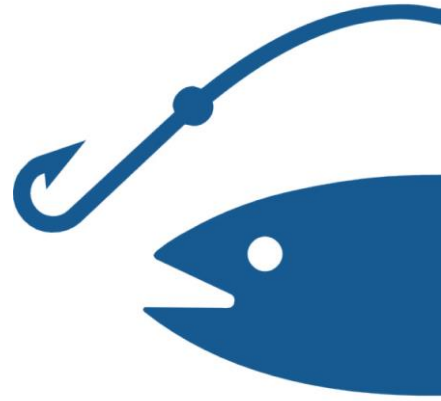


Impacts of the 2008-2009 US West Coast salmon ocean fishery closure on salmon troll vessels



Kate Richerson
Dan Holland
Northwest Fisheries Science Center

Hello!



What happened to salmon fishermen during a historic ocean fishery closure?

- ▷ Exited fishing?
- ▷ Increased participation in other fisheries?
- ▷ Who was most vulnerable?
- ▷ Can this inform us in the event of another closure?



1.

The 2008-2009 salmon ocean fishery closure

What happened?

Collapse of the Sacramento River Fall Chinook (SRFC)

- ▷ Record low returns attributed to poor ocean conditions
- ▷ Complete closure of the ocean fishery south of Cape Falcon, Oregon



Fishery declared a disaster

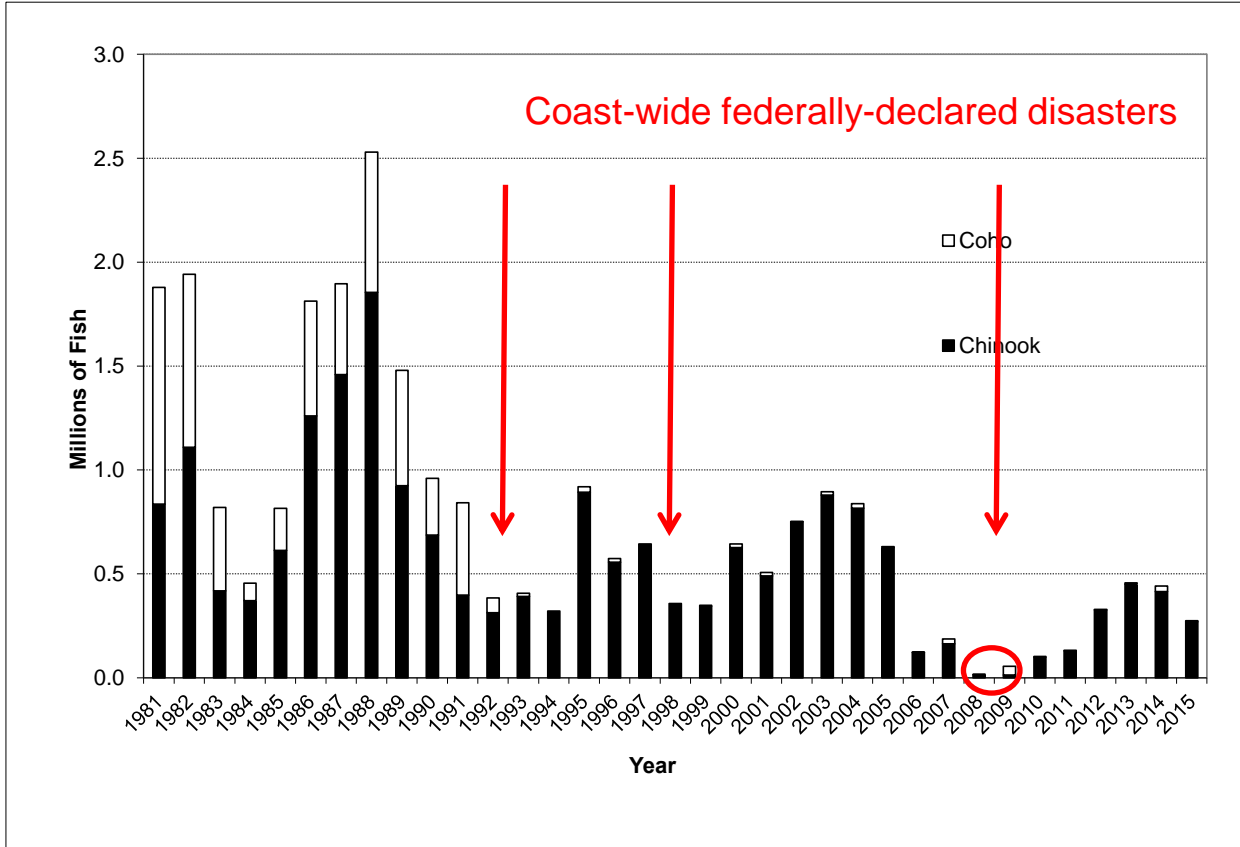


Figure IV-1. West Coast ocean non-Indian commercial Chinook and coho harvest.

