Measuring the Costs to Commercial Fisheries from Protecting Essential Fish Habitat

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The paper outlines the steps necessary to conduct a comprehensive analysis of the costs of EFH designations, including:

1) GIS work relating closures to observed fishing patterns;

2) developing a spatial model of fishing behavior;

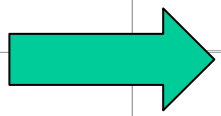
3) simulating fishermen's behavior in response to EFH designations;

4) measuring the costs to fishermen due to EFH designations;

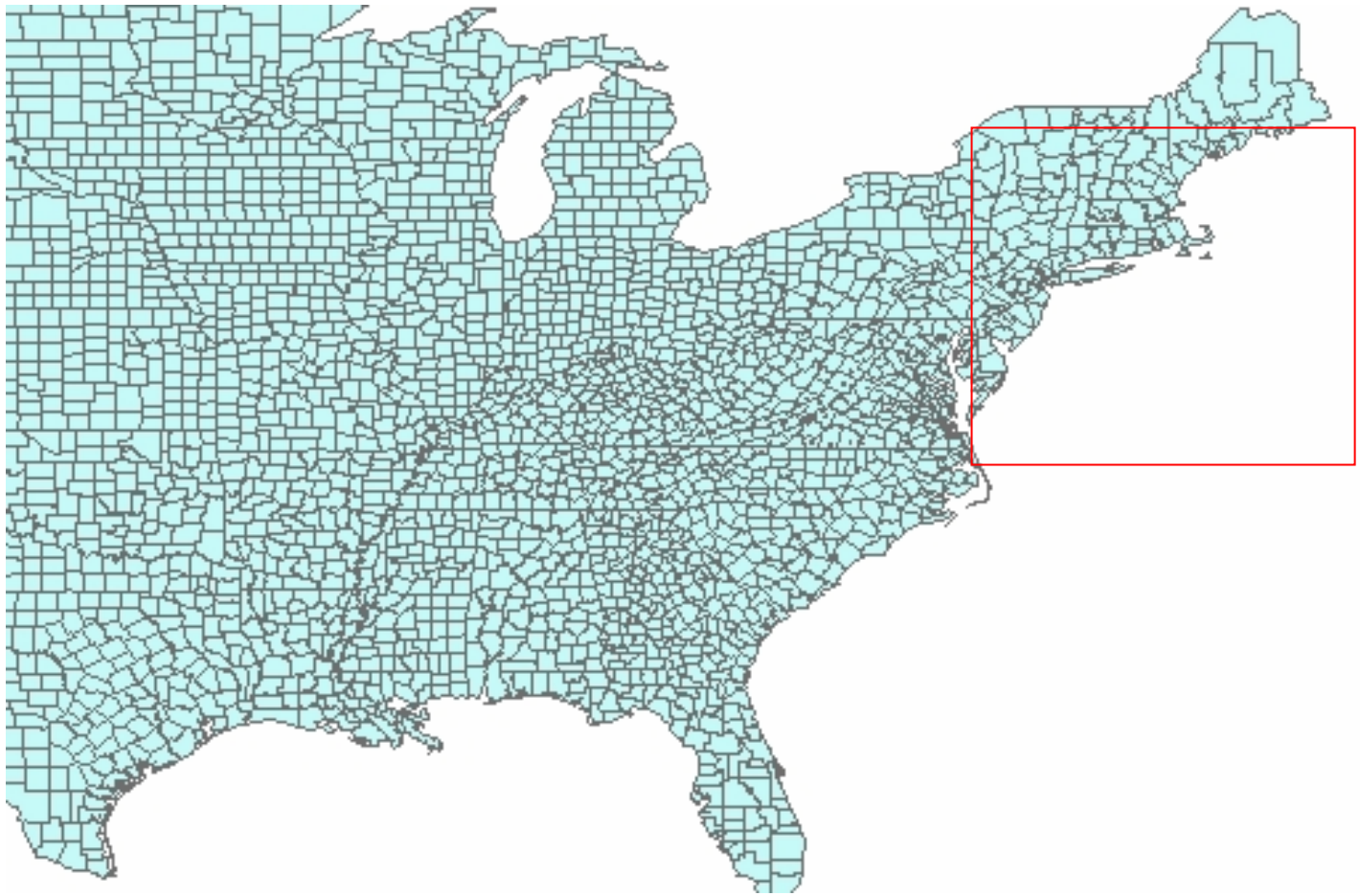
5) measuring ex-vessel market effects due to changes in supply due to changes in fishing behavior

