

The NE Pacific Ocean and Columbia River Salmon returns: past, present and future

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Should we fear The Blob? How warm mass of Pacific water could threaten B.C.'s marine ecosystem and climate

BY SUSAN LAZARUK, THE PROVINCE OCTOBER 18, 2015



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PHOTOS (13)



The ocean sunfish or mola mola is the heaviest known bony fish in the world, with an average adult weighing between 247 and 1,000 kg. — Wikipedia

Photograph by: Per-Ola Norman , Vancouver Sun

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STORY TOOLS

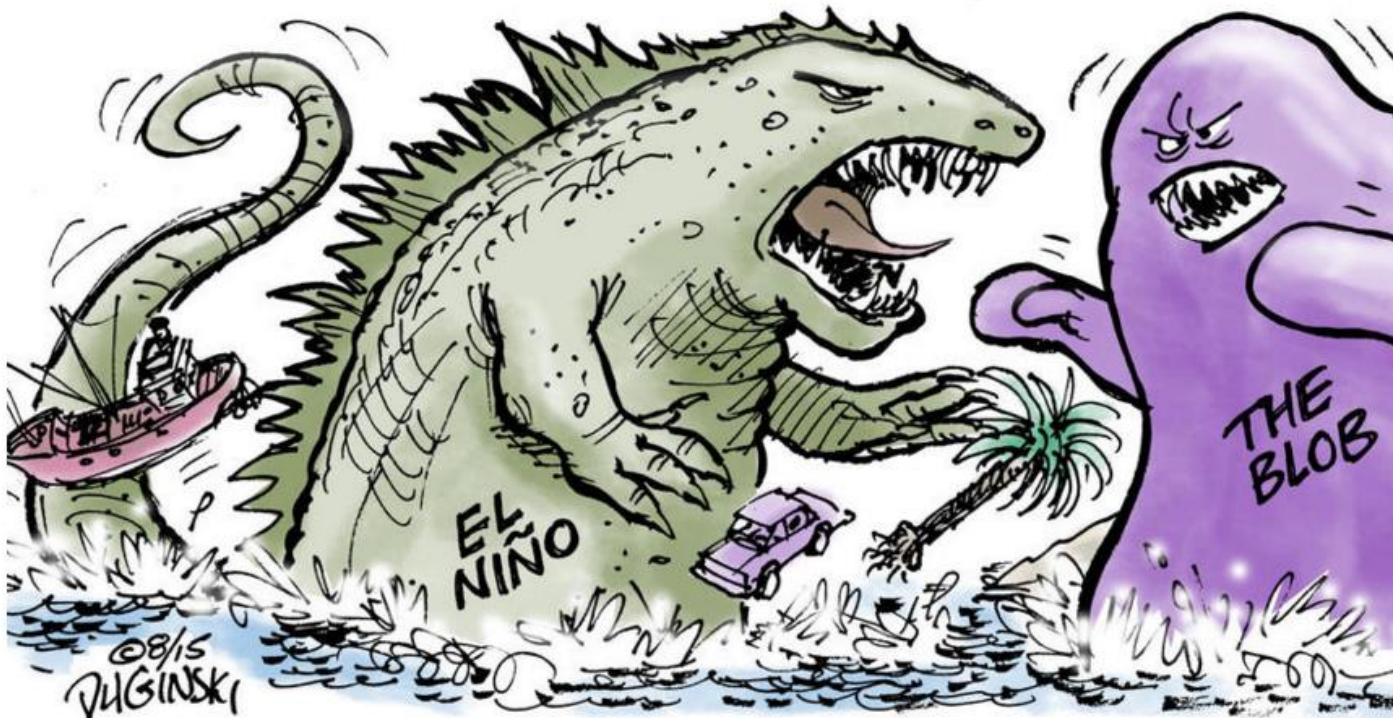


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Q&A 'Godzilla' El Niño: Unbelievable rain for California, dry winter for Midwest




A "Godzilla" El Niño could end a drought-worsening weather pattern affecting California. A persistent mass of high pressure over the Gulf of Alaska has kept wet storms away from California in recent years and has caused a growing "blob" of warmer ocean temperatures in the northeast Pacific Ocean. (Paul Duginski)

By **RONG-GONG LIN II AND CHRISTINE MAI-DUC**
Contact Reporters

EL NIÑO IS GOING TO STARVE A LOT OF FISH



The crew of the limit-seiner Miss Sherri hauls aboard a small catch of pink and chum salmon during Southeast Alaska Salmon Purse Seine.  KLAS STOLPE/AP

Goals:

Try to define current ocean conditions

Relate past ocean conditions to past adult returns

Early indicators of adult return (2016 & 2017): spring Chinook

Ocean catch of juveniles

Hatchery minijack returns

Jack return

Prognosis?

Recent events in the Ocean:

The Blob: winter 13/14 to present

El Nino/ENSO:

initiated summer 15 to present

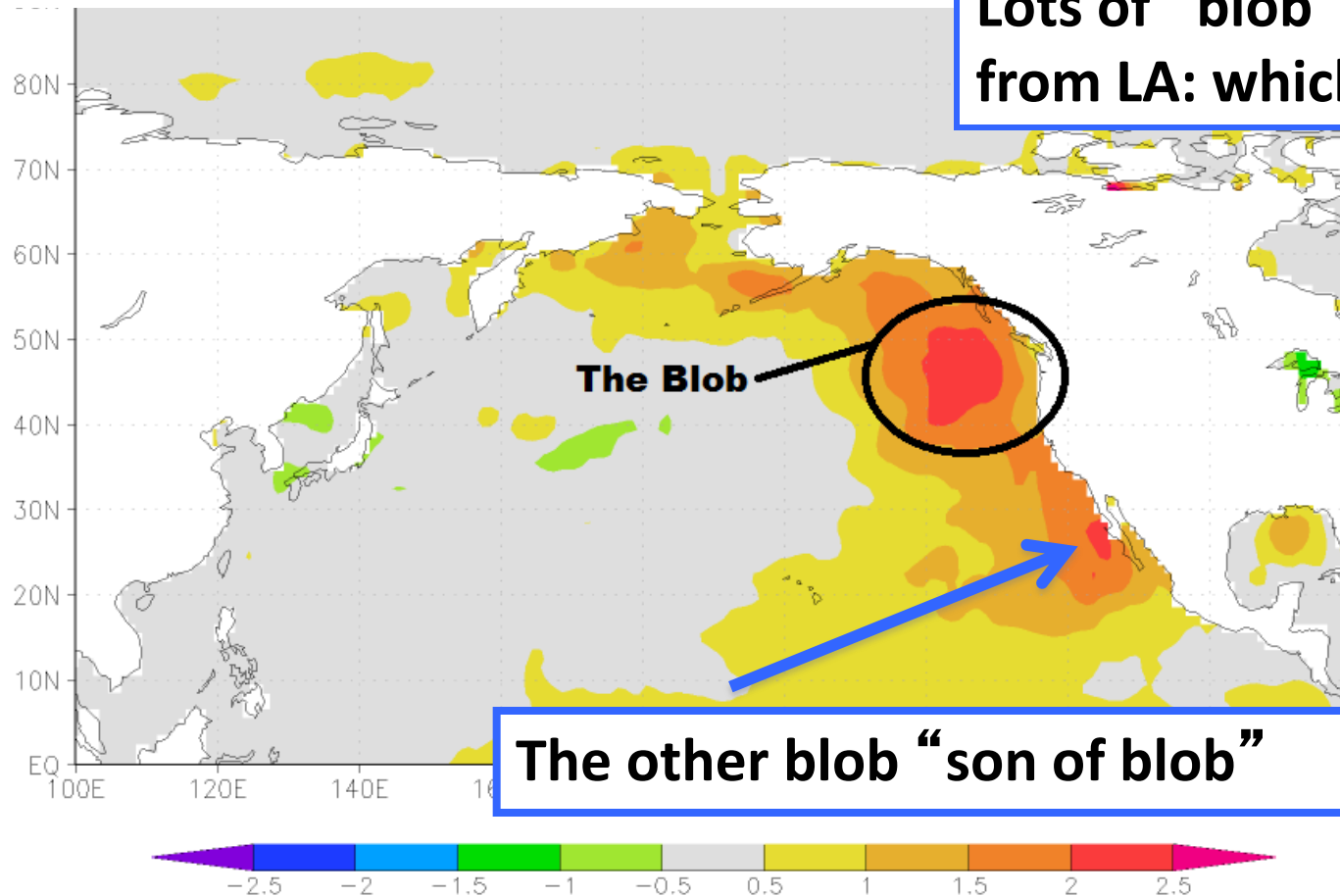
Pacific Decadal Oscillation (PDO):

warm phase shift – summer 14

Blob slide #1 – what's the blob

“new” (previously un-described)
persistent - almost 2 yrs
unclear mechanism, unpredictable

Lots of “blob” stories
from LA: which “blob”?



Source: KNMI Climate Explorer

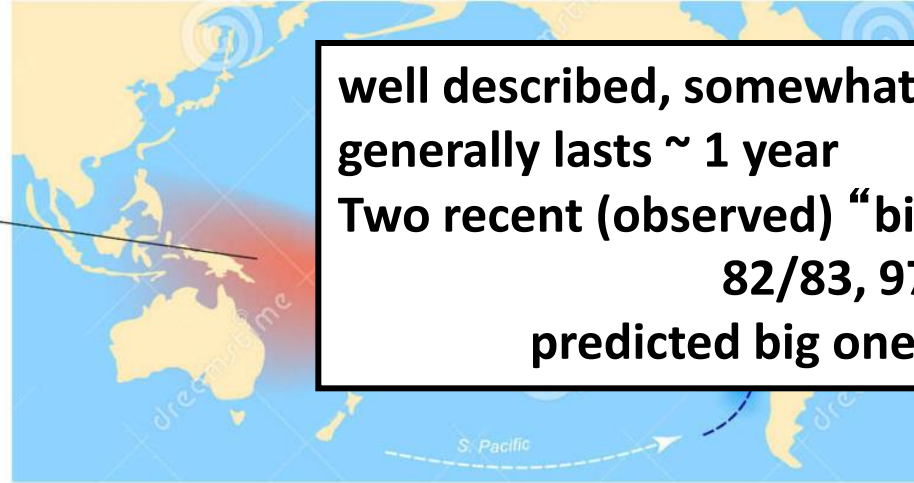
Bob Tisdale

El Nino slide #1 - mechanism

THE EL NIÑO PHENOMENON

NORMAL YEAR

Equatorial winds gather warm water pool toward the west.



well described, somewhat predictable
generally lasts ~ 1 year

Two recent (observed) “big ones”

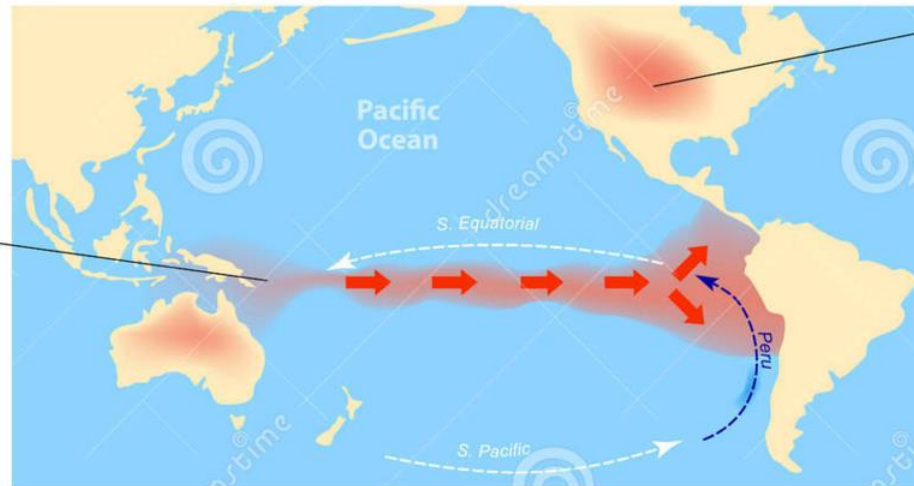
82/83, 97/98

predicted big one - 15/16?

along South American coast.