1992-1995: \$29 million in disaster aid

1998: \$11 million

2008-9: \$170 million

Another closure this year?

- ▷ Catches have been declining since 2012
- ▷ The Blob, drought, switch to positive PDO predicted to result in low returns

Another closure this year?

Grim Forecast for West Coast Chinook Seasons; Fishermen Aware of Option of Closure



SEAFOODNEWS.COM [Seafood News] by Susan Chambers - March 1, 2017

Ocean directed coho salmon season this year on the West Coast? Unlikely. Ocean Chinook season? Possibly, but don't hold your breath.

Oregon fishery managers briefed Oregon sport and commercial fishermen Monday on the 2016 salmon returns and this year's forecasts, but many commercial trollers already had an inkling the news wouldn't be positive.

Instead, it's much worse.

The Klamath River fall Chinook escapements of natural spawning Chinook for 2016 are much lower than expected, some of the worst on record.

"They're the lowest returns since the early '90s of natural spawners," Oregon Department of Fish and Wildlife Biologist Craig Foster said.

WATER & DROUGHT

MARCH 2, 2017 3:53 PM

California faces another bleak salmon-fishing season, a holdover from the drought

Fishing the North Coast: Ocean kings will be scarce in 2017

Forecasts suggest there are 230,700 Sacramento River fall run Chinook adults in the ocean this year, along with 54,200 Klamath River fall run adults. Both forecasts are lower than those of recent years, with the forecast for Klamath fall run being among the lowest on record. Salmon from these runs typically comprise the majority of salmon taken in California's ocean and inland fisheries.

2.

The West Coast salmon fishery

Who might have been affected?

Focal vessels

- ▶ Fished at least 3 years during 2001-2007
- ▶ Averaged >\$1,000/year in salmon troll revenue
- ▶ Salmon troll accounts for >5% of total annual revenue

THIS COPY FOR FISHERMAN
CALIFORNIA DIVISION OF FISH AND GAME
HOLLYWOOD MARKET 2462-201 CRESCENT CITY

NAME OF DEALER _____
PLACE WHERE FISH FIRST LANDED Trinidad
DATE 9-9 1951 GEAR Traps
BOAT NAME Mary Anne F & G NO. 5321
FISHERMAN Martin Marks
(OR DEALER FROM WHOM FISH PURCHASED)

WHERE WERE FISH CAUGHT? 133
GIVE BLOCK NO. _____

VARIETY	WEIGHT	PRICE	AMOUNT
<u>Crabs</u>	<u>220</u>	<u>20</u>	<u>44.00</u>

No. M 63450 Rec'd By L. A. S.®

FIGURE 1. The short market ticket. This form is used by the majority of wholesale fish dealers buying market fish from fishermen.

Focal vessels

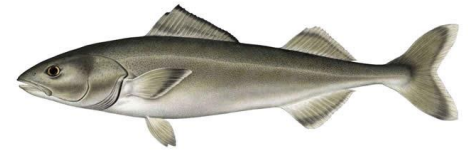
- ▷ 1,236 vessels
- ▷ Diverse in terms of location, revenue, target species

