A safer catch? The effect of catch shares on risk-taking and fishing safety
The West Coast Sablefish fixed gear fishery and the West Coast groundfish trawl IFQ program

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“The deadliest catch”

- Commercial fishing is one of the most dangerous occupations

Fatality rate by occupation
(Deaths per million hours worked, U.S.)

“The deadliest catch”
Commercial fishermen are often characterized as “risk-loving”

Ignores the fact that fisheries management itself can create a misalignment of economic incentives that escalate the risk

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
- Overcapitalized, unprofitable fishery in which the season lasts a very short time
- Dangerous fishing conditions
Motivation

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Summary and Future Projects

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- 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 overload their vessels
- This has obvious implications for fishing safety
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Incident rate

Incident rate per predicted days at sea

Annual incident and/or fatality rates are used to inform MSA National Standard 10
Some fundamental problems with the incident data:

- neglecting to report incidents to avoid Coast Guard actions
- difficult to statistically estimate probability of very rare events
- doesn’t get at the behavioral cause of incidents: *risk exposure*
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Risk Exposure

- 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.
- Thus, 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.
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The West Coast Sablefish Fixed Gear fishery

- "Primary" sector underwent a transition to catch shares in 2001
- Fishery was overcapitalized, season was only open for a few days, and vessels were not financially viable
- Safety issues:
  - fishing in poor weather or unsafe mechanical situations
  - operating at a high speed with lack of rest
- "Daily" and Open Access trip-limit-managed sectors as comparison fishery
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Data

- “Incident” data from US Coast Guard
  - collisions, sinkings, pollution events, falls overboard
- Landings data (fish ticket) from Pacific Fisheries Information Network
  - determine fixed gear sablefish trips
  - estimate spatial and temporally varying expected revenue
  - total of about 400 vessels, but not all participate in each year
- Observer data from NWFSC used to estimate trip length and trip start date
- Weather re-analysis data from the National Center for Environmental Protection to get daily “max” wind speed in each port
Methods

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

  $\text{Begin trip} = f(\text{management regime}, \text{expected revenue in each management regime, high wind indicator in each management regime})$

- Difference-in-differences, using “Daily” and Open Assess Sablefish fishery for comparison (+ vessel fixed effects)

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

Has the IFQ program in the sablefish fixed gear fishery decreased risky behavior?

**Results**

<table>
<thead>
<tr>
<th>Period</th>
<th>Mean probability of taking a trip</th>
<th>Effect of $1,000$ increase in expected revenue</th>
<th>Effect of a high wind day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Change in probability</td>
<td>Estimated coefficient</td>
</tr>
<tr>
<td>Pre-ITQ</td>
<td>23.8%</td>
<td>—</td>
<td>—0.002</td>
</tr>
<tr>
<td>Post-ITQ</td>
<td>3.5%</td>
<td>4.3%</td>
<td>0.042***</td>
</tr>
<tr>
<td>Percentage change</td>
<td>−85.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

West Coast Groundfish Trawl IFQ Program

- IFQ program instituted in 2011
  - Institutional landscape was very different from the sablefish fishery
    - Managed with a combination of daily, weekly, bi-monthly trip limits, area closures, and gear restrictions
    - Effort was smoothed over the year
  - What effects could the catch share program have on safety in this fishery?
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Safety and the West Coast Groundfish Trawl IFQ Program

![Graph of Proportion of trips in high winds for IFQ Non-Whiting, IFQ Shoreside Whiting, Crab, and Shrimp in Oregon, Washington, and California.]

- **IFQ Non-Whiting**
  - Oregon
  - Washington
  - California
- **IFQ Shoreside Whiting**
  - Oregon
  - Washington
  - California
- **Crab**
  - Oregon
  - Washington
  - California
- **Shrimp**
  - Oregon
  - Washington
  - California

Legend:
- **Blue Circle**: Pre-catch shares
- **Red Circle**: Post-catch shares
Summary

- Reduction in safety incident rates is the objective, but difficult to measure with available data
- A reduction in risk exposure is likely to be correlated with a reduction in incident rates, and tells us more about the mechanisms of change
- In a race-to-fish fishery:
  - The average fishing rate during high winds decreased by 79% after catch shares in the Sablefish Fixed Gear fishery
  - Robust to a many different methods of analysis
- In a fishery with effort artificially spread throughout the year by trip limits (Trawl IFQ):
  - There was no change in risk-taking behavior, measured by the propensity to fish in high wind weather
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Broader Conclusions

- These studies show that catch shares can have an effect on the decision-making processes that directly affects the safety of fishermen.
- Improving safety in the fishery is a listed goal of nearly all catch share management plans.
- The results are dependent on the characteristics of the management plan in place prior to catch shares and the details of the catch share program.
- Suggest that fishing safety policy should be fishery-specific (at least take management into consideration), rather than national.
Future work

- RFP and contractor to replicate this analysis for catch share programs around the country.
- Analyses will be both regional, taking into careful consideration the management institutions in place, and national, using very similar data from all regions to do a meta-analysis.
- We hope to contribute to the understanding of how management actions can affect fishing safety.
- The results will contribute to MSA-mandated reviews of catch share programs.
- The results will suggest improved indicators for monitoring safety in fisheries that work for short timelines and small fleets.
Thank you

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