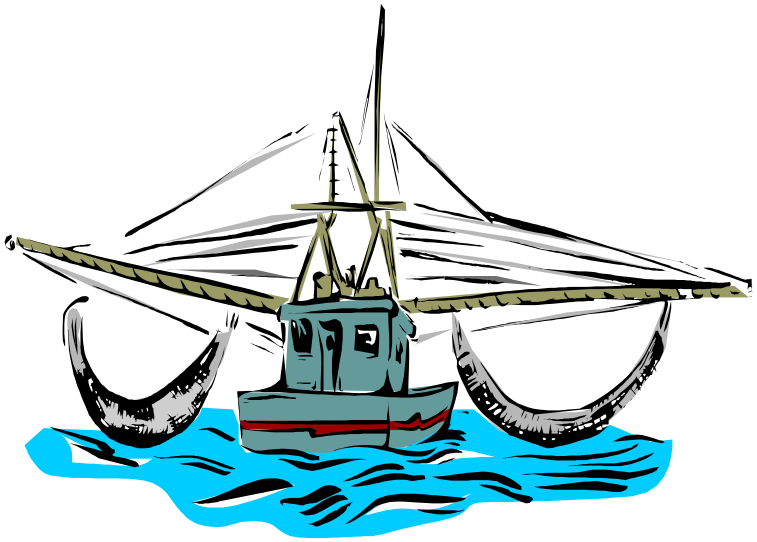
Modeling the Short-Run Impacts of Amendment 13 Management Measures



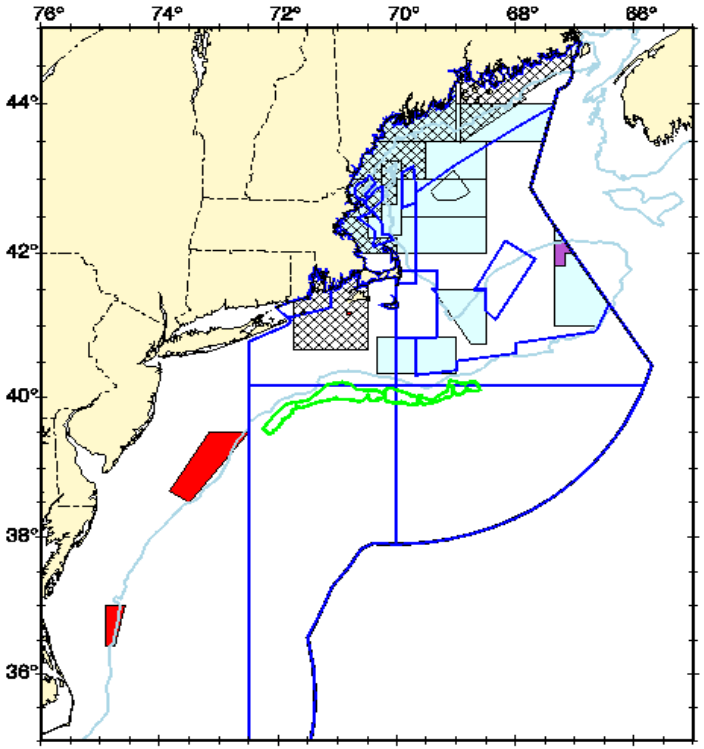
Overview

- Review Management measures considered
- Show Current Area Closure Configurations
- Review History of Area Closure Models
- Review Mortality reductions Needed
- Present NLP Model
- Show How Model was applied to Alternative 1

