



**NOAA
FISHERIES**

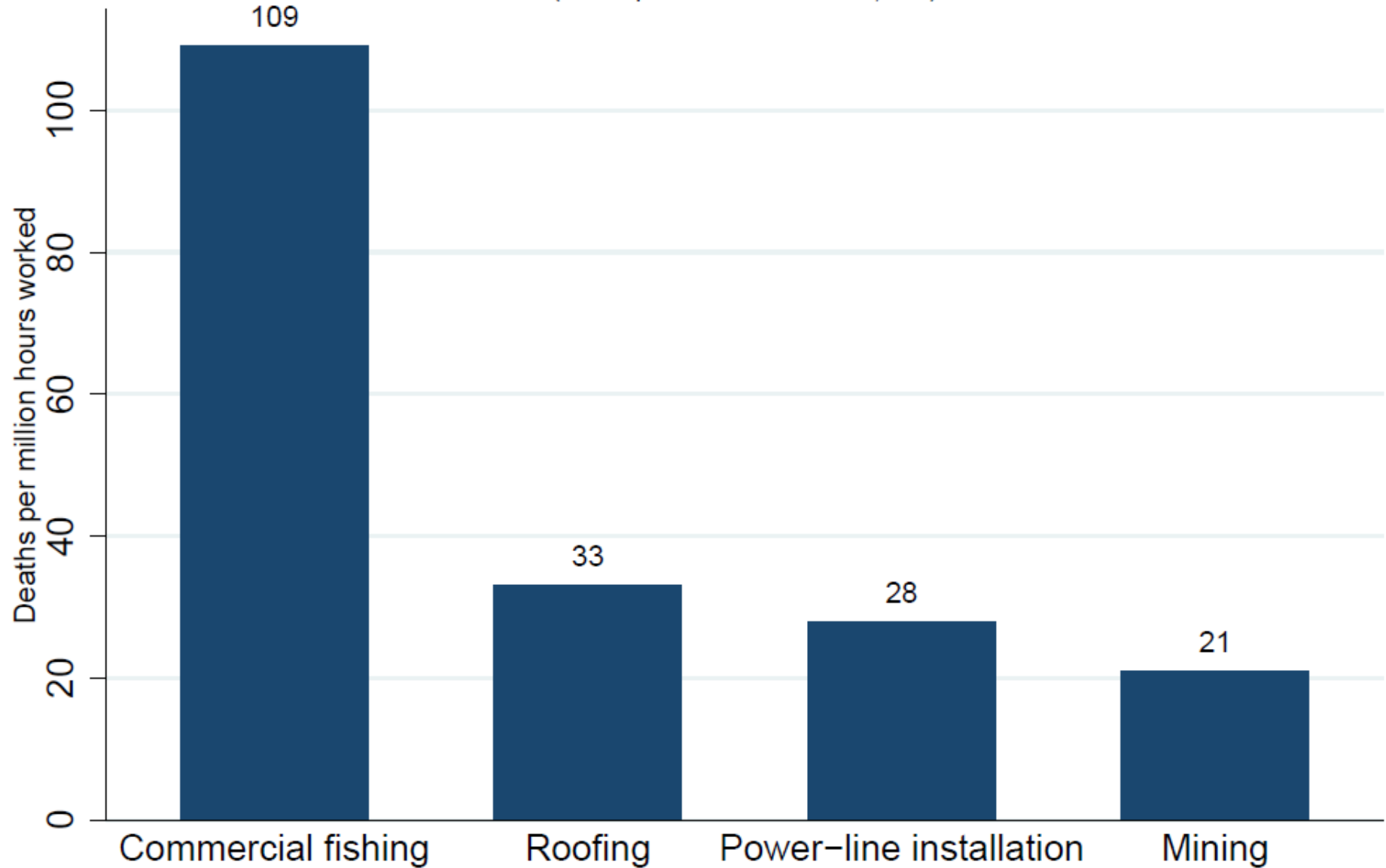
Risk Taking and Fishing Safety: Evaluation Efforts by the National Marine Fisheries Service

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Fatality rate by occupation

(Deaths per million hours worked, U.S.)



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 2007



Source: US Bureau of Labor Statistics





How can safety be measured?

