

You are what (and where) you eat: Comparative isotope analysis of hatchery and wild pink salmon in 2015



J. McMahon, Dr. K. Gorman, Dr. P. Westley

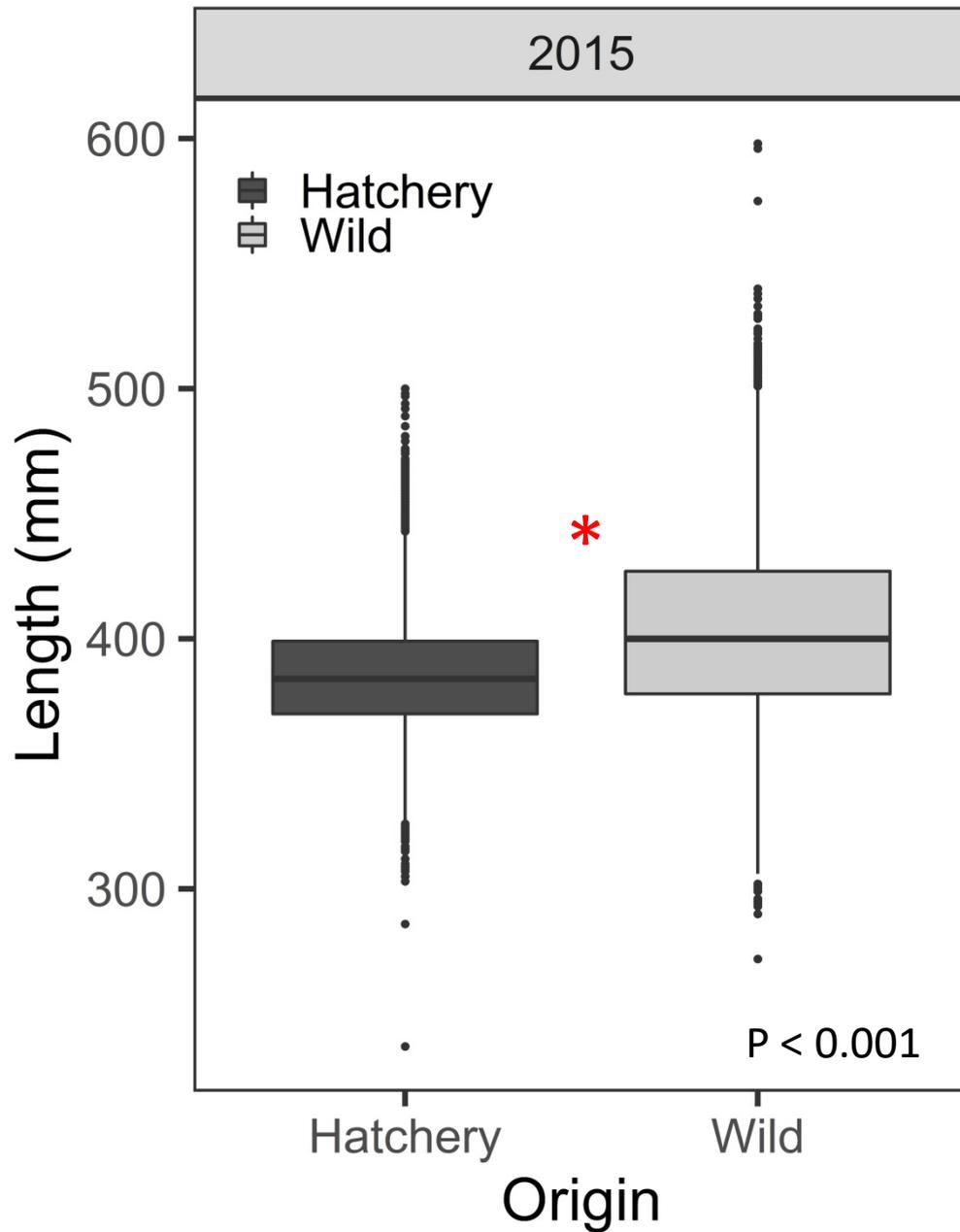
CFOS, University of Alaska, Fairbanks

AHRP Meeting – March 6th 2020

Body size; a fitness related trait

e.g. size variation in males

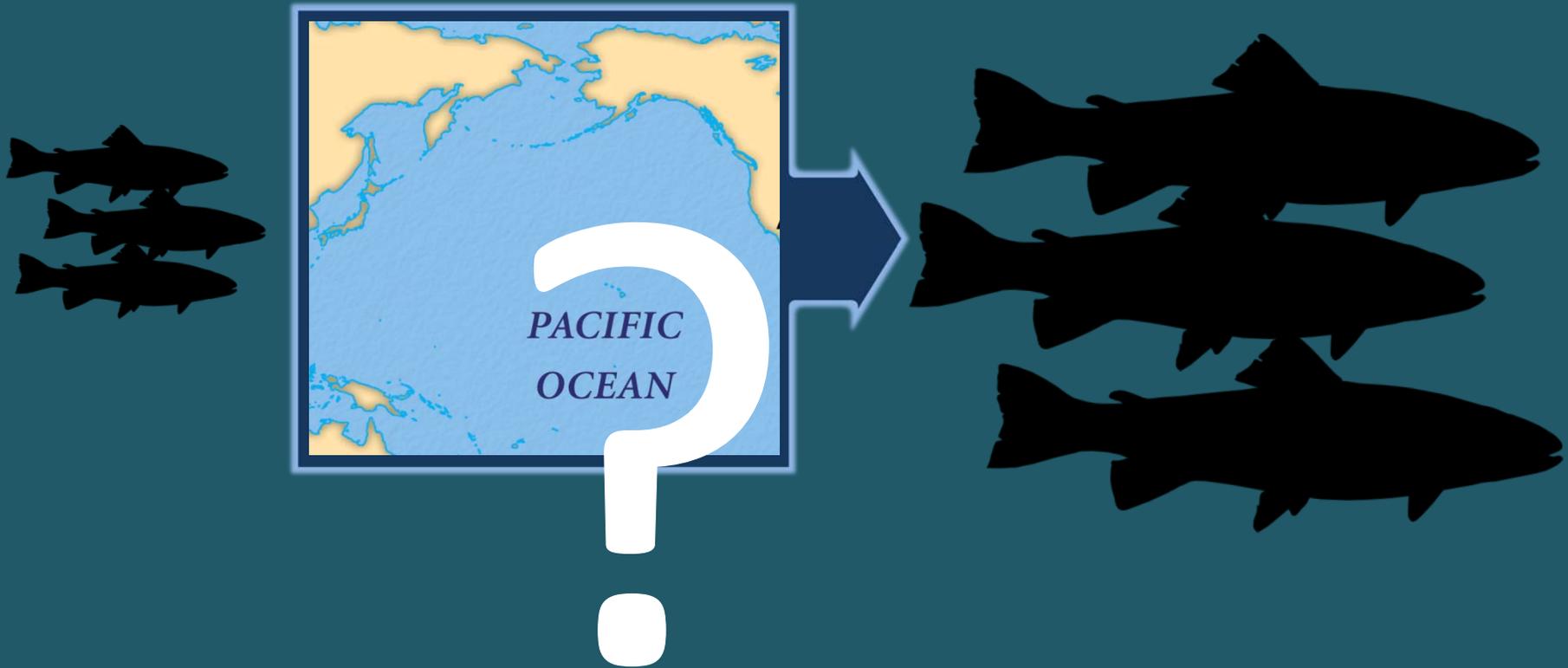




On average, hatchery fish were shorter than wild fish in 2015



Why were hatchery and wild fish different lengths in 2015?



