Quantifying and Comparing Fisher Decision-making Strategies Before and After the Deepwater Horizon Oil Spill

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Objectives

- Background, fishery, and research objectives
- Panel dataset development
- Model results and Discussion
- Ongoing and future research

Background

- DWH estimated to have cost the Gulf of Mexico's commercial fishing industry between $94.7 million to $1.6 billion and, from 740 to 9,315 jobs (U.S. Bureau of Ocean Energy Management).

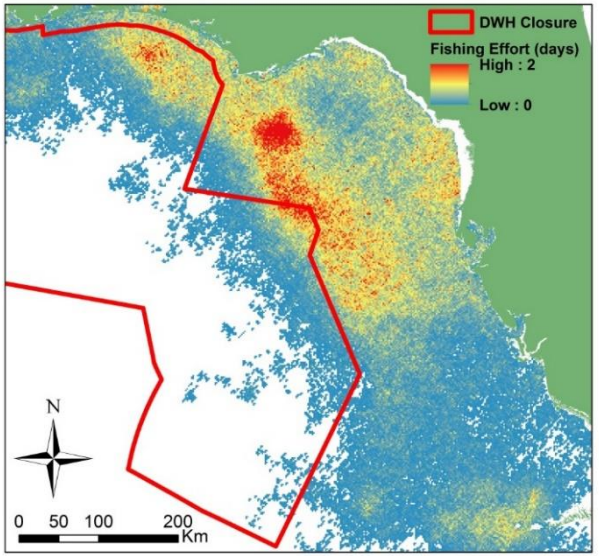
- Large spatial closures excluded fishing from frequented fishing grounds.

- Fisheries dependent data collection also affected.

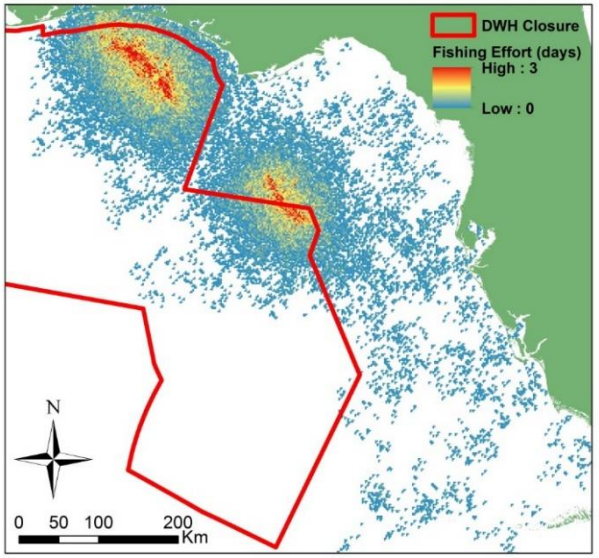
Context

- Spatially explicit bioeconomic agent-based model under development.
- West Florida Shelf model (Saul 2012) estimated that during DWH: 18% of simulated handline effort and 65% of simulated longline effort occurred within closure area.
- Full model will (1) evaluate socioeconomic and fisheries population, stock assessment, and management affects of oil spill, and (2) consider alternative response scenarios to the spill to gain insight on best practices for the future.