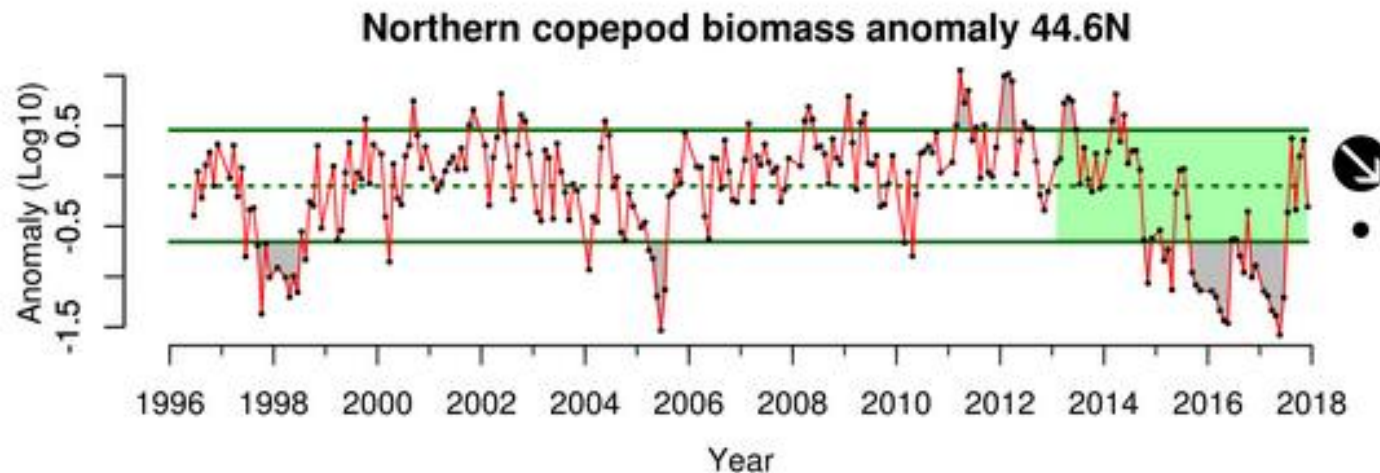
- Incident, injury, and fatality ***rates***
 - Must be matched to fishery (NMFS data necessary)
 - The denominator (crew hours at sea, ideally) is hard to calculate
 - “Guidance on Fishing Vessel Risk Assessments and Accounting for Safety at Sea in Fishery Management Design” 2015 NOAA Tech Memo.

How can safety be measured?

- Some fundamental problems with incident data:
 - neglecting to report incidents to avoid Coast Guard actions
 - doesn't capture "near misses"
 - difficult to statistically estimate probability of very rare events
 - doesn't necessarily get at the behavioral cause of incidents

How can safety be measured?

- Indicators of **risk exposure**



How can safety be measured?

- Indicators of **risk exposure**
 - Days fished in bad weather, trips exceeding weight or stability limit, number of dangerous bar crossings, expenses on safety equipment
 - We can measure the effects of management changes on these indicators
 - We expect to see a more dramatic response

How can safety be measured?

- We use fishing in poor weather as a proxy for risk taking behavior, and estimate the effect of catch shares on the propensity to fish in poor weather
- Fishermen make many choices that affect their exposure to risk
- Fishing in poor weather has been shown to contribute to safety incidents, vessel losses, and deaths
- 7 case studies

Example 1: Catch shares

- Fisheries management can create a misalignment of economic incentives that escalate risks
- Biologically-based regulation (catch limits) have often resulted in “derby” or “race for fish” type fisheries
 - Fishermen respond to limited entry and catch limits by accumulating excess capital
 - Unprofitable fishery in which the season lasts a very short time
 - **Dangerous** fishing conditions

Fisheries management also has the tools to fix it:

- *Individual fishing quotas (IFQs) or Catch Shares*
 - Allocate a specific portion of the total allowable catch to individual entities
 - Eliminates the incentive to catch the fish before anyone else does
 - Fishermen no longer have the incentive to work without rest, delay vessel repairs, fish in dangerous weather, or over-load their vessels