Body size is gained at sea

In the toolbox: Stable isotope analysis

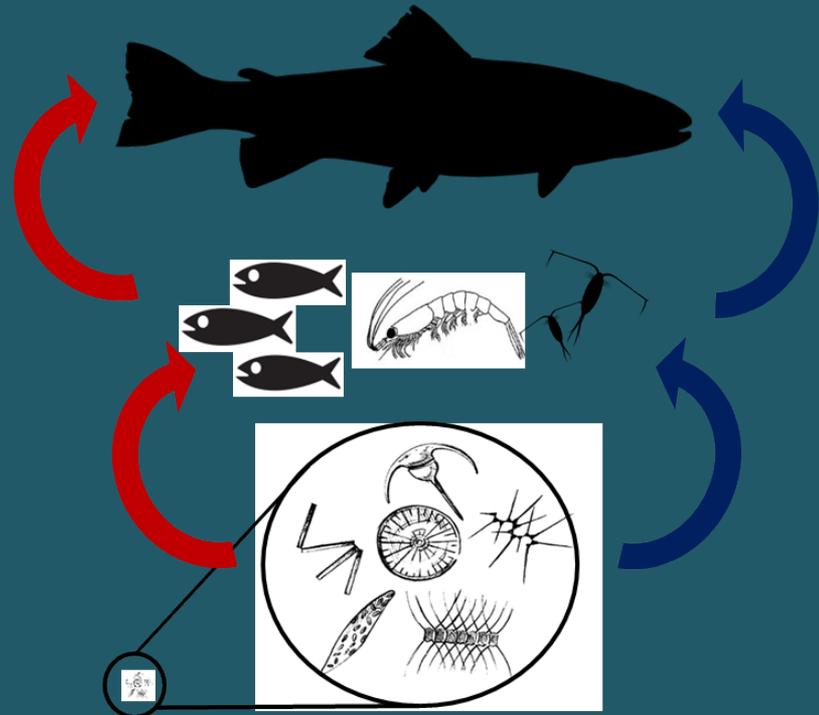
$^{13}\text{C} : ^{12}\text{C}$

$^{15}\text{N} : ^{14}\text{N}$

In the toolbox: Stable isotope analysis

$^{13}\text{C} : ^{12}\text{C}$
 $^{15}\text{N} : ^{14}\text{N}$

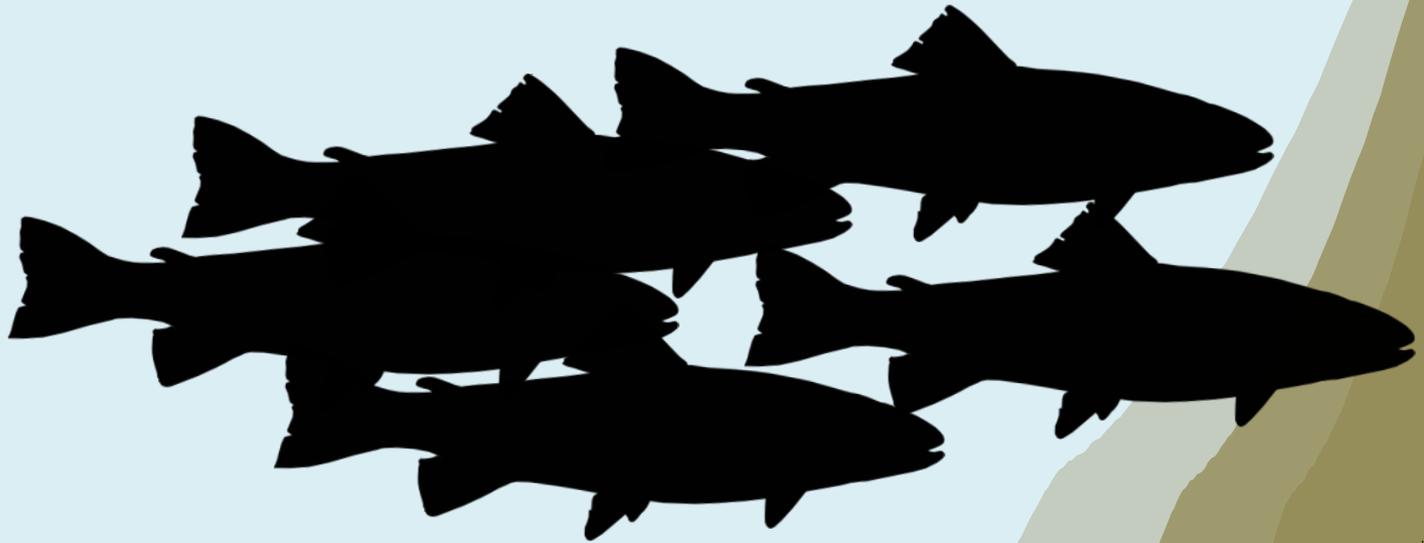
You are what
(and where)
you eat



Comparative isotope analysis



Comparative isotope analysis



~-24‰

Offshore

~-16‰

Nearshore

Location = Carbon

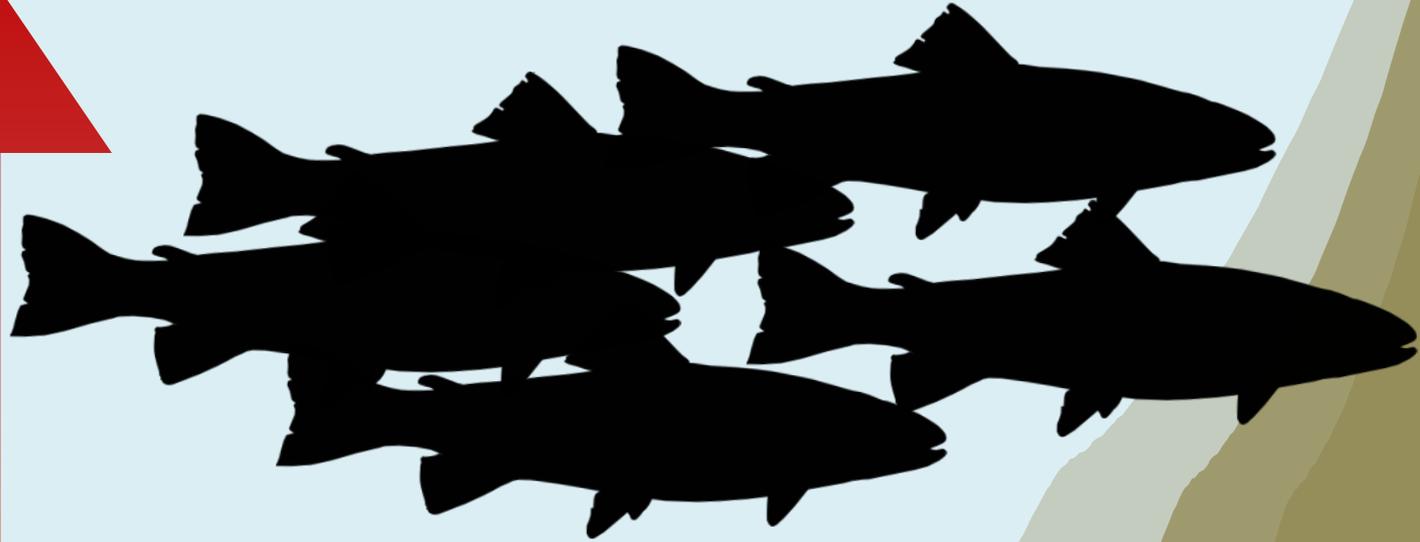
Comparative isotope analysis

Trophic position

~15‰
Higher

= Nitrogen

~2‰
Lower



~-24‰
Offshore

~-16‰
Nearshore

Location = Carbon

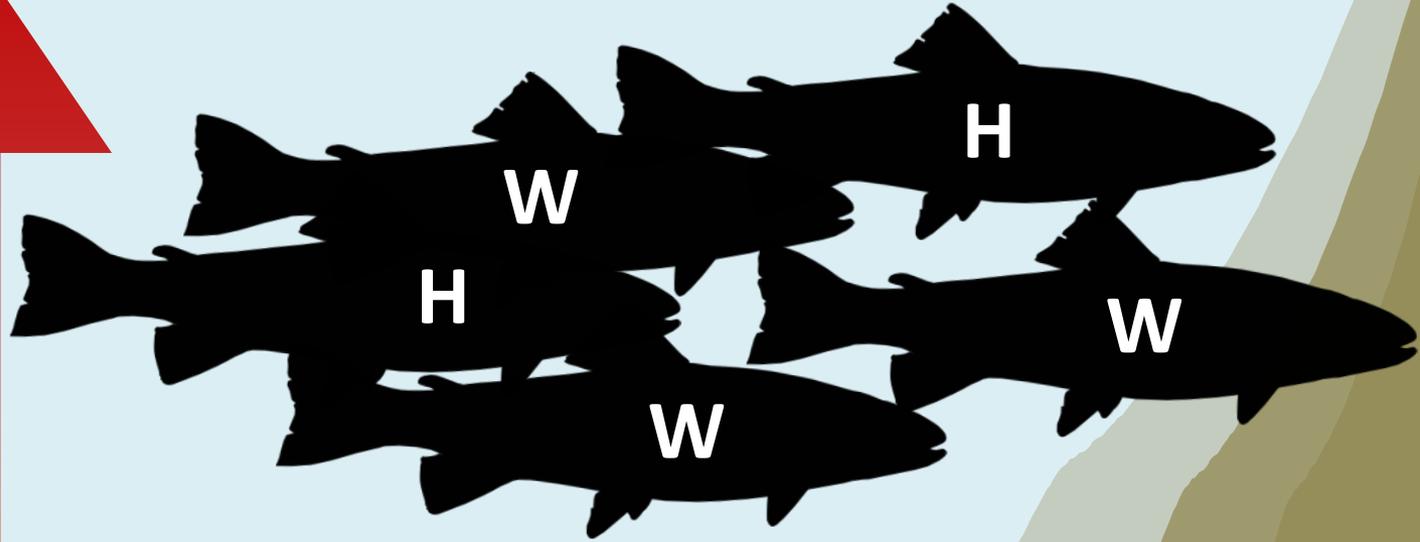
Comparative isotope analysis

Trophic position

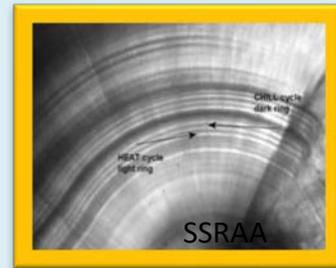
~15%
Higher

= Nitrogen

~2%
Lower



**Ocean
Caught**



**Stream
Sampled**



Location = Carbon



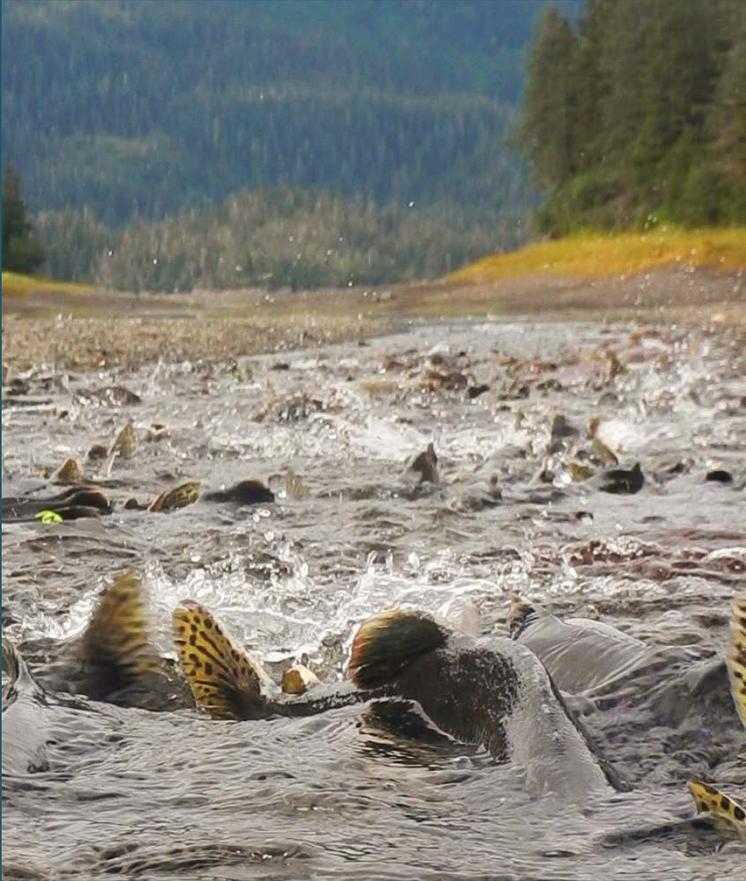
Were hatchery and wild fish foraging at different locations or trophic positions?

2015

~ 3,420 isotope samples
from 1,140 fish

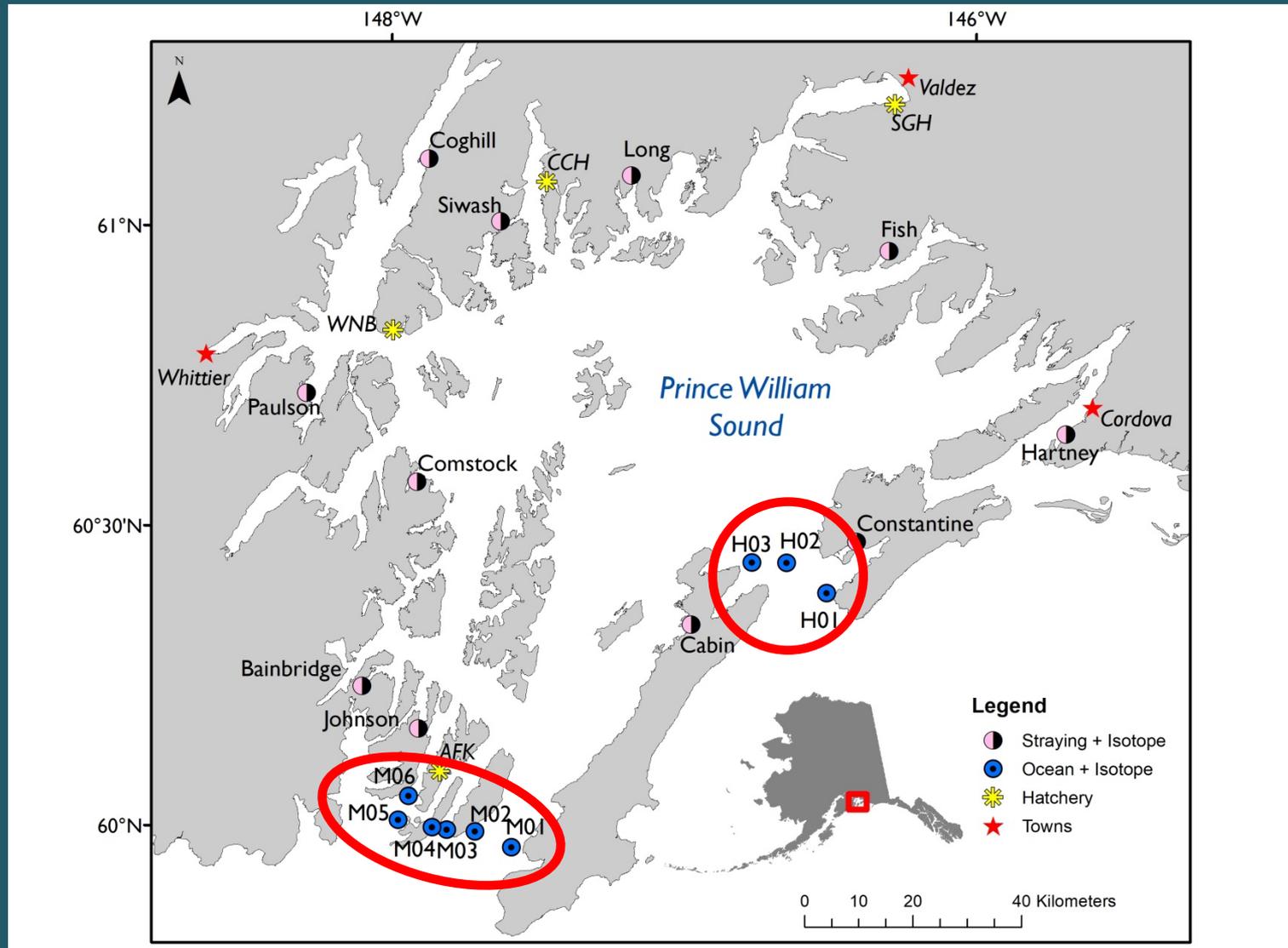
Big picture
result:

Yes, hatchery
and wild fish
were isotopically
different

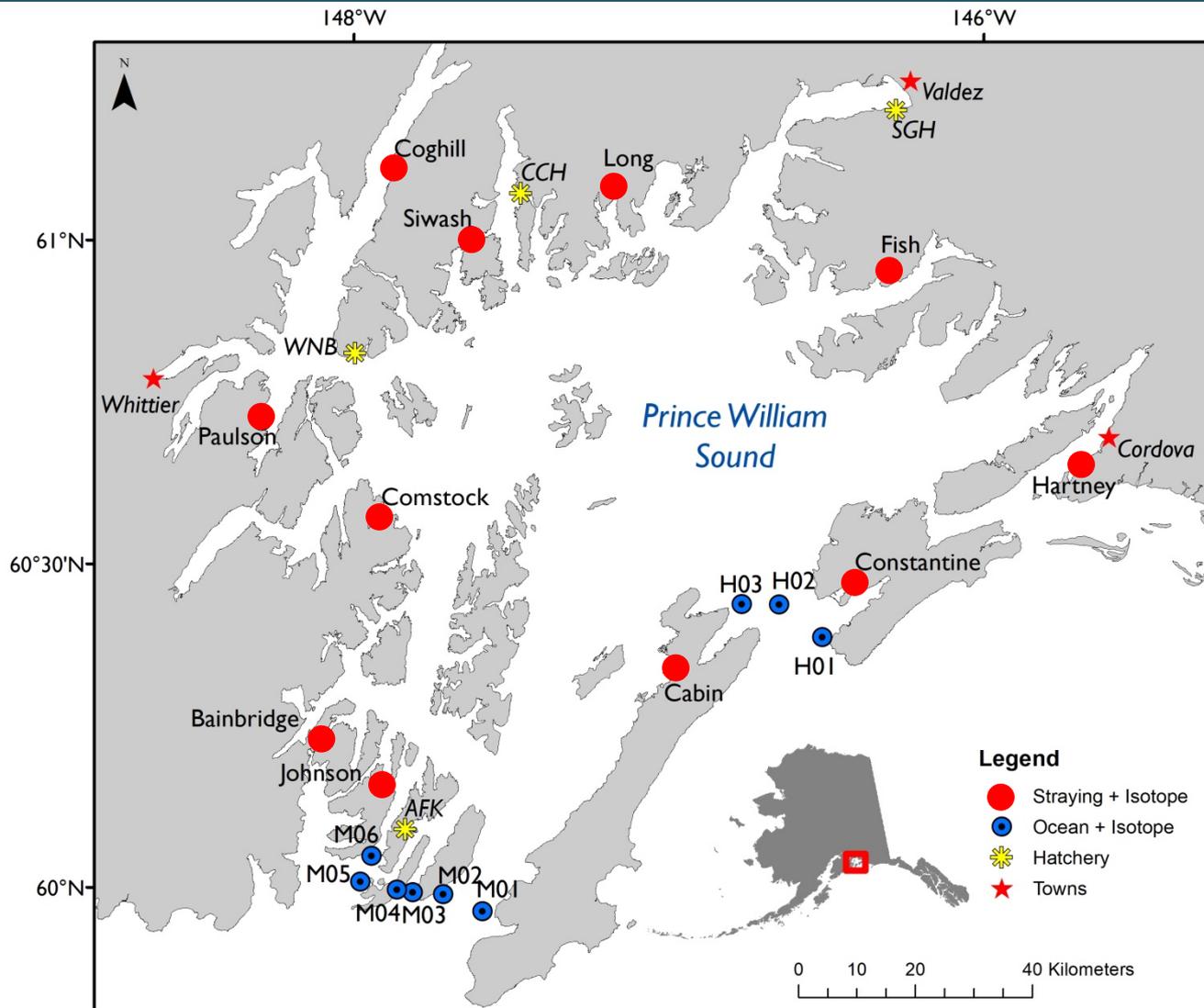


2015

Ocean fishing stations 2015

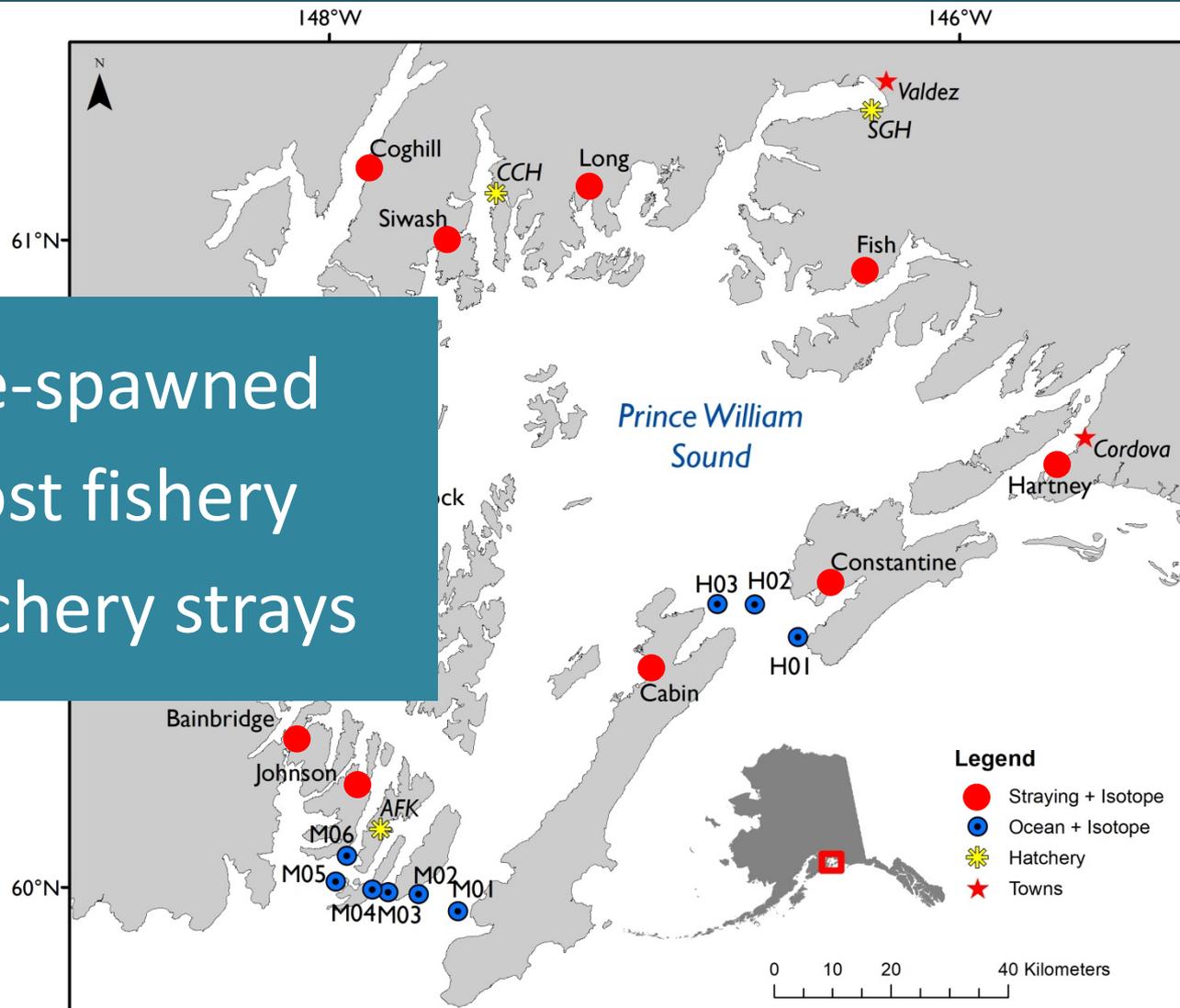


Stream sampling 2015

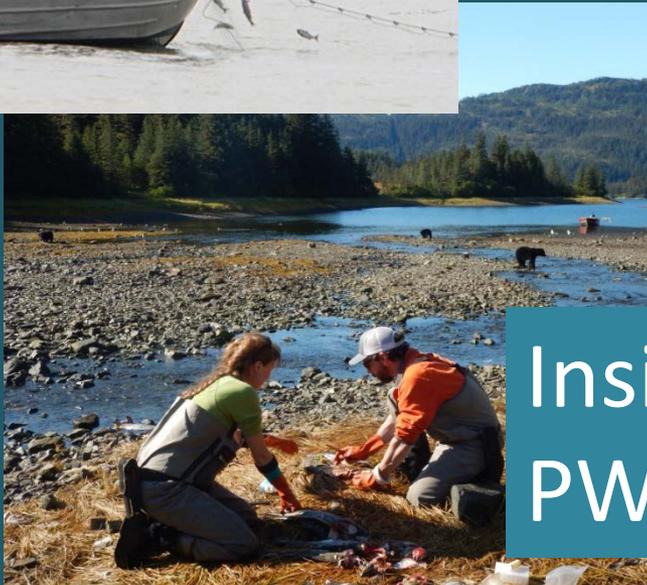


Stream sampling 2015

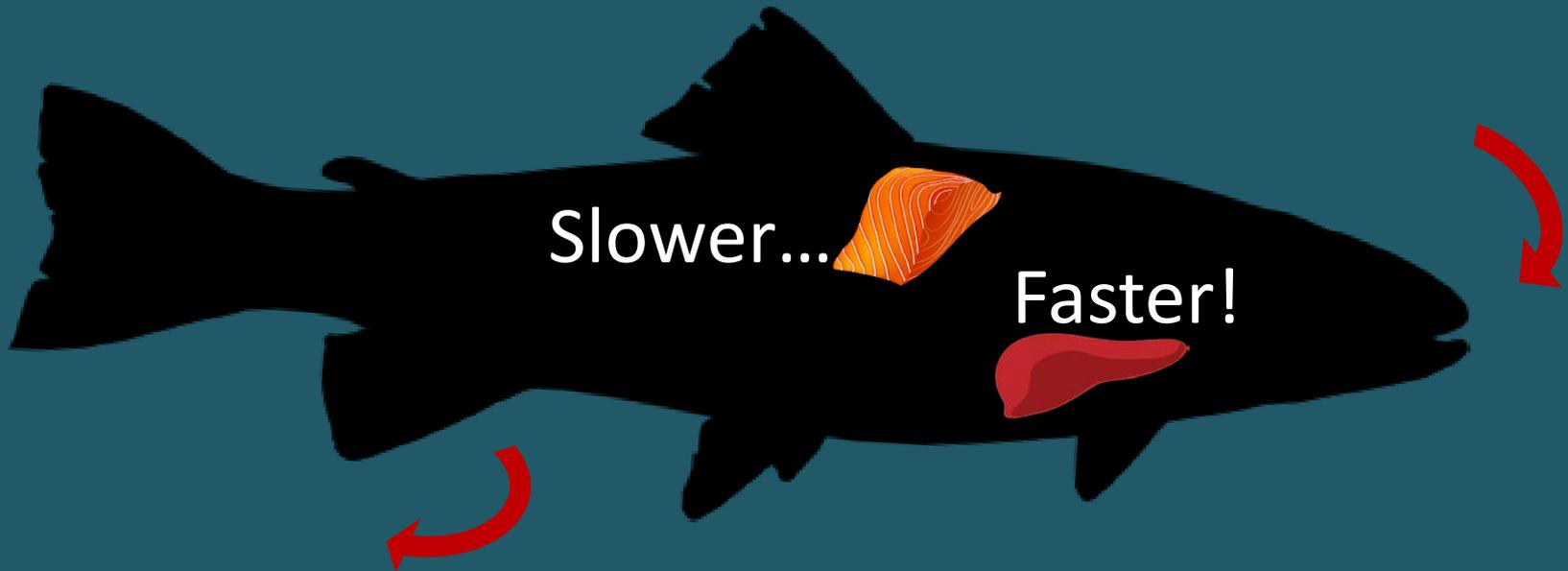
Pre-spawned
Post fishery
Hatchery strays



