A safer catch? Fisheries management and risk taking in the most dangerous industry

The West Coast Sablefish fixed gear fishery and the West Coast groundfish trawl IFQ program

Lisa Pfeiffer\(^1\)

\(^1\)Economics and Social Sciences Research Program, NOAA NMFS NWFSC

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Motivation

The West Coast Sablefish Fixed Gear Fishery

West Coast Groundfish Trawl IFQ Program

Summary

“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
- Fisheries management also has the tools to fix it
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- **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
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Incident rate

Incident rate per predicted days at sea

Catch shares program

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Incident rate

- 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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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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"Daily" and Open Access trip-limit-managed sectors as comparison fishery.
Has the IFQ program in the Sablefish fixed gear fishery decreased risky behavior?

![Graph showing the average annual rate of fishing on high wind days before and after the ITQ program. The graph includes error bars and regression lines for trip limit and primary fisheries.]

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

<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

Average annual rate of fishing on high wind days

Pre–Catch shares

Post–Catch shares
### Safety and the West Coast Groundfish Trawl IFQ Program

Marginal rates of substitution between expected revenue and fishing on high-wind days

<table>
<thead>
<tr>
<th>Fishery</th>
<th>Pre-catch shares</th>
<th>Post-catch shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFQ Whiting</td>
<td>28.2</td>
<td>48.5</td>
</tr>
<tr>
<td>IFQ Non-whiting</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Crab</td>
<td>62.6</td>
<td>97.4</td>
</tr>
<tr>
<td>Shrimp</td>
<td>422.4</td>
<td>179.0</td>
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</table>
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- One concern: 100% Observer requirement
- Greatest concern for non-whiting IFQ trips from California, where the vessel must pay for (and wait for) an Observer to travel to them

![Graph showing mean observer cost per day at sea from 2011 to 2014 for South of Eureka and North of Eureka.]
West Coast Groundfish Trawl IFQ Program

- Additional cost and wait time makes:
  - trips less profitable
  - more likely that a vessel will miss their weather window
  - less likely to take a trip
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Graph showing the average annual rate of fishing on high wind days for Pre-Catch and Post-Catch shares, categorized by North and South of Eureka.
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.
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  - There was no change in risk-taking behavior, measured by the propensity to fish in high wind weather
- Concerns that Observer requirements are forcing more risky trips appear to be unfounded
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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.
Thank you!

lisa.pfeiffer@noaa.gov