Simulated Handline Fishing Effort

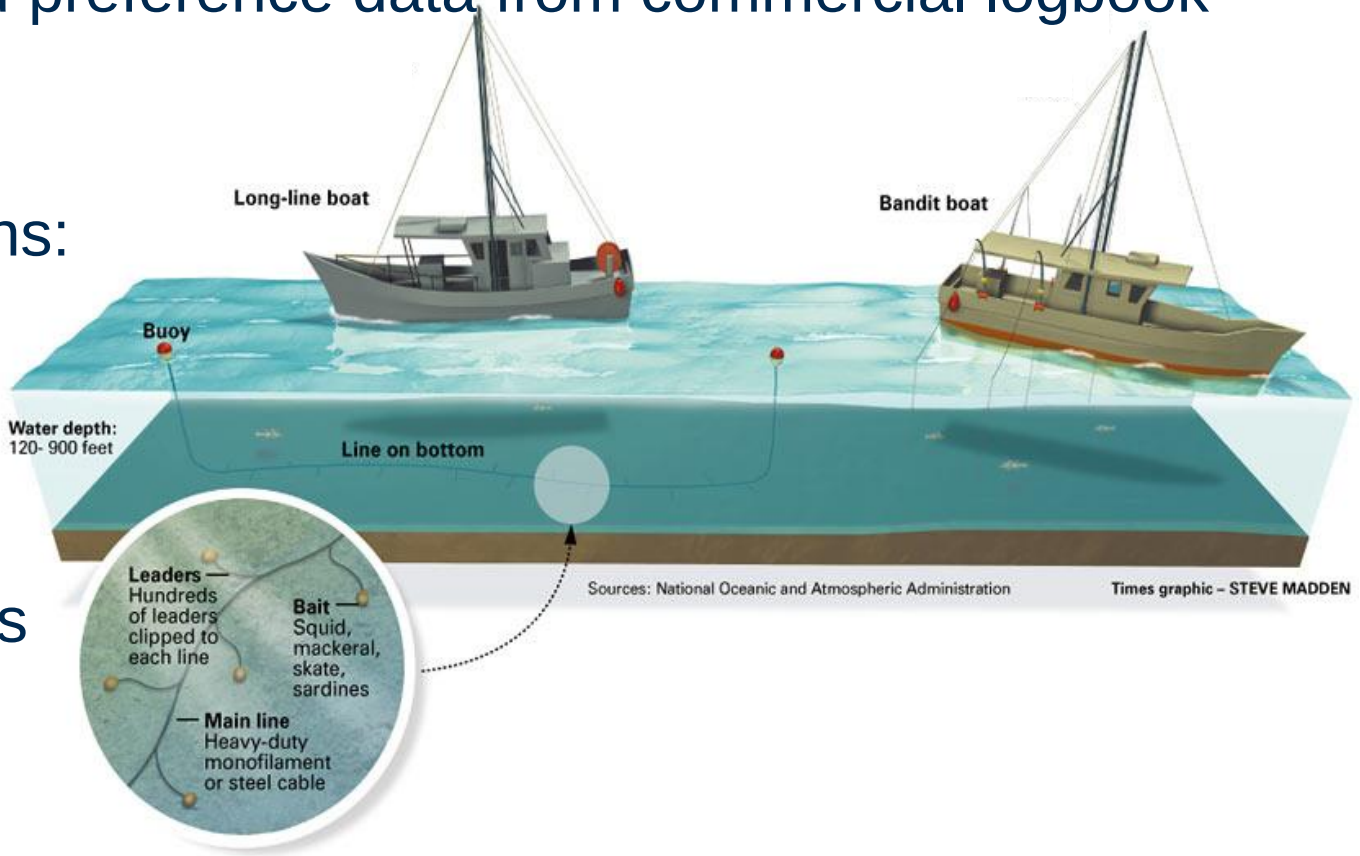


Simulated Longline Fishing Effort



Study Objectives and Fleets

- Discrete choice models of fisher behavior: before DWH, after DWH, and once ITQs implemented.
- Uses revealed preference data from commercial logbook observations
- Three decisions:
  - Participation
  - Site choice
  - Return to port
- Nested models



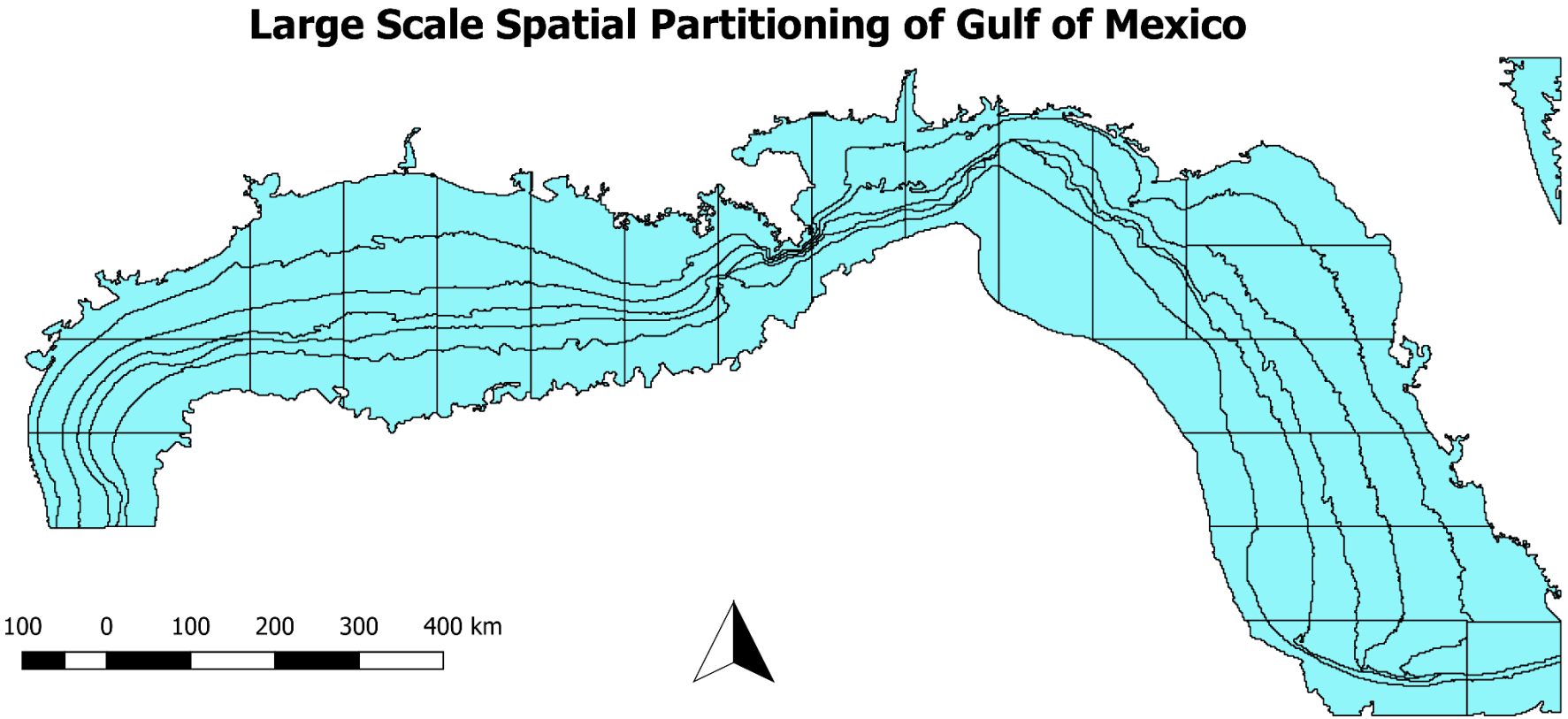
Context

- Years 2005 and 2007 indicated:
  - The larger your boat, the less frequently you will take a trip.
  - Wind impacts handline boats but has minimal impact on longline boat site choice
  - An increase in fuel price reduces trip frequency, and alters where one decides to fish when they go.

(Saul et al. 2016. Modeling the decision making behavior of fishers in the reef fish fishery on the West Coast of Florida. Human Dimensions of Wildlife 21(6): 567-586).