West Coast Sablefish Fixed Gear fishery



Methods

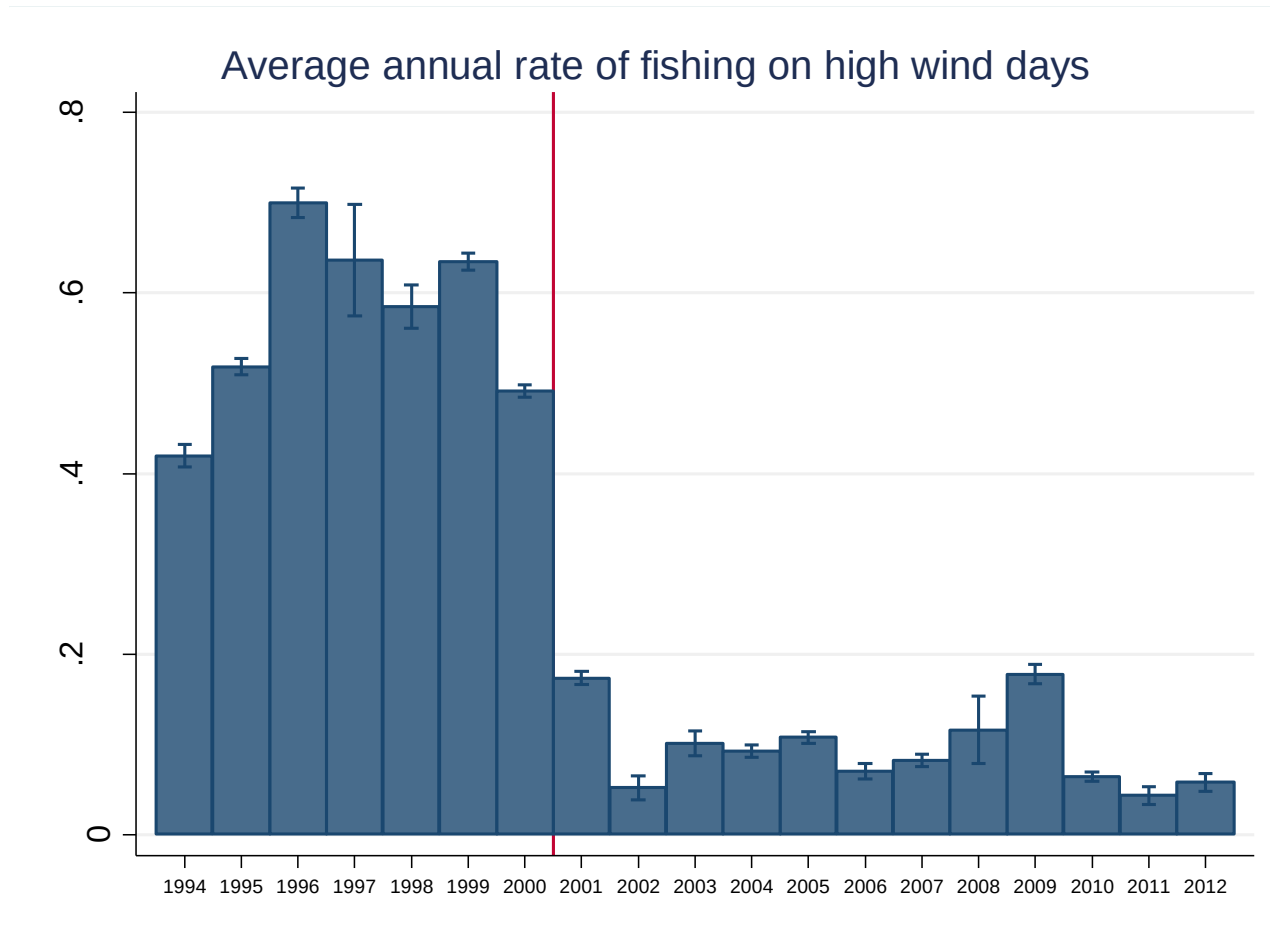
- Matched wind speed data (reanalysis) to NMFS data: the days when vessels took fishing trips
- Difference-in-differences, using “Daily” and Open Access sablefish fishery for comparison (+ vessel fixed effects)

$$\text{Avg. ann. fishing rate} | \text{High wind}_{ift} = \alpha_i + \beta \text{PostIFQ}_{it} + \gamma \text{Primary}_{if} + \theta \text{PostIFQ}_{it} * \text{Primary}_{if} + \epsilon_{ift}$$

