

Analyzing the proposed  
measures for minimizing to the  
extent practicable the adverse  
effects from fishing on fish  
habitat

NEFMC Habitat Ctte

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# Outline

- Review:  $Z_{\text{net}}$ , X and E
- Proposed measures
- Methods and Results
  - Closure removal options
  - Closure options
  - Gear modification options
- Conclusions

# Review: $z_{net}$

Total accumulated adverse effect for each fishing trip

- Sums  $Z$  across all years of durable effect (i.e. until the affect is no longer felt)
- Provides one number summarizing the total adverse effect from a unit of fishing, allowing comparison across tows, trips, gears, etc.

$$z_{ip}^{net} = \sum_{t=1}^n z_{ip}$$

# Review: $x$

## Profit generated from each fishing event

- Product of revenues and variable trip costs
  - Variable trip costs do not include, for groundfish or GC scallop, costs associated with obtaining quota
  - No revenue or cost data for the SC/OQ gear type
- Trip costs based on model derived from obs data

$$x_{ip} = (r - c)_{ip}$$

# Review: $e$

## Cost-efficiency ratio

- Cost (adverse effect) to Benefit (profit)
- Profits reported in \$1,000
- Helps to understand trade-offs between minimizing adverse effects and the financial benefits derived from fishing

*“How much adverse effect can we abate per dollar”*

$$e_{ip} = \left( \frac{z^{net}}{x} \right)_{ip}$$

# Proposed measures

## Closure removal

- Measures for Georges Bank habitat closed areas
  - *Eliminate CAll habitat closed area Eliminate*
  - *CAI habitat closed area(s)*
  - *Eliminate NLCA habitat closed area*
- Measures for the WGOM habitat closed area
  - *Eliminate WGOM habitat closed area*
- Measures for the Georges Bank mortality closures
  - *Open non-spawning areas within mortality closures to fishing year round*
  - *Open mortality closures year round, with specific seasonal spawning closures*

# Proposed measures

## Closure:

- Measures for Georges Bank LISA clusters 5, 6 & 7
  - Cluster 5 (Georges Shoals)
    - *Close to all mobile bottom-tending gear*
    - *Close to all trawl gear*
  - Cluster 6 (Great South Channel)
    - *Close to all mobile bottom-tending gear*
    - *Close to all trawl gear*
  - Cluster 7 (Brown's Ledge)
    - *Close to all mobile bottom-tending gear*
    - *Close to all trawl gear*

# Proposed measures

## Closure:

### – Measures for SBNMS

- *Closed to all bottom-tending gear*
- *Closed to all mobile bottom-tending gear*
- *Closed to selected mobile-bottom tending gear*



# Proposed measures

## Gear modification

- Measures for the WGOM habitat closed area
  - *Change gear restrictions in WGOM habitat closed area*
- Measures to reduce adverse effects via gear restrictions
  - Implement roller gear maximum sizes in cluster areas 1, 3, and 4
    - *12 inch maximum diameter*
    - *20 inch maximum diameter*
    - *28 inch maximum diameter*
  - Implement ground cable length maximum sizes in cluster areas 1, 3, and 4