EL NIÑO YEAR

Easterly winds weaken. Warm water to move eastward.



Warmer winter



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Dreamstime.com

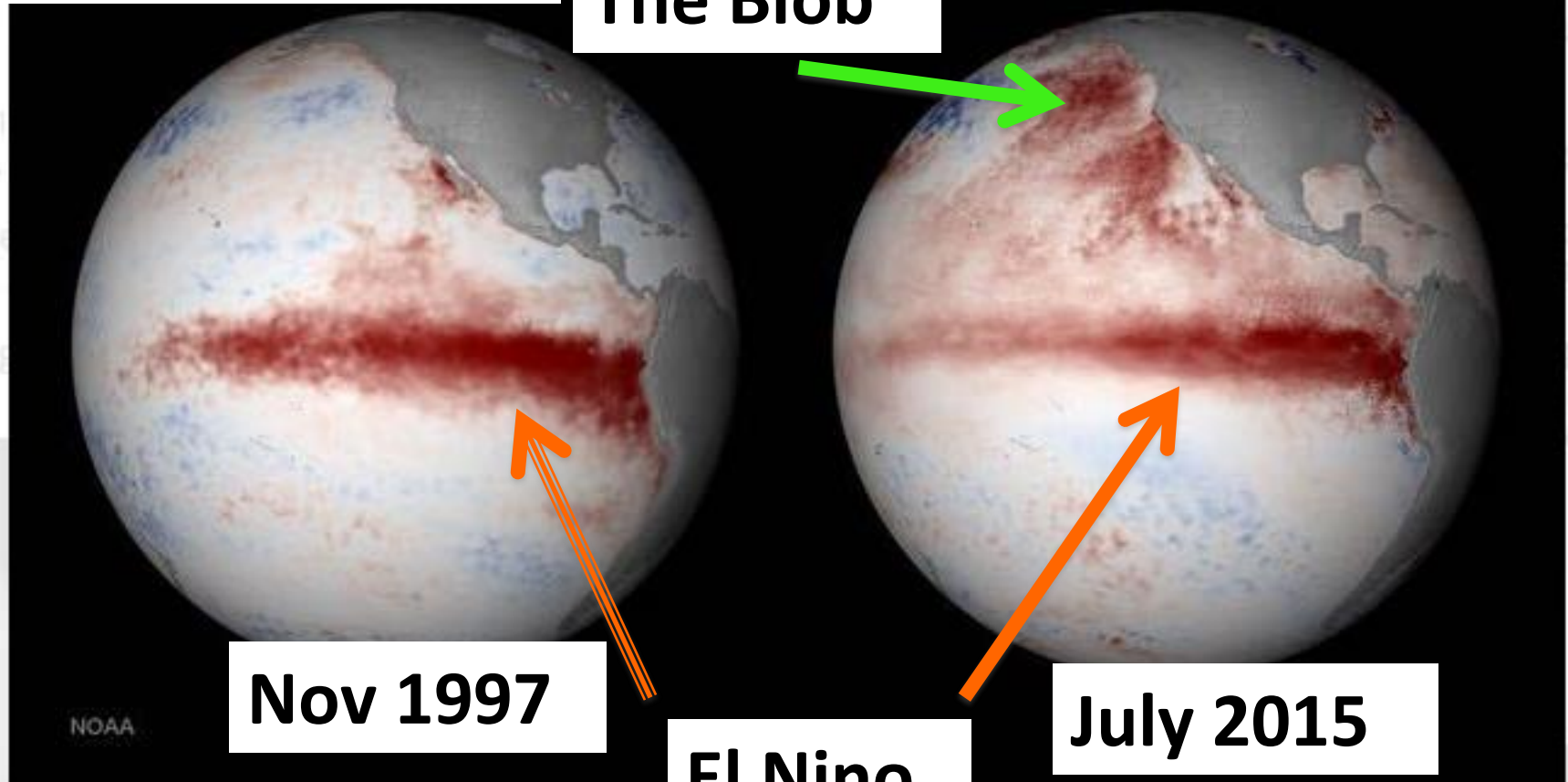
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El Nino slide #2

The Blob

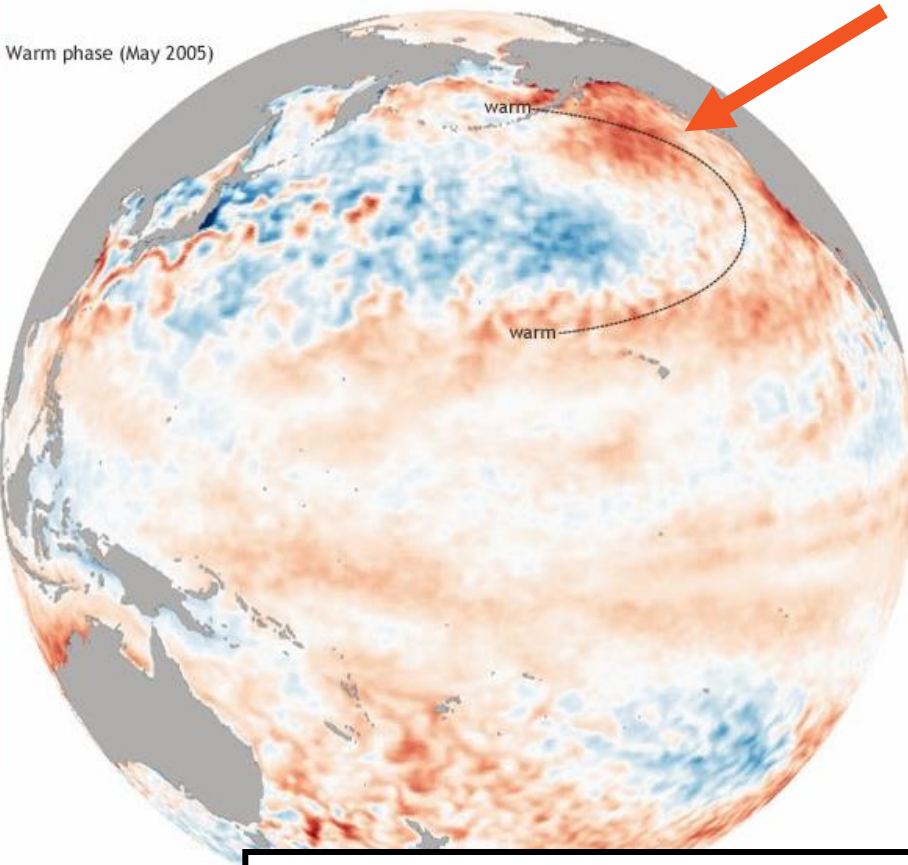


Conditions are currently warming up in the Pacific, and the NOAA Climate Prediction Center expects a greater than 90% chance that El Niño will continue through the winter and most likely into the spring. This image shows the July 13-19, 2015 sea surface temperature departure from the 1981-2010 average. In addition to the warmer than normal waters generated by the El Niño conditions, the Pacific Decadal Oscillation is also creating persistently higher than normal sea surface temperatures in the northeastern Pacific. (National Oceanic and Atmospheric Administration)

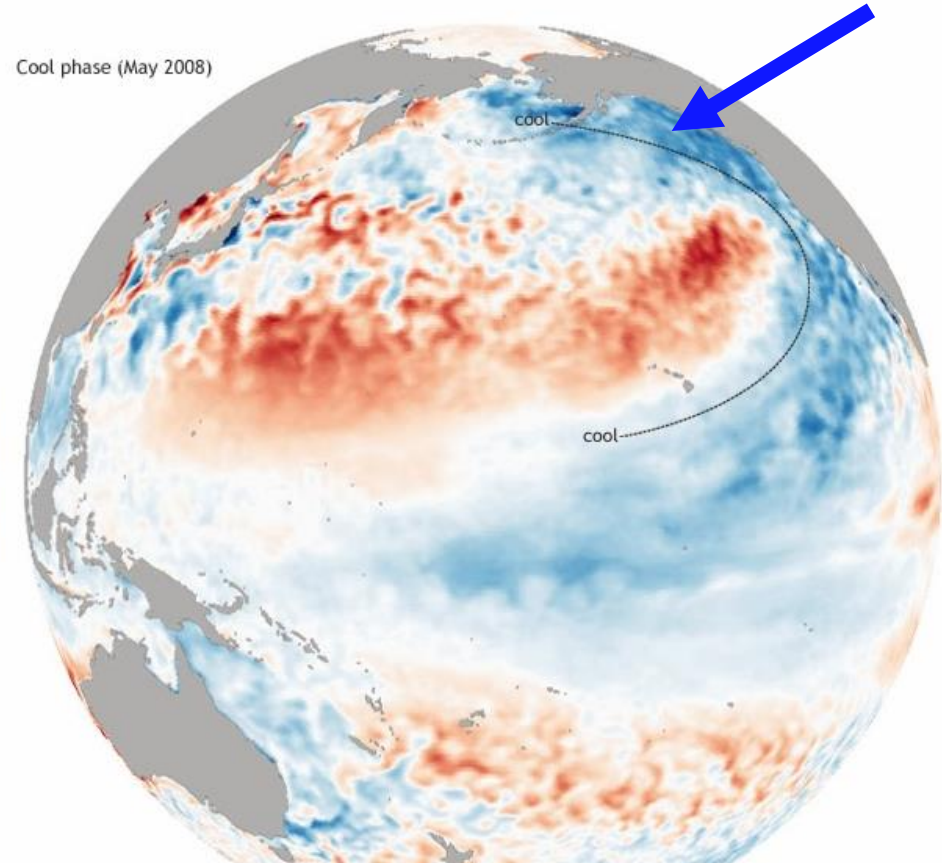
PDO slide #1 – the PDO oscillates between warm and cool phases

Pac

Warm phase (May 2005)



Cool phase (May 2008)



well described

warm or cool phases may last decades

mechanisms not fully understood, unpredictable

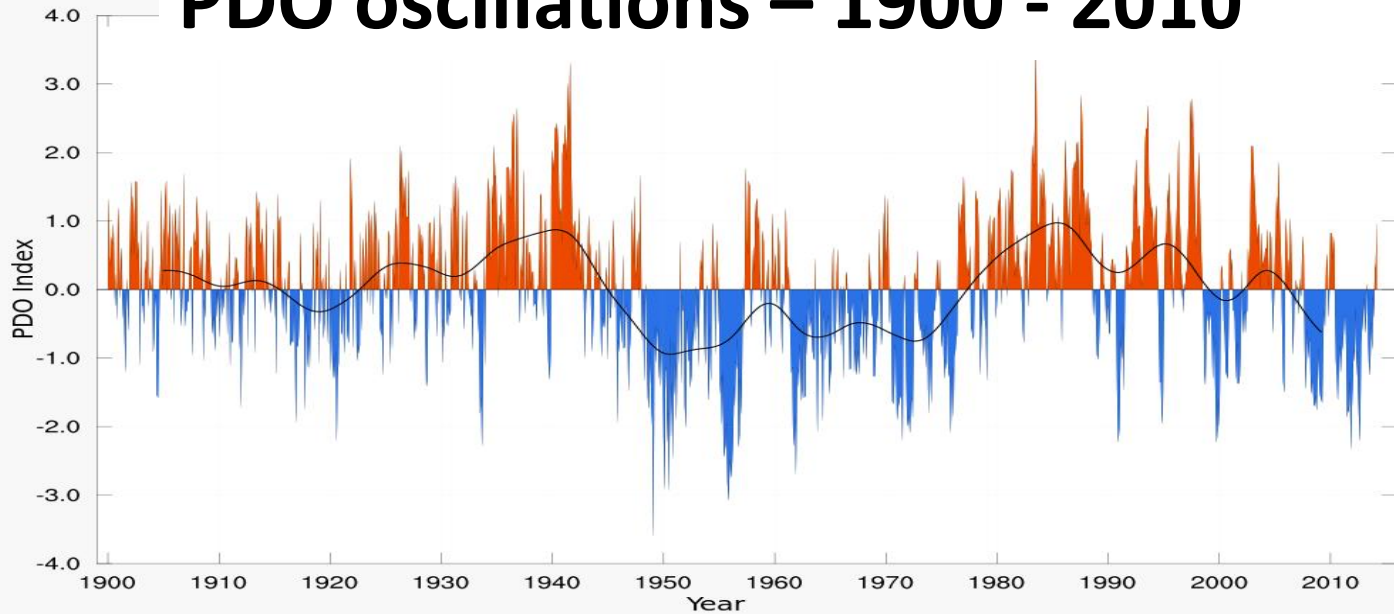
PDO slide #2: phases may last decades

Pacific Decadal Oscillation

Warm phase (May 2005)