Activity Affected

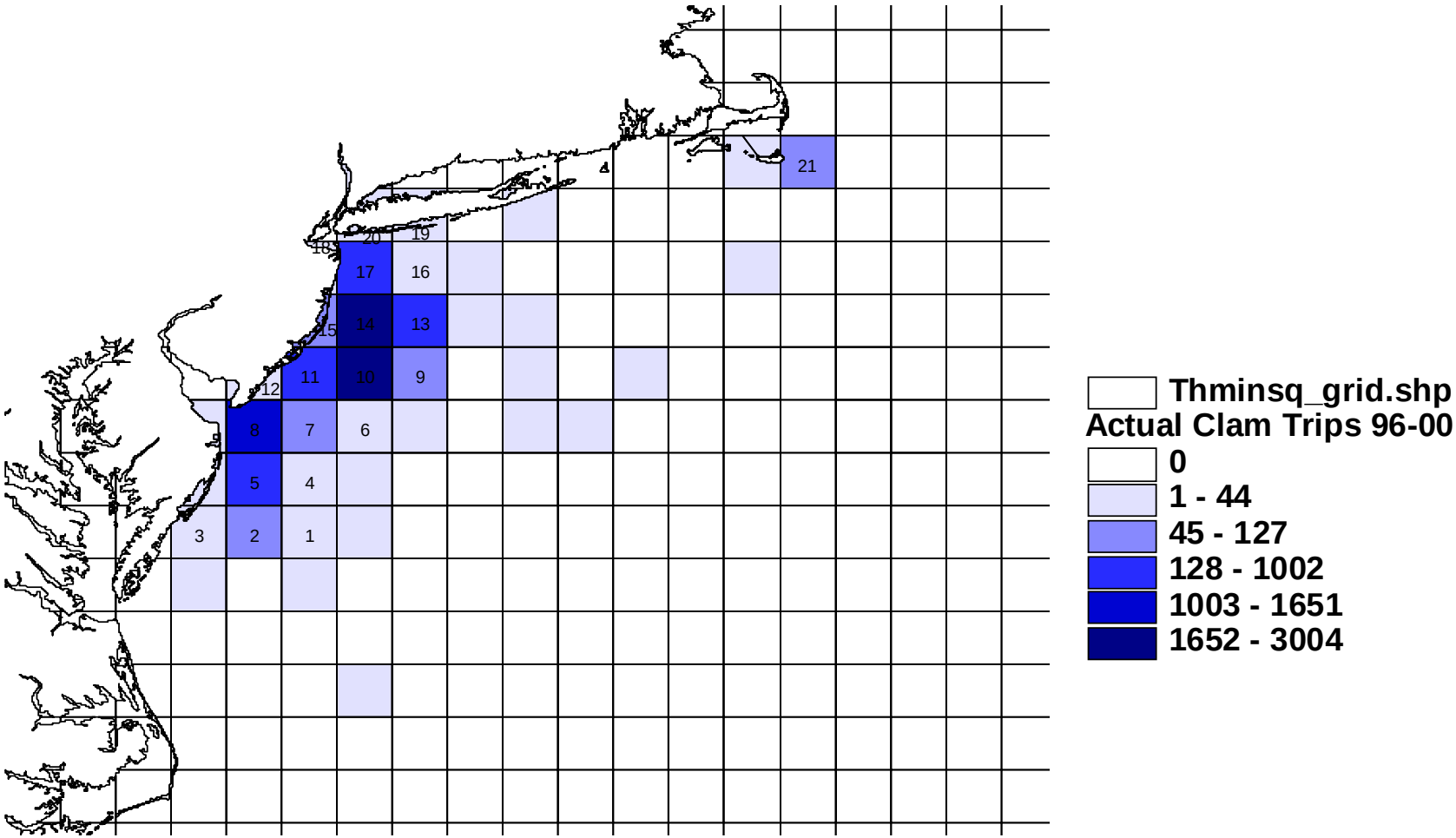
	Product	Status Quo (96-00 avg)
Permits	Surfclams	32
	Quahogs	29
	ME Quahogs	34
Trips	Surfclams	2,114
	Quahogs	2,137
	ME Quahogs	1,898
Revenues	Surfclams	$23,766,216
	Quahogs	$17,299,881
	ME Quahogs	$2,307,032