Parameter	Estimate	Std. Error	t-value	Pr(>|t|)	Significance Category
DistanceKm	-0.0011	0.0014	-0.7890	0.4301	
ExpCpueRG	0.0029	0.0041	0.6994	0.4843	
ExpCpueGG	-0.0004	0.0007	-0.5725	0.5670	
ExpCpueRS	-0.0098	0.0136	-0.7228	0.4698	
ExpCpueMS	0.0004	0.0005	0.7384	0.4603	
ExpCpueVS	0.0008	0.0108	0.0778	0.9380	
Length.VOU:8	-0.0289	0.0097	-2.9782	0.0029	**
Length.VOU:9	-0.0238	0.0061	-3.8814	0.0001	***
Length.VOU:10	-0.0232	0.0062	-3.7659	0.0002	***
Length.VOU:13	-0.0251	0.0072	-3.4974	0.0005	***
Length.VOU:16	-0.0223	0.0058	-3.8473	0.0001	***
Length.VOU:17	-0.0276	0.0079	-3.5135	0.0004	***
Length.VOU:20	-0.0190	0.0087	-2.1994	0.0279	*
Length.VOU:21	-0.0267	0.0066	-4.0400	0.0001	***
Length.VOU:24	-0.0214	0.0069	-3.0998	0.0019	**
Length.VOU:26	-0.0290	0.0087	-3.3329	0.0009	***
Length.VOU:30	-0.0191	0.0092	-2.0695	0.0385	*
WindSpeedKnots:8	0.0029	0.0157	0.1835	0.8544	
WindSpeedKnots:9	0.0162	0.0122	1.3278	0.1842	
WindSpeedKnots:10	0.0111	0.0096	1.1486	0.2507	
WindSpeedKnots:13	0.0113	0.0105	1.0829	0.2788	
WindSpeedKnots:16	0.0127	0.0093	1.3671	0.1716	
WindSpeedKnots:17	0.0082	0.0096	0.8543	0.3929	
WindSpeedKnots:20	0.0110	0.0088	1.2497	0.2114	
WindSpeedKnots:21	0.0106	0.0087	1.2149	0.2244	
WindSpeedKnots:24	0.0061	0.0102	0.5916	0.5541	
WindSpeedKnots:26	0.0080	0.0092	0.8637	0.3877	
WindSpeedKnots:30	-0.0340	0.0579	-0.5883	0.5563	
RealDieselPrice:8	-0.7011	0.1829	-3.8332	0.0001	***
RealDieselPrice:9	-0.8248	0.1085	-7.6008	<0.0001	***
RealDieselPrice:10	-0.7839	0.1135	-6.9093	<0.0001	***
RealDieselPrice:13	-0.8276	0.1294	-6.3953	<0.0001	***
RealDieselPrice:16	-0.8556	0.1095	-7.8152	<0.0001	***
RealDieselPrice:17	-0.7585	0.1287	-5.8914	<0.0001	***
RealDieselPrice:20	-0.9009	0.1539	-5.8530	<0.0001	***
RealDieselPrice:21	-0.8100	0.0962	-8.4171	<0.0001	***
RealDieselPrice:24	-0.8597	0.1230	-6.9921	<0.0001	***
RealDieselPrice:26	-0.7712	0.1122	-6.8750	<0.0001	***
RealDieselPrice:30	-0.7293	0.1473	-4.9500	<0.0001	***
iv	0.0899	0.1146	0.7840	0.4330	

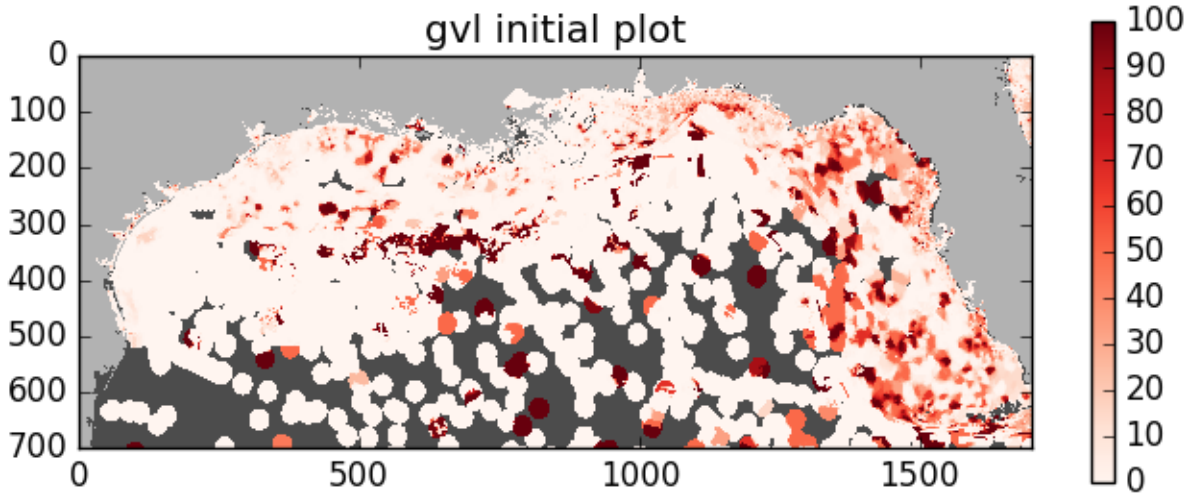
Spatial Partitioning for Site Choice



Panel Dataset Construction

- Logbook data
- Habitat (dbSEABED bottom composition)
- Fuel price data (CPI adjusted)
- Wind speed, NOAA buoy data
- Fish price, landings data (CPI adjusted)
- Vessel characteristics, vessel registration
- Fish house location information

Species Name	Code	Gutted-lbs	Whole-lbs	Gear	Area	Depth
Amberjack-Great	1812	#	#			'
Amberjack-Lesser	1815	#	#			'
Almaco	1810	#	#			'
Banded Rudder	1817	#	#			'
Crevalle	0870	#	#			'
Cobia	0570	#	#			'
Dolphin Fish	1050	#	#			'
GROUPER Black	1422	#	#			'
GROUPER Gag	1423	#	#			'
GROUPER Warsaw	4740	#	#			'
GROUPER Red	1416	#	#			'
GROUPER Scamp	1424	#	#			'
GROUPER Snowy	1414	#	#			'
GROUPER Yellowedge	1415	#	#			'
GROUPER Yellowfin	1426	#	#			'



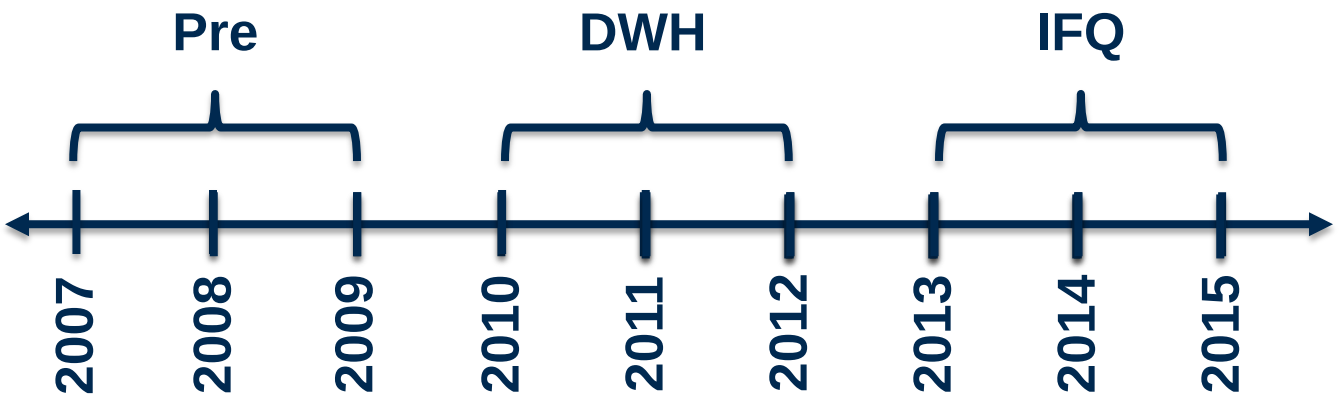
Model Development: Factors Considered

- Participation decision tested: wind speed, vessel length, fuel price, days since last trip, day of the week, fish prices, fuel price