# Methods – Closure removal options

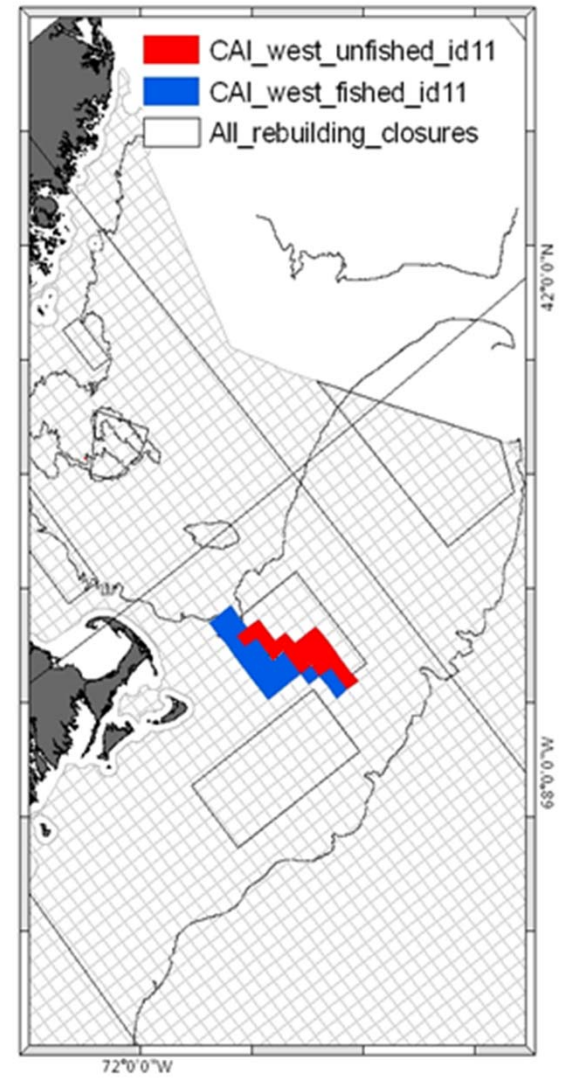
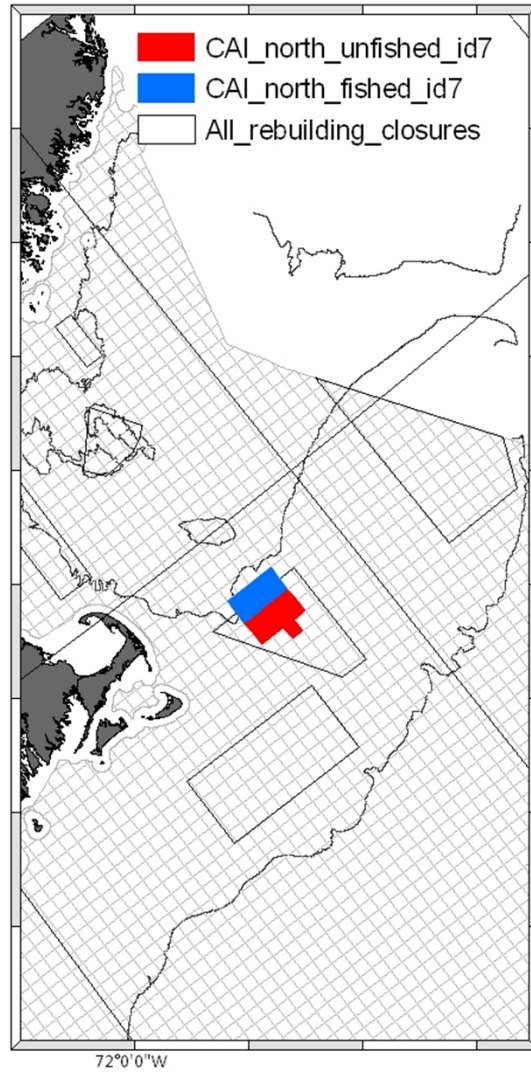
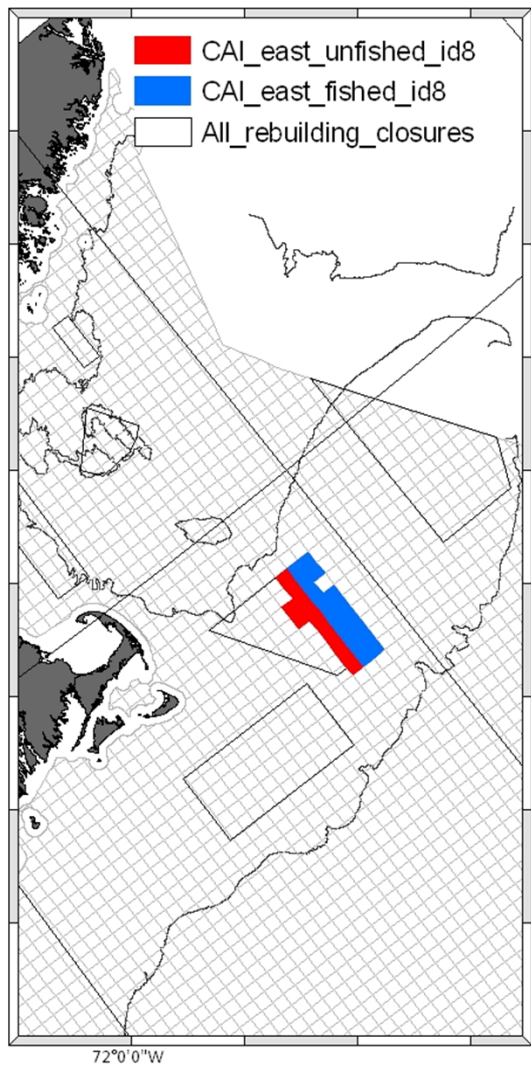
- With exception of *Measures for the Georges Bank mortality closures*, all options are for removal of *Habitat Closure* designation only
- Actual first-order impact of these options is **zero change** for anyone—fishing still not permitted without additional regulation
- Analysis here is for the reasonably foreseeable future action of, for example, an SAP within each area
- Focus is on the operational closure (mortality) and not necessarily habitat closure boundaries

# Methods – Closure removal options

Problem: *no (or little) empirical data to base assumptions on what happens when fishing is allowed inside a previously closed area*

Solution:

- Compare portions of previously closed areas to similar fishable areas (proximate open areas) for all years 1996-2009 averaged
- Define 11 different areas as proximate open/closed



# Methods – Closure removal options

Must fill in for missing data by answering three questions:

1. How much different will adverse effects be in the areas potentially being opened?
2. How much different will catch rates be?
3. How much effort will flow into these areas?