Crab



Chinook - Female

Groundfish



Coastal pelagics



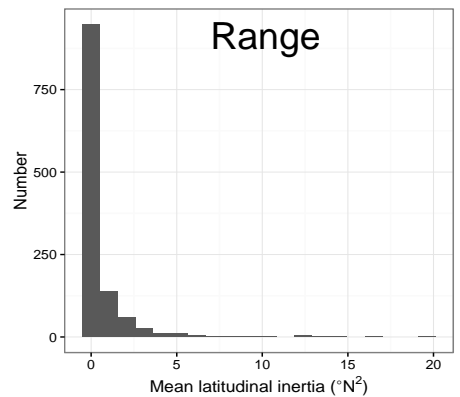
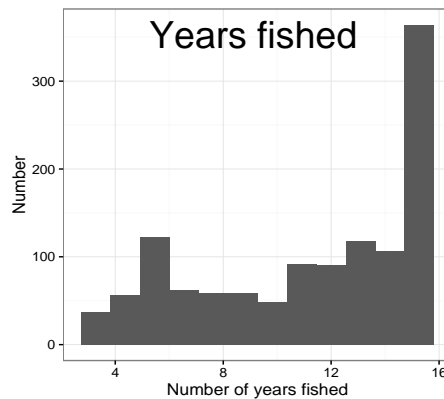
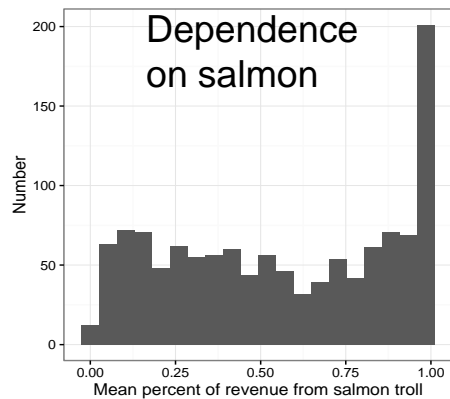
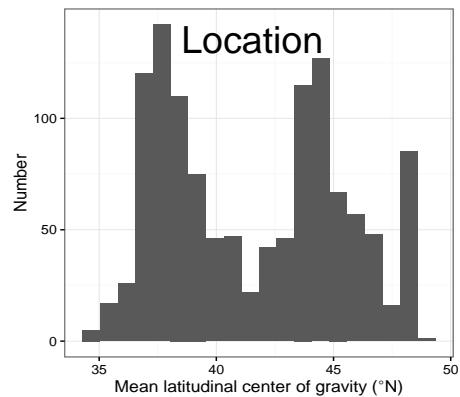
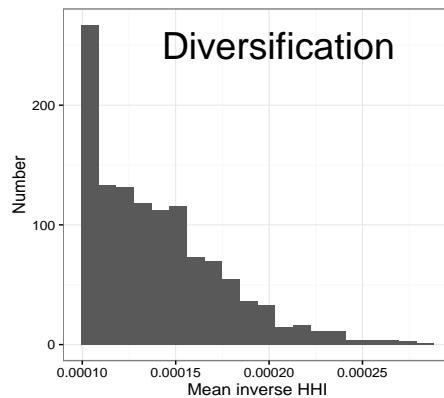
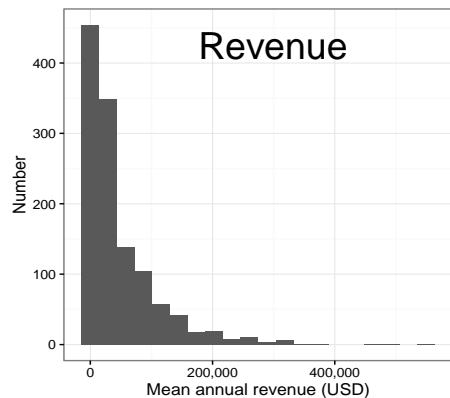
Highly migratory species

Shrimp



wiseGEEK

Vessel characteristics



3.

Impacts of the closure

What happened to these vessels?

Modeling the vessel-level impact of the closure

- ▷ Does a vessel fish in a given year?
- ▷ If so, how much money does it make relative to its long term average?
- ▷ How did the closure affect 1 and 2?
- ▷ Did vessels exit permanently?
- ▷ Can vessel characteristics predict responses?

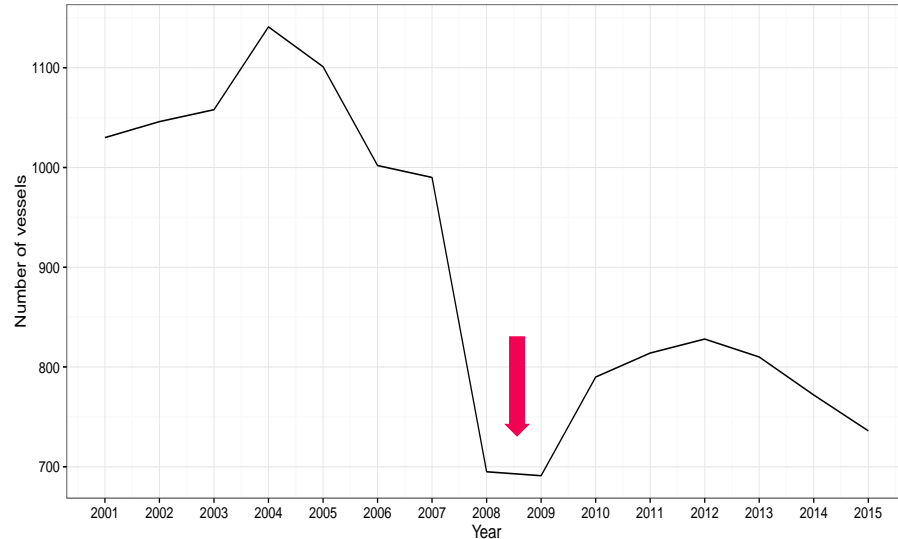
Modeling the vessel-level impact of the closure