- Site choice decision tested: distance, windspeed, habitat composition, fuel price, fish price, expected catch, habit

- Return decision tested: ratio catch to fish hold size, wind speed, fuel price, day of the week, vessel length, fish prices

Model Development: Time Blocks



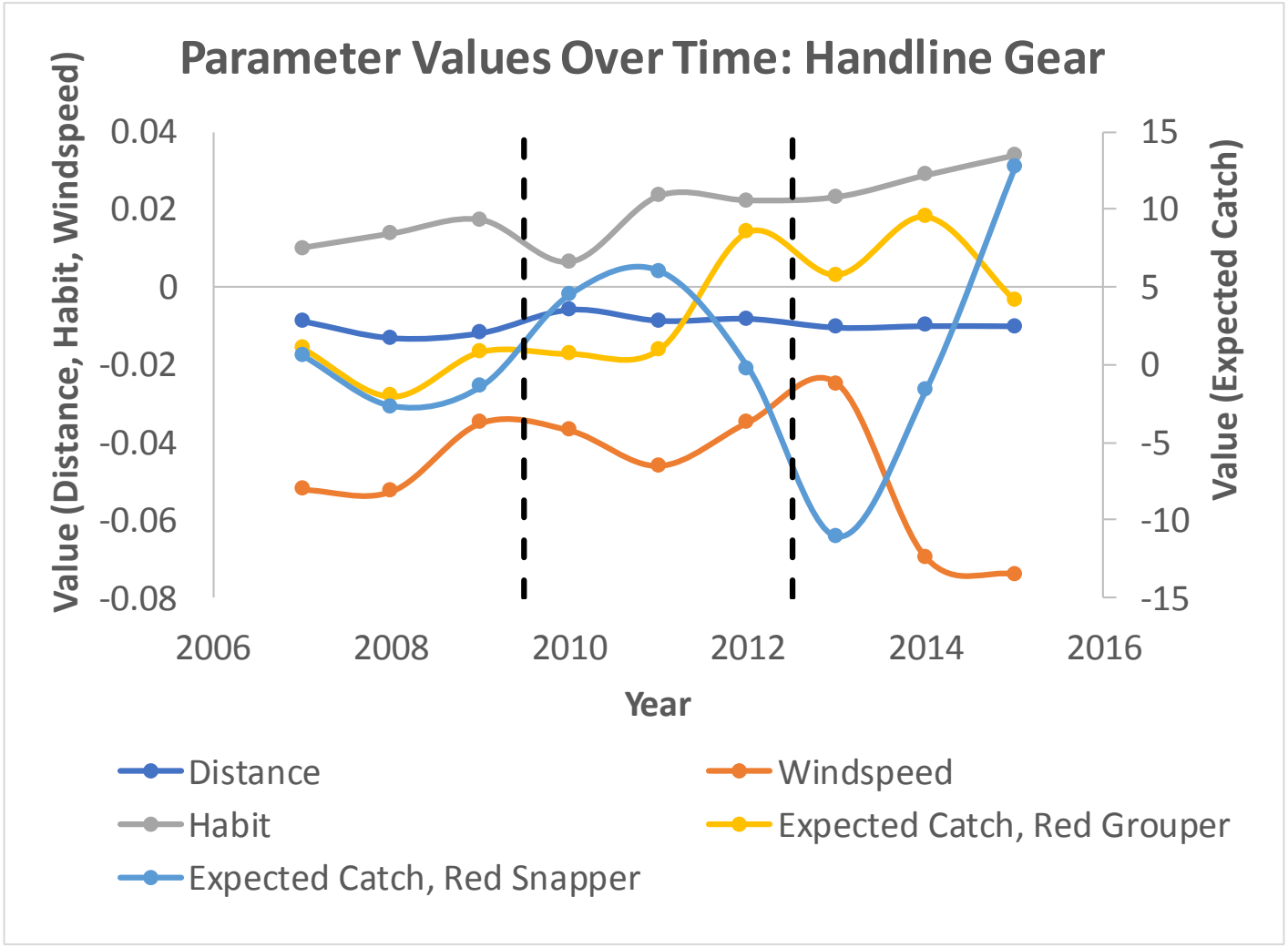
Experimental red snapper IFQ

IFQ, all reef fish; LL spatial restrictions (turtles)