Ocean & stream sample collection represents “outside” & “inside” PWS



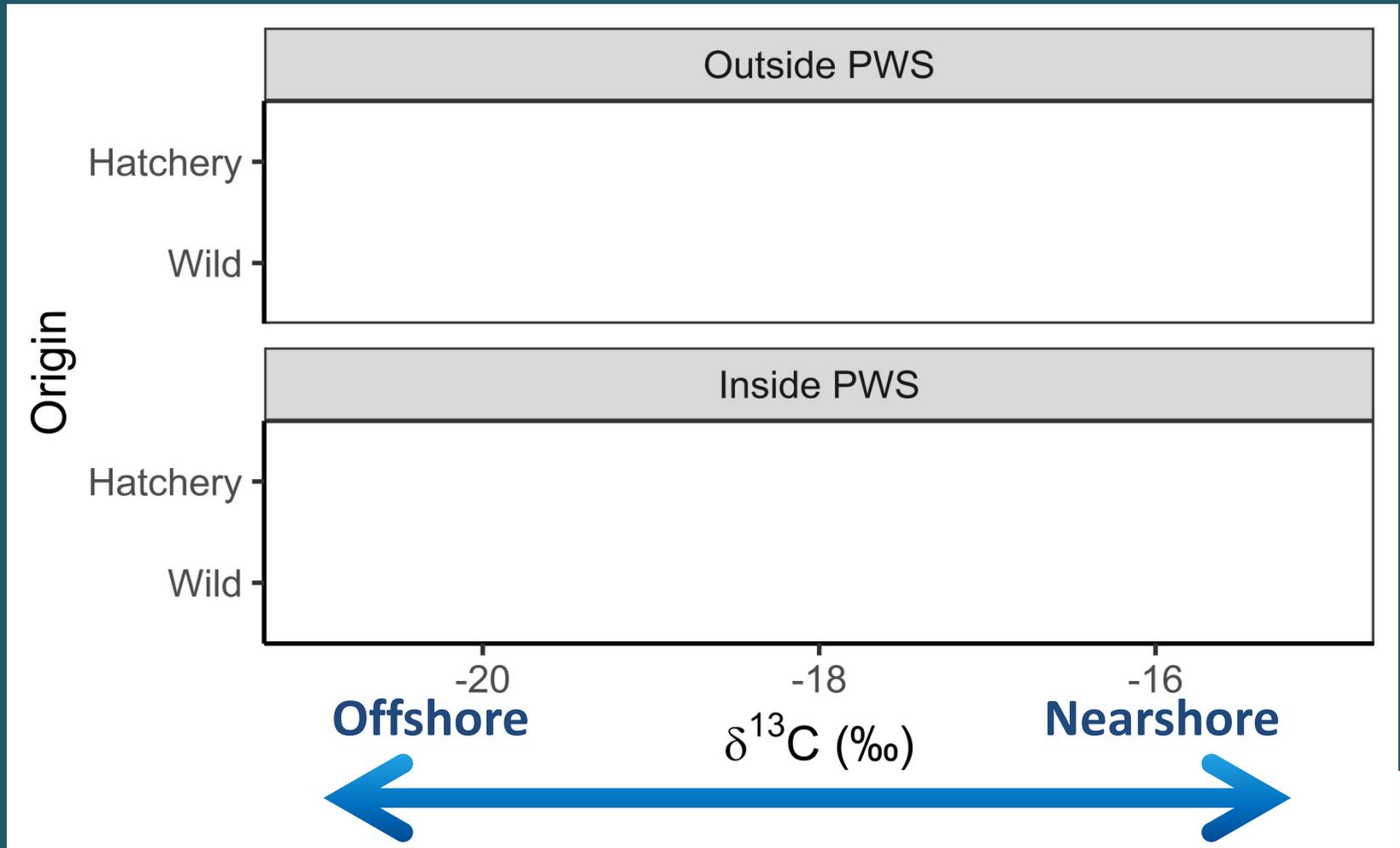
Tissue specific metabolic rates



Muscle: ~ 6 months

Liver: ~ 3 months

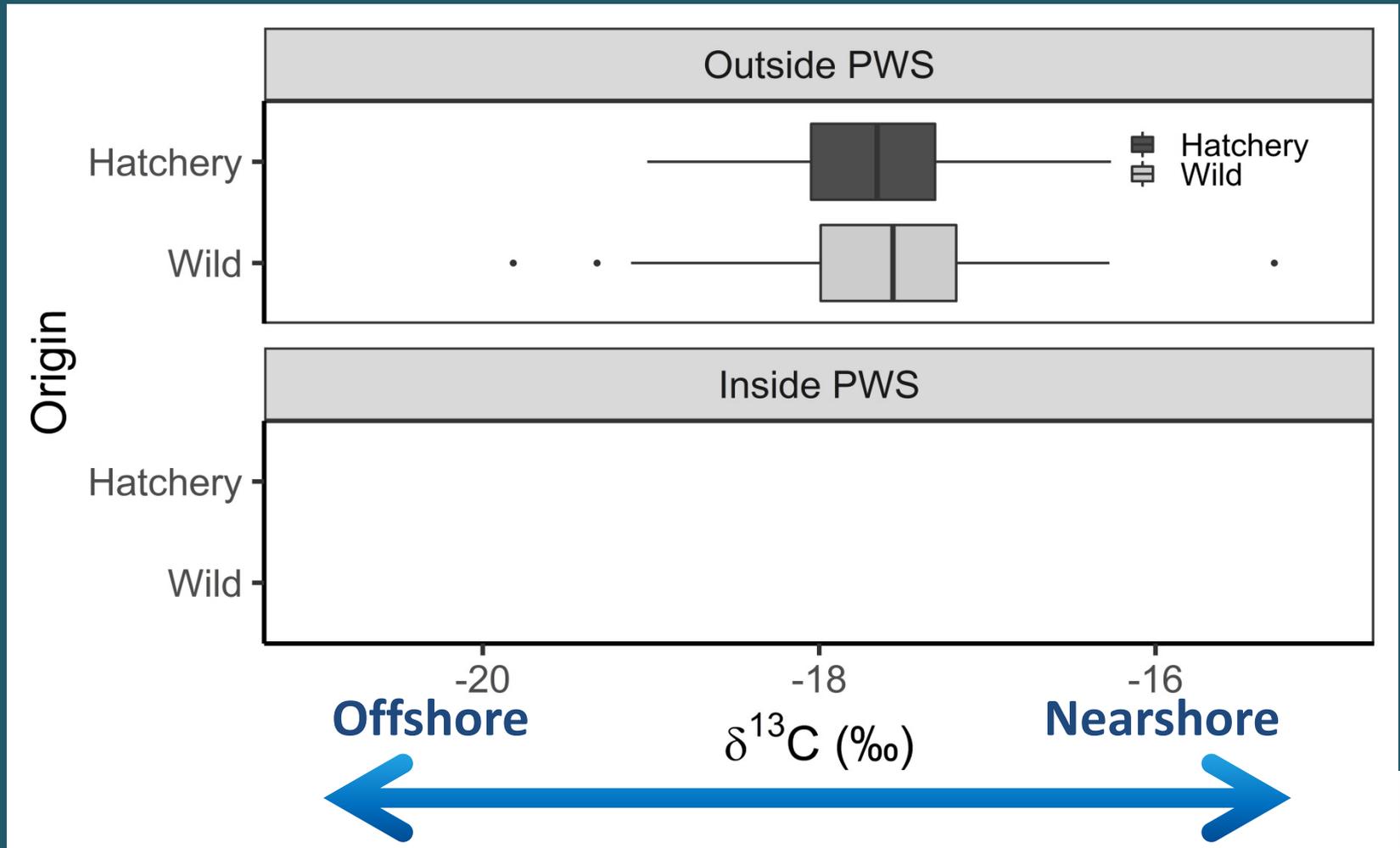
Location
~ 6 months



Location
~ 6 months



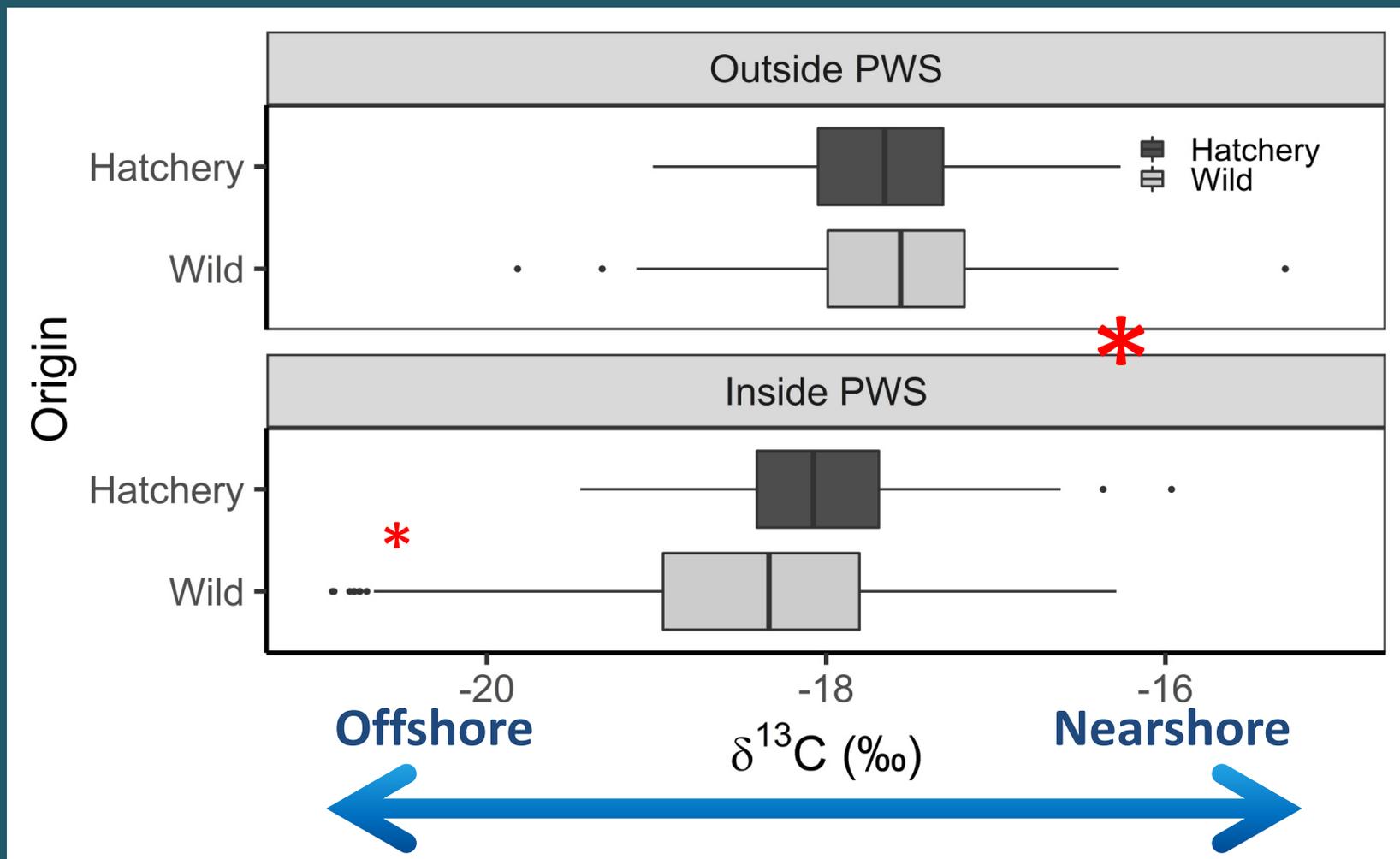
Ocean caught hatchery
and wild foraged in
similar locations



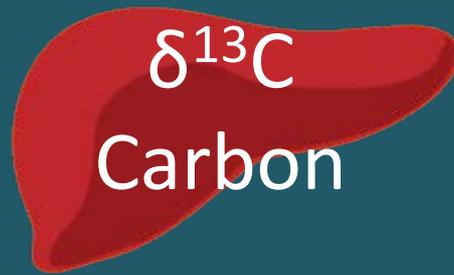
Location
~ 6 months



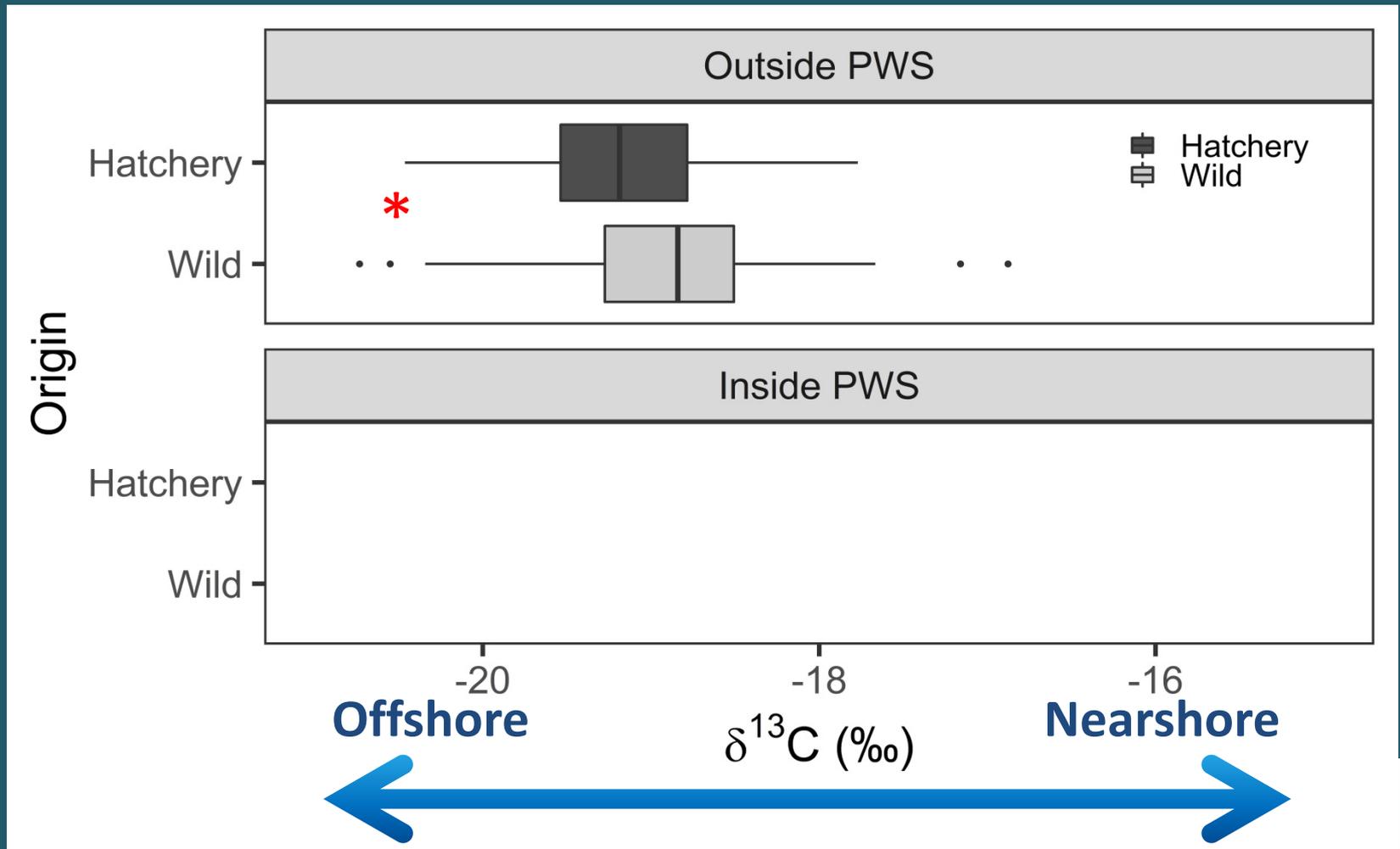
Curious offshore signal
from inside PWS



Location
~ 3 months



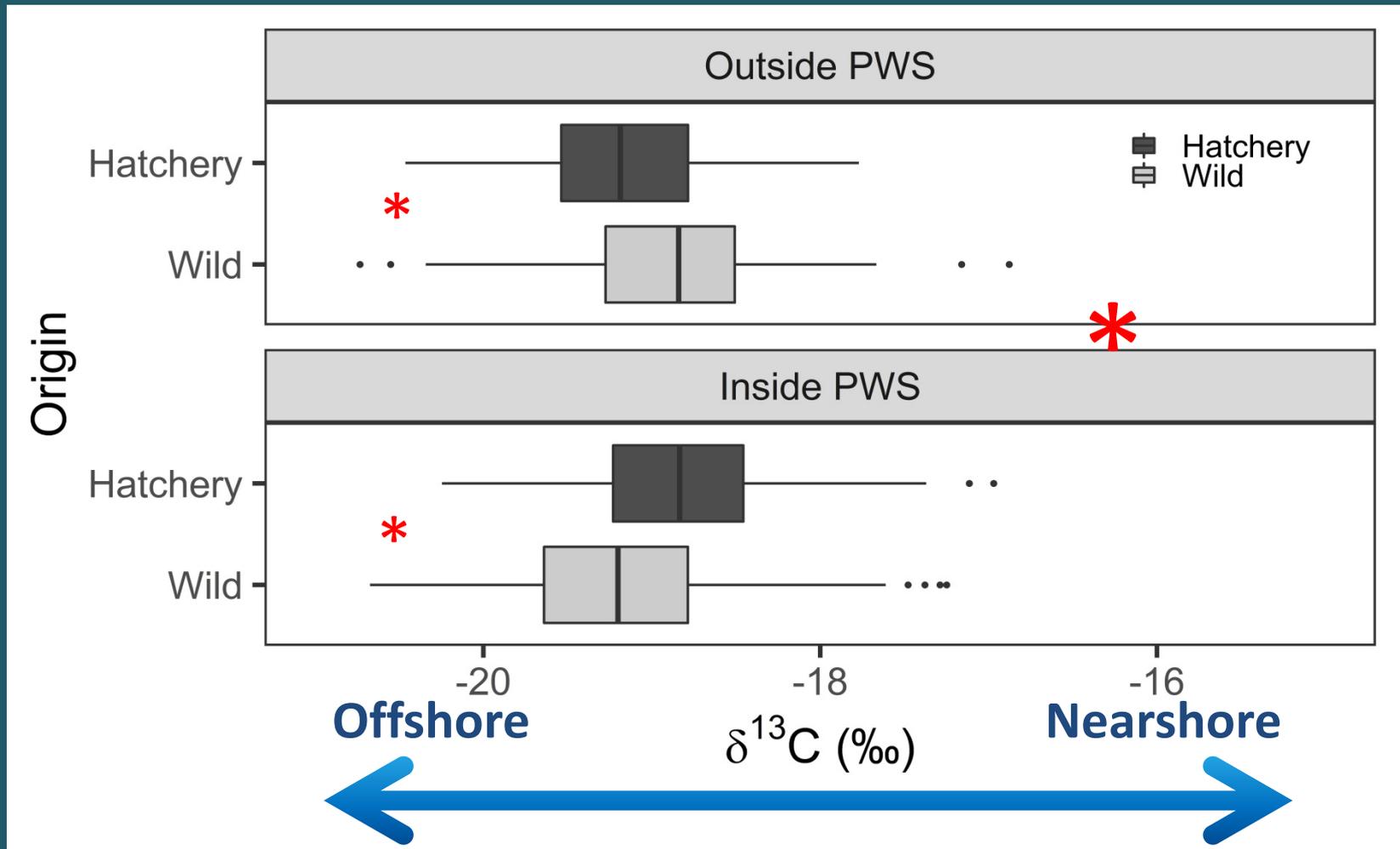
Hatchery and wild
foraged in different
locations