- ▷ Choice to fish: logistic mixed-effects model
- ▷ Choice to exit: logistic model
- ▷ Revenue: linear mixed-effects models
- ▷ Effects of year, vessel characteristics, and presence of closure

Modeling the vessel-level impact of the closure

▷ Vessels less likely to fish at all during closure, particularly if they were:

- More dependent on salmon
- Less diversified
- Further south
- Higher revenue



Modeling the vessel-level impact of the closure

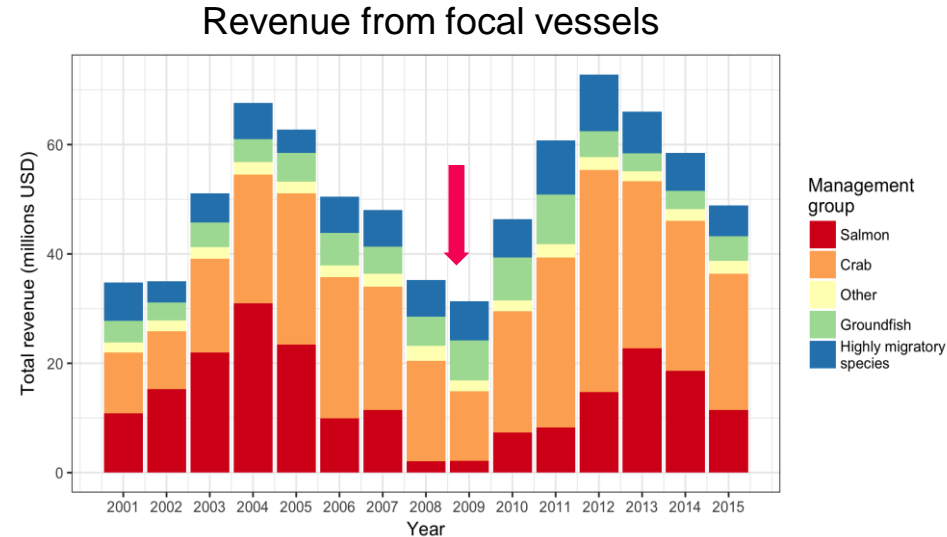
- ▷ Many vessels returned after closure, but ~17% exited permanently. They tended to be:
 - More dependent on salmon
 - Fished fewer years
 - Lower revenue
 - Less diversified

Modeling the vessel-level impact of the closure

- ▷ Vessels made less money relative to their long-term mean, particularly if they were:
 - More dependent on salmon
 - Higher revenue
 - Fished fewer years

Impact on total revenue

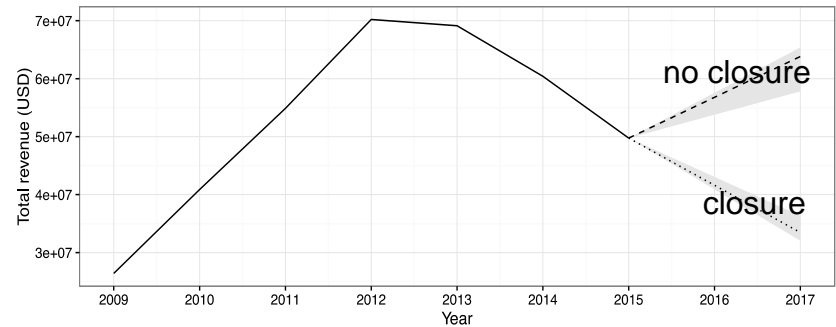
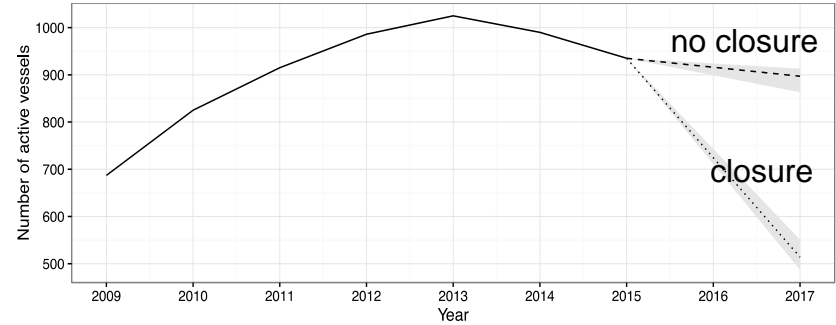
- ▷ 5-year average before closure: \$55 million
- ▷ 2008-2009: \$32-36 million
- ▷ Overall loss: ~\$43 million
- ▷ Salmon loss: ~\$35 million