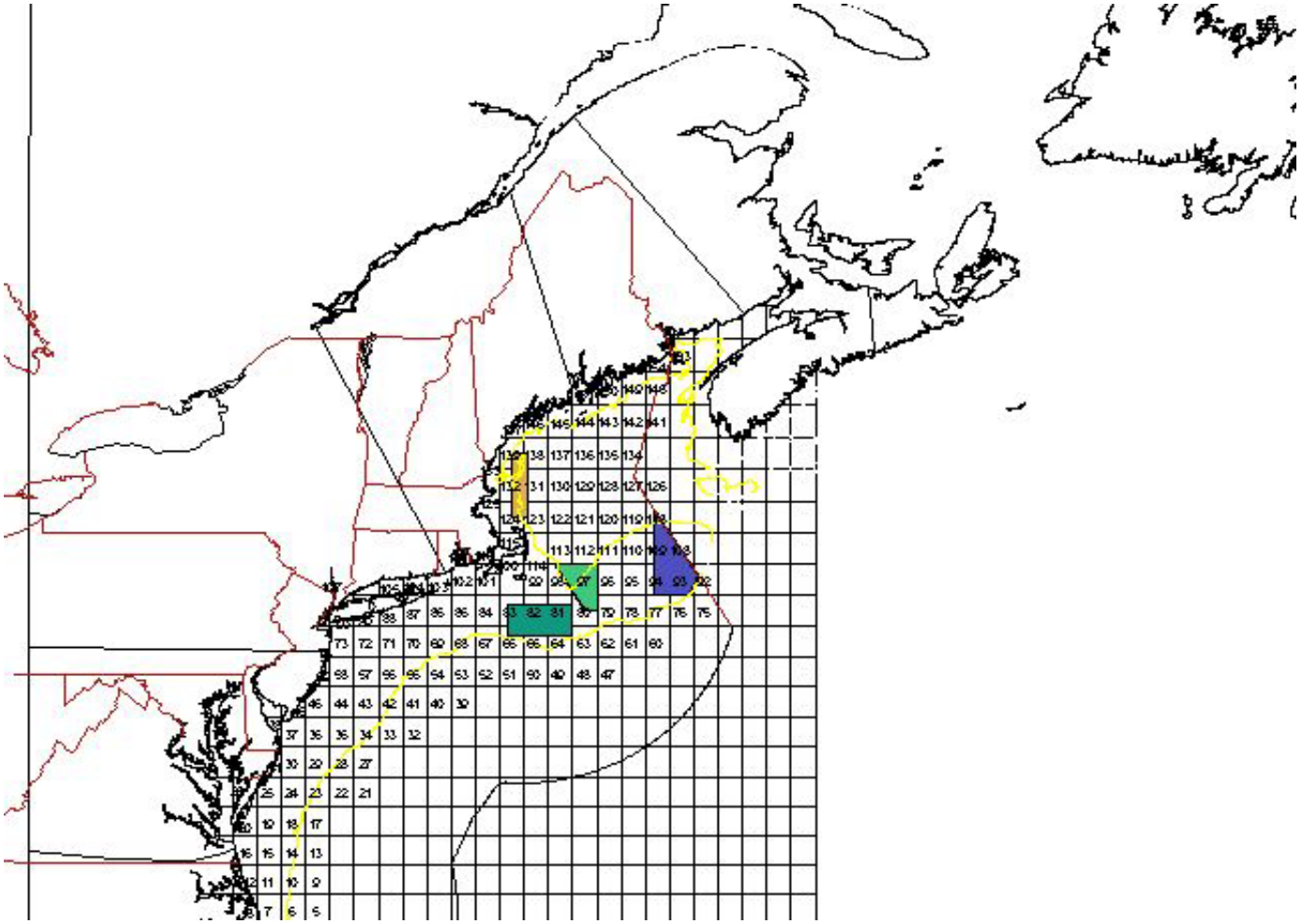
Management Measures Considered during Development of Amendment 13

- Further Area Closures
- Trip Limits
- Days at Sea Reductions
- Gear restrictions, minimum fish sizes

Area Closures in the Northeast Region



Northeast Region Grid Numbering System



History of Groundfish Modeling in the Northeast Region

- Used a simple Mixed Integer Programming model for Amendment 5.
- Expanded this model to a Linear programming Model for Amendment 7.
- Developed a “two-bin” model for Amendment 7.
- Developed a Non-Linear Programming Model for framework actions initiated under Amendment 7, and for reviewing options for Amendment 13.

History (Continued)

- Model is based on an article by Howitt (1995) which first appeared in AJAE, and is called “Positive Mathematical Programming”.
- Model was initially reviewed by the Plan Development Team
- A subsequent review by the Social Sciences Advisory Committee took place in May, 2001.
- A different version of the model was used by Jim Kirkley (VIMS) to look at area closures for the Squid, Mackerel and Butterfish fisheries.

Mortality Reductions Needed for Rebuilding Selected Stocks under Amendment 13.