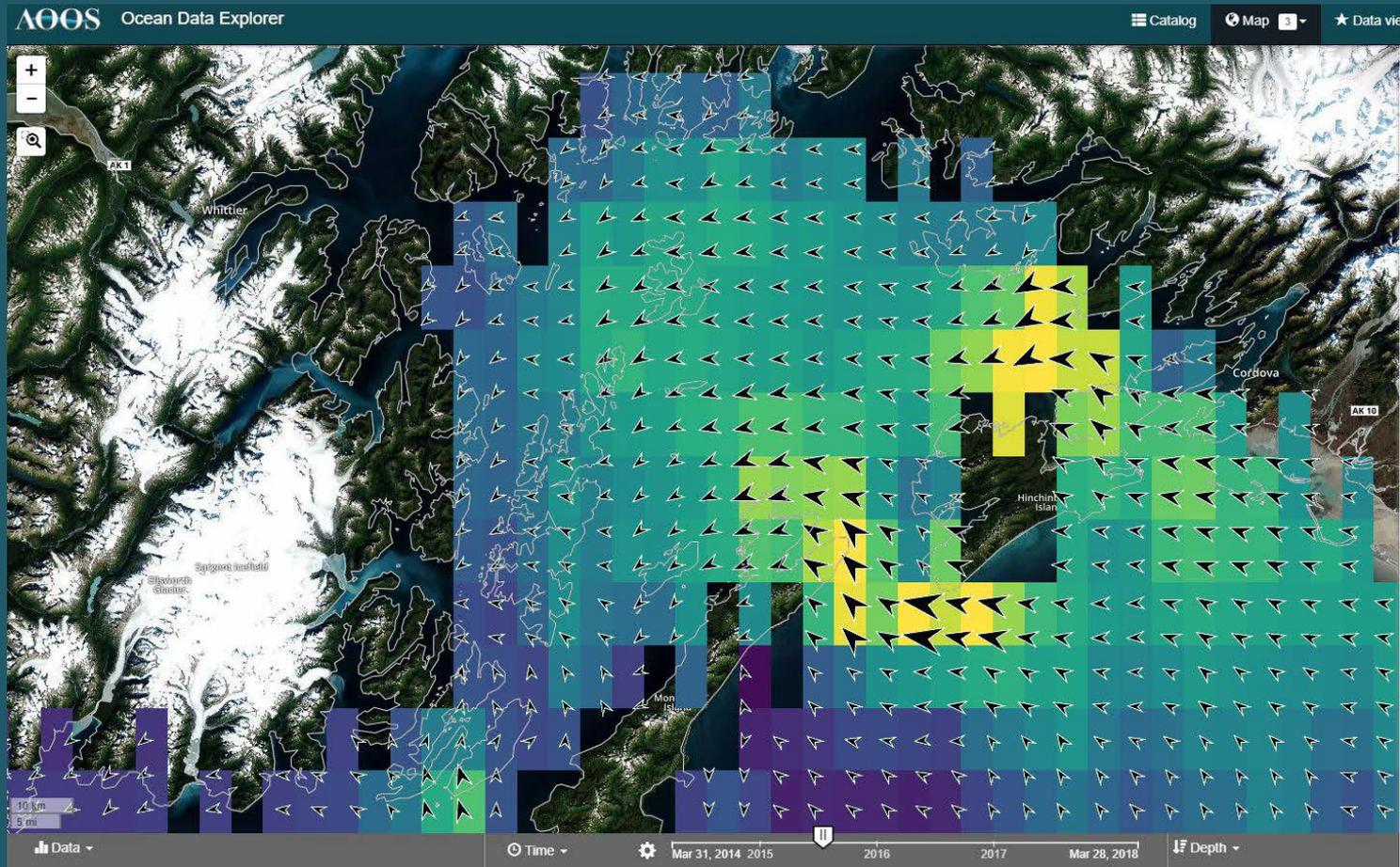
Location
~ 3 months

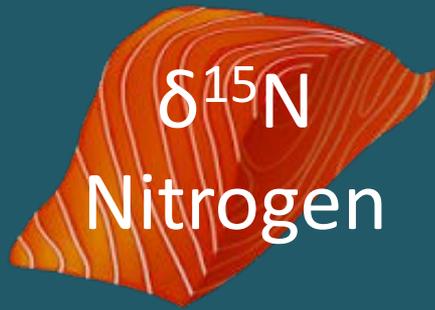


Foraged in different
locations, opposite
pattern

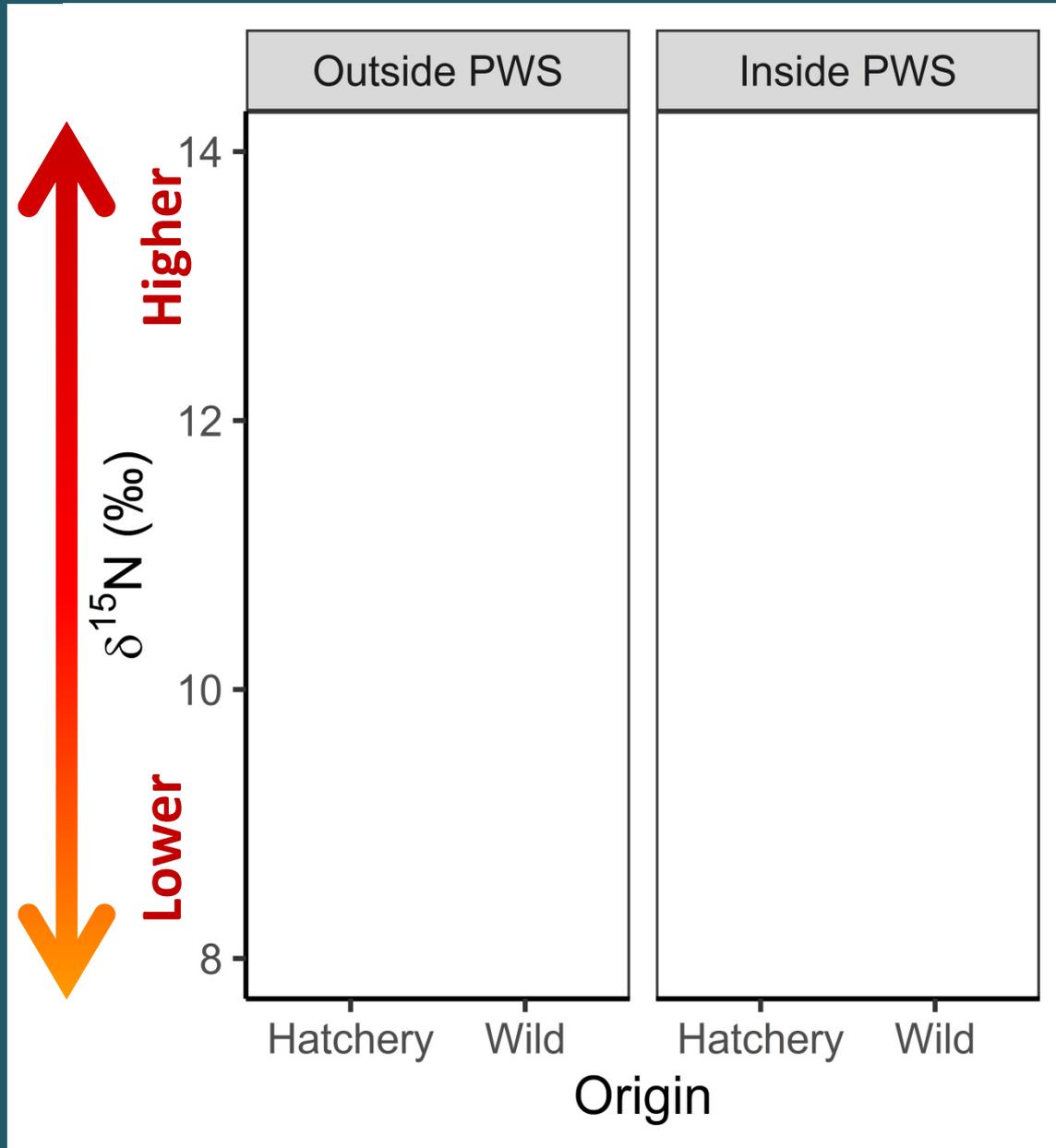


Ocean currents and plankton are dynamic in space and time; possible freshwater input





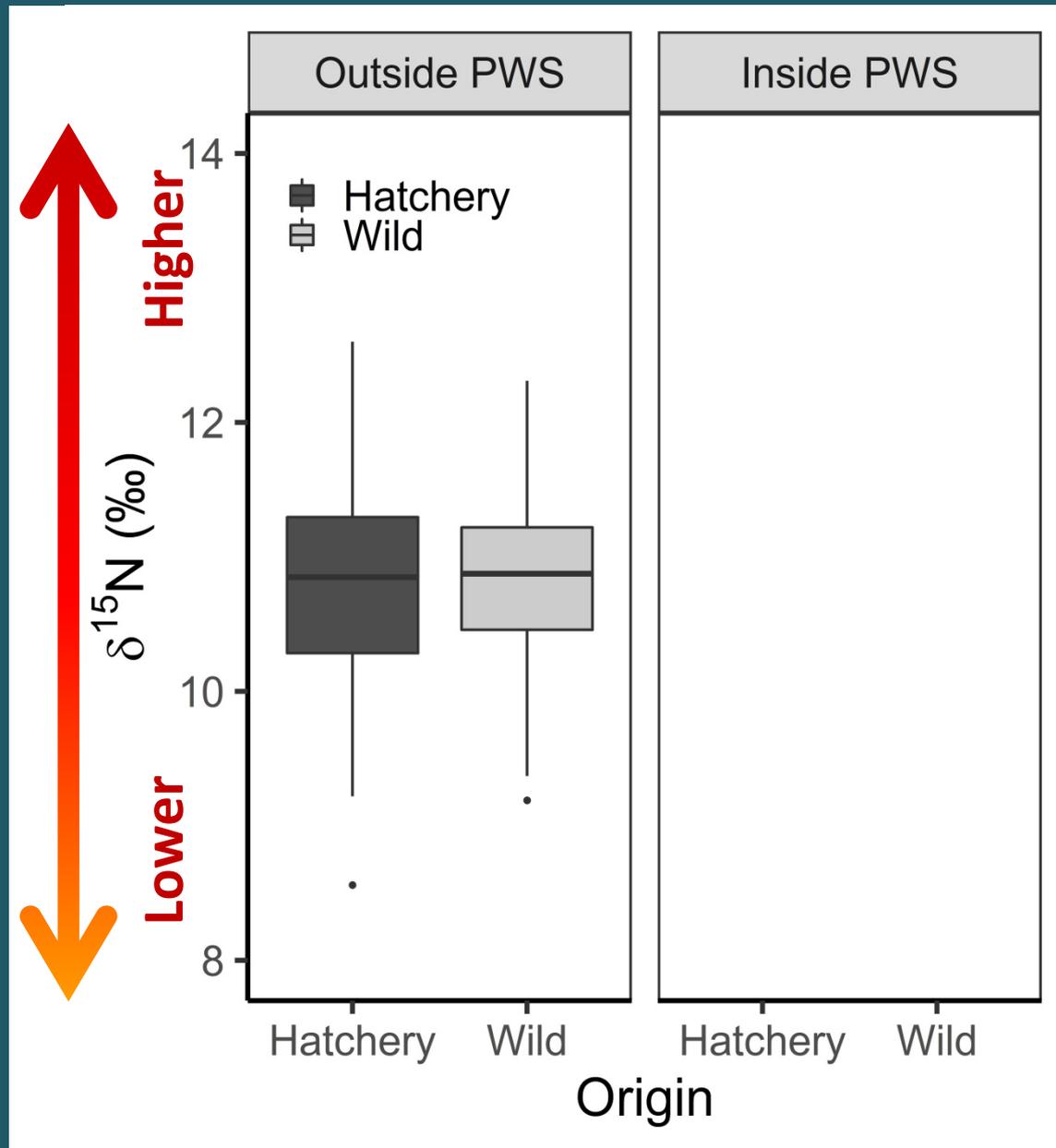
Trophic Level
~6 months





Trophic Level
~6 months

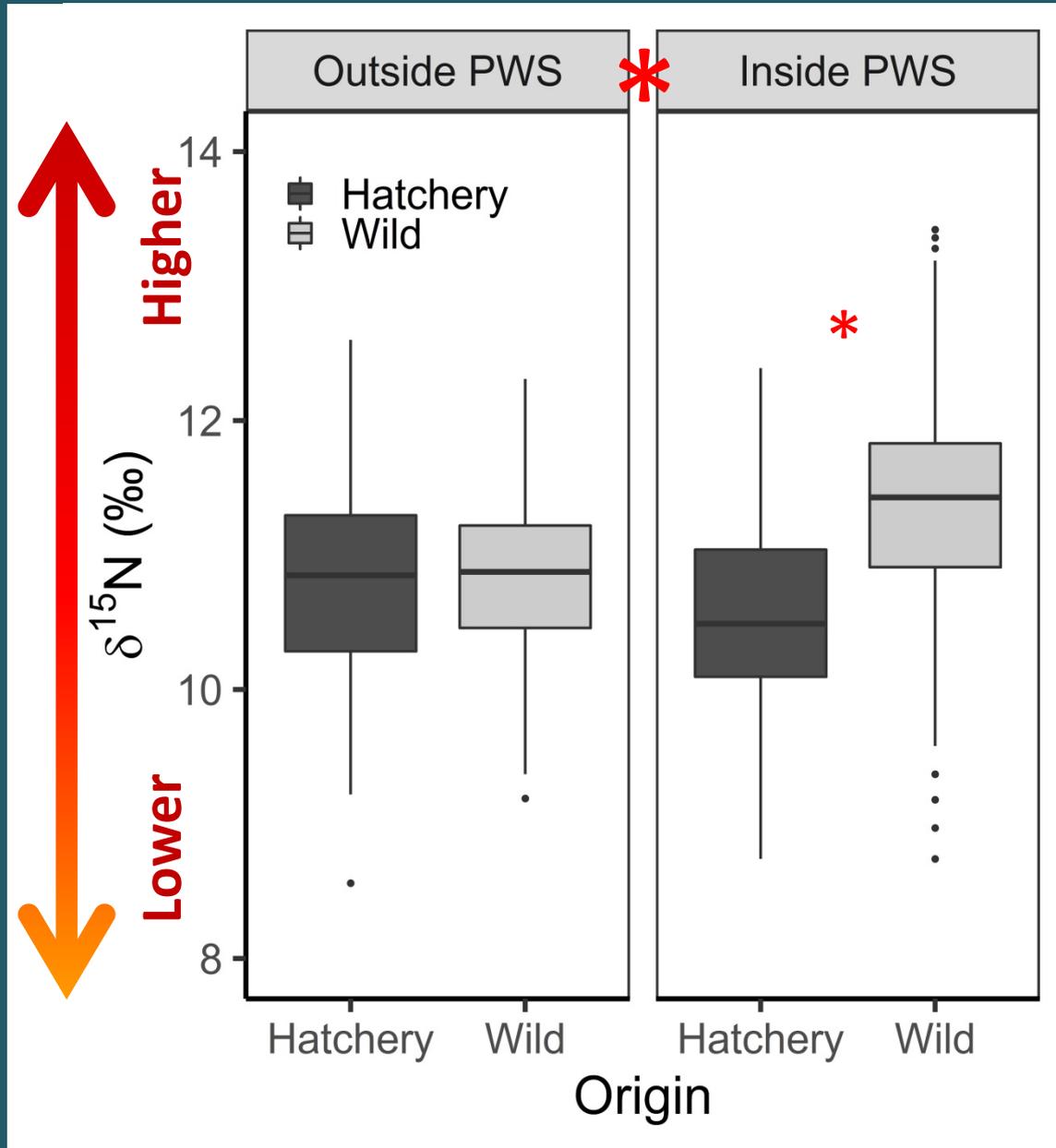
Hatchery and wild
fish foraged on
similar things