# Question 1, vulnerability

*Assumption: Vulnerability of previously closed areas is somewhat different than that observed in proximate open areas*

1. Compare the  $Z_{inf}$  estimates between proximate open and closed areas
2. Apply correction for  $Z^{net}$  estimates from the mean open area value as the new mean unfished area value

# Question 1, vulnerability

Average pct\_z\_inf\_difference

Row Labels	GC Scal Dr	Gillnet	Hydraulic Dr	LA Scal Dr	Longline	Otter trawl	Pot/Trap	Raised trawl	Shrimp trawl	Squid trawl
Cashes	-1.62%	-1.01%	0.93%	-1.62%	-0.83%	-3.56%	0.25%	-3.56%	-3.56%	-3.56%
Closed Area 1 East	-2.94%	-3.76%	-2.25%	-2.94%	-4.68%	0.16%	-2.99%	0.16%	0.16%	0.16%
Closed Area 1 North	3.17%	0.96%	9.68%	3.17%	1.15%	4.83%	2.82%	4.83%	4.83%	4.83%
Closed Area 1 West	4.48%	3.84%	1.63%	4.48%	3.97%	5.35%	3.28%	5.35%	5.35%	5.35%
Closed Area 2 Central	-0.87%	0.59%	1.38%	-0.87%	-0.02%	-0.67%	-0.60%	-0.67%	-0.67%	-0.67%
Closed Area 2 North	3.77%	1.56%	7.28%	3.77%	1.44%	4.65%	3.75%	4.65%	4.65%	4.65%
Closed Area 2 South	1.96%	1.12%	7.22%	1.96%	1.53%	2.05%	1.28%	2.05%	2.05%	2.05%
Jeffries	2.85%	5.05%	-6.81%	2.85%	4.98%	3.25%	7.29%	3.25%	3.25%	3.25%
NLCA East	4.21%	3.47%	1.87%	4.21%	3.93%	11.80%	3.18%	11.80%	11.80%	11.80%
NLCA West	-3.26%	0.11%	0.03%	-3.26%	-0.17%	-2.01%	5.14%	-2.01%	-2.01%	-2.01%
WGOM	-3.97%	-1.39%	-2.59%	-3.97%	-1.27%	-2.30%	0.11%	-2.30%	-2.30%	-2.30%

# Question 2, catch rates

Assumption: *catch rates likely to be higher in unfished areas, at least in short term*

1. Model per-unit expected profit from unfished areas based on realized per-unit profits from proximate fished areas,
2. Apply factor adjustment of btwn 0 and 50% to these estimates
  - higher for scallop dredge gears in certain areas



# Question 3, effort shifts

*Assumption: an unknown amount of effort will be drawn into newly opened areas and this will draw effort off of previously opened areas*

1. Model total expected profit from unfished areas based on realized total profits from proximate fished areas
2. Apply factor adjustment of btwn 1 and 5 times as much total profits coming from inside the newly opened CA

# Results – closure removal

## High and Low estimates

### – High:

- Catch rates increase btwn 0 and 50%
- Effort inside is multiple of btwn 1 and 5 of the proximate outside effort

### – Low:

- Catch rates increase btwn 0 and 25%
- Effort inside is multiple of btwn 1 and 2 of the proximate outside effort

# Results – closure removal

Unfished area	Total Z_net	High estimate		Low estimate	
		Change in total after single-area opening	% change	Change in total after single-area opening	% change
Cashes	158,882	(5,183)	-8.8%	(420)	-2.2%
Closed Area 1 East	158,882	(5,510)	-4.1%	(1,315)	-1.6%
Closed Area 1 North	158,882	(3,000)	-2.3%	(245)	-1.5%
Closed Area 1 West	158,882	(6,248)	-7.0%	(1,303)	-2.3%
Closed Area 2 Central	158,882	(7,734)	-2.2%	(907)	-0.7%
Closed Area 2 North	158,882	(4,247)	-11.3%	319	-3.7%
Closed Area 2 South	158,882	(6,530)	-1.6%	(2,091)	-0.8%
Jeffries	158,882	(278)	-0.5%	129	0.1%
NLCA East	158,882	(4,265)	-5.6%	(1,030)	-2.2%
NLCA West	158,882	(3,902)	-5.4%	1,311	-1.6%
WGOM	158,882	(1,446)	-6.6%	599	-0.2%

