CIMAS

Cooperative Institute for Marine and Atmospheric Studies

Modeling effects of fishing closures in the Western Florida Shelf

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UNIVERSITY OF MIAMI

NOAA

Sea Grant
NOAA National Sea Grant College Program

CCS High Performance Computing

Outline

- Effects of fishing closures
- DWH Fishing closures
- Resources/fleets affected
- Evaluating impacts of DWH fishing closures
  - Spatial model of West Florida Shelf
    - Dynamic of fishing fleets
    - Reef fish dynamics
  - Other models

Effects of fishing closures on living resources

- Reduces or eliminates fishing mortality in a given area/period
  - Target species
  - Bycatch
- Reduces or eliminates impacts of fishing in habitat (if any are associated)
- May redirect fishing to other areas/period

Effects of fishing closures on fishery stakeholders

- Changes fleet operations
  - Revenue and cost
  - Schedules
    - Commercial fishers
    - Recreational fishers
    - Recreational fishing providers
- Changes availability of seafood products
  - For consumers
  - For processors
- Monitoring and enforcing requirements

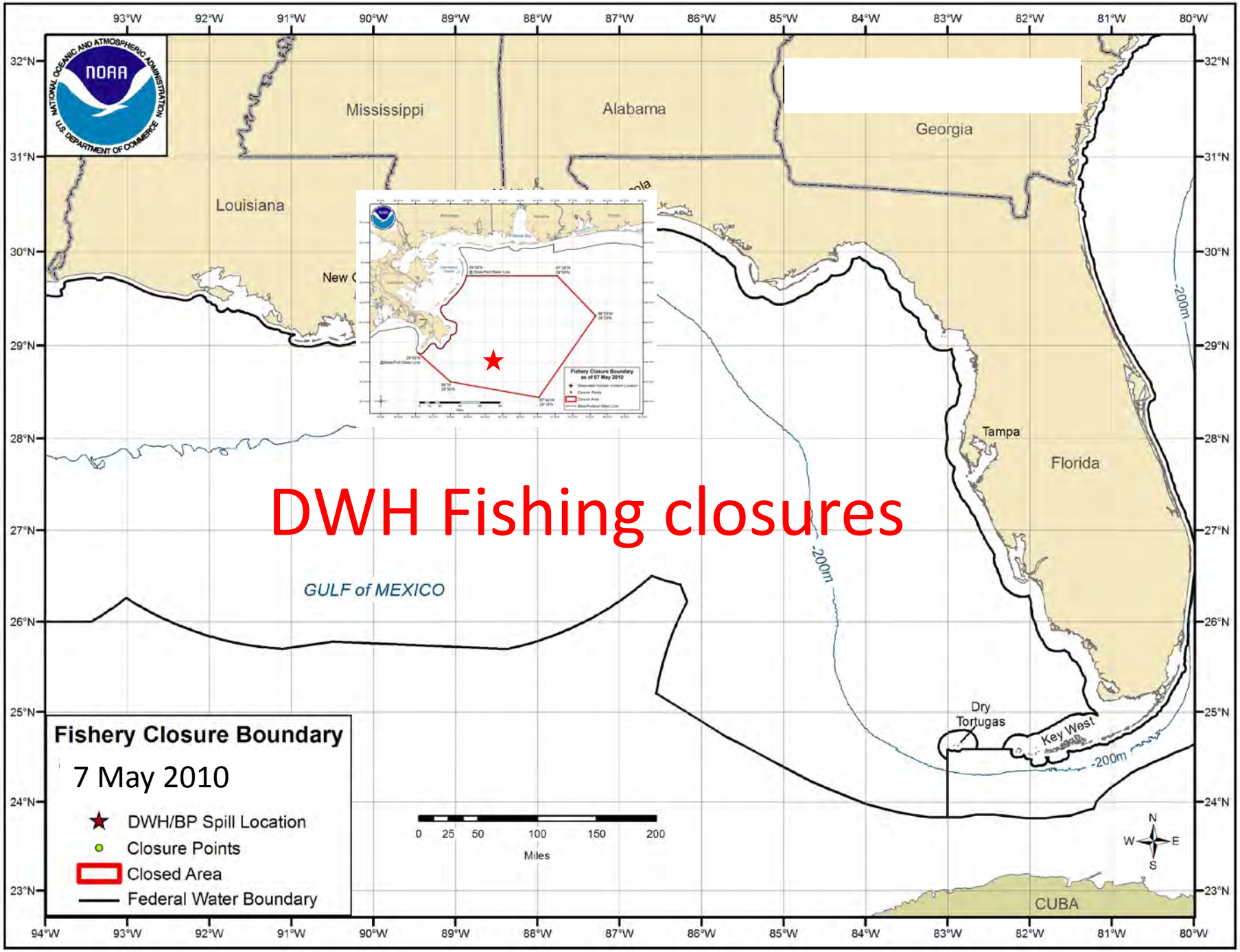
DWH fishing closures: human health risk management

