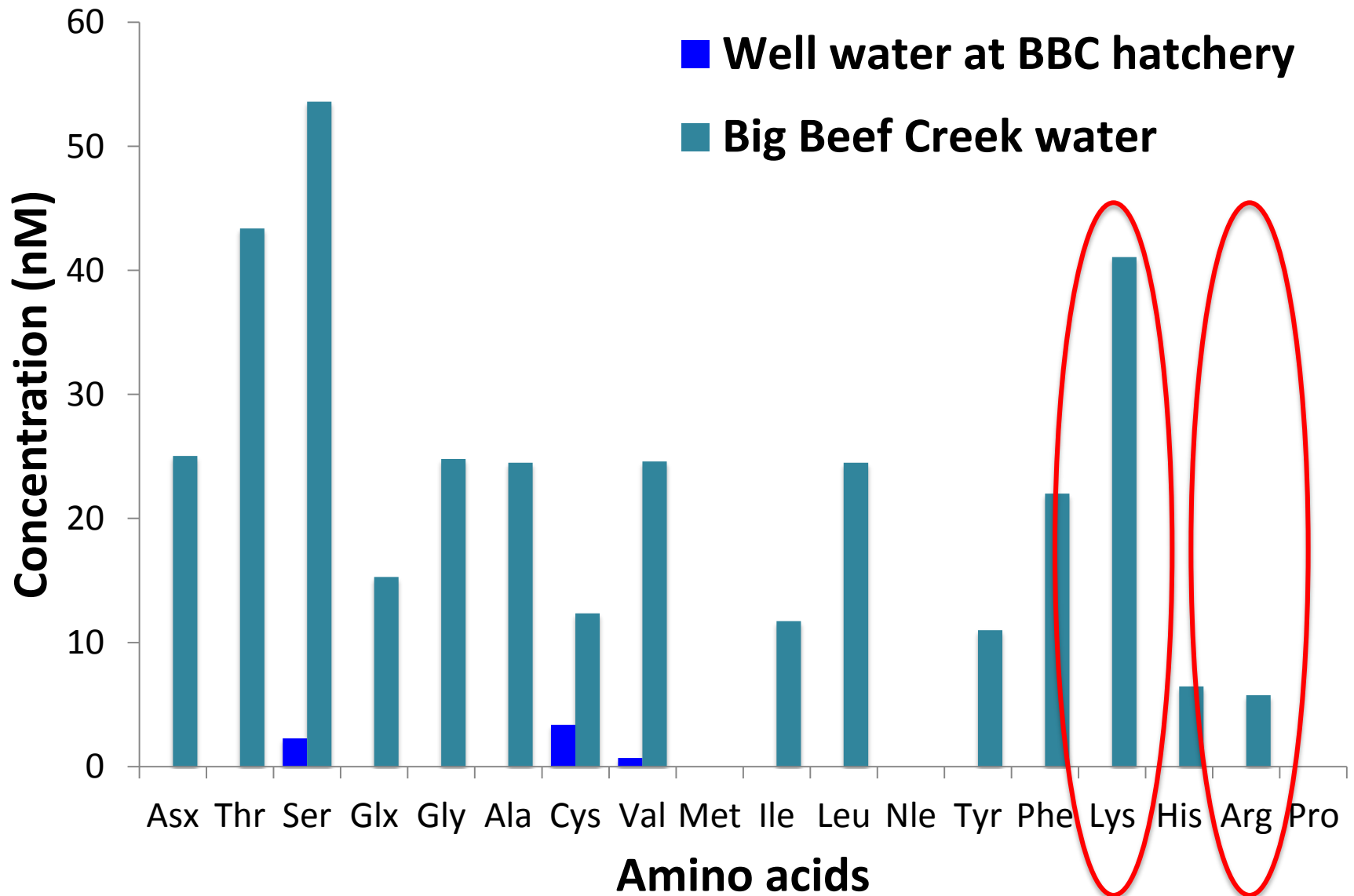


# Smolting-associated changes in odorant receptor expression