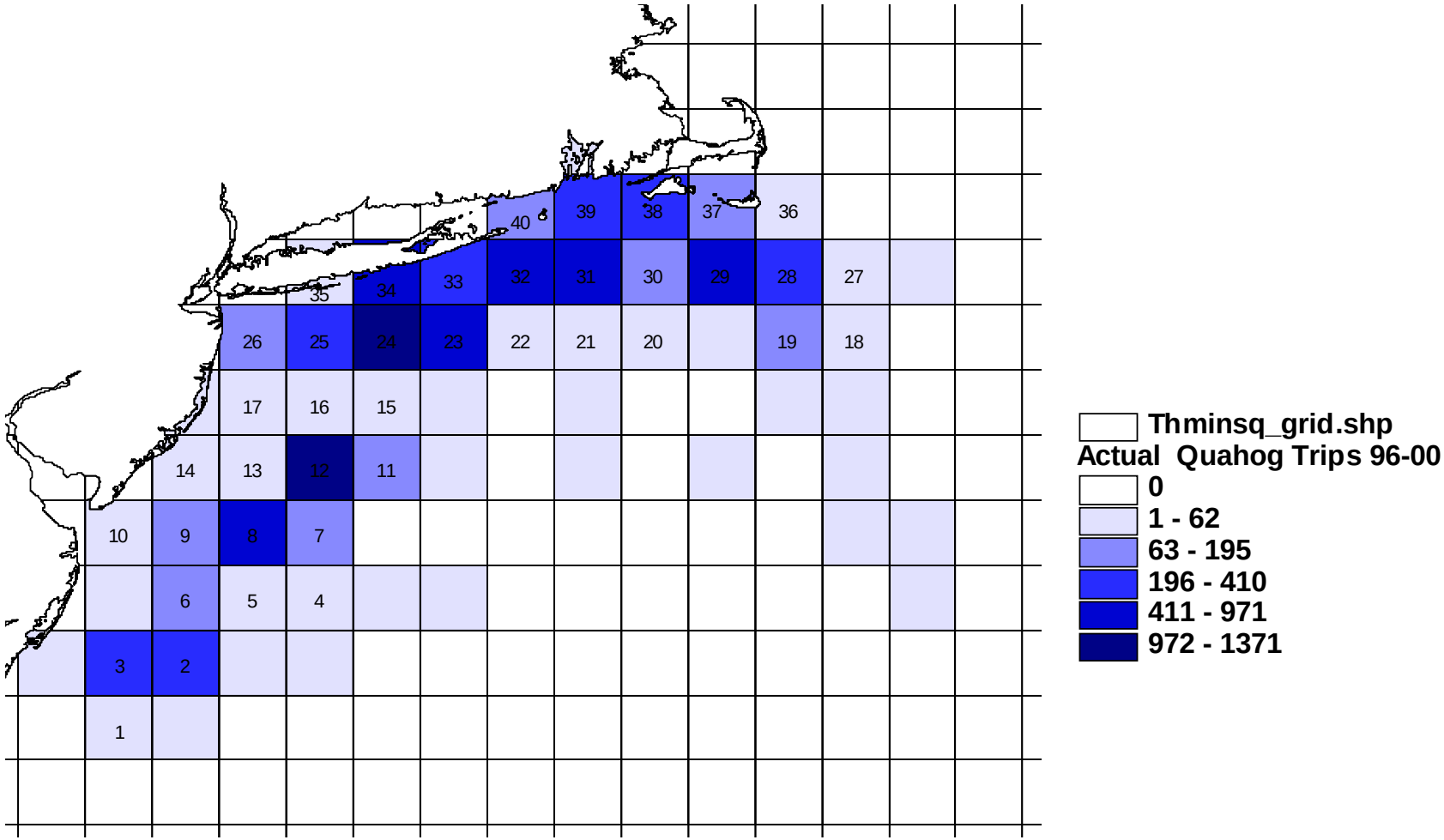
Area of Interest



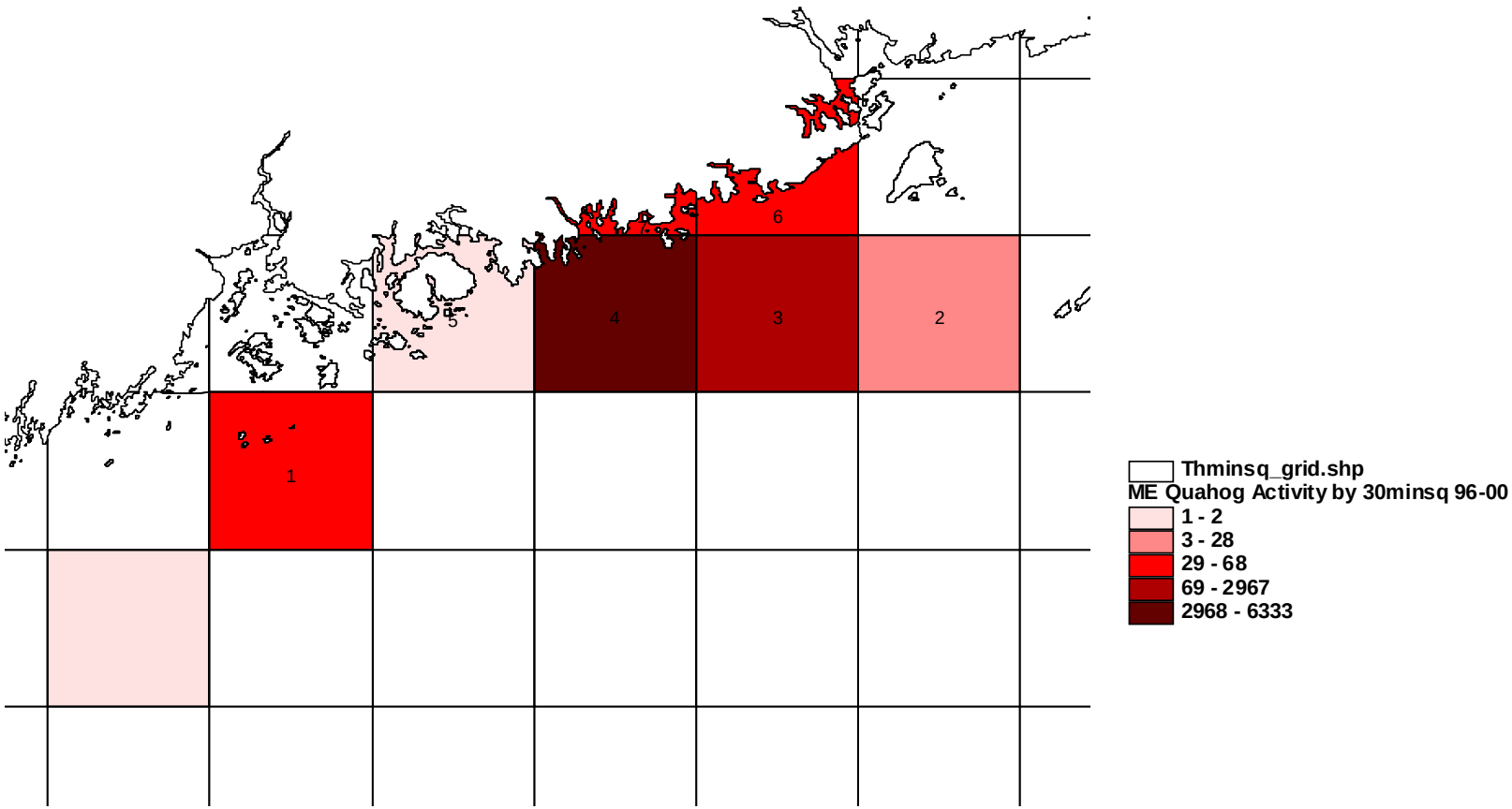
Map 1. Clam Actual Trips (1996-2000) and definition of choice set.



Map 2: Quahog Actual Trips (1996-2000) and definition of choice set.



Map 3: Maine Quahog Actual Trips (1996-2000) and definition of choice set.



