Bycatch Avoidance under Cooperative Management

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4. Empirical analysis of Bycatch Rates & Avoidance Behavior under cooperative management

Motivaton

West Coast Catch Share Program Failure Keeps Vessel Off Fishing Grounds for 2016 Season

SEAFOOD.COM NEWS [Seafood News] by Susan Chambers - March 21, 2016

Criticism that the West Coast catch shares program is underperforming came to the forefront recently at the Pacific Fishery Management Council meeting in Sacramento.

West Coast trawlers have been operating in fear of a "disaster tow" or "lightning strike" of a choke species since the beginning of the individual quota program in 2011. And for the F/V Seeker, a disaster tow of 47,000 pounds of canary rockfish – a species at the time listed as overfished -- in November 2015 will prevent it from fishing for all of 2016.

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- Holland (2010) considers management when bycatch production is stochastic and "lumpy", characteristics that describe certain west coast fisheries.
- If vessels can imperfectly control their exposure to bycatch through costly avoidance behavior, all *potentially* binding species may affect early-season fishing behavior even if the quota are non-binding at the end of the season.

Introduction to Pacific Whiting Fishery

- Three non-tribal sectors/fleets: Catcher-Processors (CP, 34%, 5−9 vessels), Mothership-Catcher Vessels (MSCV, 24%, 4−6 motherships, 10−23 catcher-vessels), and Shoreside Catcher Vessels (SS, 42%, 29−40 vessels). CP/MSCV fleets are collectively known as the at-sea fishery.

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- High volume, low value, high quota attainment marginal fishery. Generates contribution profit for pollock fleets (at-sea sector) and Pacific mixed groundfish trawl vessels.

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- Cooperatives institute enforceable bycatch avoidance rules and information sharing to mitigate moral hazard.
- Five bycatch species of major concern: Canary, Widow, and Darkblotched Rockfish; Chinook Salmon; Pacific Ocean Perch

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- Bycatch mitigation strategies/penalties in other sectors are not public.

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  - Mid-season avoidance is higher for those who experienced early season bycatch (potential demanders) than those who did not (potential suppliers).

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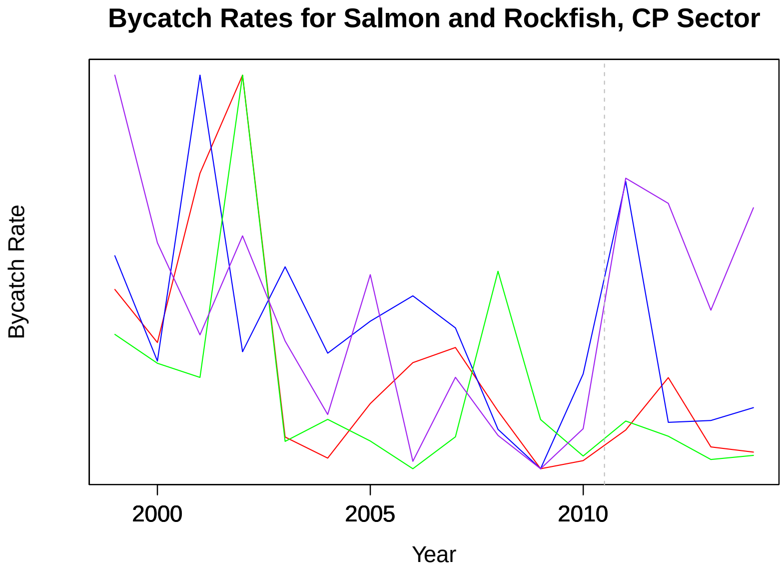
- The optimal solution is a linear compensation model
  - Intuition

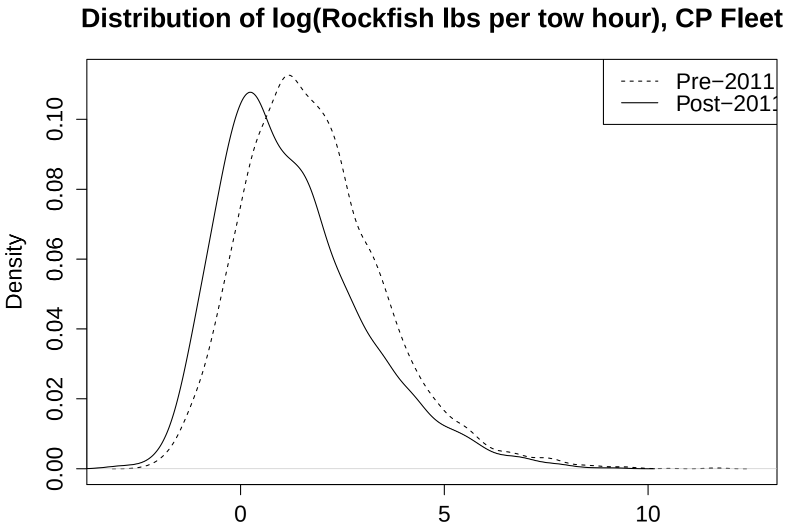
Data

- CP: Observer data, 1999-2014
- MSCV: Observer data, 1999-2014 (observers on board MS, not CV)
- SS: Fish ticket data, 1999-2014; Observer data 2011-2014