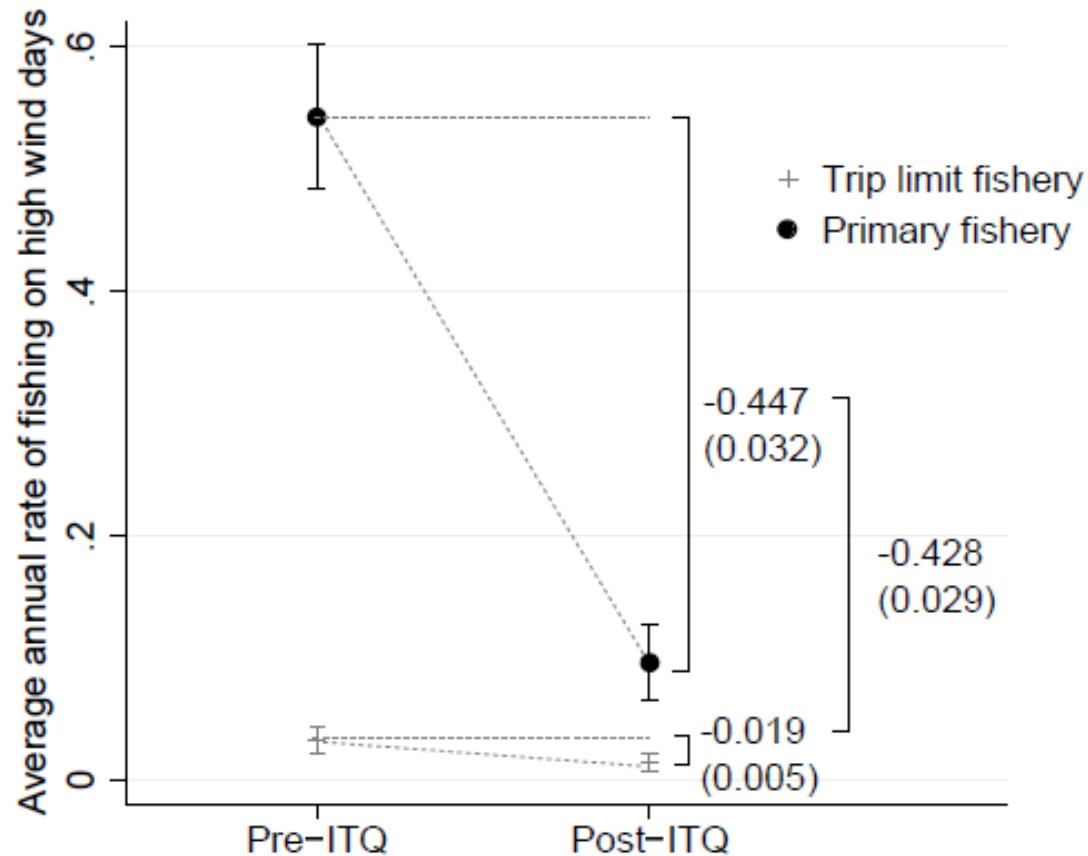
- Fixed effects logit model at the level of a vessel, day

Begin trip = f(management regime, expected revenue in each management regime, high wind indicator in each management regime)