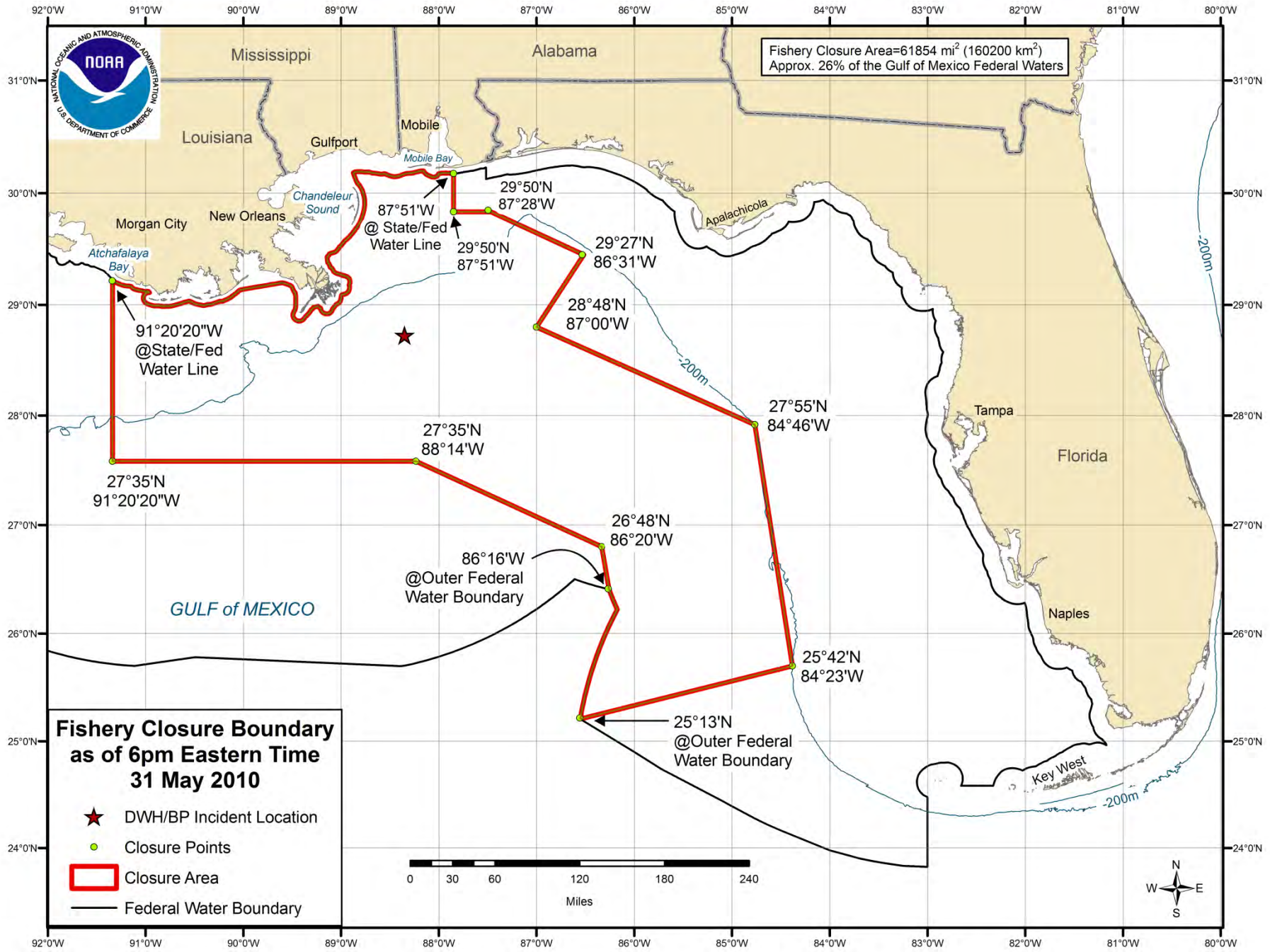
Effects of fishing closures on fishery stakeholders