		Stock Areas		
Species	Stock	Assumed F	F rebuild	Needed Reduction in F
Cod	GB	0.45	0.18	-60%
	GOM	0.36	0.22	-38.89
Haddock	GB	0.2	0.25	+25%
Yellowtail Flounder	GB	0.14	0.23	+64.29
	SNE/MA	0.74	0.18	-75.68
	CC/GOM	0.95	.09	-90.53
American Plaice		0.26	0.15	-42.31
Witch Flounder	No Formal rebuilding program required			
Winter Flounder	GB	No Formal Rebuilding Program required		
	GOM	No Formal Rebuilding Program required		
	SNE/MA	0.45	0.25	-44.44%

Alternative 1

Effort Reduction	Area Closures	Seasonal Closures	Trip Limits
55%	Status-Quo Year Round	March -121,122,123 April 121-125, 129-133 May 124-125, 129-133, 136-140 June 132-133, 139-140, 141-147, 152 October 124,125 November 124,125	●GOM Cod -800 lb/day, 4,000 lb/trip. ●GB Cod – 2,000 lb/day, 20,000 lb/trip ●CC/GOM yellowtail – March1-May 31 250 lb. possession limit. June1-Feb. 28, 750 lb/day, 3,000 pounds per trip

Other Management Measures (non-modeled)

- Net Caps on Both Day and Trip Gillnet Vessels
- Gear restrictions based on area fished for Trawl Vessels
- Limits on total hooks for vessels based on area fished
- Minimum Size Limits by Species
- Changes in F brought about by these measures were estimated and incorporated into the results from the Area Closure model.

Estimating Mortality Changes Under Each Management Option

- Desirable features:
  - A focus on 30 minute square blocks, and monthly time periods.
  - Estimate changes in mortality by species and stock area
  - The ability to incorporate days at sea changes, trip limit changes and area closures simultaneously.
  - A focus on the individual vessel level, and revenue changes.

Math Programming Model

$$Max\ \mathrm{TR}_a = \sum_i \sum_j \sum_s P_{js} * (\beta_{ijs} - \delta ijs * E_{ij}) * E_{ij} \quad (1)$$

s.t.

$$\mathrm{E}_i \leq 30 \quad (2)$$

$$\sum_i \sum_j \mathrm{E}_{ij} \leq EFF \quad (3)$$

$$\mathrm{E}_{ij} \geq 0 \quad (4)$$

Math Programming Model (continued)

- i=month, j=block, s=species
- P=Price
- B=Intercept
- δ=slope coefficient
- E=effort
- EFF = total allowable effort

Data

- Logbook data from the years 1998-2001 were used to determine landings, days at sea and CPUE per block
- Vessel trip data were aggregated to a monthly level in each block
- Price data were based on dealer records for the years 1998-2001.
- Prices were deflated to 1998 levels using the GDP implicit price deflator

Data (Continued)

- 156 blocks, 12 months, 10 species.
- 1,872 distinct choices per vessel.
- Lack of Cost Data on an individual vessel level precluded using a profit maximizing framework.
- Revenue maximizing model may be better choice given the lay systems used for crew payments.
- A formal price model could not be incorporated because the models developed are on an annual, not monthly basis.

Procedure

- **Run Model with the status-quo management options**
- **Run model again with the proposed new management options**
- **Compare landings under proposed management options and status quo to determine change in exploitation.**
- **Changes in revenue and distributional impacts were also provided.**
- **Model results should be interpreted as an ordinal ranking of alternatives. Information from the model helps managers choose alternative.**

Change in Exploitation Rates from Alternative 1

			Stock Areas				
		GOM	GB	SNE	CAPE	Mid-Atlantic	Other
Cod		-45.5	-43.4				
Haddock		-47.7	-44.2				
Winter Flounder		-50.6	-36.3	-58.3			
Yellowtail Flounder			-38.9		-60.3	-72.7	
Windowpane Flounder		-31.6					
American Plaice							-52.9
Witch Flounder							-50.6
Pollock							-42.3
Redfish							-49.3
White Hake							-47.7

Limitations

- Model only allows vessel effort to shift into areas or times where the vessel has previously fished. Mortality reductions and revenue losses may be overestimated.
- Non-linear programming model assumes “perfect” planning and foresight. Will maximize revenue for every vessel in the model.
- Did not integrate non-groundfish activity in model, due to model size.
- Latent effort could not be incorporated into model.
- Provides an ordinal ranking of alternatives, not precise point estimates of impacts.

Summary

- **Suite of Management Measures for Amendment 13 was analyzed using a non-linear math programming model.**
- **Model should be viewed as a yearly planning tool, and not one that gives advice for a long time horizon.**
- **Model should be used to rank alternatives with regard to mortality reductions, but planners should recognize the uncertainty around the estimates.**