Trophic Level
~6 months

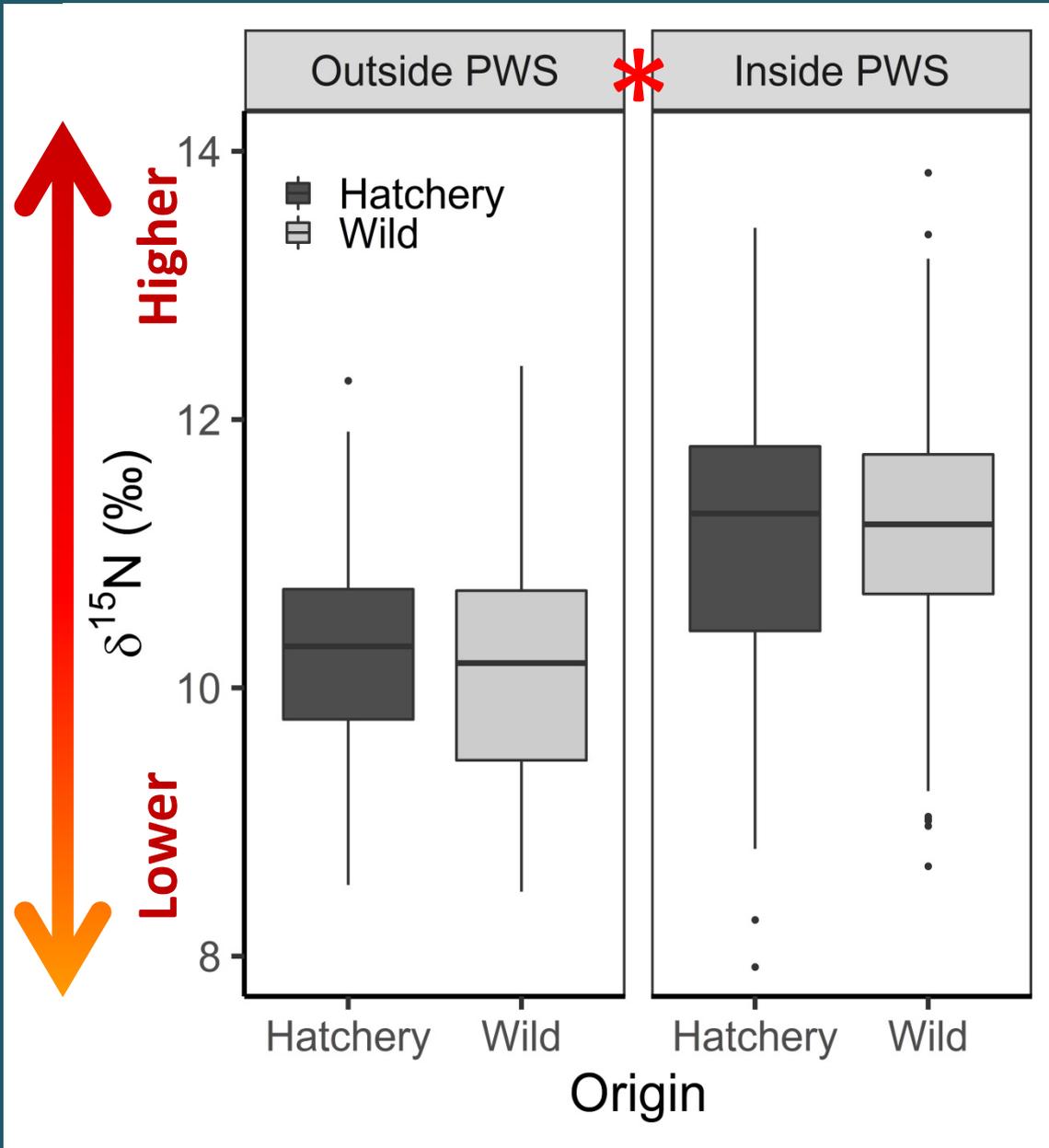
In PWS, wild fish
foraged on
different prey than
hatchery fish



$\delta^{15}\text{N}$
Nitrogen

Trophic Level
~3 months

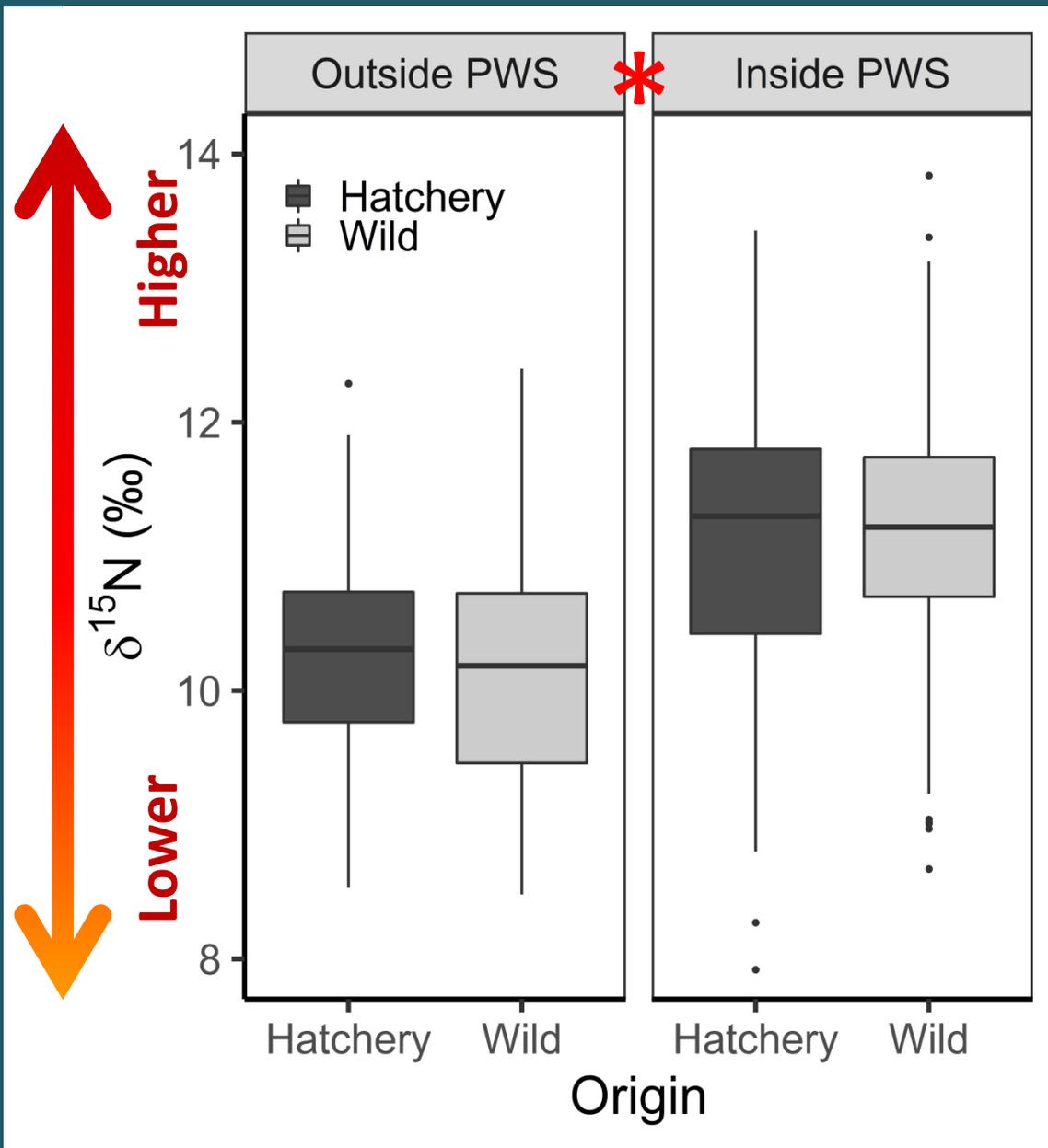
In PWS, isotope values indicated
prey shift OR
starvation

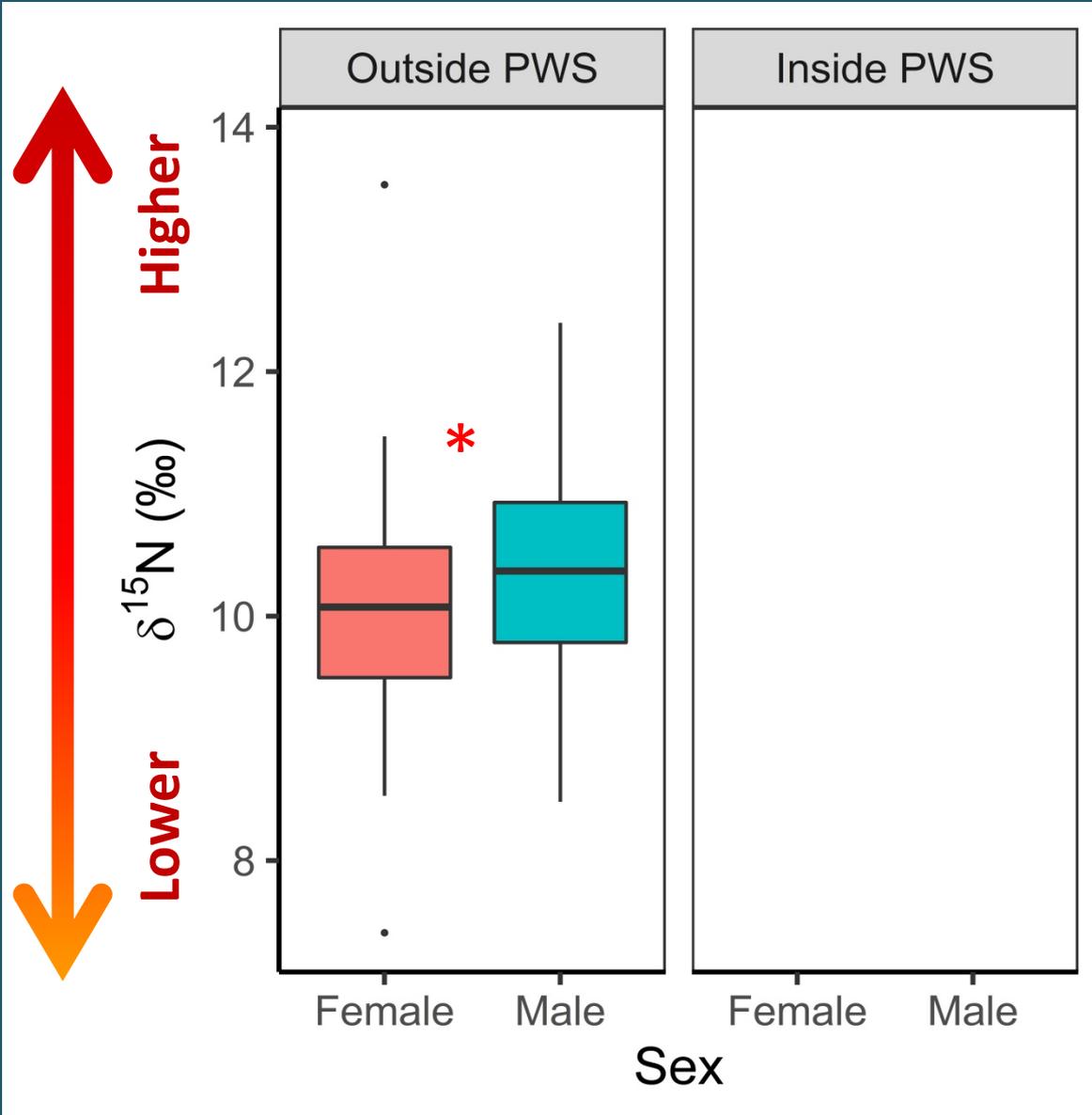




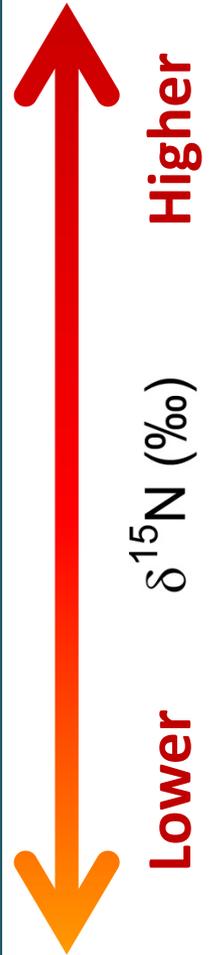
Digging deeper

How do sex, length, or sample date influence isotope values?