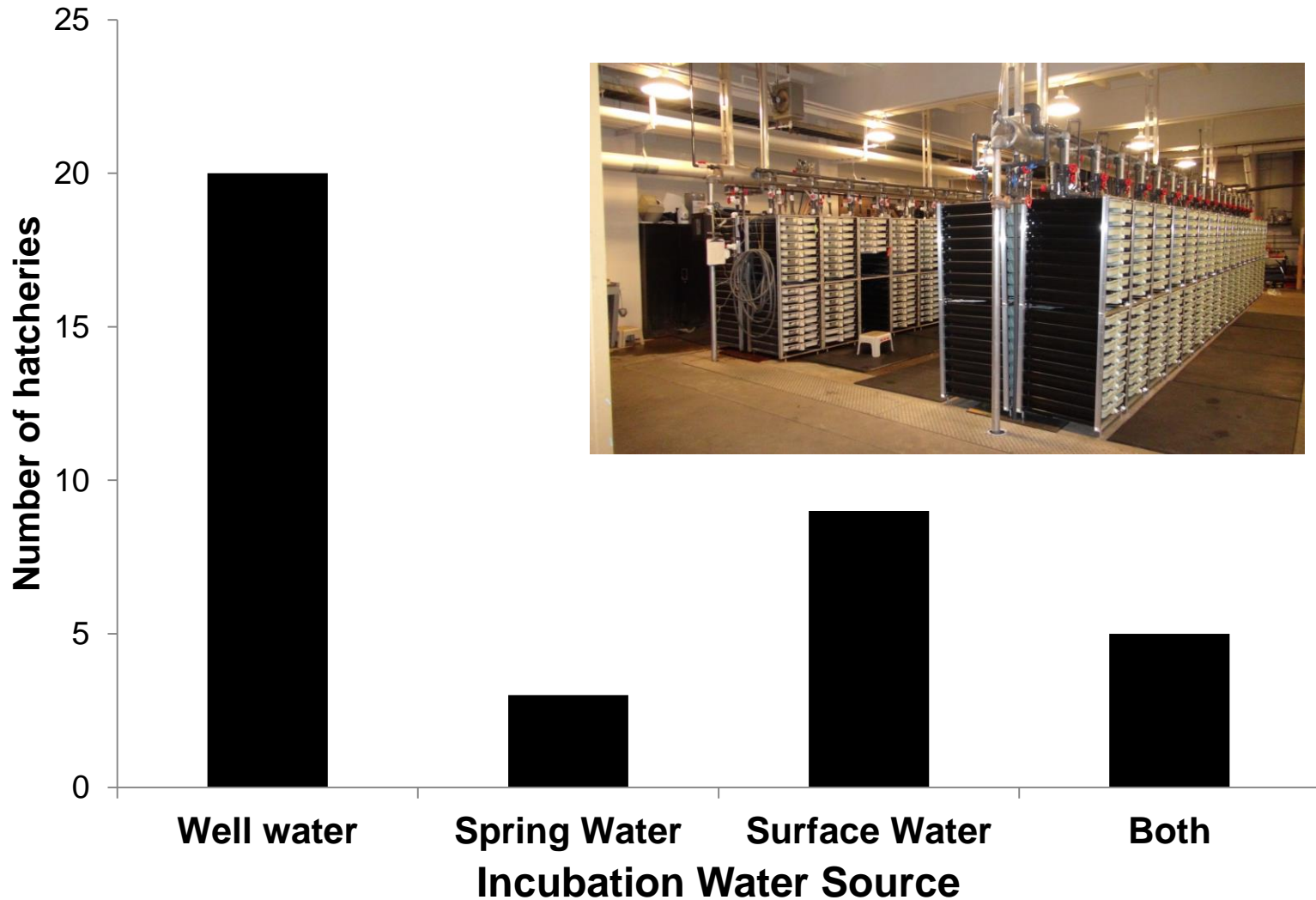
# Amino acid profile of well water vs. stream water