Cool phase (May 2008)

PDO oscillations – 1900 - 2010



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Jack return

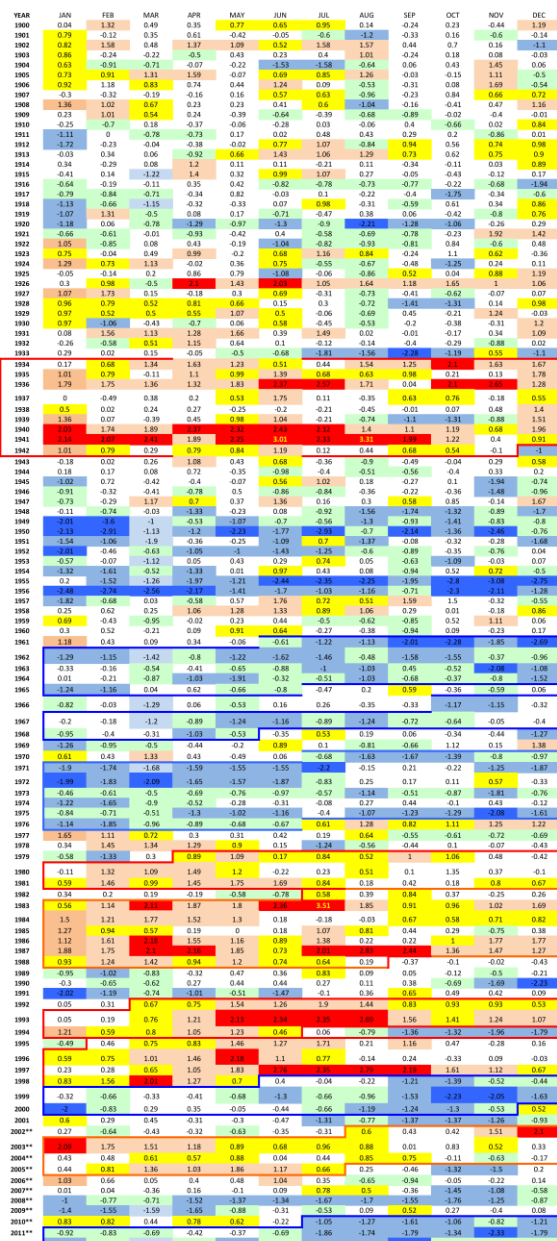
Prognosis?

1900

year

2015

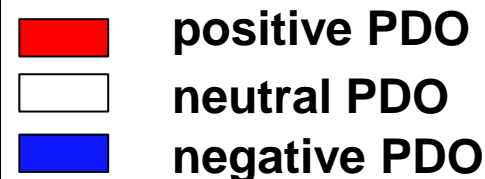
J ← month → D



A century of the Pacific Decadal Oscillation (PDO)

Warm phase

Cool phase



76/77 regime shift

Snake River coho extinct

Multiple ESA listings West Coast Salmonids

97/98 El Nino, 98/99 La Nina, regime shift?

Record returns of Chinook & Sockeye
to Bonneville

Relate past ocean conditions to past adult returns

Discuss 3 groups of salmon:

spring Chinook - above Bonneville

fall Chinook - above Bonneville

steelhead - above Bonneville

Relate past ocean conditions to past adult returns

Analytical approach:

simplistic

Adult counts @ Bonn vs Ocean Conditions

(SpCS = lag 2, FaSC = lag 2, Stlhd = lag 1)

assumptions, no effects by:

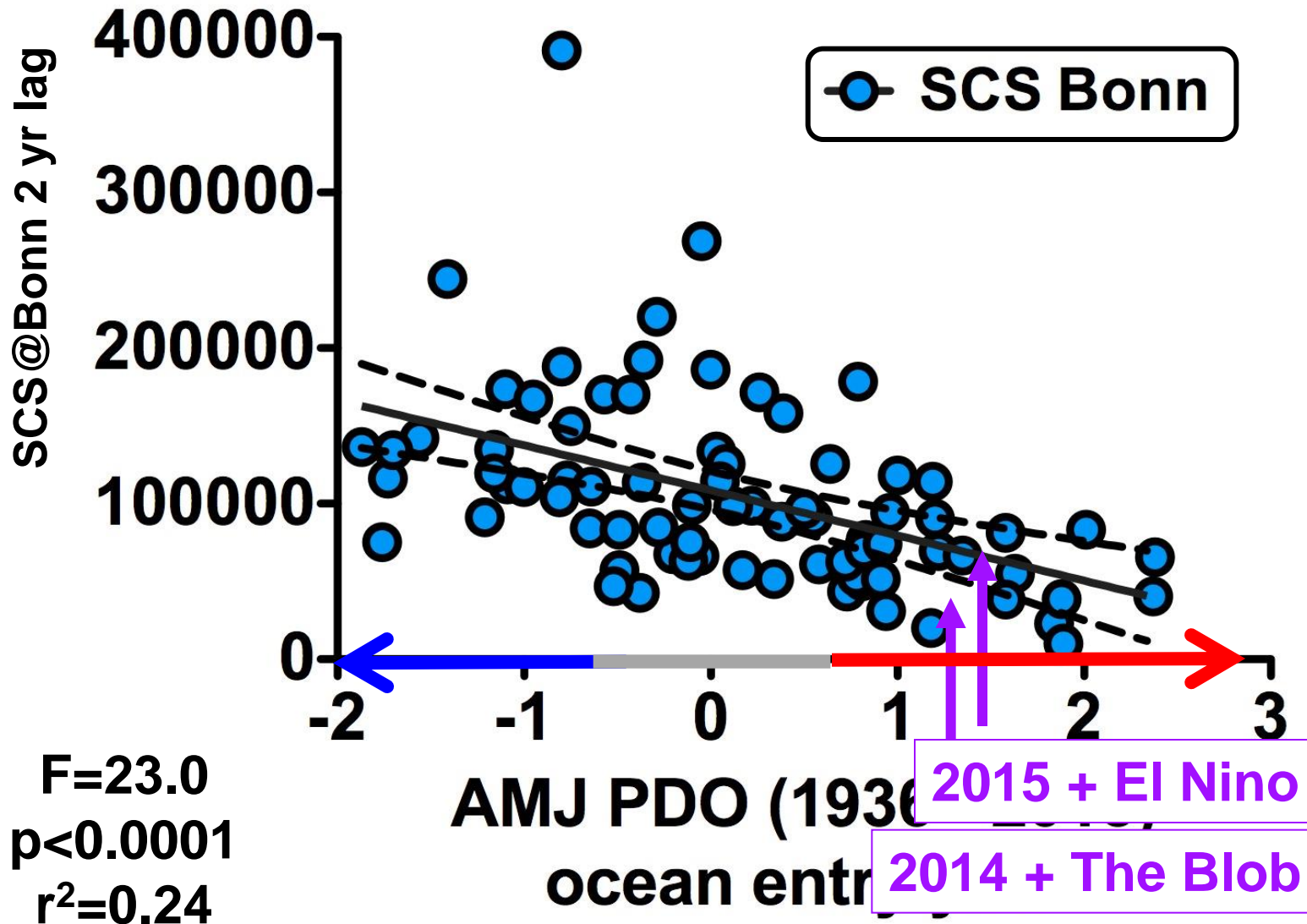
harvest

dams

hatcheries

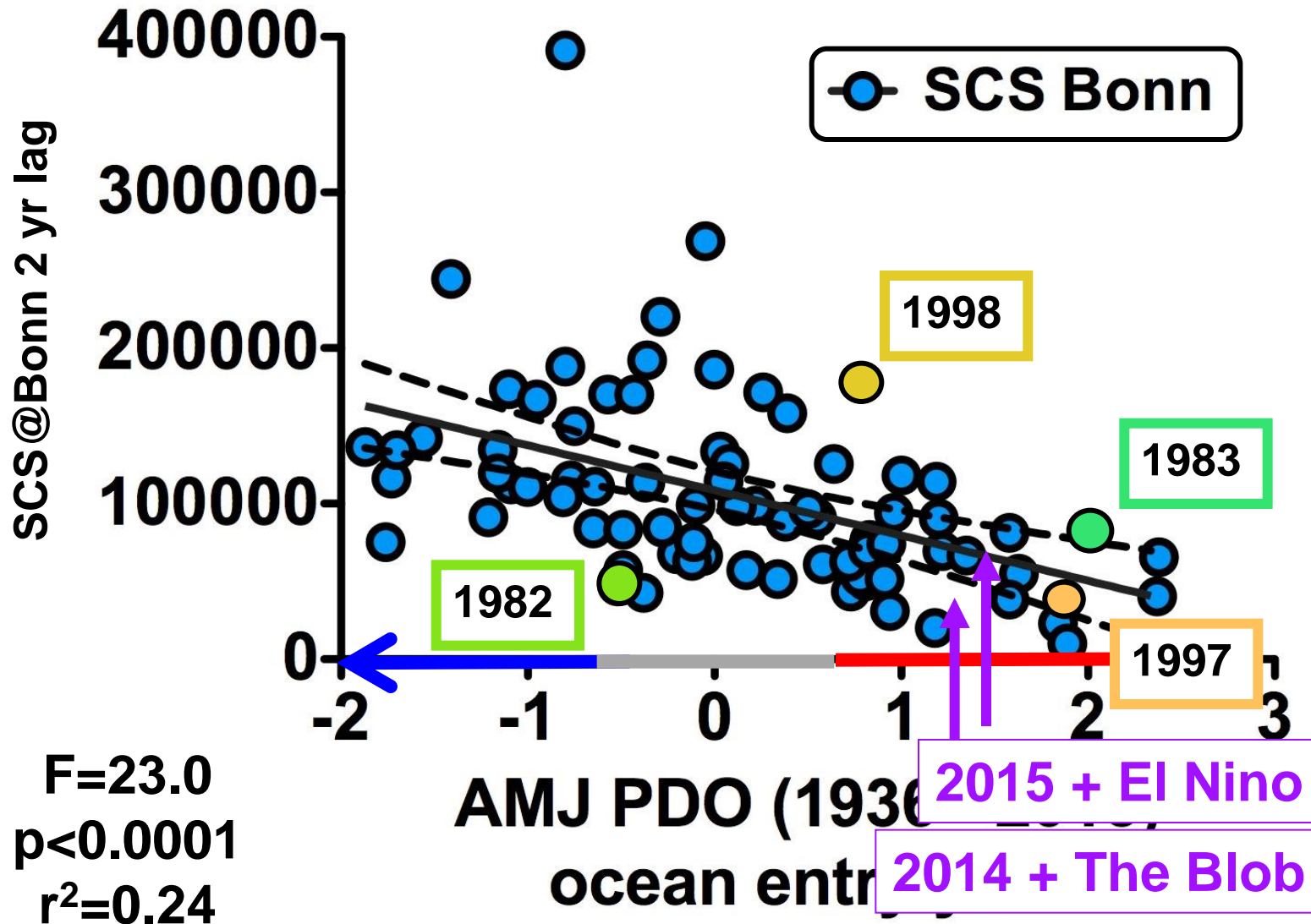
simple regression

Spring Chinook counts are never high when PDO is positive



El Nino may occur during positive or negative PDO

El Nino effect on return mixed



Relate past ocean conditions to past adult returns

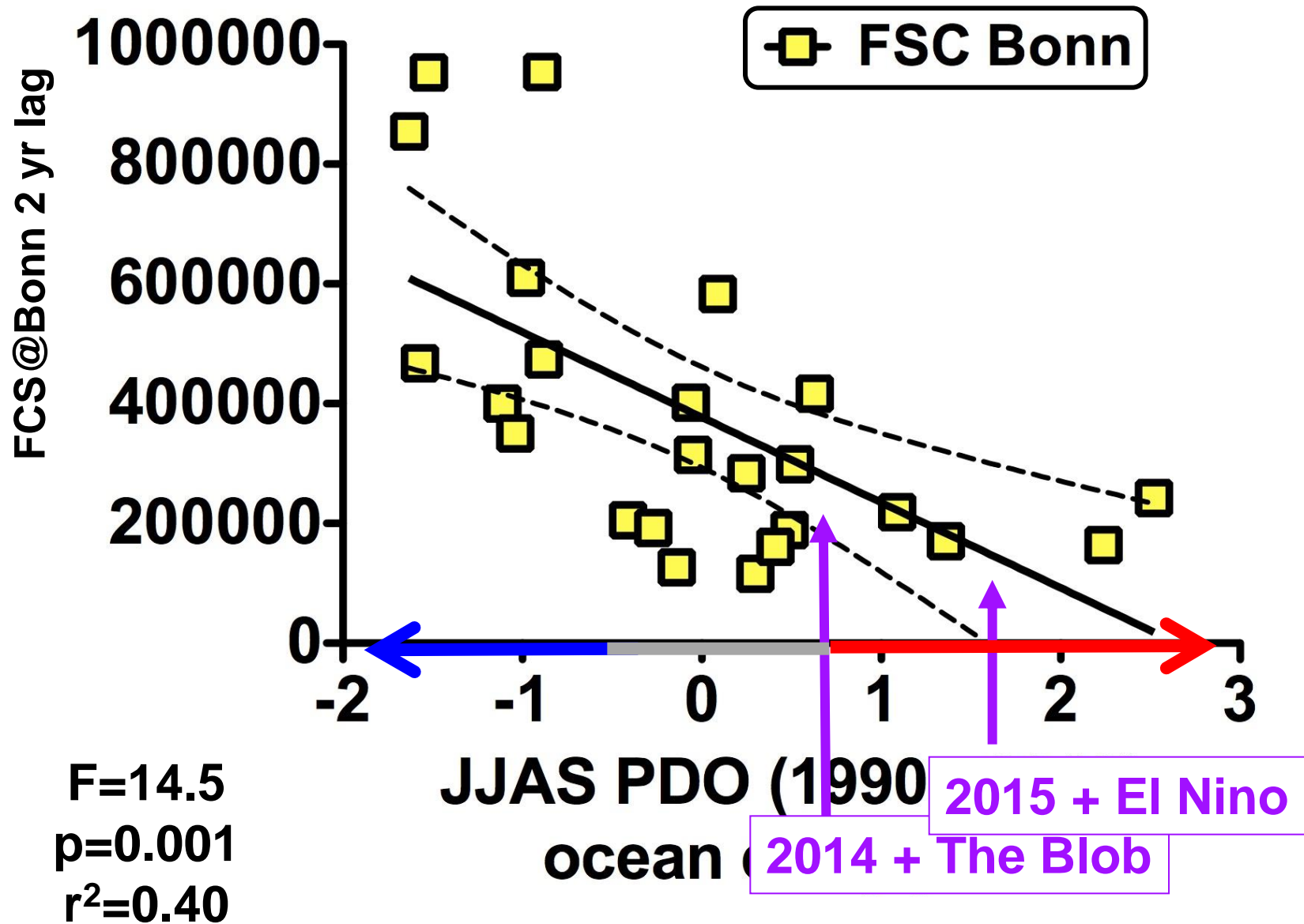
Discuss 3 groups of salmon:

spring Chinook - above Bonneville

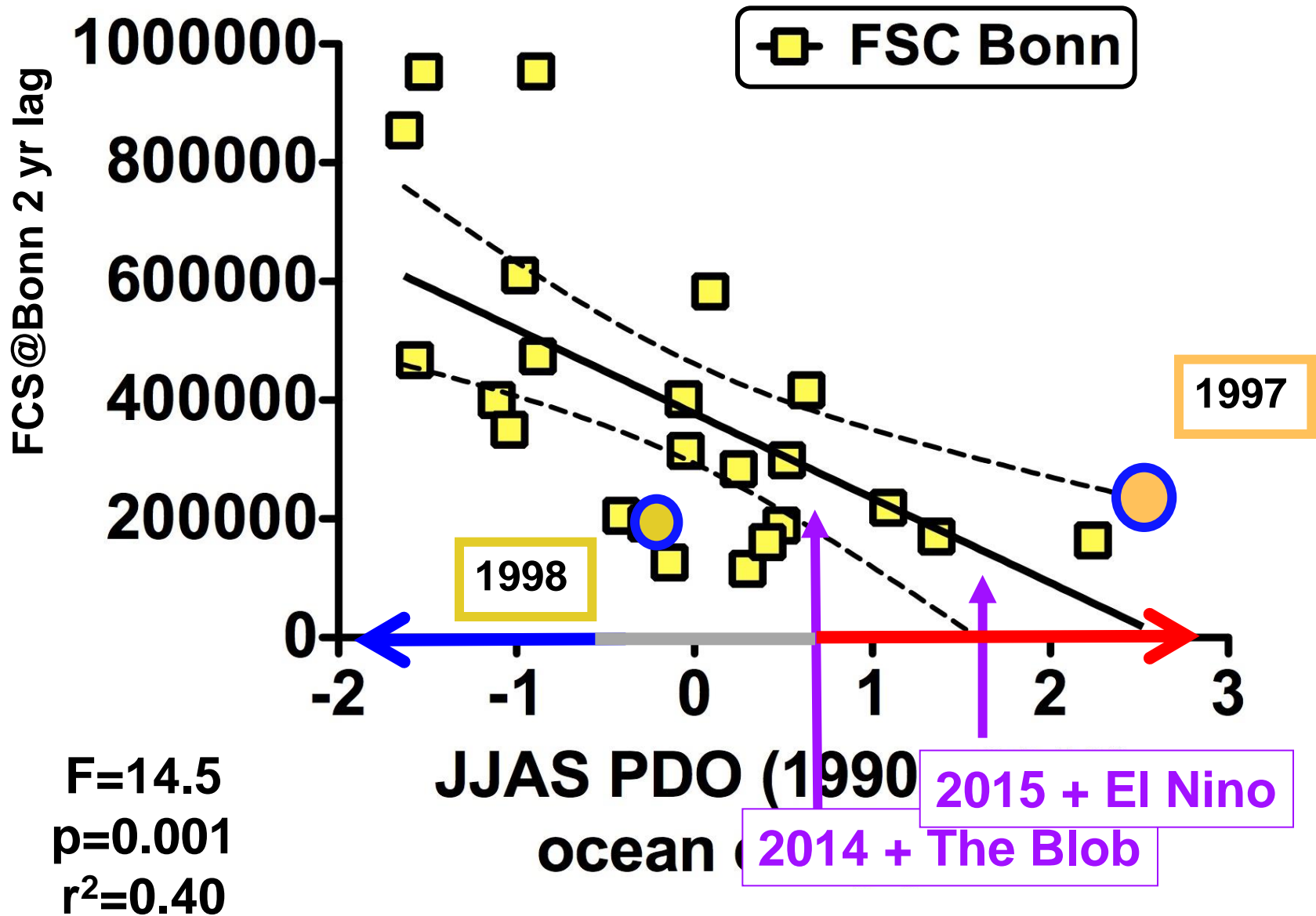
fall Chinook - above Bonneville

steelhead - above Bonneville

Fall Chinook returns are never high with positive PDO



Fall Chinook: El Nino effect on return mixed



Relate past ocean conditions to past adult returns

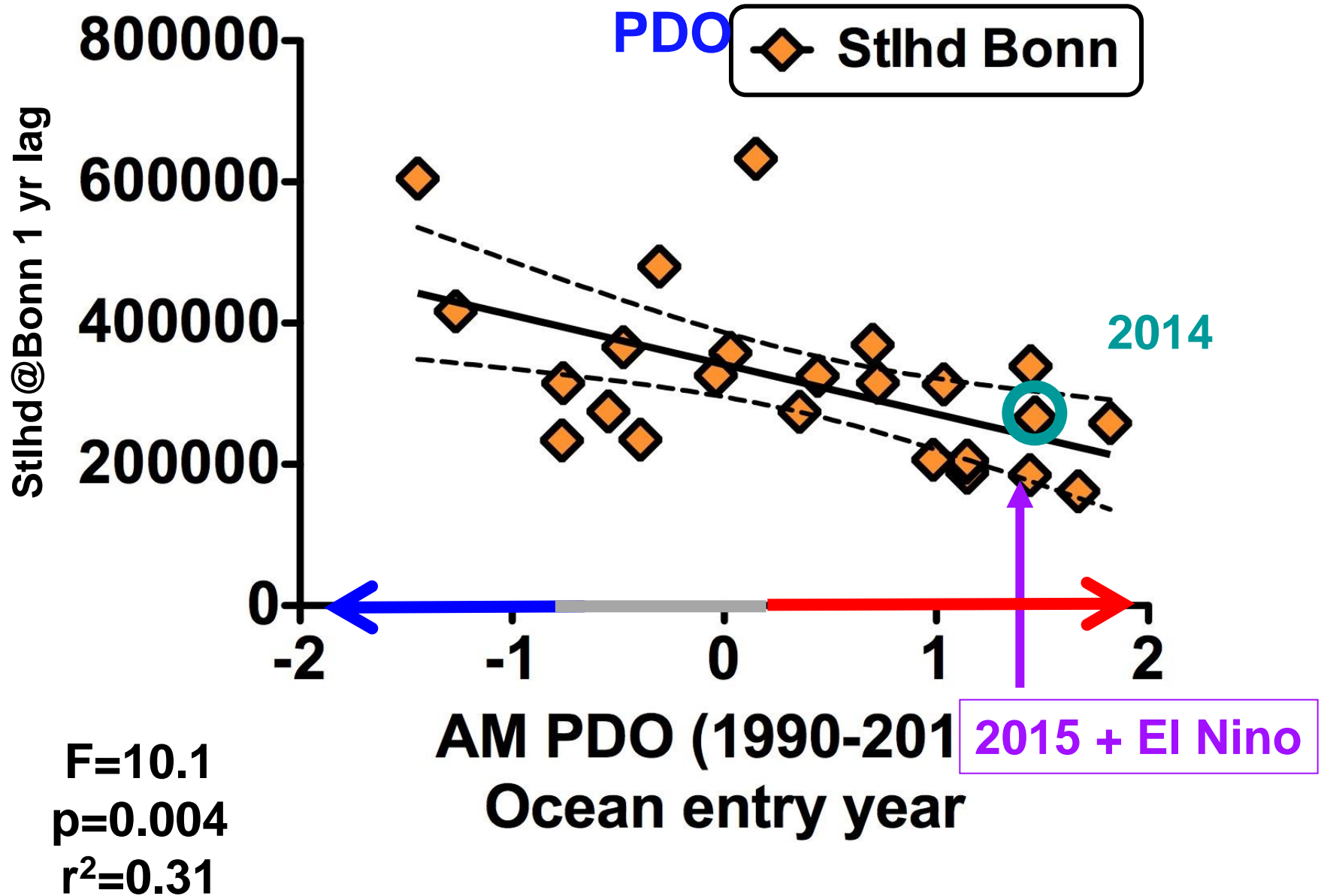
Discuss 3 groups of salmon:

spring Chinook - above Bonneville

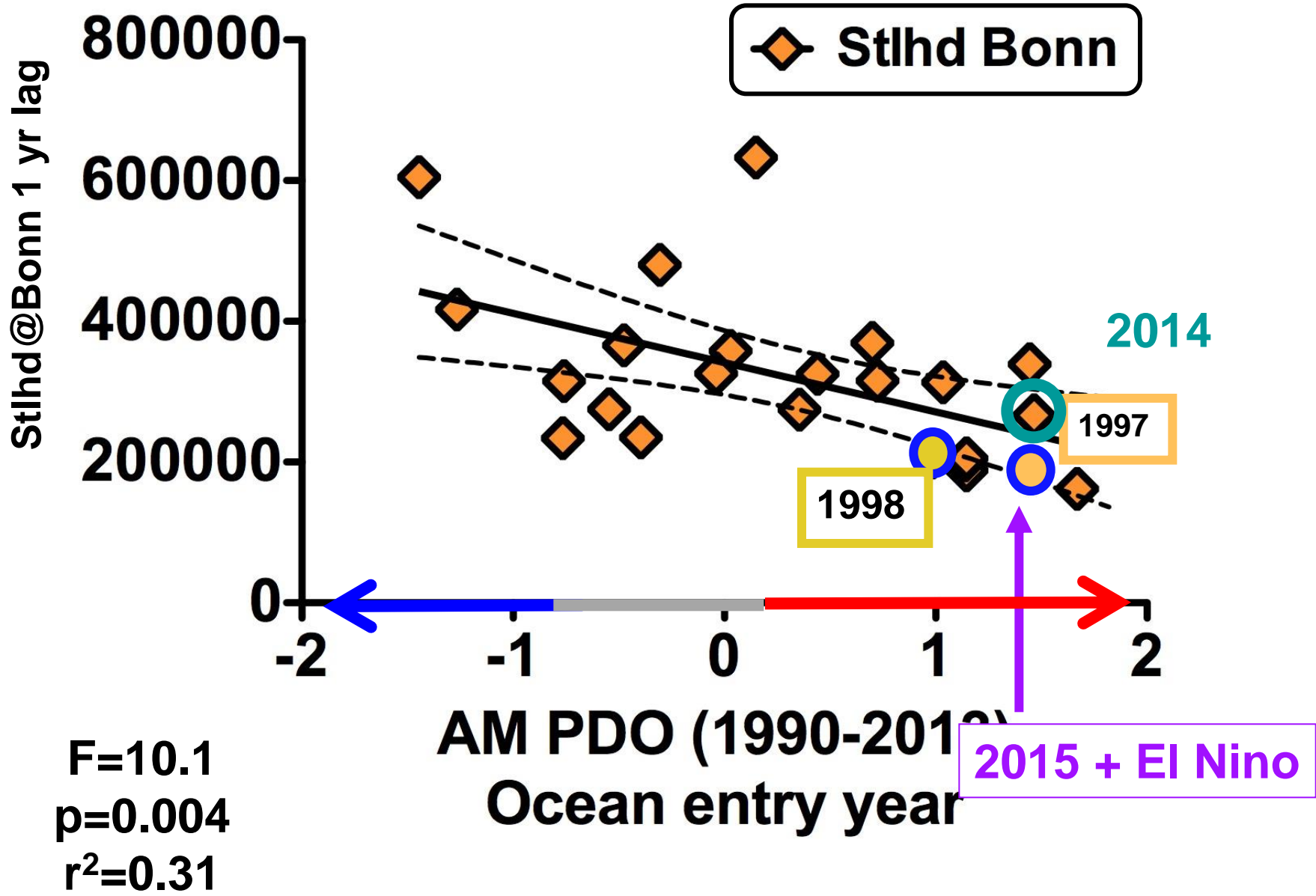
fall Chinook - above Bonneville

steelhead - above Bonneville

Steelhead returns are never high with positive



Steelhead: El Nino effect on return “minimal”



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Ocean catch of juveniles

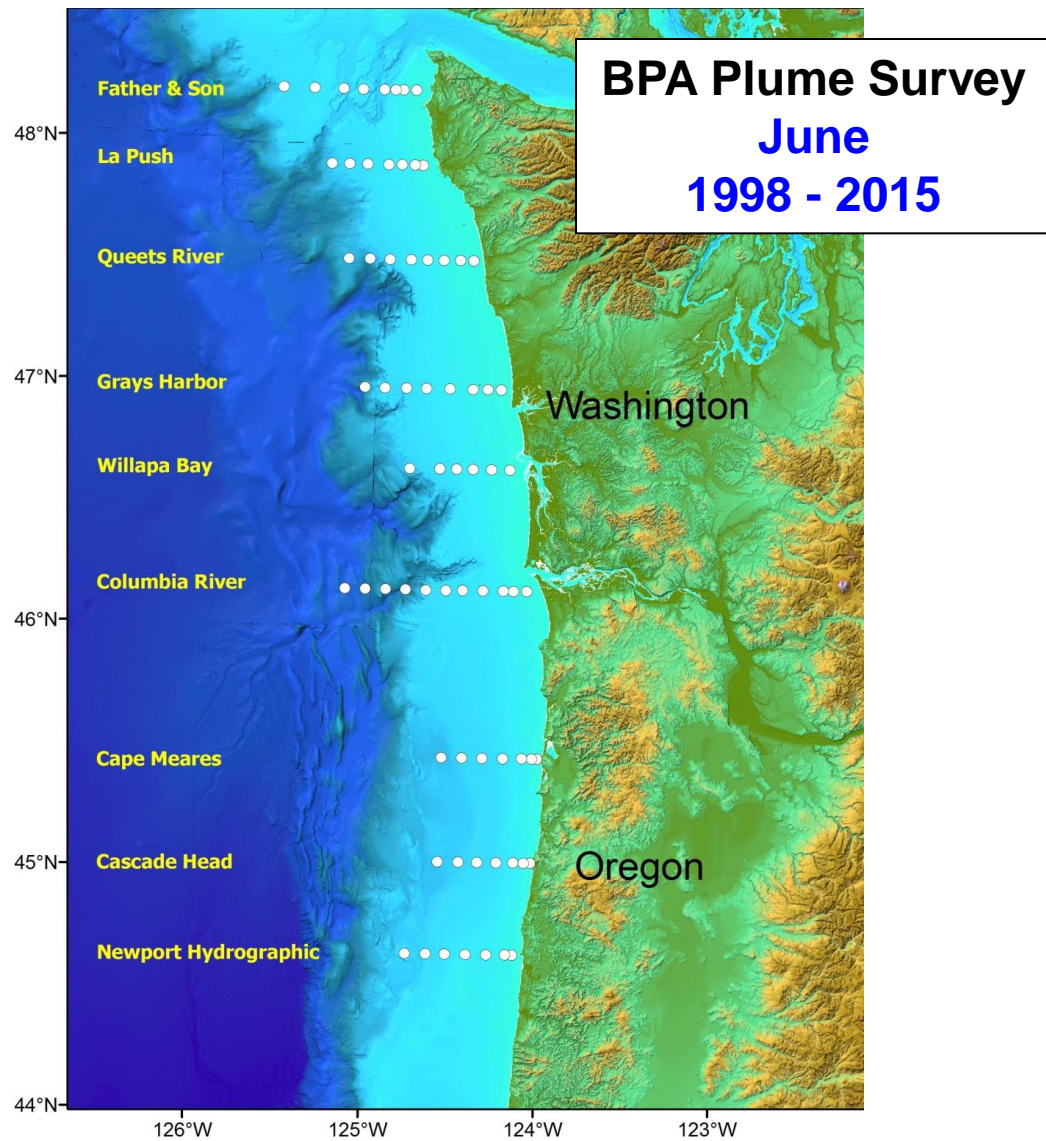
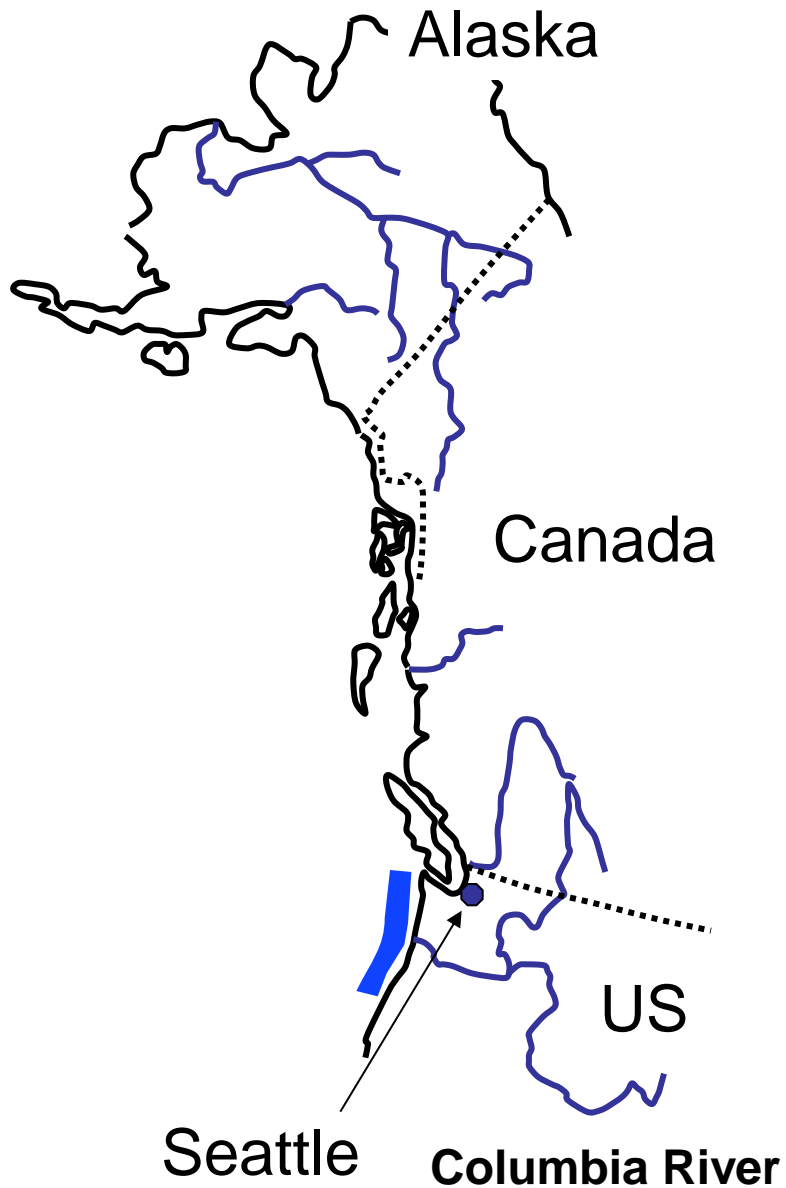
Hatchery minijack returns

Jack return

Prognosis?