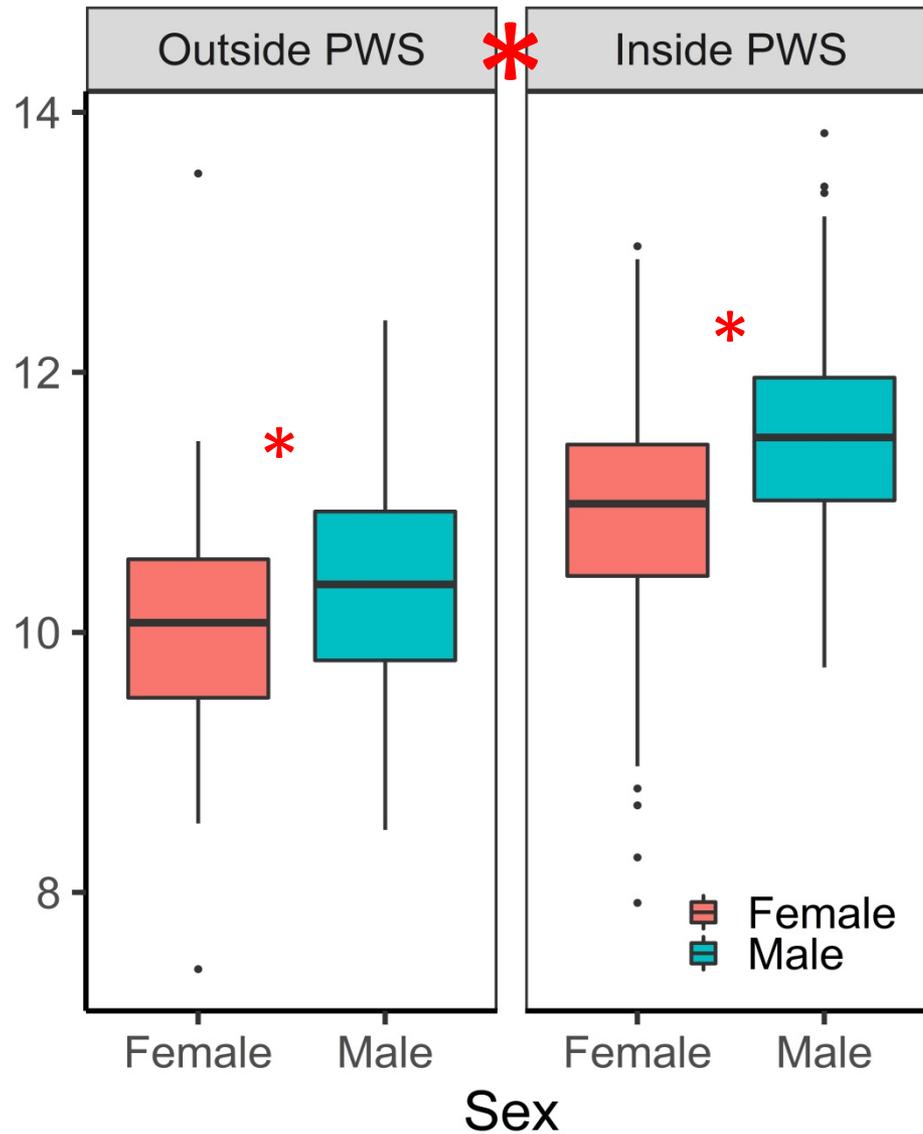




Sex influenced trophic position (diet) outside and inside PWS

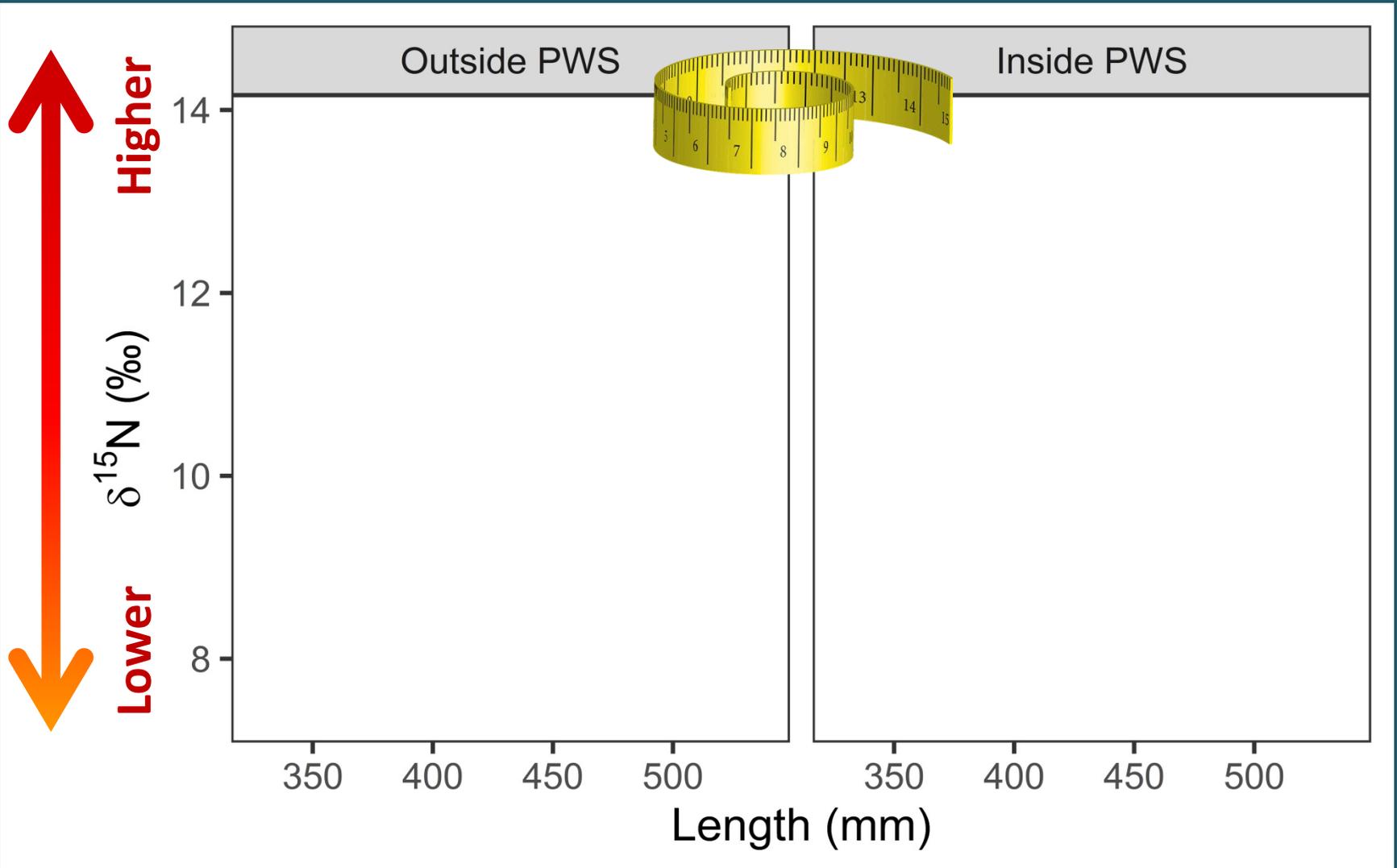


Higher
 $\delta^{15}\text{N}$ (‰)
Lower

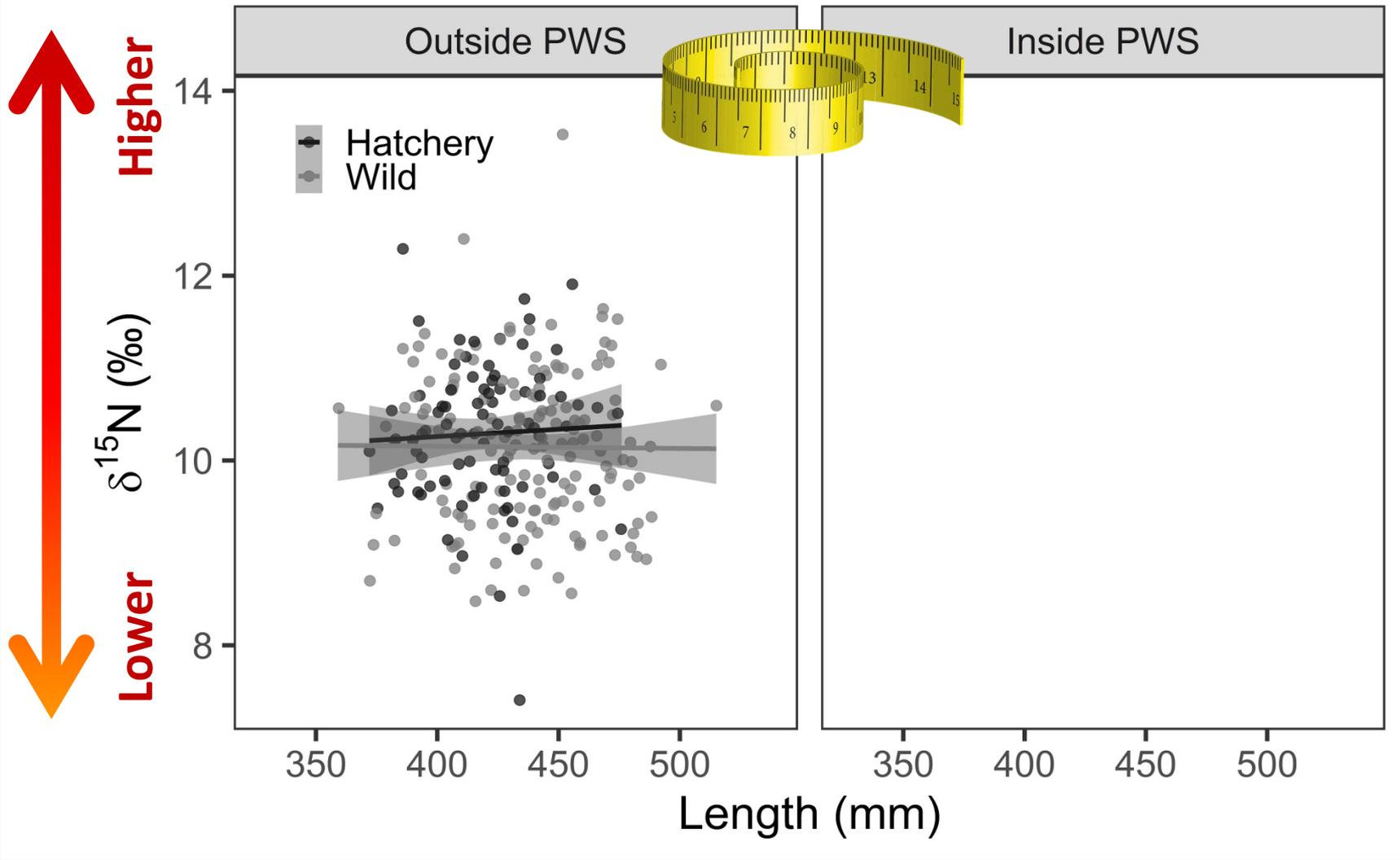


Sex influenced
trophic position
outside and
inside PWS

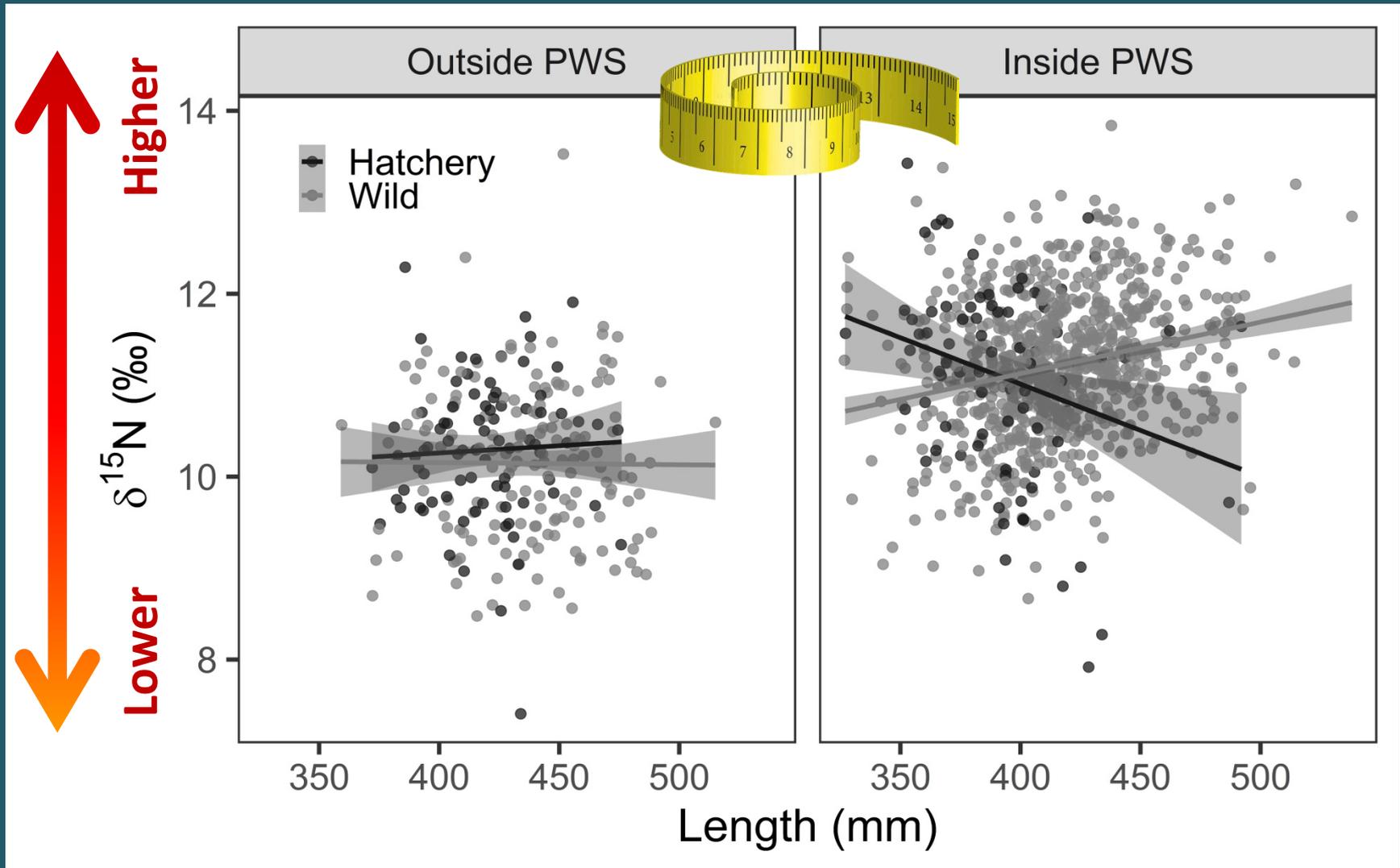
Did trophic position (diet) change with size?



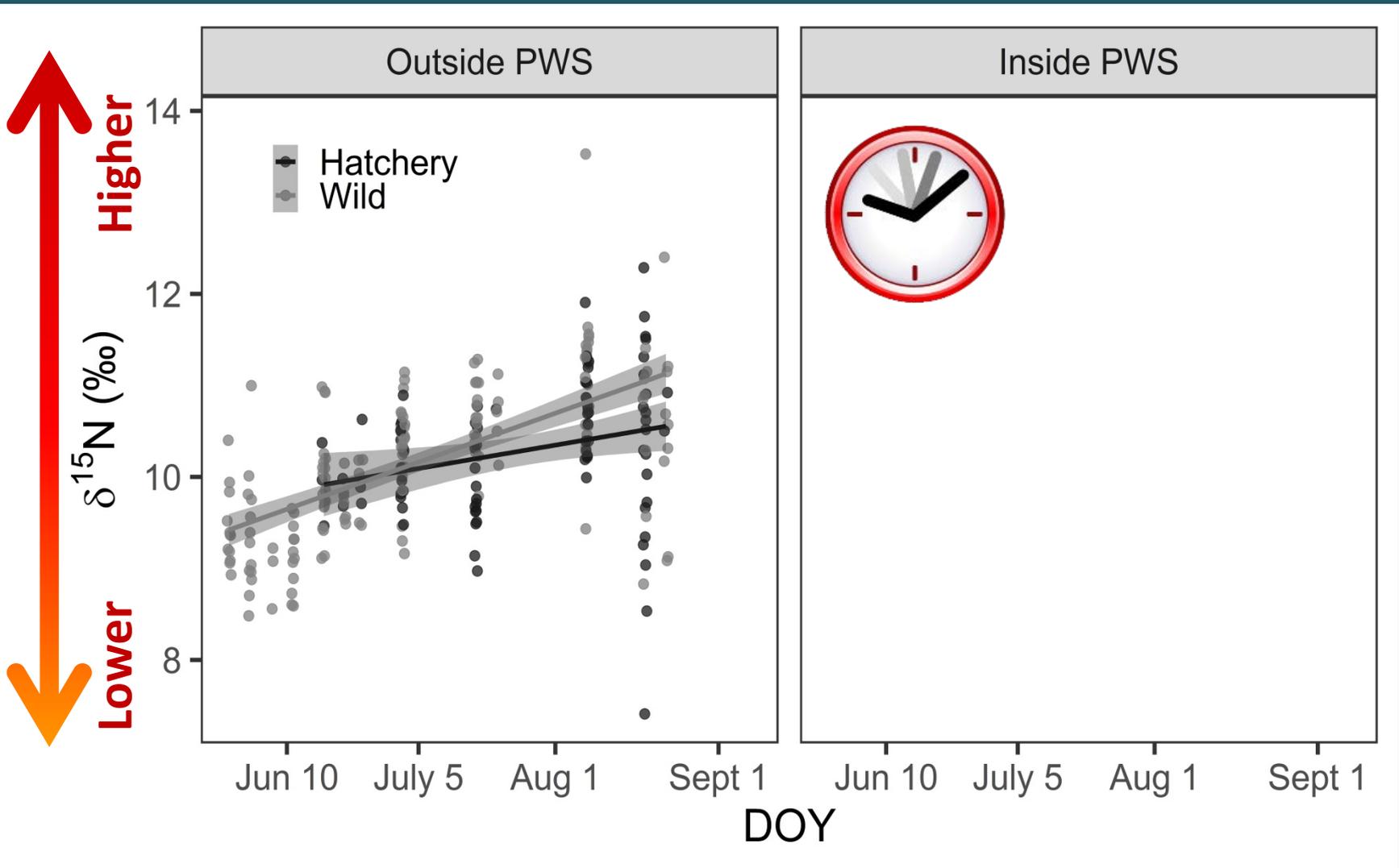
Size did not influence trophic position in ocean caught fish