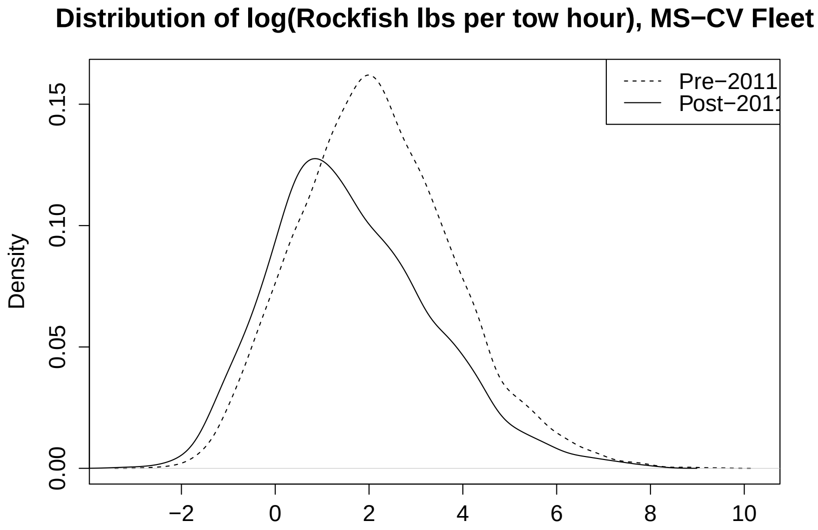
Overall Bycatch Rates



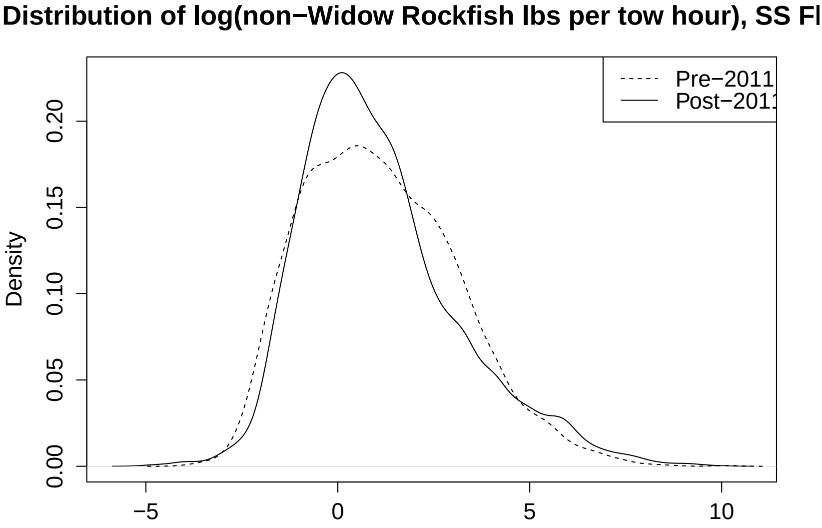
Bycatch per unit effort: CP Sector



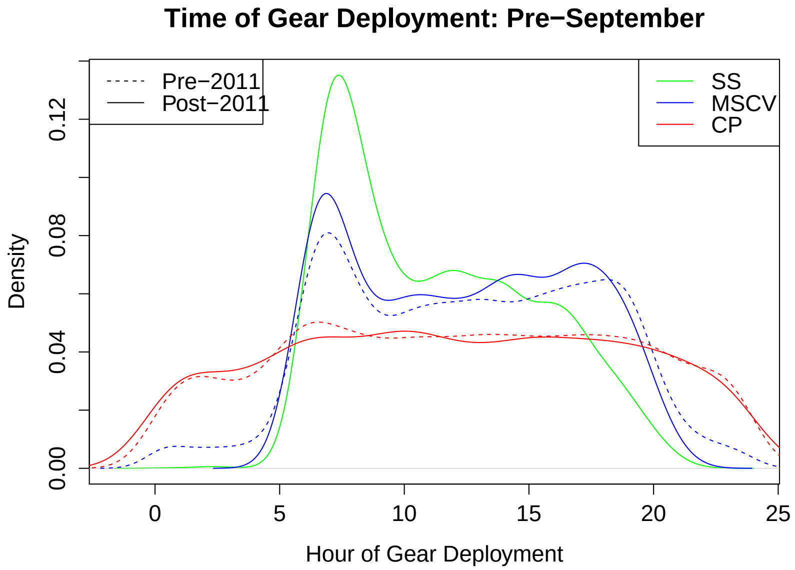
Bycatch per unit effort: MSCV Sector



Bycatch per unit effort: SS Sector



Night Fishing: Pre-September



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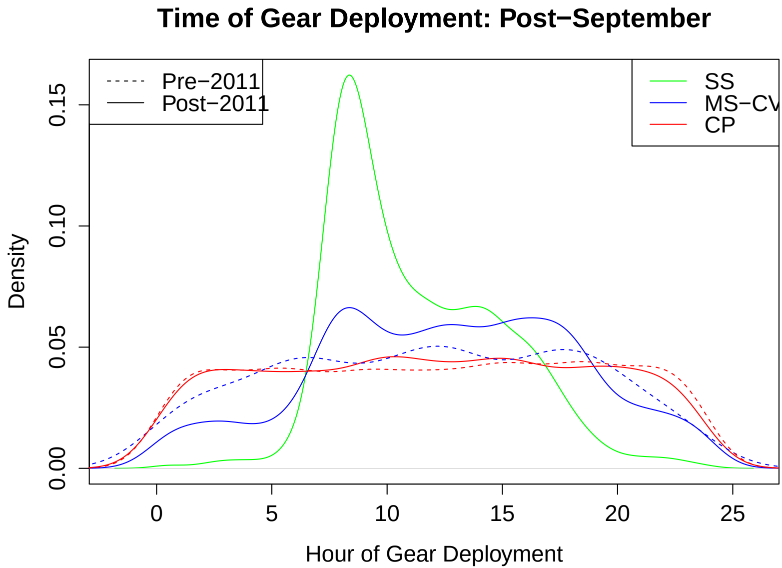

Move-on Behavior

$$
\begin{aligned}
log(\text{Distance Moved}_{i,t}) = &\ \beta_0 + \beta_1 \text{Whiting}_{i,t-1} + \beta_2 \text{Rockfish}_{i,t-1} \\
&+ \beta_3 \text{Rockfish}_{i,t-1} \times \text{post-2011} \\
&+ \textit{Vessel FE} + \textit{Year FE} + \varepsilon_{i,t}
\end{aligned}
$$

Move-on Behavior

Dependent variable:	SS	CP	MS-CV
Log(Distance Moved)	Sector	Sector	Sector
$\text{Hake}_{i,t-1}$	-0.006^{***}	-0.020^{***}	-0.010^{***}
	(0.0004)	(0.001)	(0.001)
$\text{Rockfish}_{i,t-1}$	0.100^{***}	0.087^{***}	0.203^{***}
	(0.022)	(0.021)	(0.059)
$\text{Rockfish}_{i,t-1} \times$ post-2011	-0.082	0.639^{***}	0.391^{**}
	(0.056)	(0.187)	(0.149)
Observations	19,783	18,680	2,103
R-Square	0.037	0.060	0.235
Note:			*p<0.1; **p<0.05; ***p<0.01