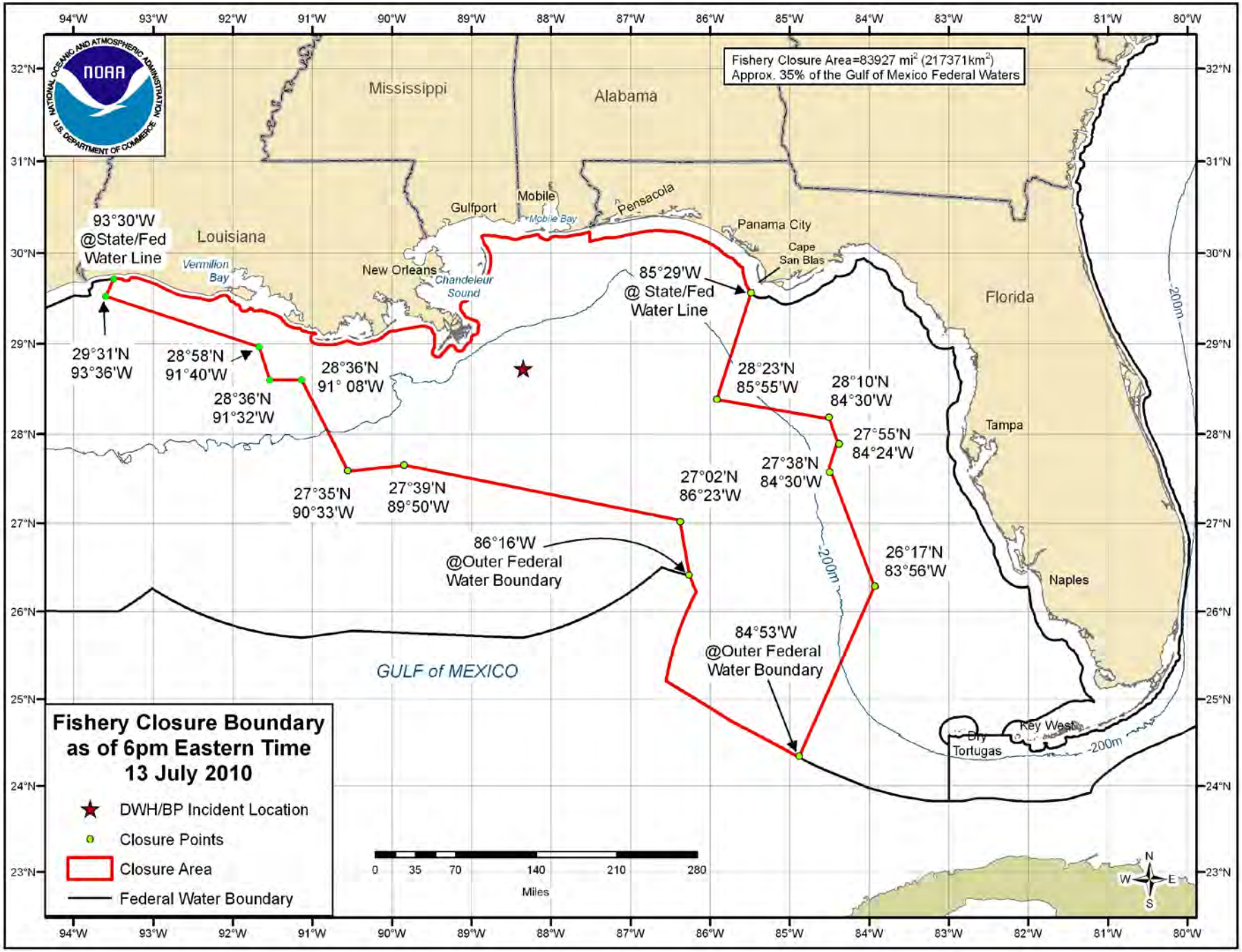
- Changes fleet operations
  - Revenue and cost
  - Schedules
    - Commercial fishers
    - Recreational fishers
    - Recreational fishing providers

