Fishery Participation and Location Choice

The West Coast Salmon Fishery

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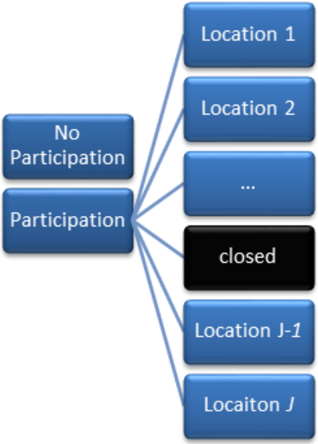
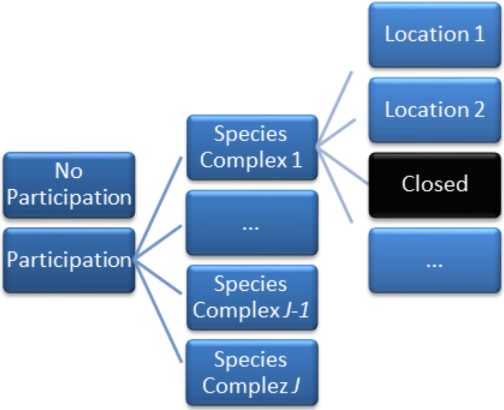
Motivation: Fisherman Behavior

- Modeling fisherman behavior has long been a tradition in Fisheries Economics.
  - Fishery Participation (Bockstael & Opaluch, 1983)
  - Entry/Exit (Ward & Sutinen, 1994)
  - Location Choice (Holland & Sutinen, 1999; Smith & Wilen, 2003; Abbott & Wilen, 2011)
- A question that has been heavily explored is: How fishermen behavior respond to spatial policies?
- *Random Utility Models* have been the horseshoes for modeling of fishermen behavior.

Fisherman Behavior: Single fishery



Research Objective: Fishery Participation Location Choice



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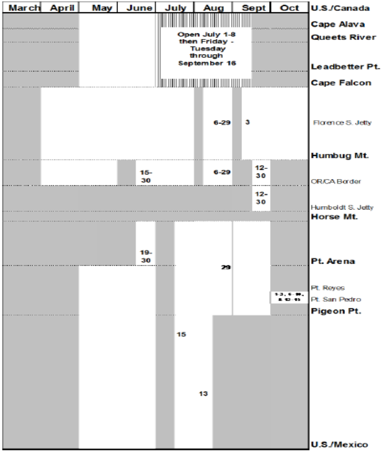
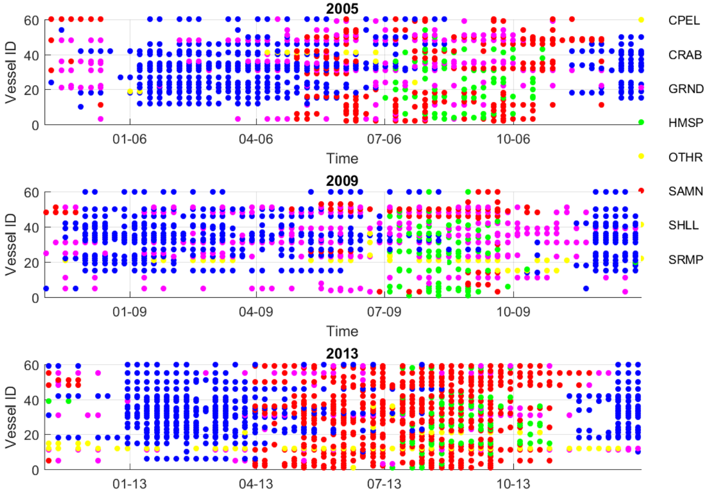


Fish Ticket (FT) Data

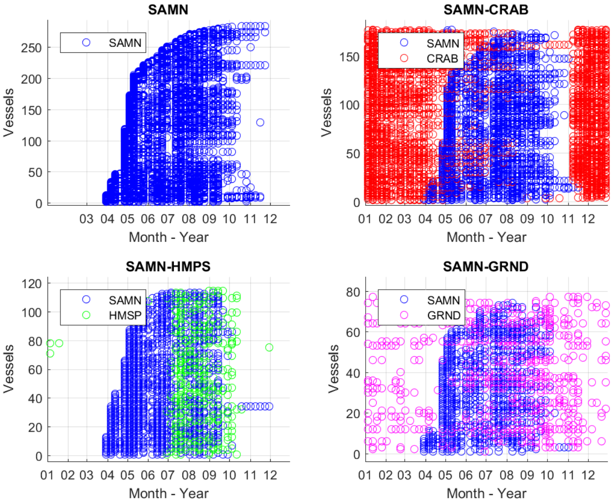
Individual Fish Ticket Data from the PacFIN (PSMFC)