# Methods – closure options

- Similar, but using  $Z^{\text{net}}$  and  $e$  data averaged over 2007-2009
- Sum profit and  $Z^{\text{net}}$  that occurred inside potential closure cells and remove it from the total
- Re-distribute the profits proportional to average per-cell profits for all open areas, scaling for the vulnerability of the open cells
- Calculate the change in total  $Z^{\text{net}}$  after re-distribution

# Methods – closure options

- Restricted to GOM and GB cells only
- Run for Otter Trawl (gear 10) and LA Scallop Dr (gear 20) only
- Assumes all other areas remain closed

# Results – closure options

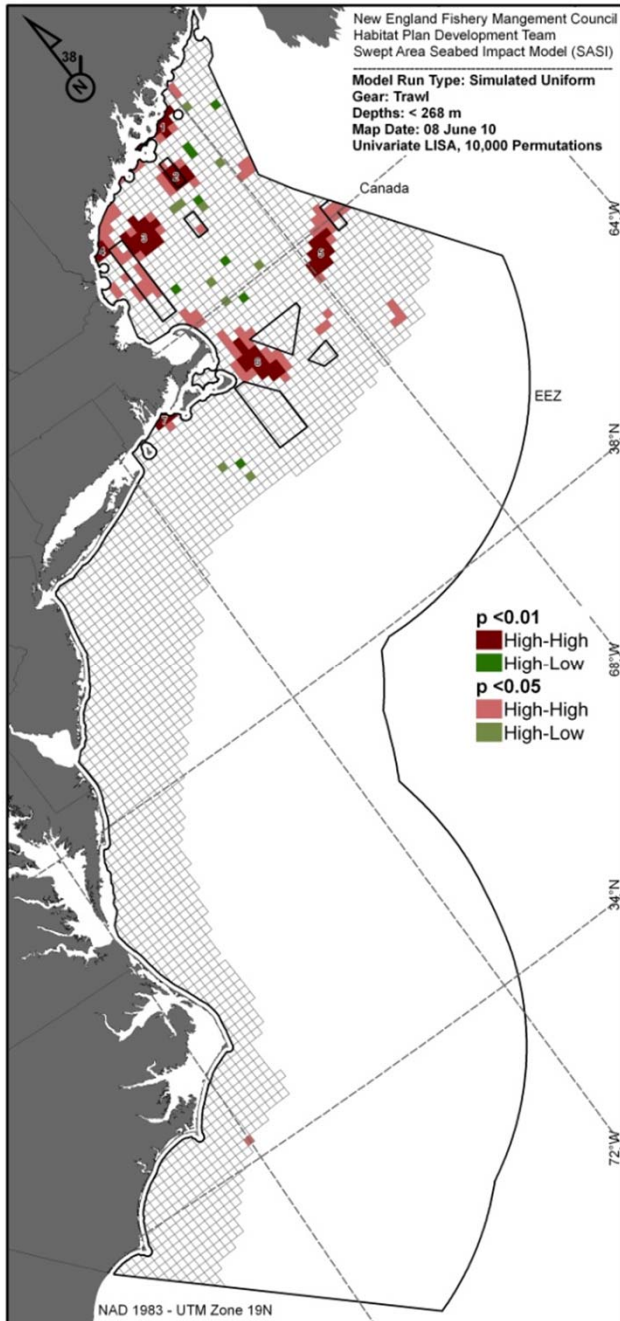
	<b>Pre-closure profit</b>	<b>Profit at risk</b>	<b>Change in z_net</b>	<b>% reduction z_net</b>
<b>Cluster 5</b>	\$163,074	\$7,404	804	1.8%
<b>Cluster 6</b>	\$163,074	\$5,044	1,576	3.6%
<b>Cluster 7</b>	\$163,074	\$310	-46	-0.1%

# Caveats - Nothing has changed

- We don't know everything; need better hard-bottom data in GOM, groundtruthing of vulnerability estimates, research into costs of gear modifications, etc.
- Some parcels highly likely to warrant durable protection
- Must have concrete objectives!
- Fundamentally, minimizing adverse effects = maximizing efficiency\*

*\*in our region, conditional on our assumptions, etc.*

# Parting thoughts



This analysis shows that effort displacement has a greater likelihood of increasing adverse effects than area closures have of abating them

Nothing here should be surprising: same conclusions reached based on ocular analysis of areas of highest vulnerability and areas currently closed