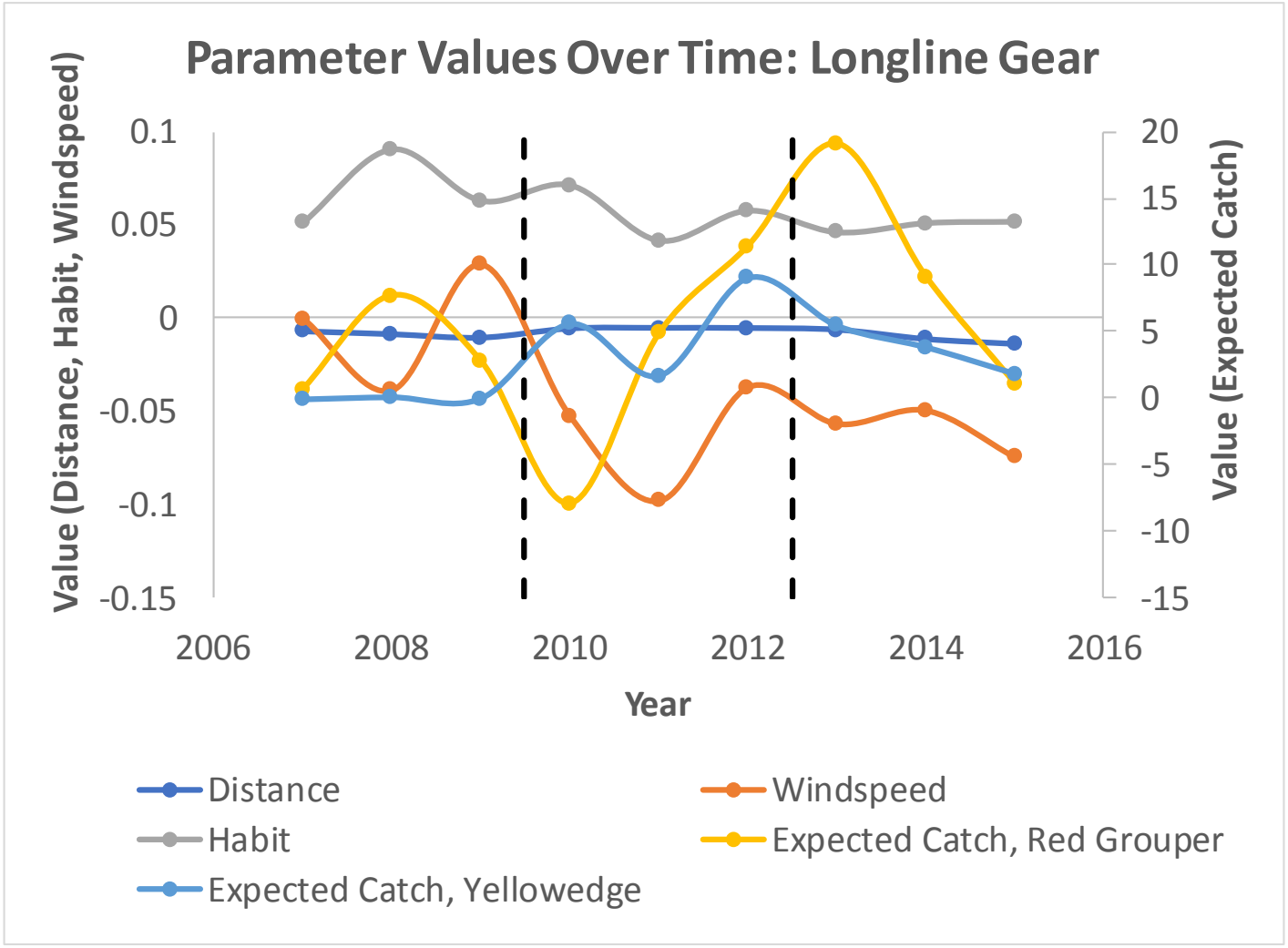
TAC Commercial and Recreational Separation; change in closed season to shorter time-area closure.

Continued increase in commercial red snapper quota throughout time period.

Site Choice: Non-alternative Specific Parameters

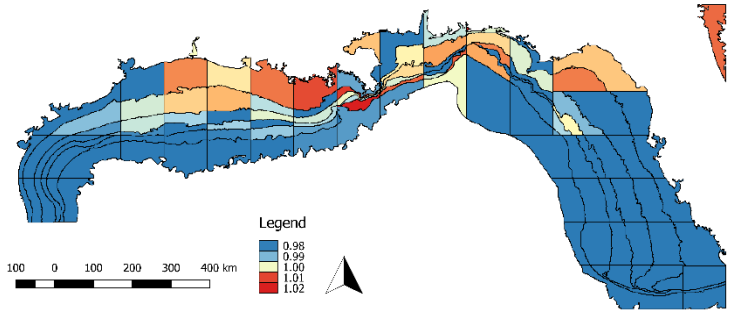


Site Choice: Non-alternative Specific Parameters

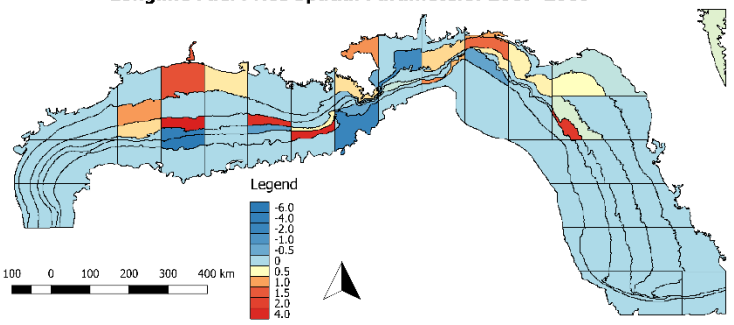


Site Choice: Alternative Specific Fuel Price

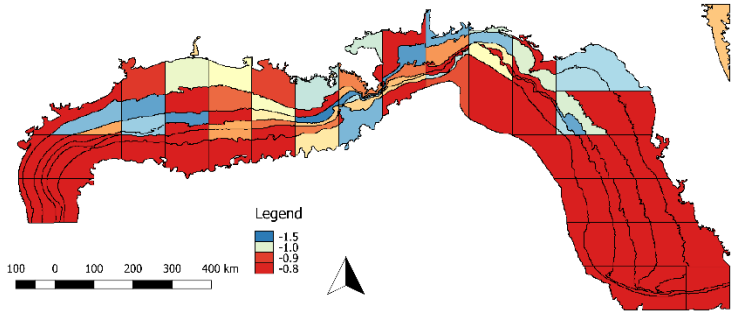
Handline Fuel Price Spatial Parameters: 2007-2009



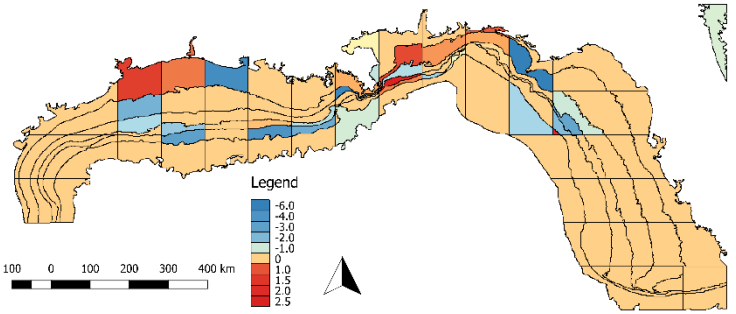
Longline Fuel Price Spatial Parameters: 2007-2009