- All salmon trollers in WA, OR, & CA.
- All FT from all fisheries they participated.
- For all years: 2005 -2014
- Over a million Fish Tickets
- Vessel Id, Landing Port, Species Composition, Gear, Weight, & Price
- No Information on Trip Duration

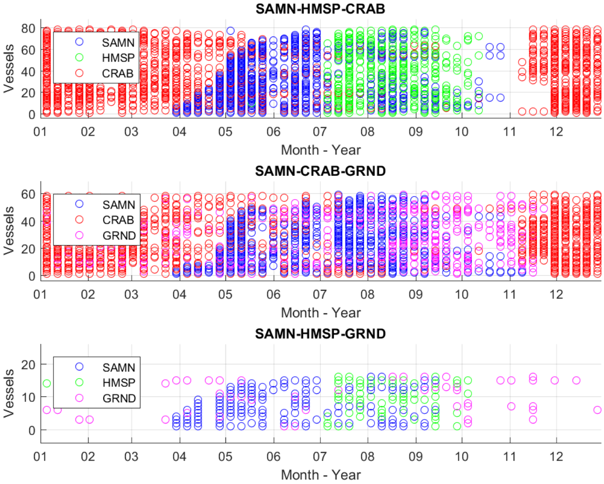
FT & Weekly Fishery Participation



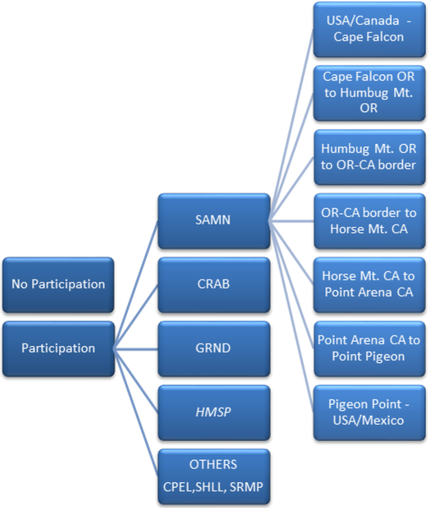
Fishery Participation Behavior



Fishery Participation Behavior



WC Salmon Fishery Participation Location Choice Behavior



Random Utility Model

At each time t fisherman n chooses an alternative j from a set of discrete alternatives $j = 1, ..., 14$. Denoting U_{njt} as the *utility* that a fisherman n obtains from choosing alternative j at time t we can state the fisherman n problem as:

$$\max_{j \in \{1,...,J\}} \{U_{n1t}, ..., U_{nJt}\} \tag{1}$$

Fisherman n chooses alternative j at time t if and only if:

$$U_{njt} > U_{nit} \forall i \neq j$$

FPLC *Representative Utility*

From FT data and vessel registration one can define the following *Representative Utility*

$$U_{njt} = \alpha_j + \beta_1 ER_{njt} + \beta_2 closure_{jt} + \sum_{i=1} \theta_i d^i_{nj\tau} + \sum_{m=1} \mu_m Y^m_{nt} + \varepsilon_{njt} \quad (2)$$

where

- α_j are alternative specific constant.
- ER_{njt} is the expected revenue of j
- $closure_{jt}$ indicator of closure
- $d^i_{nj\tau}$ state dependence variables.
- Y^m_{nt} are m vessel specific characteristics.
- ε_{njt} indicates the unobserved part of the utility