The Model

$$EU(W_j) = \underbrace{\alpha \ln(W^0 + E(\pi_j)) + \frac{\beta Var(\pi_j)}{2(W^0 + E(\pi_j))^2}}_{\text{Second order expansion of a log utility function}} + \underbrace{\delta FLEET + \phi FLEET2}_{\text{Information/congestion effects}} + \varepsilon_j$$

Parameter Estimated	Variable	Definition
α	lnw_i	$\log(W^0+)$
β	varw	$.5(Var()/(W^0+)^2)$
δ	fleet	Number of trips in past 30 days at site i
	fleet2	$fleet^2$

Expect that $\beta = -\alpha$

The Results

Parameter*	Clams	Quahogs	ME Quahogs
b_lnw	11.23 (19.01)	25.05 (29.29)	30.35 (11.23)
b_varw	-682.72 (14.13)	-50.77 (3.67)	-95.28 (4.32)
b_fleet	.11 (84.67)	.16 (69.96)	.05 (57.36)
b_fleet2	-.00071 (52.11)	-.0018 (37.97)	-.00011 (42.04)
Average # Choices	14.33	21.92	7
% Predicted Correctly	37.74	25.74	74.01

*All parameter estimates have expected sign and are significant at the 5% level.

Policies
Option 1: Status Quo
Option 2: Close Georges Bank
Option 3: Close waters east of 70d20m
Option 6: Close Tilefish Area
Option 8: West of ME Zone 1

Simulations:

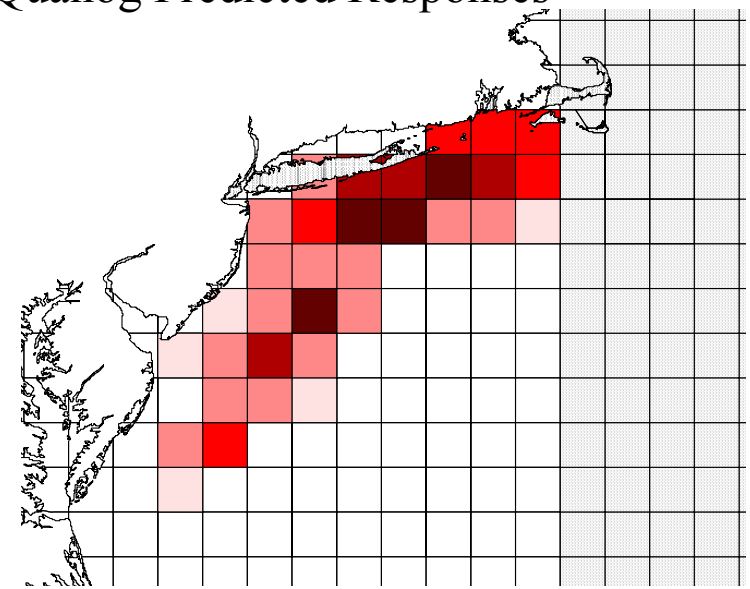
Areas would be closed and the choice probabilities calculated for each vessel, assuming the historic number of trips at a site (FLEET).This vector P* produces an estimated number of days fished in each site, permitting a new estimate of the variable FLEET*.

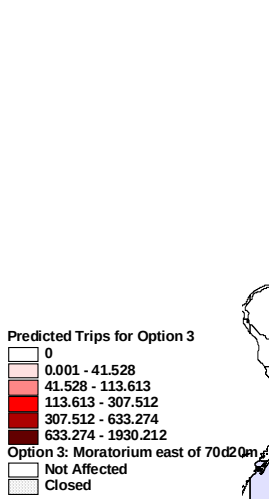
With the new value (FLEET*), the probabilities are re-calculated for each vessel. The new probabilities allow a new value of FLEET** to be calculated. It is used to determine a new set of probabilities.

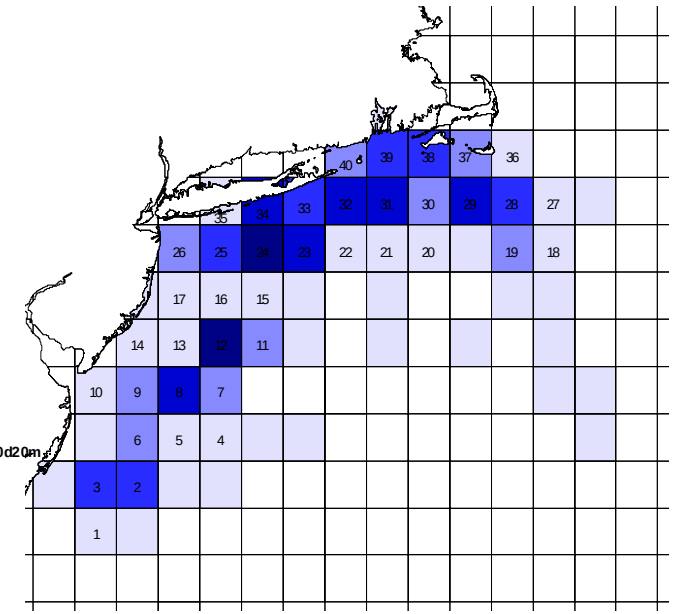
These iterations are continued until the probabilities do not change. This is then the new distribution of the fleet.