Predictions

▷ Current salmon vessels are slightly less dependent on salmon, less diversified

▷ Models predict similar impacts if there is another closure this year



4.

Impacts on other fisheries

Did vessels divert their effort into other fisheries?

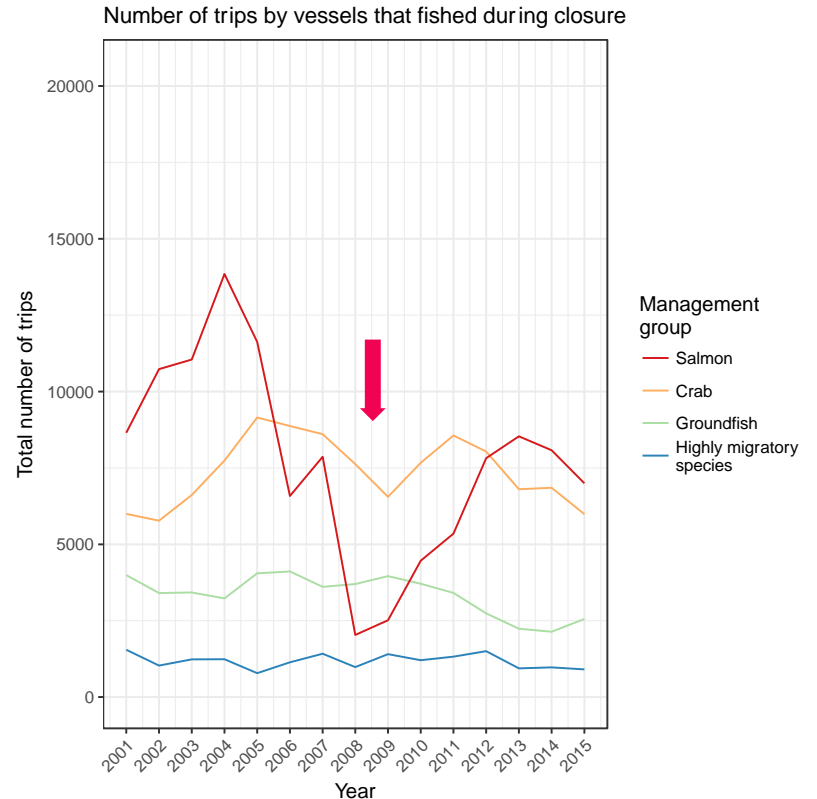
Participation in other fisheries

- ▷ Little evidence that vessels were more likely to participate in non-salmon fisheries in 2008-9.



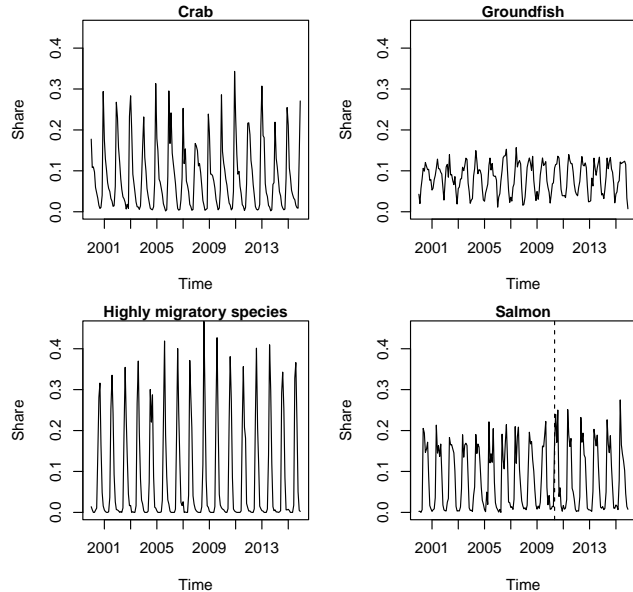
Participation in other fisheries

- ▶ Little evidence that vessels took more trips in non-salmon fisheries in 2008-9.