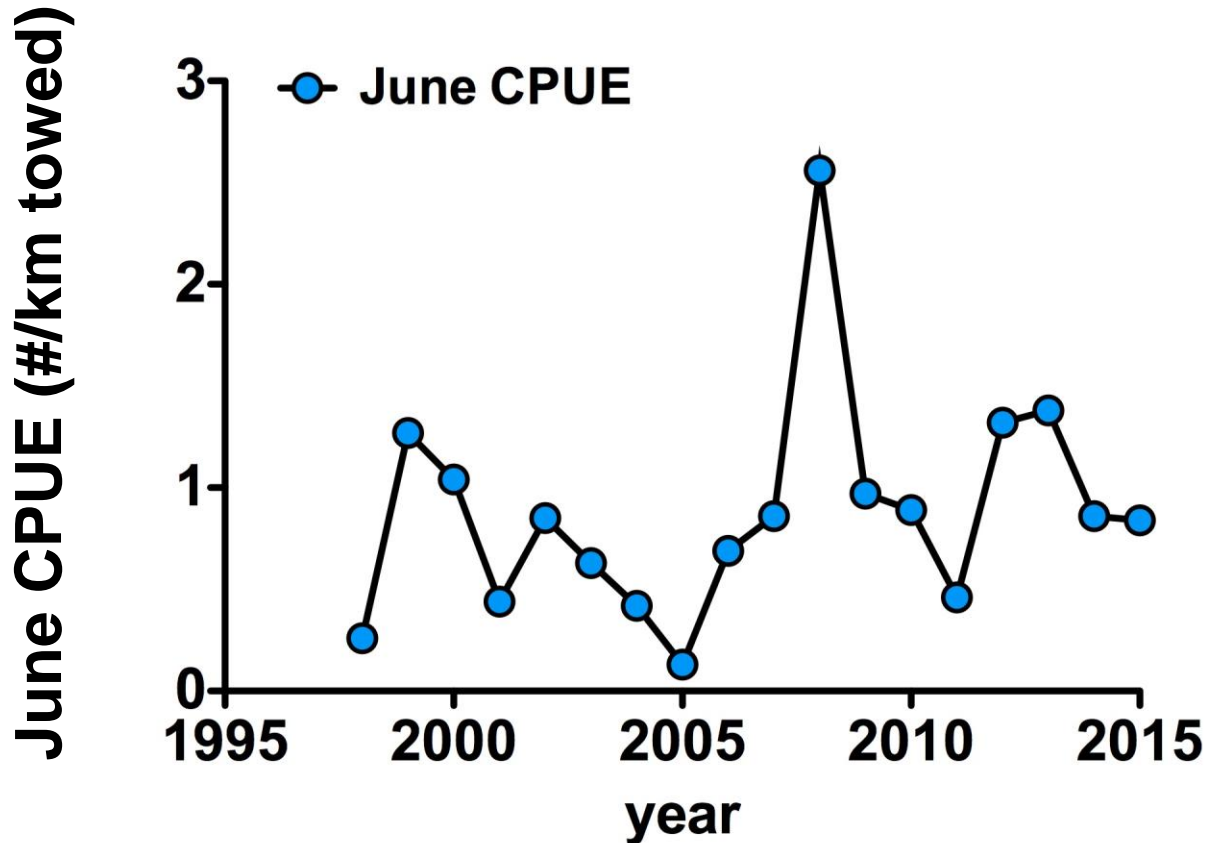
NOAA Juvenile Salmon Ocean Survey





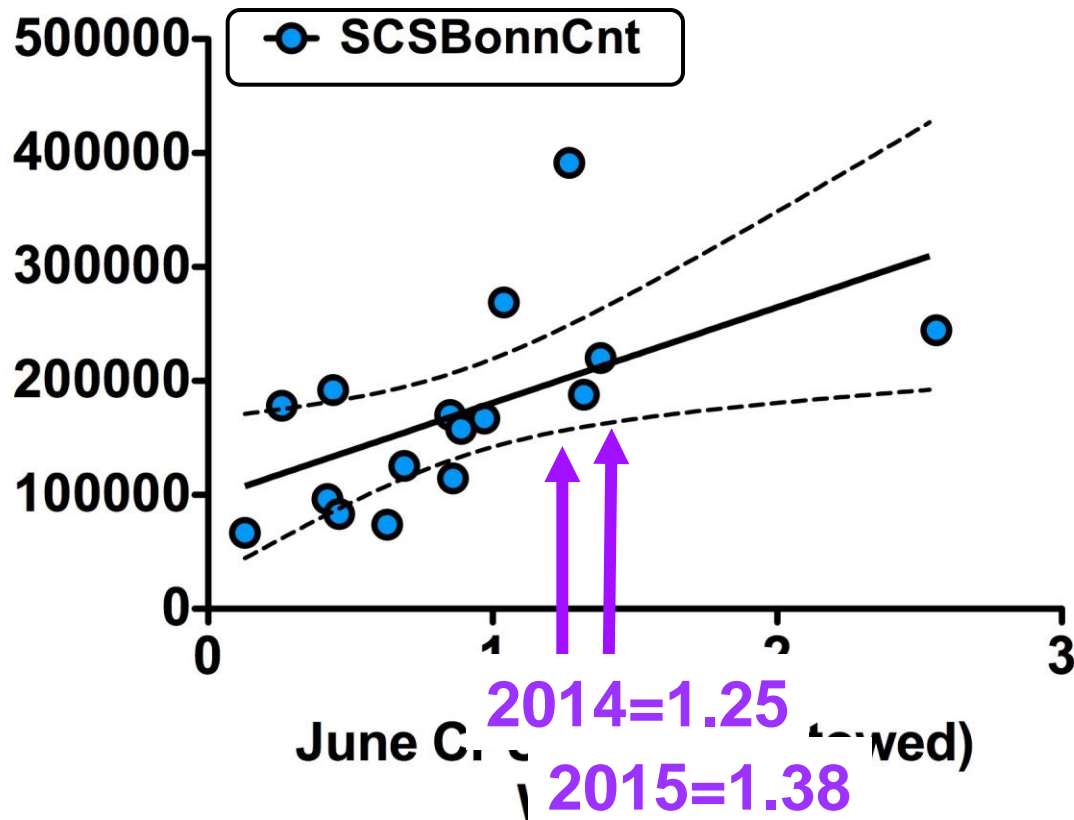
early indicators

Catch of yearling Chinook (CPUE) varies in June



early indicators

Catch of yearling Chinook is correlated to Adult return (+2), (1998-2013)