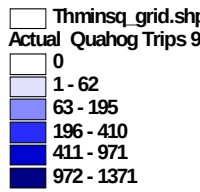
Simulated Effects of Policies

Option 3 (Close Areas East of 70º20’)
: Quahog Predicted Responses

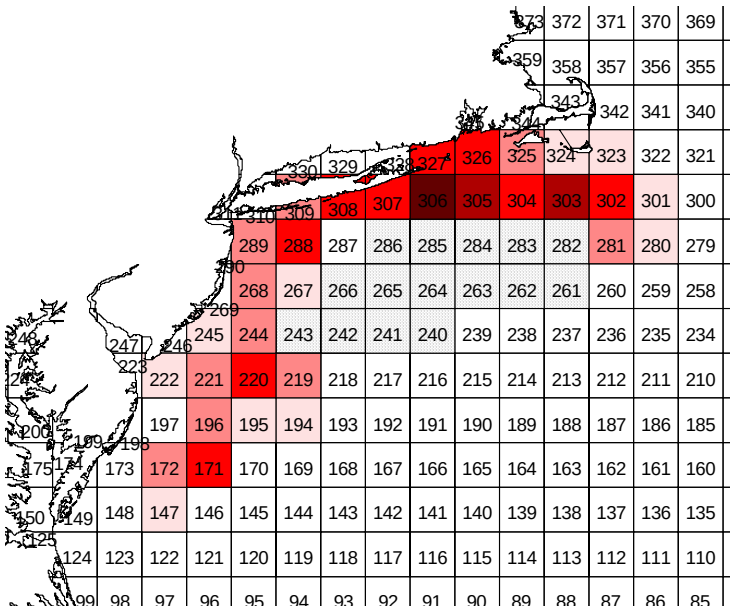


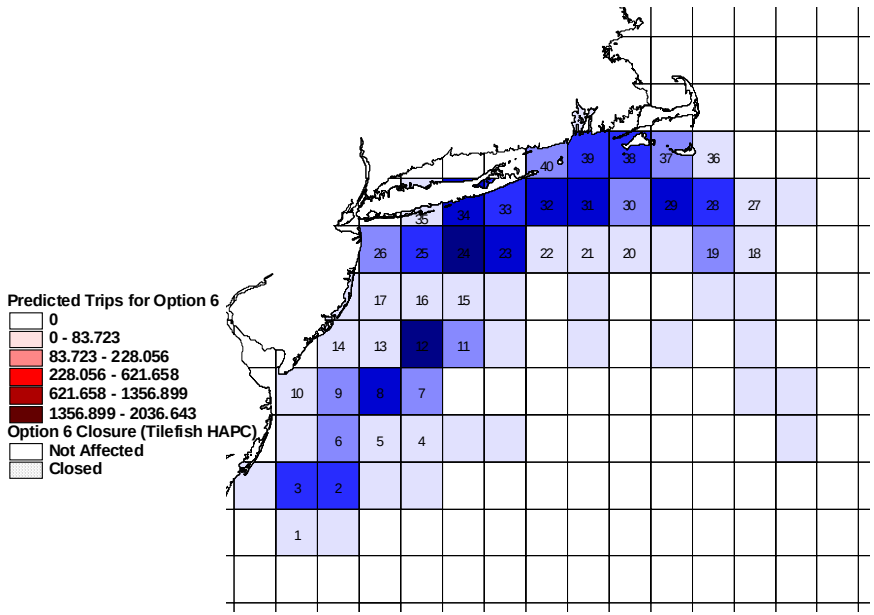




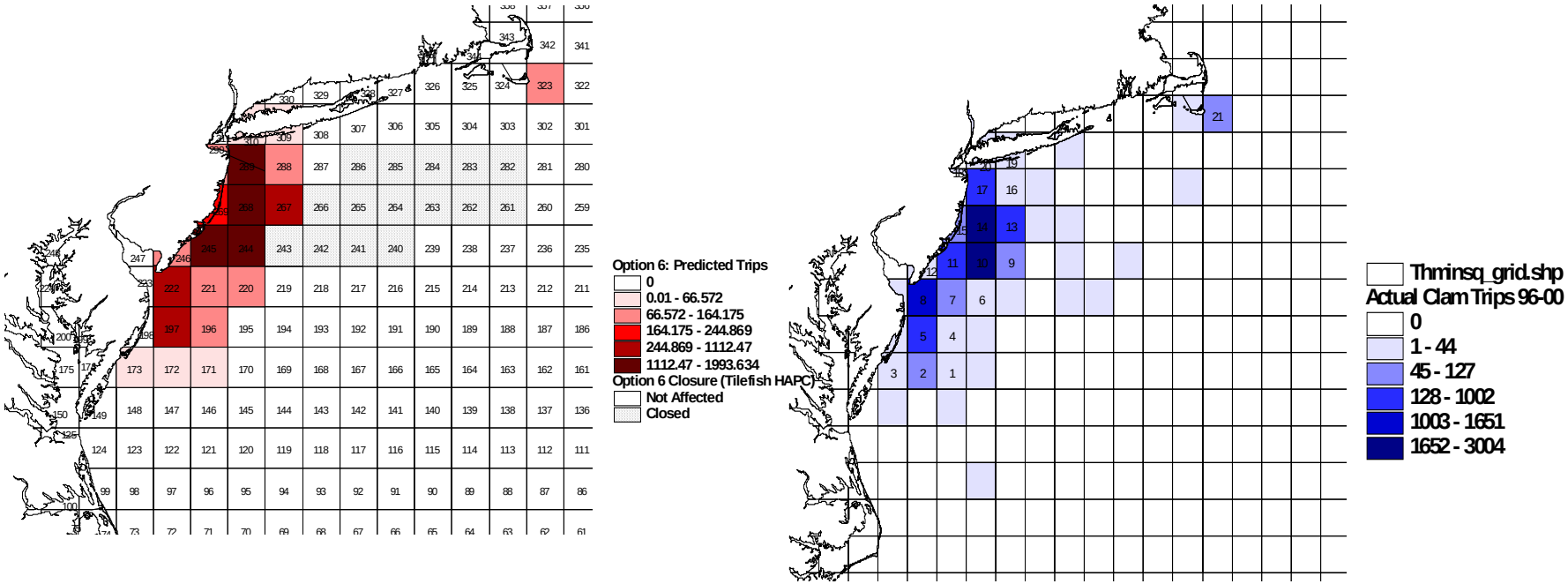


Option 6 (Close Tilefish Area):
Quahog Predicted Responses





Option 6: Surf clam predicted responses



Welfare measure

$$EV = \left\{ EV \,|\, V^1(W^0 + E(\pi^0), \sigma_a^2(\pi)^0) = V^0(W^0 + E(\pi^0) + EV, \sigma_a^2(\pi)^0) \right\}$$

$$= \left\{ EV \,|\, log\left(\sum_{a \in A'} e^{U_a(W^0 + E(\pi_a^0), \sigma_a^2(\pi_a)^0} \right) = log\left(\sum_{a \in A} e^{U_a(W^0 + E(\pi_a^1) + EV, \sigma_a^2(\pi_a)^0} \right) \right\}$$

Welfare Effects

		Per Trip EV	Trips	Total EV
Surf Clam	Option 2	0	2114	0
	Option 3	$2	2114	$4,228
	Option 6	$71	2114	$150,094
	Option 8	0	2114	0
Quahog	Option 2	0	2137	0
	Option 3	$1,065	2137	$2,275,905
	Option 6	$2,637	2137	$5,635,269
	Option 8	0	2137	0
Maine Quahog	Option 2	0	1898	0
	Option 3	Complete Closure	0	Complete Closure
	Option 6	0	1898	0
	Option 8	$888	1898	$1,685,424

What we did not discuss include:

- Impacts on the processor/consumer
- Benefits of the regulations

Conclusions:

EFH designations to protect marine species can be costly to commercial fisheries in the short run.

Our model allows anglers to re-optimize their current choice when faced with closures by making a guess as to what the rest of the fleet may do and then choose their best area accordingly. While crowding did not prove to be a major driver of area choice in this case, there may be other fisheries for which this could be a significant problem.

More research needed into the manner in which variation in expected returns is modeled.