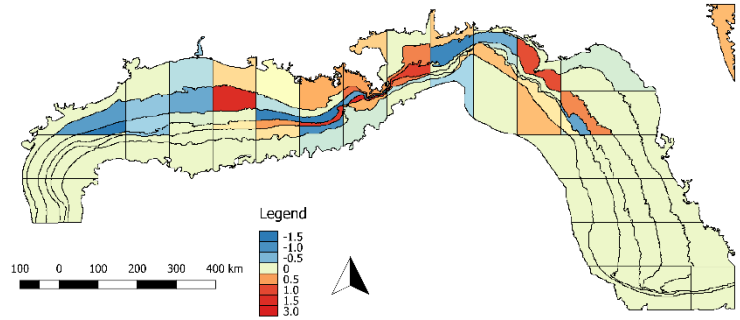
Handline Fuel Price Spatial Parameters: 2010-2012



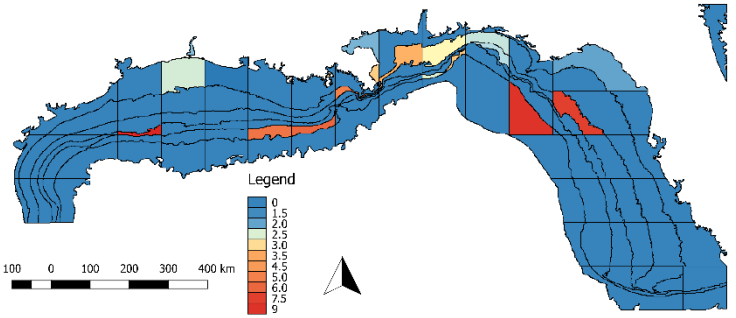
Longline Fuel Price Spatial Parameters: 2010-2012



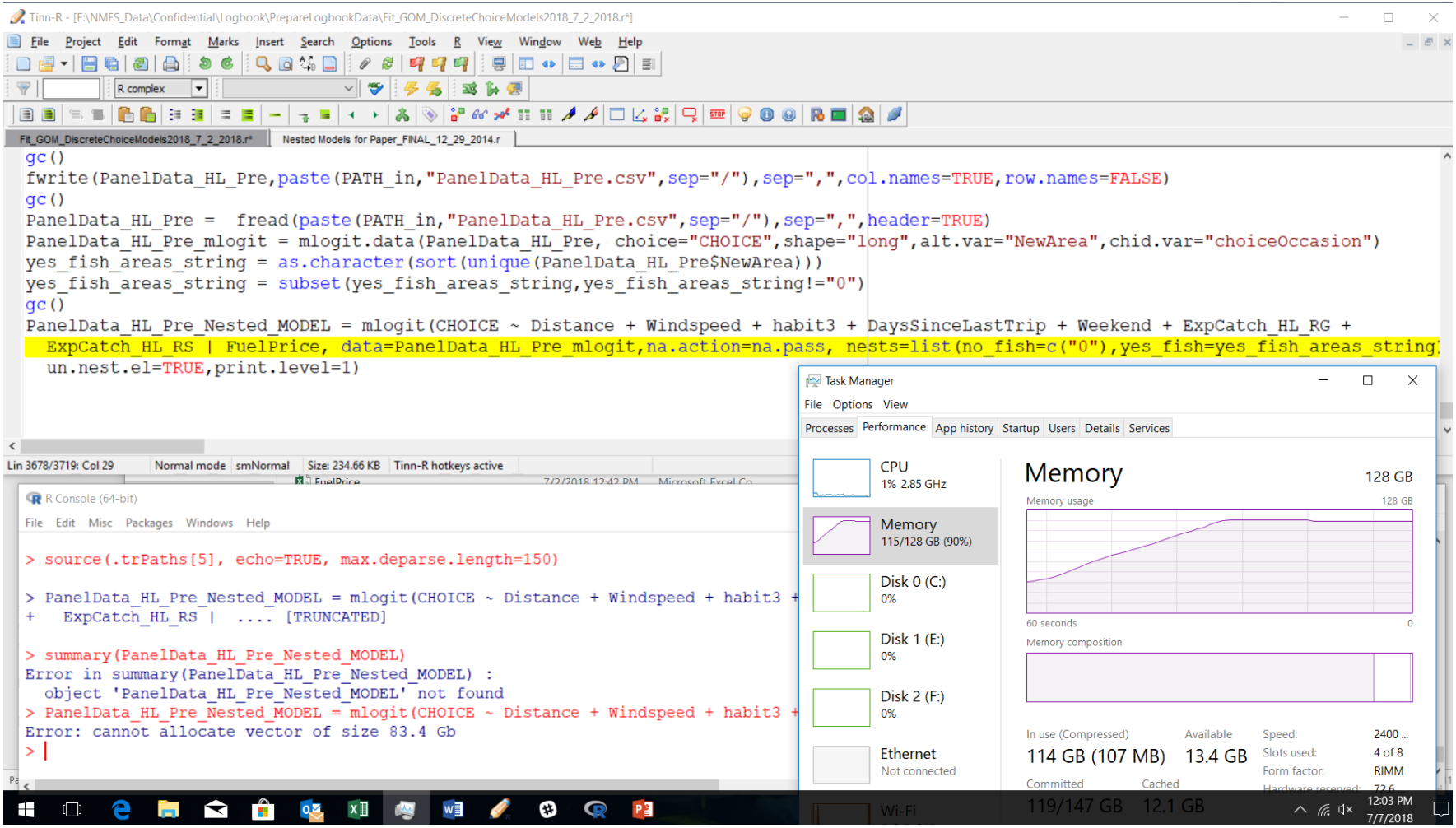
Handline Fuel Price Spatial Parameters: 2013-2015