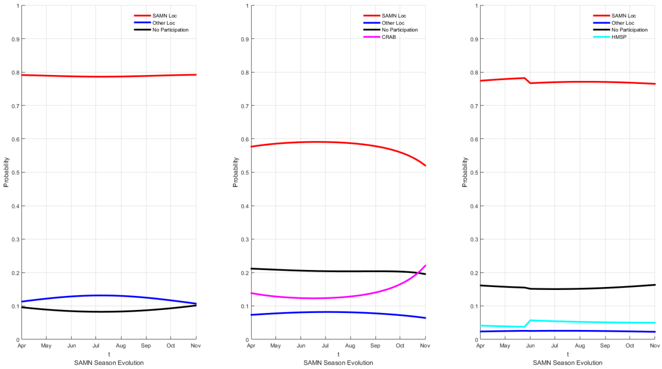
RUM Preliminary Results

	SAMN	SAMN CRAB	SAMN HSMP	SAMN GRND
ExpRev	0.000388***	0.000174***	0.0000641**	0.000387***
	(0.0000713)	(0.0000123)	(0.0000198)	(0.0000418)
Closure	-1.387***	-1.297***	-1.529***	-0.755***
	(0.126)	(0.124)	(0.113)	(0.121)
LastWeek	1.608***	1.456***	1.317***	1.373***
	(0.0792)	(0.0493)	(0.0340)	(0.0787)
LastYear	0.863***	0.629***	0.878***	0.695***
	(0.0617)	(0.0295)	(0.0276)	(0.0502)
Ommited Dissimilarity Parameters, Vessel Characteristics, and Alt. Constants				
N	133304	306729	493371	161721

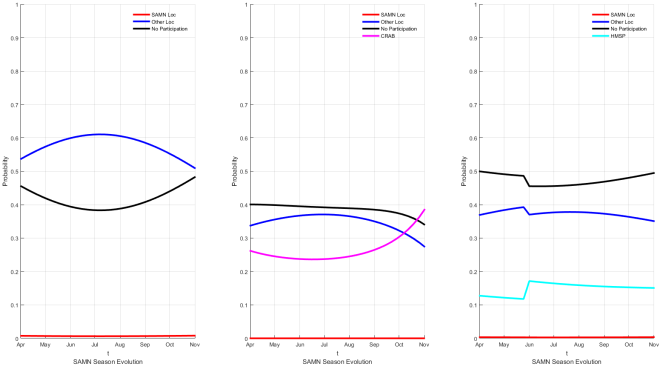
Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

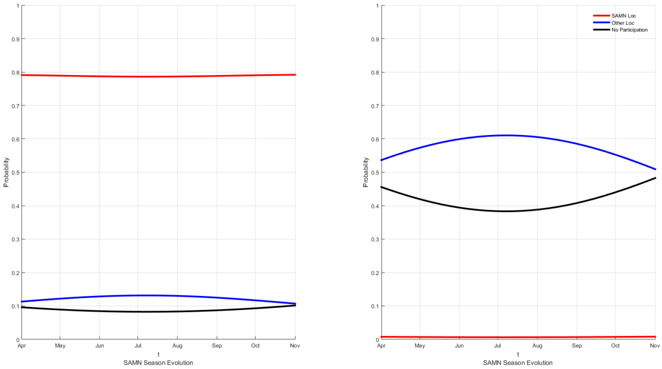
Predicted Probabilities, Last Chosen Alternative Open



Predicted Probabilities, Last Chosen Alternative Closed



Predicted Probabilities, Open vs Closed



Conclusions

Results

- Evidence of effort redistribution across alternative fisheries.
- Evidence of how a spatial policy established in one fishery spillovers to other fisheries.

Potential application of this model:

- Predict intra-seasonal behavior of WC salmon fishermen.
- The model provides a set of methodological procedures for analyzing effect of spatial closures; applicable to other multi-species fisheries settings.

Thank you

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Questions

References

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Fishery Participation Behavior

Fishery Participation	Percentage
Salmon & HMSP	23.28
Salmon & HMSP & Crab	16.57
Salmon	14.10
Salmon & Crab	11.28
Salmon & Crab & Groundfish	9.34
Salmon & HMSP & Crab & Groundfish	7.40
Salmon & Groundfish	6.52
661 vessels	

RUM Estimation Steps

1. Weekly revenue normalization using a translong production function (Holland and Sutinen, 1999; Abbott and Wilen, 2011).
2. Mean Revenue per fishery conditioned on season progress.
3. Own vessel revenue information and group mean revenues.
4. Estimate information signal weights with equation.
5. Predict *Expected Revenue* for all alternatives for all choice occasions using estimated signal weights.
6. Estimate parameters of *Representative Utility* with a unordered discrete choice model.