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\text{Duration}_{i,t} &= \beta_0 + \beta_1 \mathit{log}(\text{Distance Moved}_{i,t}) \\
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&+ \beta_5 \text{Rockfish}_{i,t-1} \times \text{post-2011} \\
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Dependent variable:	SS	CP	MS-CV
Tow Duration (Minutes)	Sector	Sector	Sector
log(Distance Moved)	-1.954^{**}	-9.472^{***}	-7.816^{***}
log(Dist.) $\times$ post-2011	2.033	-4.520***	7.53*
$\text{Hake}_{i,t-1}$	-1.363	0.288^{***}	-0.317^{***}
$\text{Rockfish}_{i,t-1}$	-8.829	-1.289^{***}	14.491^{**}
$\text{Rockfish}_{i,t-1} \times$ post-2011	-8.901	-36.523^{***}	-43.790^{**}
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  - One metric ton of rockfish is associated with 89% and 48% increases in distance moved for the CP and MS-CV sectors, respectively.
  - Effect sizes for tow duration are relatively small except for the estimated effect of tow duration after a rockfish encounter. One metric ton of rockfish is associated with 37 and 44 minute decreases in tow duration on the following tow for the CP and MS-CV sectors, respectively.
- No significant evidence from the shoreside sector, although this may be a limitation of the data or the statistical model.