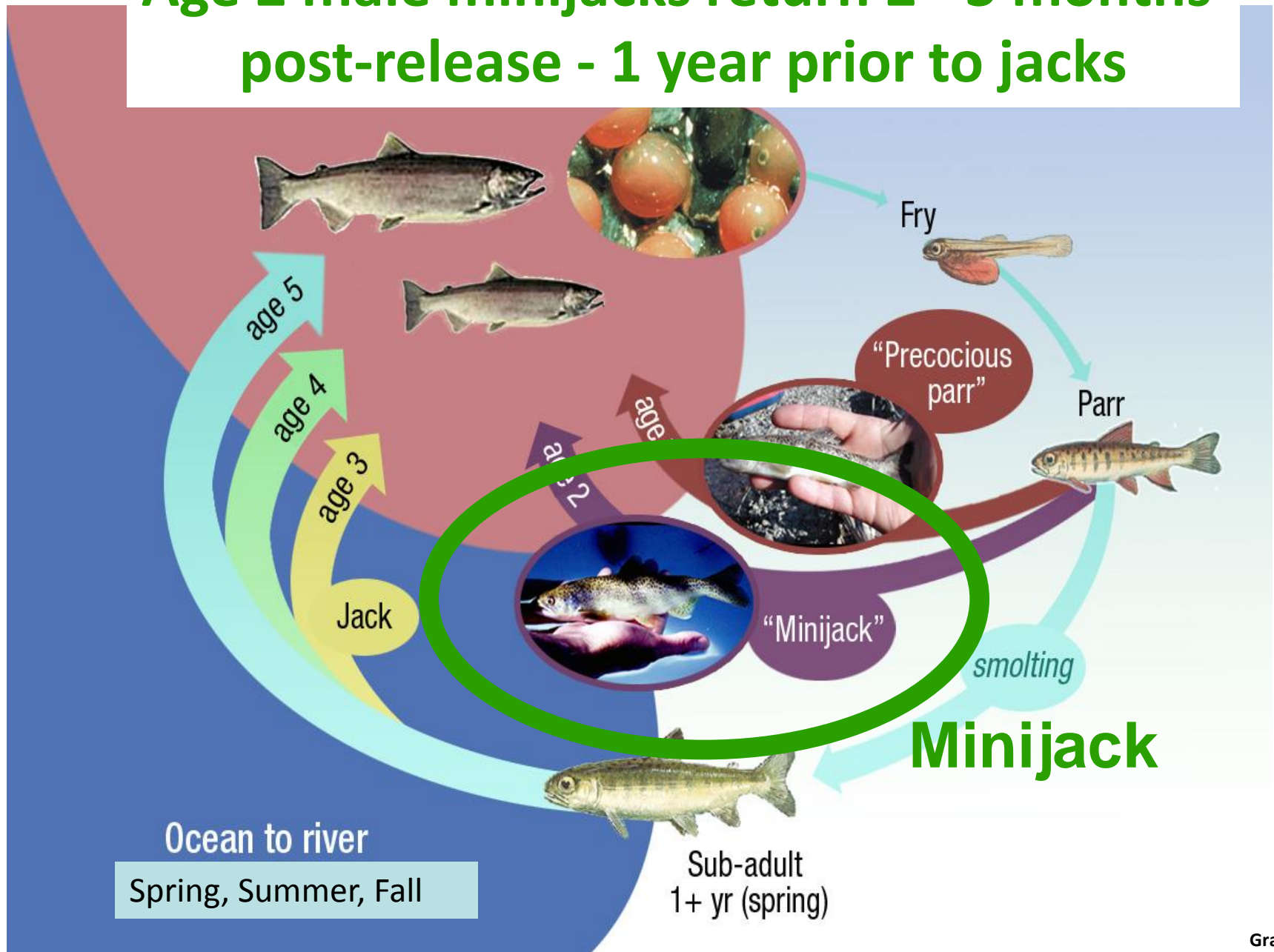


$F=7.2$
 $p=0.02$
 $r^2=0.34$

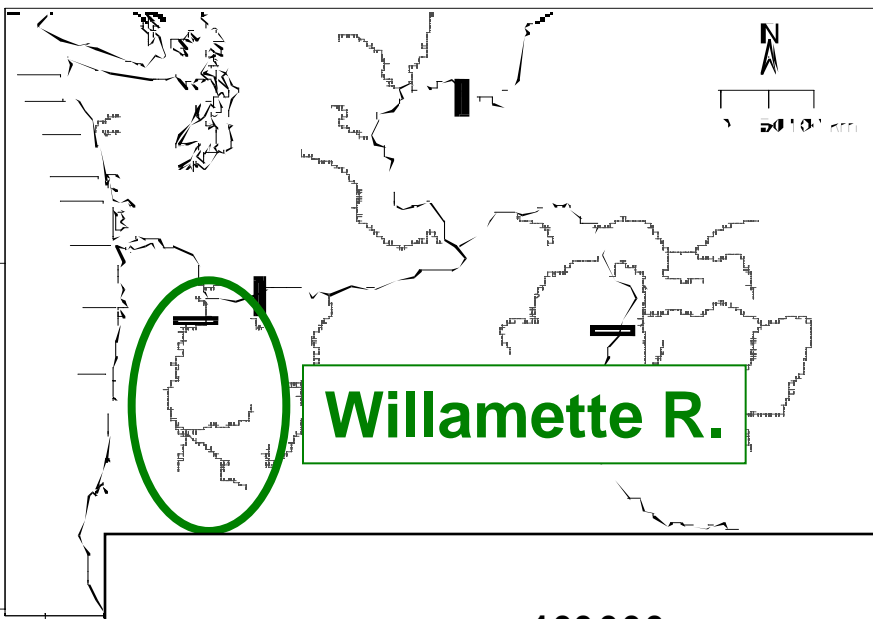
early indicators

Hatchery minijacks

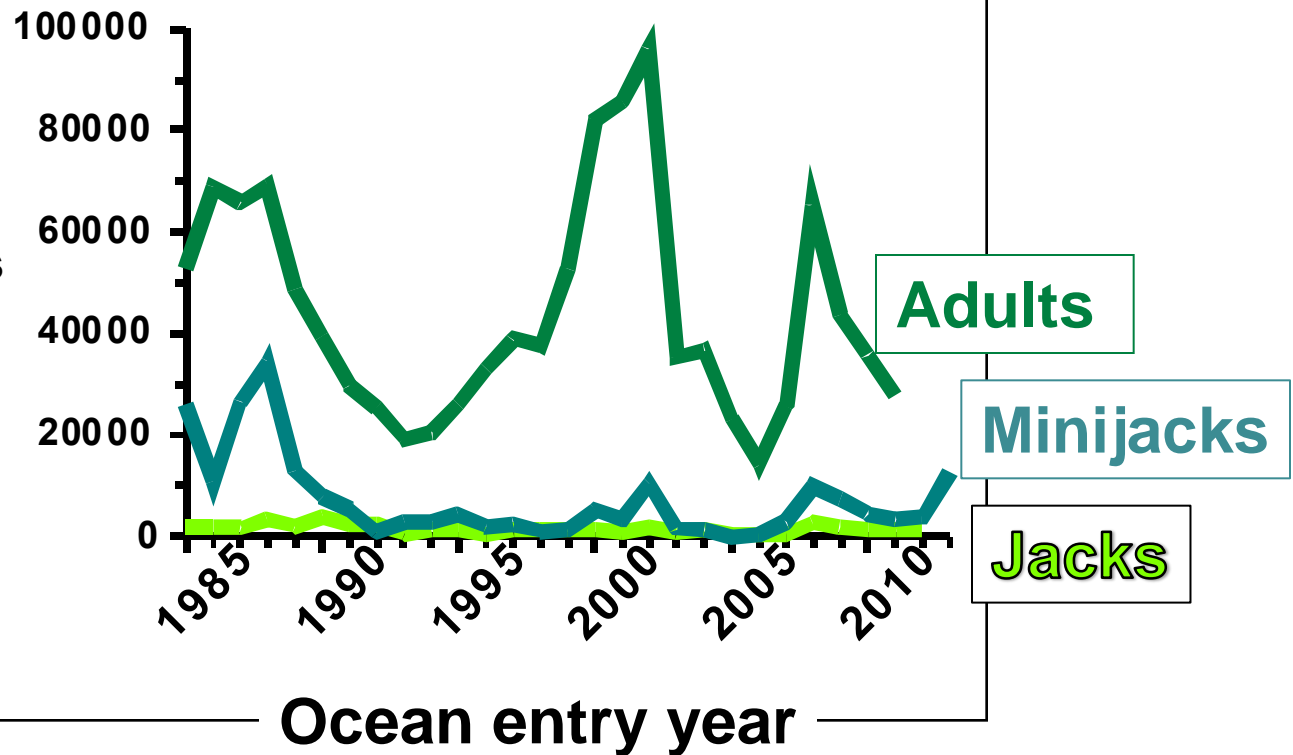
Age 2 male minijacks return 2 - 3 months post-release - 1 year prior to jacks