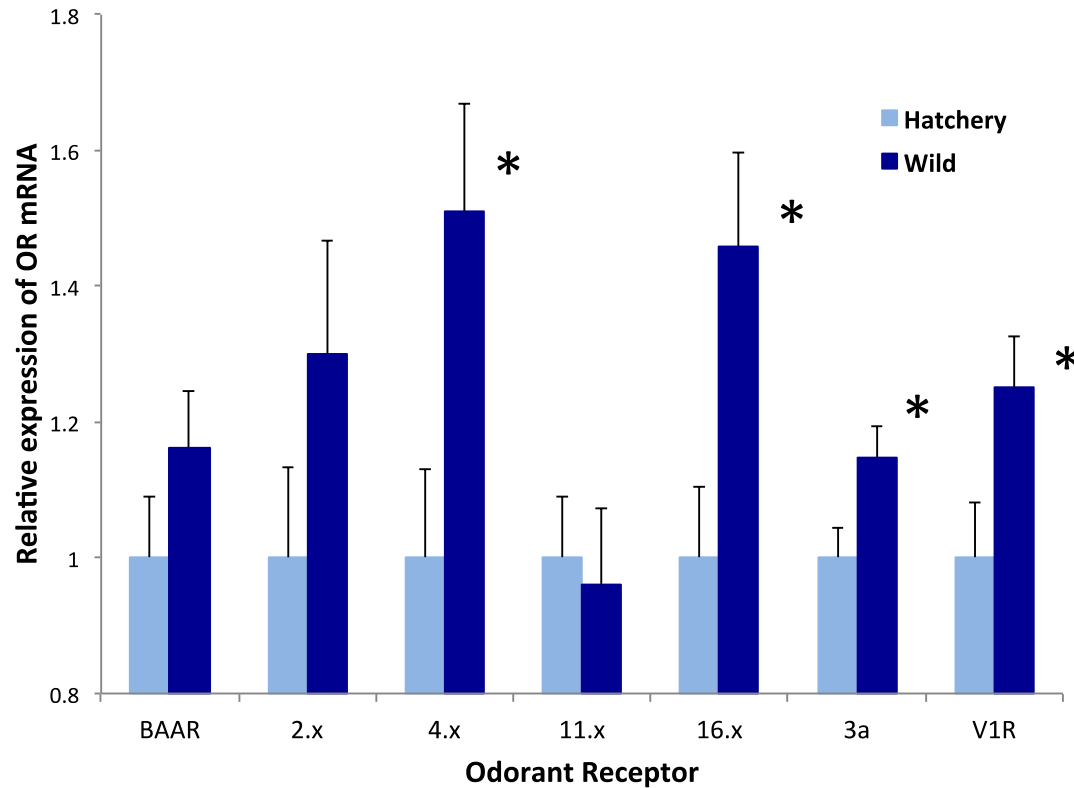
# Does hatchery rearing affect the olfactory system?