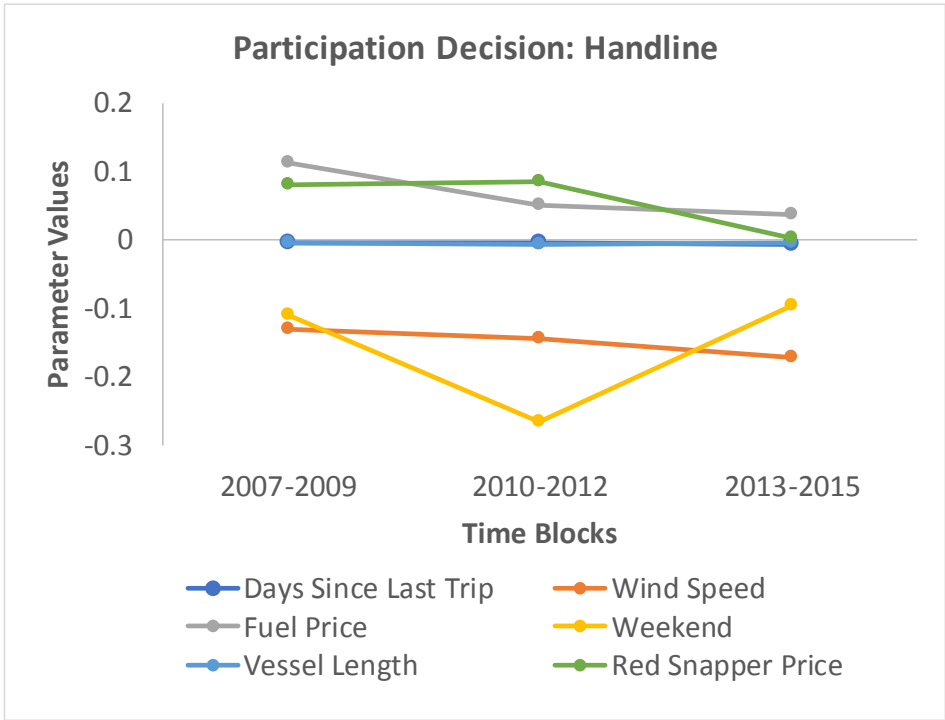


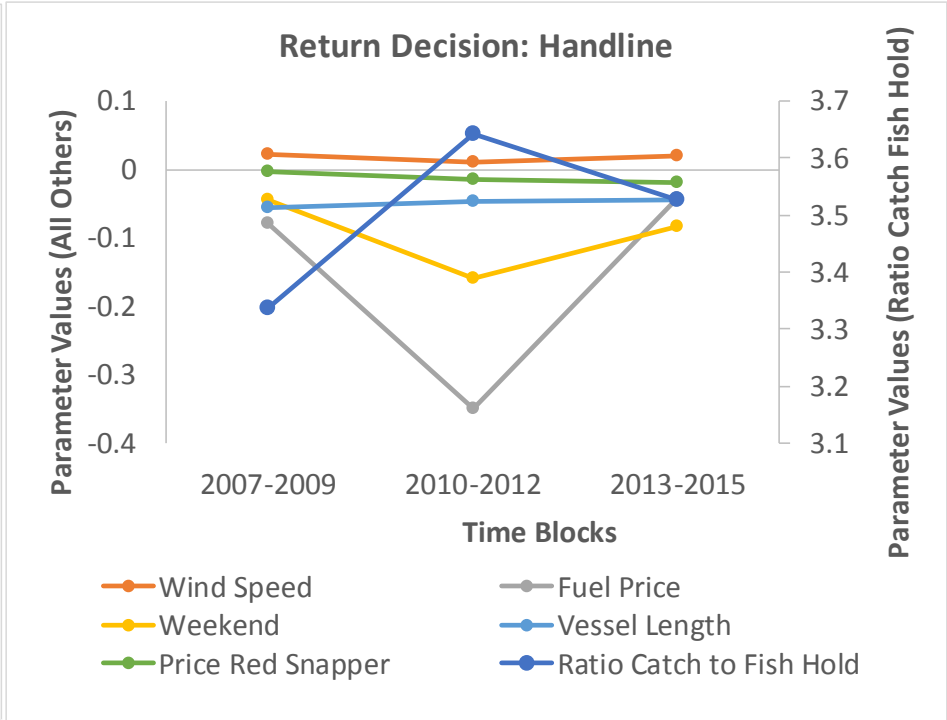
Longline Fuel Price Spatial Parameters: 2013-2015