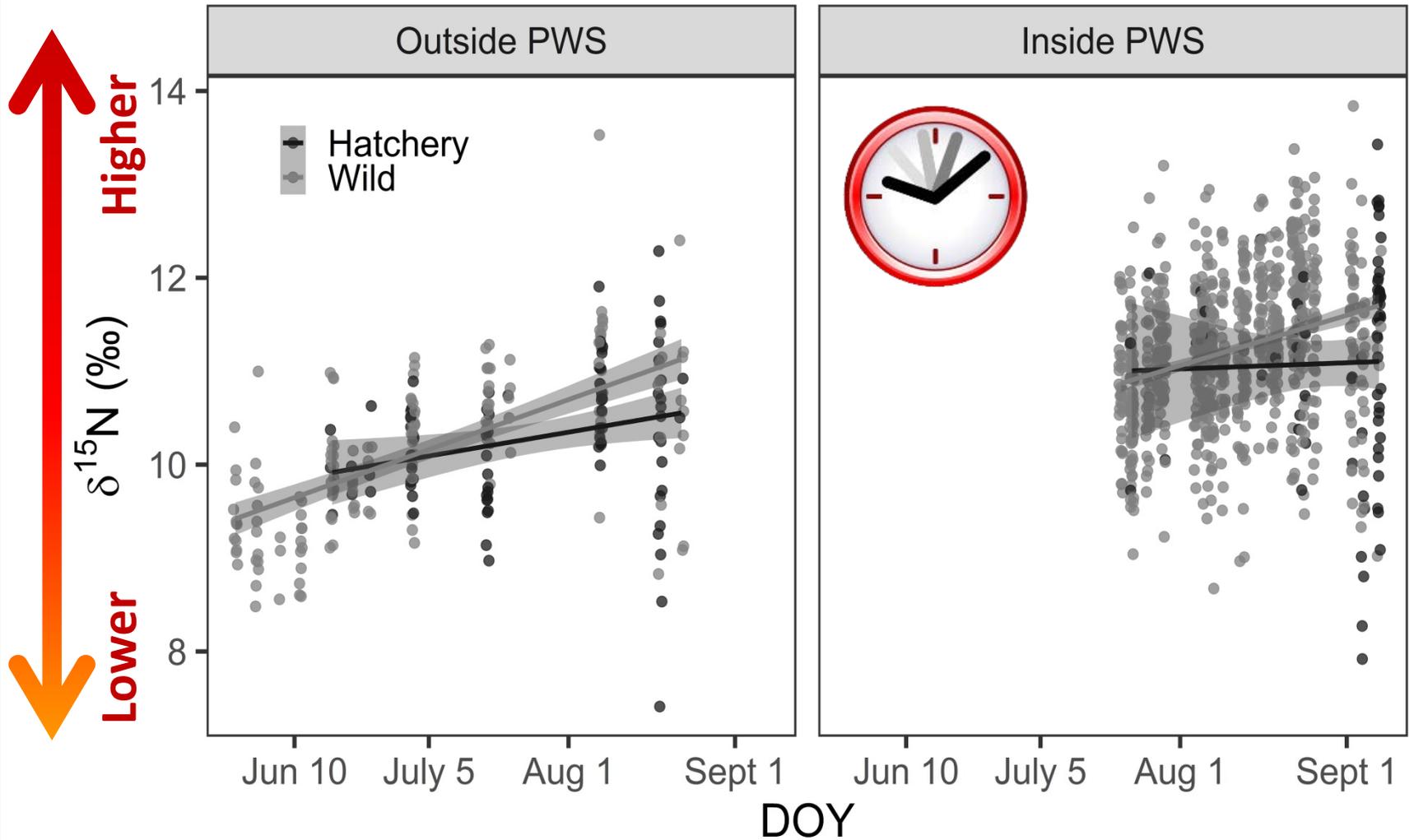
Size and trophic position of hatchery and wild fish had opposite trends within PWS



Trophic position increased as season progressed

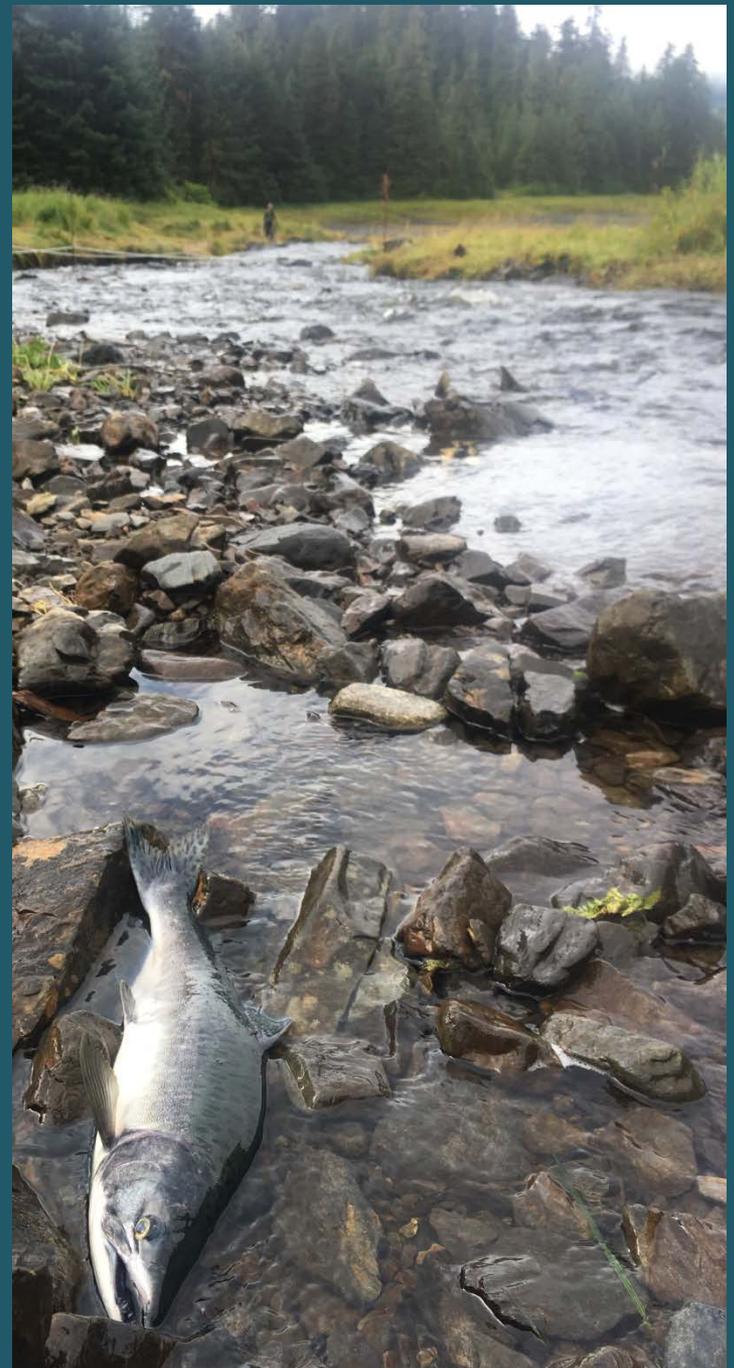


Trophic position consistently higher for wild fish outside and inside PWS



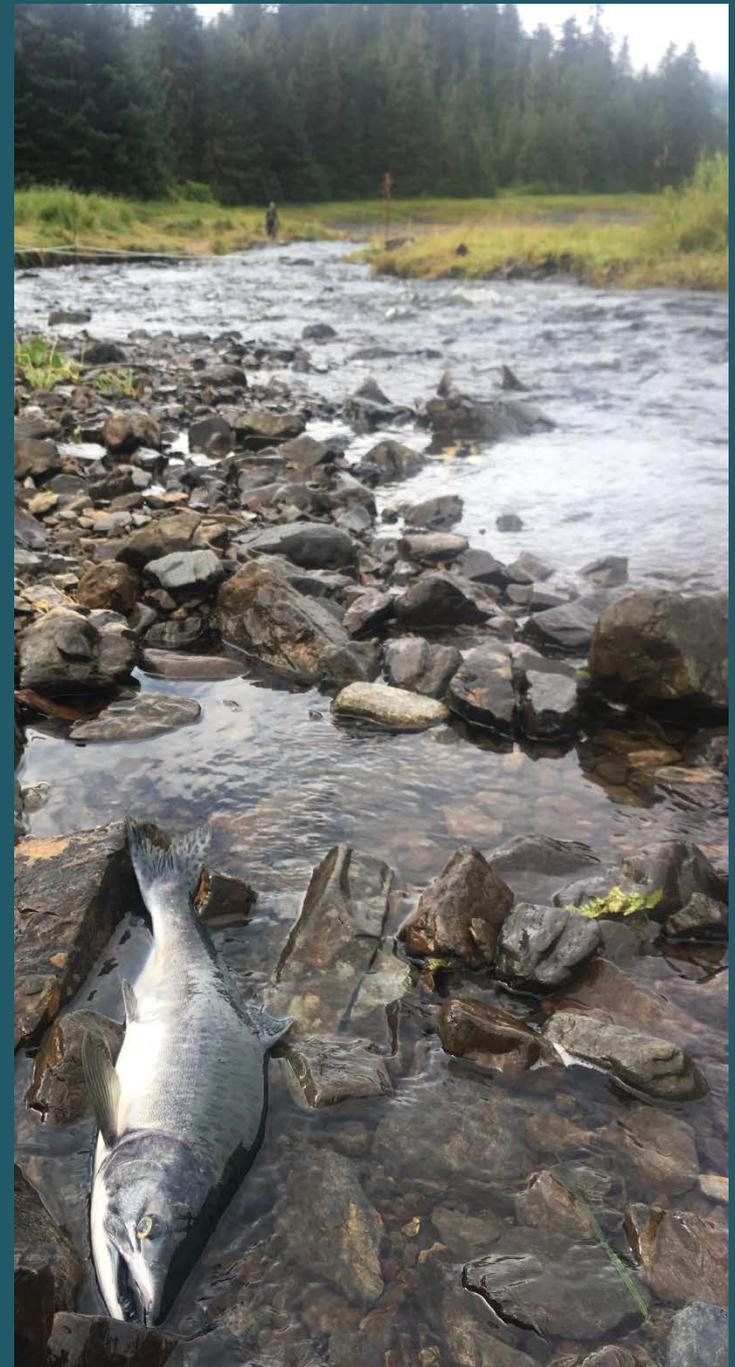
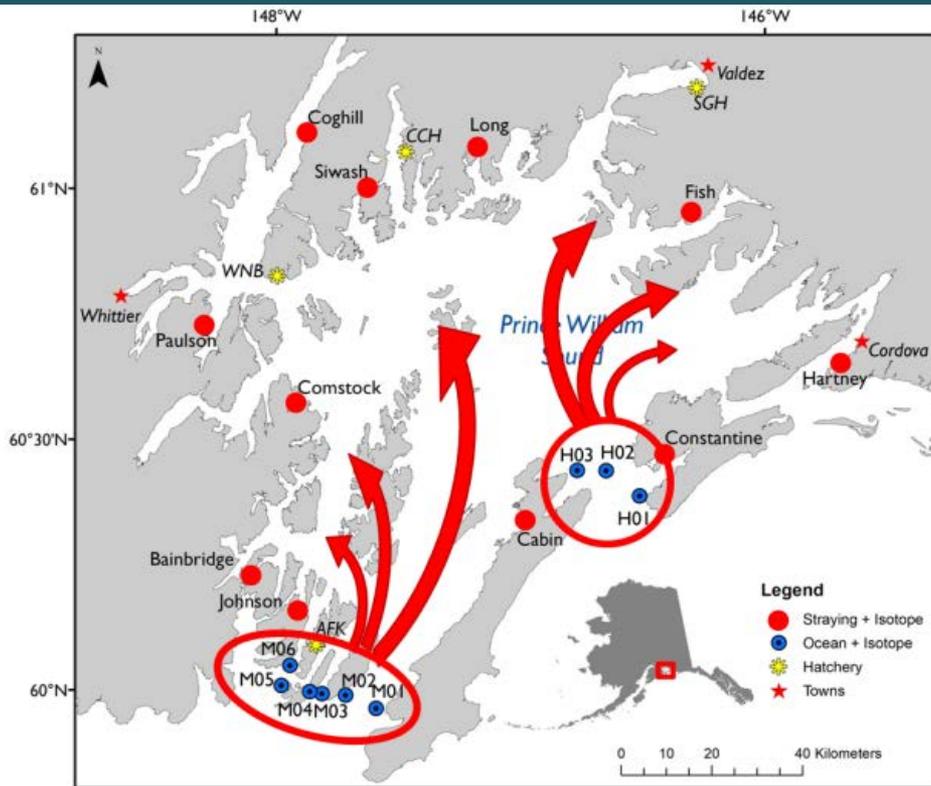
Next steps

Isotope values depend on
sex, size and time:
Include in further analyses



Next steps

Migration patterns



Preliminary results in summary

Hatchery and wild fish were
foraging in different locations
&
eating different things
within PWS, but not outside





PRINCE WILLIAM SOUND
SCIENCE CENTER

Questions?



Thank You



Stream sample collection 2015 represents “inside” PWS



<http://stable-isotope.coas.oregonstate.edu>

Ocean sample collection 2015; represents “outside” of PWS



<http://stable-isotope.coas.oregonstate.edu>