Translog Production Function

Variable	SAMN	CRAB	HMSP	GRND	OTHERS
Length	-8.356***	5.358***	0.0409	-1.583	-26.81***
	(1.011)	(1.349)	(2.287)	(1.293)	(5.098)
Tonnage	1.212***	0.0783	0.273	-0.162	2.957*
	(0.209)	(0.249)	(0.471)	(0.268)	(1.320)
HPower	0.719***	-1.096***	-2.319***	1.669***	4.402***
	(0.211)	(0.224)	(0.458)	(0.365)	(0.839)
$Length^2$	1.619***	-0.712***	0.0797	0.920***	5.160***
	(0.154)	(0.208)	(0.337)	(0.208)	(0.770)
$Tonnage^2$	0.0924***	0.0906***	0.209***	0.0356**	0.164**
	(0.00920)	(0.00867)	(0.0164)	(0.0135)	(0.0521)
$HPower^2$	-0.0526***	0.0679***	0.0893***	0.0645***	0.00935
	(0.00613)	(0.00498)	(0.0100)	(0.0111)	(0.0302)
Cross-products and Spatial Dummies omitted					
N	55738	64728	16515	21759	6193

Coarse-Scale Regression

Variable	SAMN	CRAB	HMSP	GRND	OTHERS
NWsince1W	2.902	-94.66***	4.809	81.29***	-110.5***
	(4.504)	(3.755)	(8.845)	(9.756)	(11.86)
NW^2	-0.0677	1.676***	0.0805	-1.404***	2.023***
	(0.112)	(0.0737)	(0.221)	(0.178)	(0.214)
Temporal and Spatial Dummies Omitted					
	(55.58)	(57.15)	(108.3)	(177.7)	(190.5)
N	55738	64728	16515	21759	6193
R^2	0.086	0.012	0.005	0.009	0.025

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Information weight estimates

	Information sets				
Info Signal	1	2	...	15	16
Const	-0.7**	0.56**	...	-0.66**	0.42**
Coarse	1.08**	0.46**	...	0.81**	0.48**
OldFine			...	-0.13**	-0.16**
OldFinest			...	0.34**	0.22**
RecFine			...	0.07**	0.01
RecFinest		0.46**	...	0.44**	0.39**
# of obs	28400	22517	...	7468	21314
R^2	0.278	0.392	...	0.368	0.48
ll	-46253	-31172	...	-10577	-27129
F-stat	10959**	7267**	...	1086**	3931**

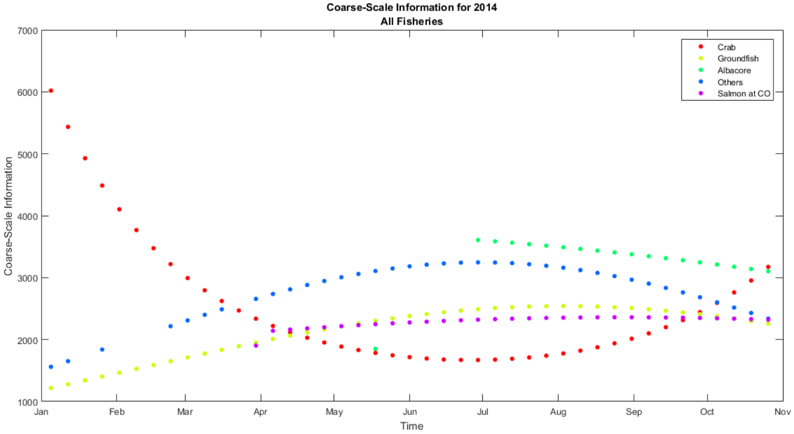
**Significant at 95% level
*Significant at 90% level
Std Errors have been ommited

FT & Trip Duration

Only 10% of FT contains information on Trip Duration.

Species Group	Mean Num of Days Fished
SAMN	1.7
CRAB	1
GRND	1.8
HMSP	5.8

Coarse-Scale Predictions for 2014



Final