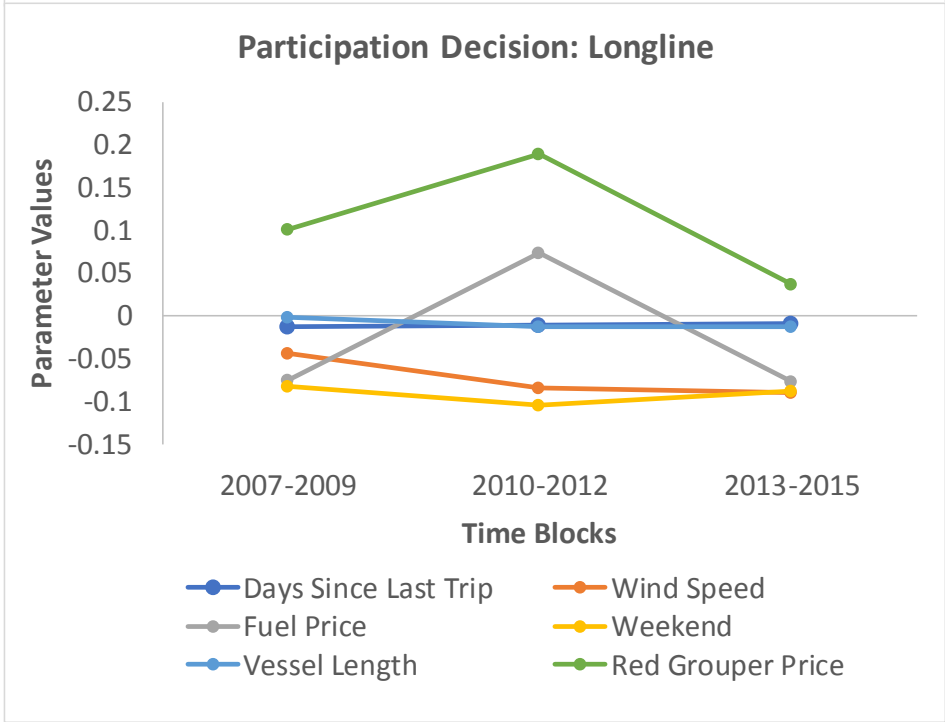


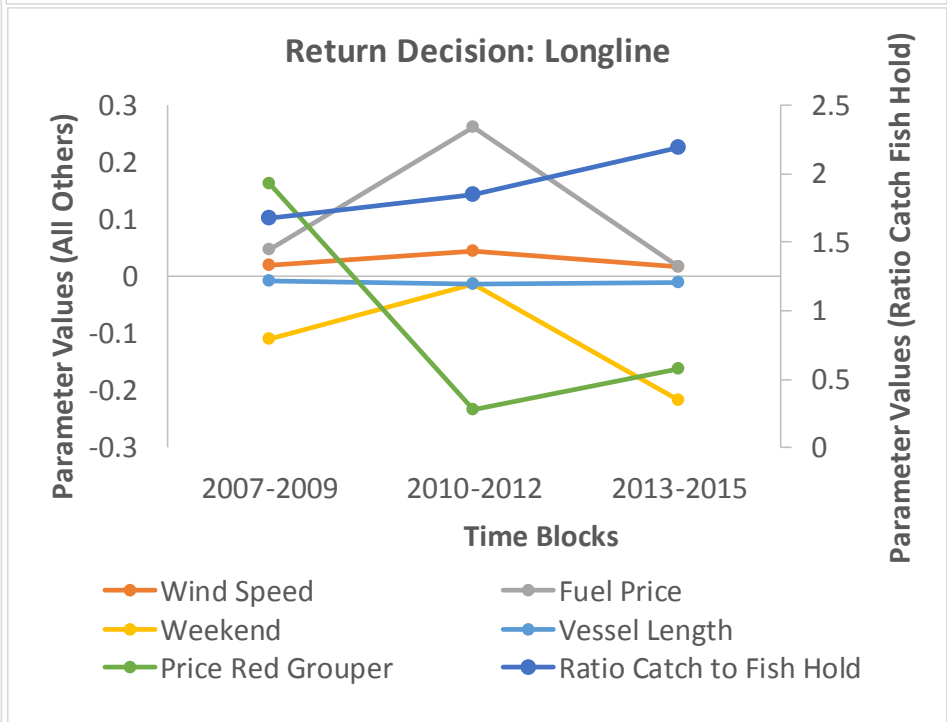
Nested Models




Participation Decision: Handline
Parameter Values
0.2
0.1
0
-0.1
-0.2
-0.3
2007-2009
2010-2012
2013-2015
Time Blocks
Days Since Last Trip
Wind Speed
Fuel Price
Weekend
Vessel Length
Red Snapper Price


Return Decision: Handline
Parameter Values (All Others)
0.1
0
-0.1
-0.2
-0.3
-0.4
Parameter Values (Ratio Catch Fish Hold)
3.7
3.6
3.5
3.4
3.3
3.2
3.1
2007-2009
2010-2012
2013-2015
Time Blocks
Wind Speed
Fuel Price
Weekend
Vessel Length
Price Red Snapper
Ratio Catch to Fish Hold


Participation Decision: Longline
Parameter Values
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2007-2009
2010-2012
2013-2015
Time Blocks
Days Since Last Trip
Wind Speed
Fuel Price
Weekend
Vessel Length
Red Grouper Price

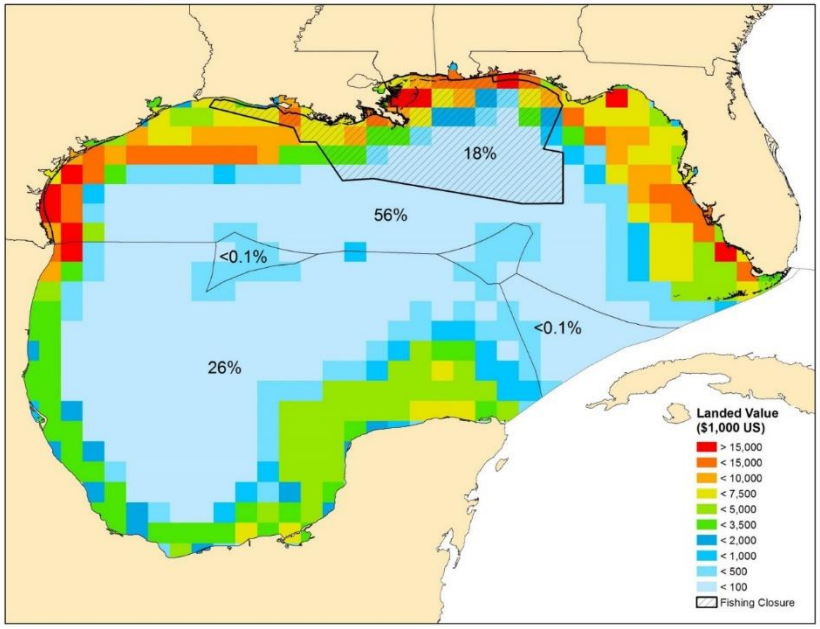

Return Decision: Longline
Parameter Values (All Others)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
Parameter Values (Ratio Catch Fish Hold)
2.5
2
1.5
1
0.5
0
2007-2009
2010-2012
2013-2015
Time Blocks
Wind Speed
Fuel Price
Weekend
Vessel Length
Price Red Grouper
Ratio Catch to Fish Hold

Summary

- Could not tease out much of a signal in fisher behavioral changes around the time of the oil spill.
  - This could be due in part to other events occurring in the fishery
  - No significant behavioral change occurred, or it occurred for such a short time.
- Habitat parameters were tried in each site choice model but did not have sufficient contrast against the data to fit (info is very coarse).
- Distance, habit, ratio catch to fish hold, and days since last trip all showed expected signs and were consistent across time blocks.
- Changes in wind speed sign and magnitude since a change toward being more selective about when and where one fishes.
- Expected catch of indicator species increasing may signal that people were becoming more selective (i.e. showing more preference for those sites with known higher abundances) when choosing a place to fish.

Future Research

- Split the GOM into regions
- Survey commercial fishers along the Gulf Coast
- Fit nested multinomial models
- Does fishery-dependent data contain a biased due to changes in fisher behavior in response to DWH?
- Effect of oil pollution on the survival of adult fish, recruitment (larval fitness and survival), and how this affects fishing.
- Consider alternative response scenarios to the spill with respect to fisheries.



Source: The Sea Around Us Project, University of British Columbia

Acknowledgements

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