## Incubation water in Columbia River hatcheries



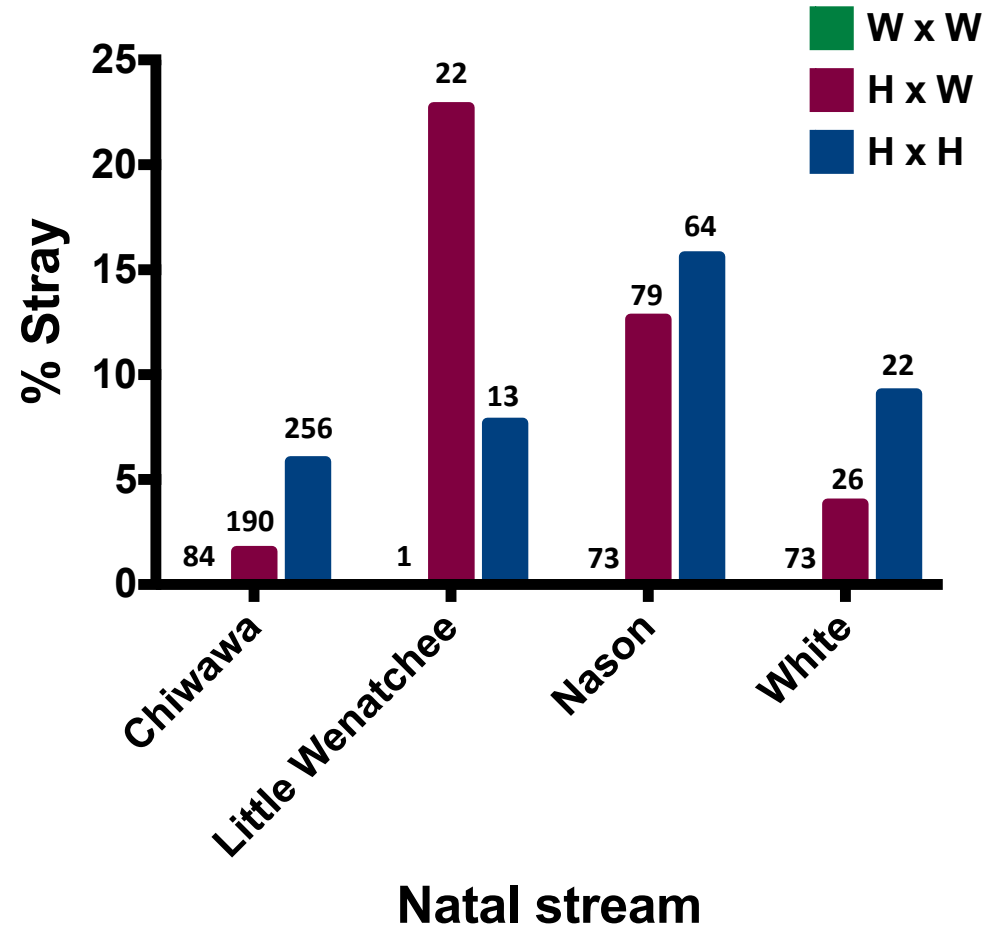
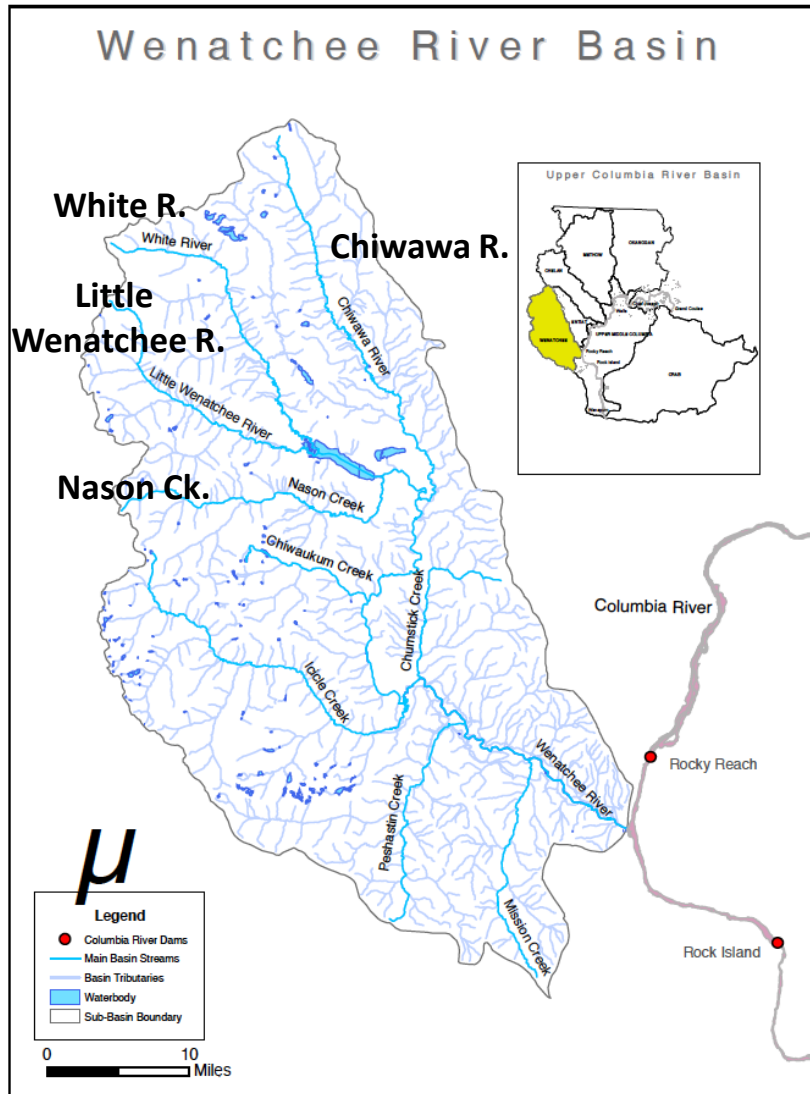


# Does hatchery rearing affect the olfactory system?





# Effects of origin on straying by naturally spawned salmon





# Effects of hatchery rearing on olfactory system and olfactory imprinting

- **We observed differences in imprinting-associated olfactory gene expression in steelhead reared in different water sources.**
- **We observed differences in olfactory gene expression in naturally migrating hatchery vs. wild steelhead.**
- **In future studies, we hope to assess these differences in a controlled experiment and assess mechanisms.**
- **We have developed effective physiological tools to assess anthropogenic effects (e.g. transport, hatchery practices, etc) on olfactory imprinting.**



# Acknowledgments

A large fish, possibly a salmon, is captured mid-jump, leaping out of the water. The fish is dark in color and is positioned centrally, with its body arched and its tail just below the water's surface. The water around the fish is turbulent, with many white, frothy bubbles and splashes, indicating the point of exit from the water. The background is a deep blue-grey, suggesting the depth of the water.

## UW

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