Willamette River Spring Chinook Salmon returns by age class

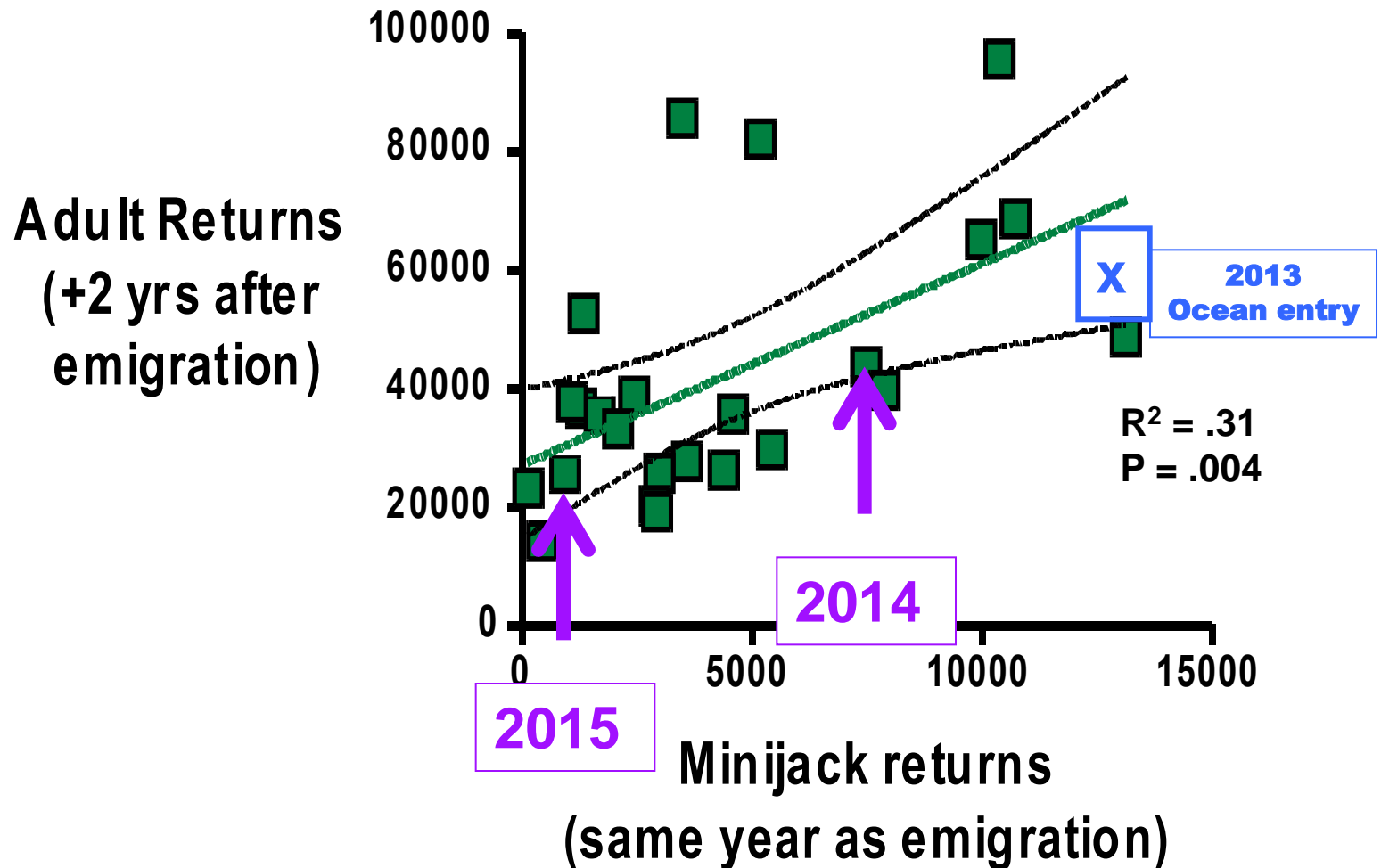


Returns to
Willamette Falls
Dam

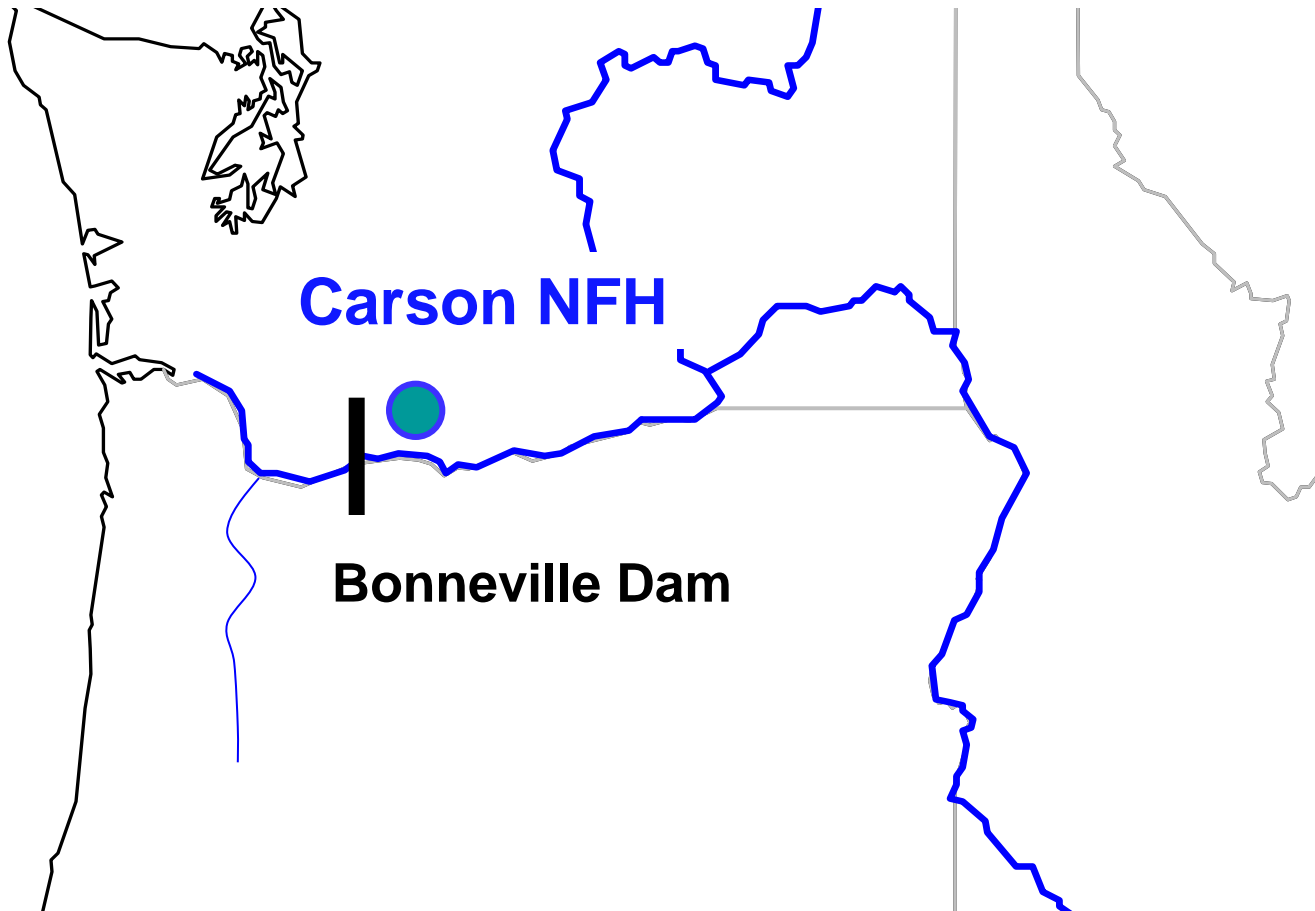


early indicators

Minijack counts are related to Adult counts (+2)
@ Willamette Falls

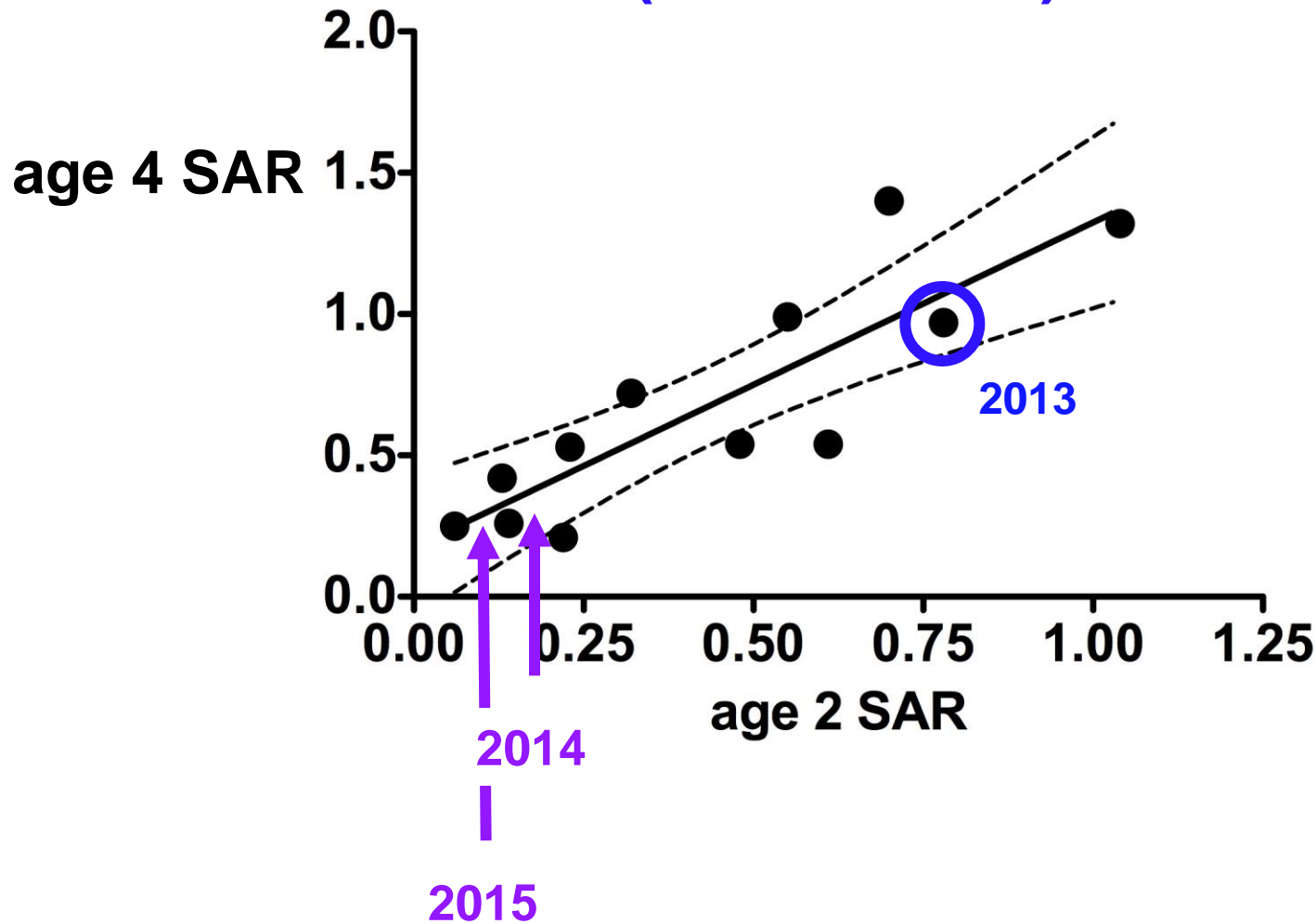


PIT-tagged spring Chinook are released from Carson NFH – possible to calculate Smolt to adult return (SAR)

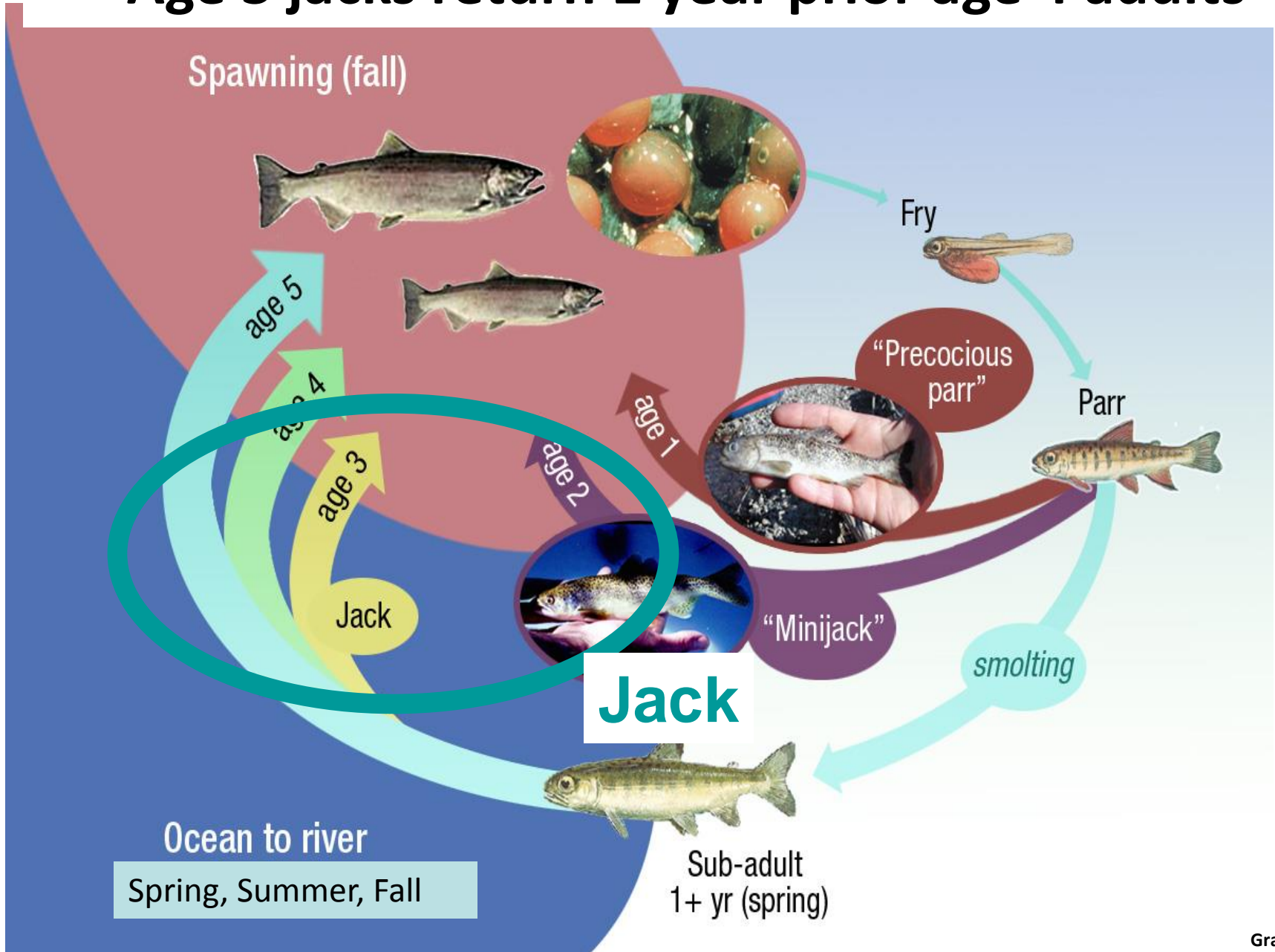


early indicators

Carson minijack SAR is correlated to age 4 SAR
(2002 – 2013)

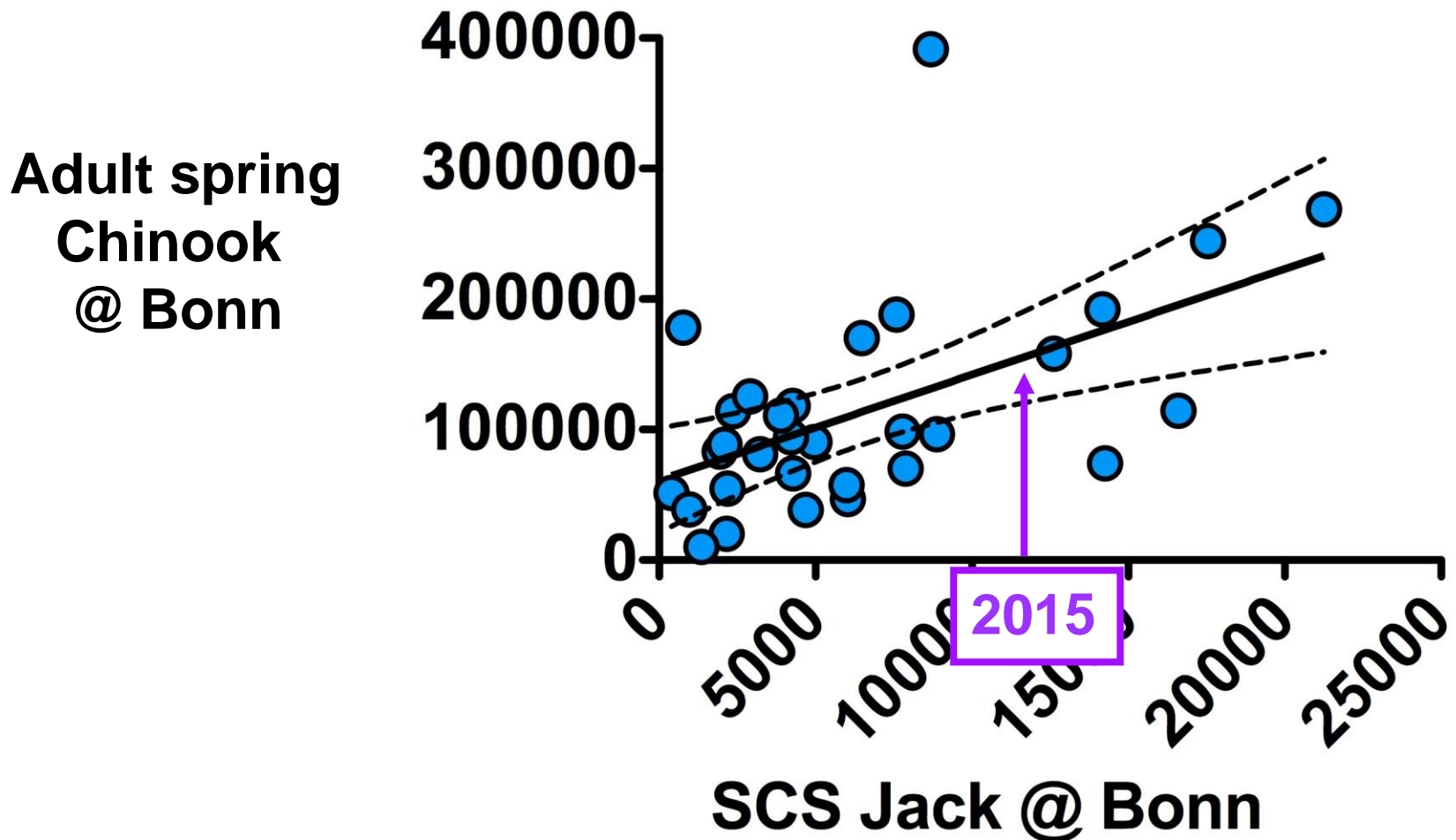


Age 3 jacks return 1 year prior age 4 adults



early indicators

2015 Jack “predictor” @ Bonneville = average +



outliers (09, 11, 13) removed

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Prognosis?

Ocean conditions 2013 – 2016

=> 2015 looks difficult

Ocean Entry

Year

PDO

blob

El Nino

2013

Cold phase /neutral

no

no

2014

Warm phase

yes

no

2015

Warm phase

yes

yes

2016

?

?

yes

The Blob?

**Coho returns 2015 Or - BC
quite poor**

**Col R ~30% 10 year average
lowest since 1997**

Early indicators for spring Chinook suggest OK/poor returns

Ocean Entry Year	Ocean CPUE	Minijack return	Jack return
2014	average	average/ poor	average (+?)
2015	average	poor*	??

***really, really warm river temperatures**

Overall

Neither PDO nor Jacks are highly correlated with adult returns: imperfect predictors

Either Blob or El Nino effects will be short-term – one or two years

Longer term – warm phase PDO is a concern

1900

J ← month → D

year

2015

A century of the Pacific Decadal Oscillation (PDO)

Warm phase

Cool phase

positive PDO
neutral PDO
negative PDO

Will current warm phase be
short-term (years)
long-term (decades)?