Participation in other fisheries

- ▷ Little evidence that vessels altered their seasonal fishing patterns.



Conclusions

1. Many vessels didn't fish at all during the closure, and some never returned.
2. Vessel characteristics influenced response to closure.
3. Little evidence of increased participation in other fisheries.
4. Another closure predicted to have similar effects.



Thanks!

Any questions?

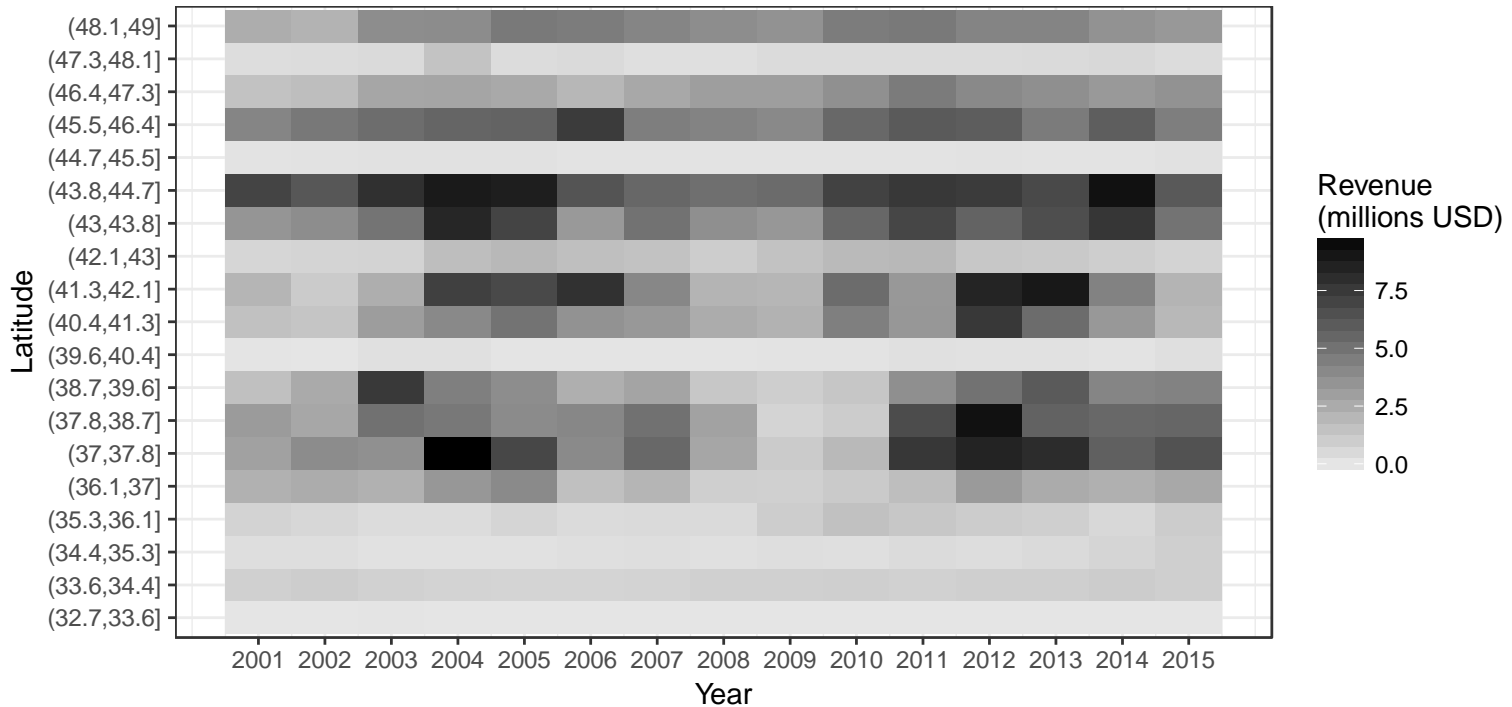
Focal vessels

Characterized by:

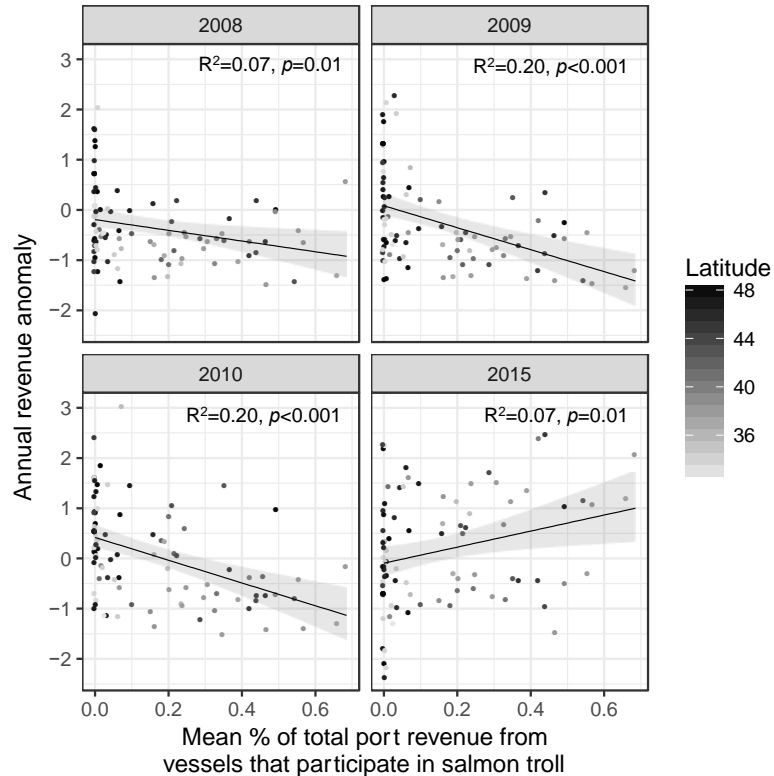
- ▷ **Revenue** (mean annual revenue)
- ▷ **Dependence on salmon** (mean percent of revenue from salmon)
- ▷ **Location** (mean latitudinal center of gravity)
- ▷ **Range** (mean latitudinal inertia)
- ▷ **Diversification** (inverse HHI)
- ▷ **Years fished**

Community-level effects

Total revenue from salmon troll vessels



Community-level effects



Models

$$\begin{aligned} \text{logit}(p_{yi}) = & a + b_1y + b_2\text{closure}_y + b_3\text{mean.revenue}_{yi} + b_4\text{mean.HHI}_{yi} + b_5\text{mean.percent.troll}_{yi} + \\ & b_6\text{mean.LCG}_{yi} + b_7\text{mean.LI}_{yi} + b_8\text{years.fished}_{yi} + b_9\text{closure}_y \times \text{mean.revenue}_{yi} + \\ & b_{10}\text{closure}_y \times \text{mean.percent.troll}_{yi} + b_{11}\text{closure}_y \times \text{mean.LCG}_{yi} + \\ & b_{12}\text{closure}_y \times \text{mean.LI}_{yi} + b_{13}\text{closure}_y \times \text{years.fished}_{yi} + a_i \end{aligned}$$

$$\begin{aligned} z_{yi} = & a + b_1y + b_2\text{closure}_y + b_3\text{mean.revenue}_{yi} + b_4\text{mean.HHI}_{yi} + b_5\text{mean.percent.troll}_{yi} + \\ & b_6\text{mean.LCG}_{yi} + b_7\text{mean.LI}_{yi} + b_8\text{years.fished} + b_9\text{closure}_y \times \text{mean.revenue}_{yi} + \\ & b_{10}\text{closure}_y \times \text{mean.HHI}_{yi} + b_{11}\text{closure}_y \times \text{mean.percent.troll}_{yi} + b_{12}\text{closure}_y \times \text{mean.LCG}_{yi} + \\ & b_{13}\text{closure}_y \times \text{mean.LI}_{yi} + b_{14}\text{closure}_y \times \text{years.fished}_{yi} + e \end{aligned}$$

$$\begin{aligned} \text{logit}(p) = & a + b_1\text{mean.revenue} + b_2\text{mean.HHI} + b_3\text{mean.percent.troll} + \\ & b_4\text{mean.LCG} + b_5\text{mean.LI} + b_6\text{years.fished} \end{aligned}$$