Effects of a catch share (ITQ) program on trips taken in bad weather



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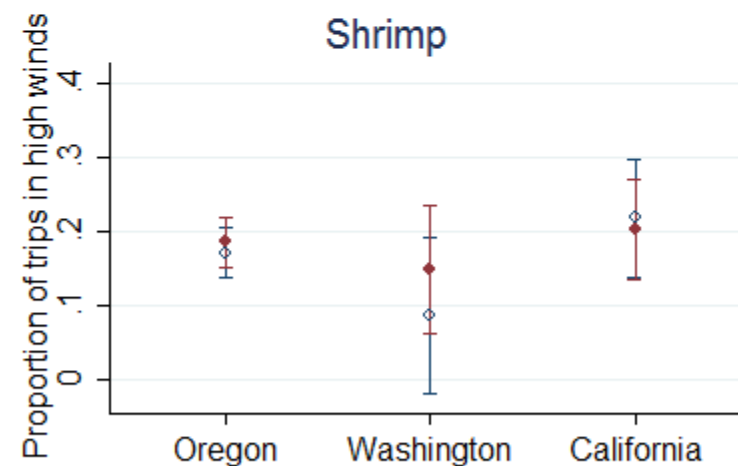
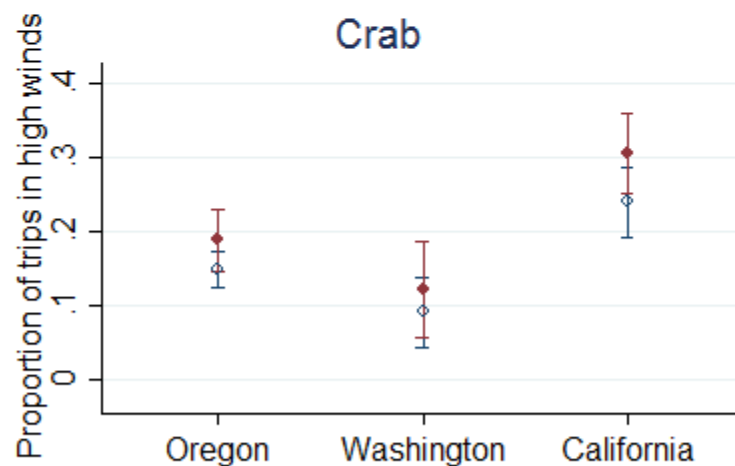
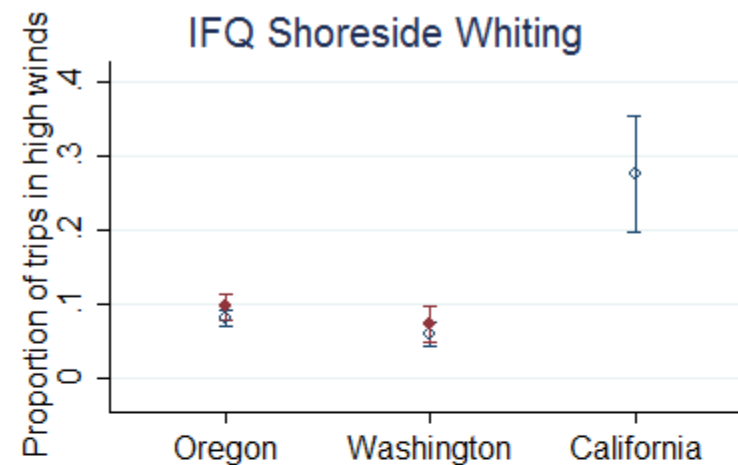
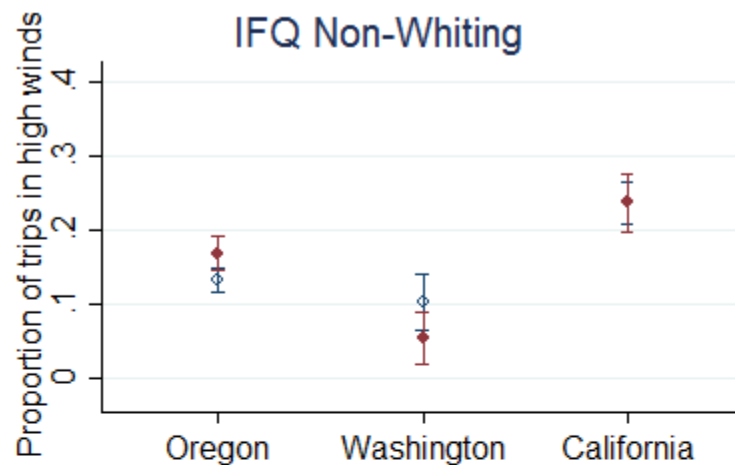
Period	Mean probability of taking a trip	Effect of \$1,000 increase in expected revenue		Effect of a high wind day		Marginal rate of substitution
		Change in probability	Estimated coefficient	Change in probability	Estimated coefficient	
Pre-ITQ	23.8%	—	−0.002	−31.3%	−0.376***	—
Post-ITQ	3.5%	4.3%	0.042***	−82.0%	−1.387***	33.0
Percentage change	−85.3%					

Conclusions: Case study 1

- The incentive to race for fish matters, a lot
- Fishermen are always making a trade-off between perceived risk and potential profit
- Removing the race-to-fish incentive allows for rational decision-making

West Coast Groundfish Trawl Catch Share Program





○ Pre-catch shares ● Post-catch shares

Conclusions: Case study 2

- Pre-IFQ incentives matter too!
- Under trip limits, harvesters already had the flexibility to make rational safety-related decisions
- These studies show how incentives matter in the decision-making processes that directly affects the safety of fishermen

Questions?



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