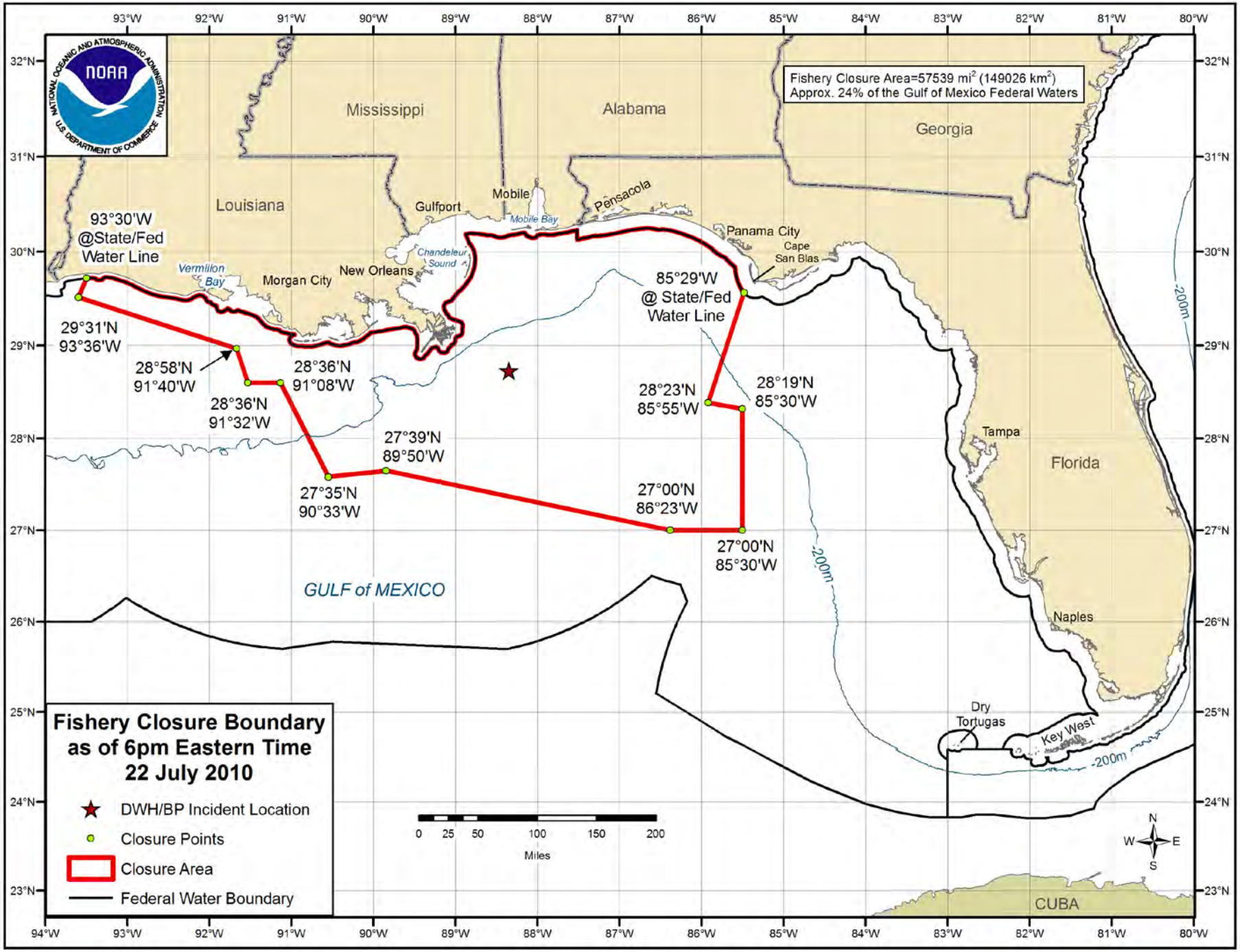
- Changes availability of seafood products
  - For consumers
  - For processors

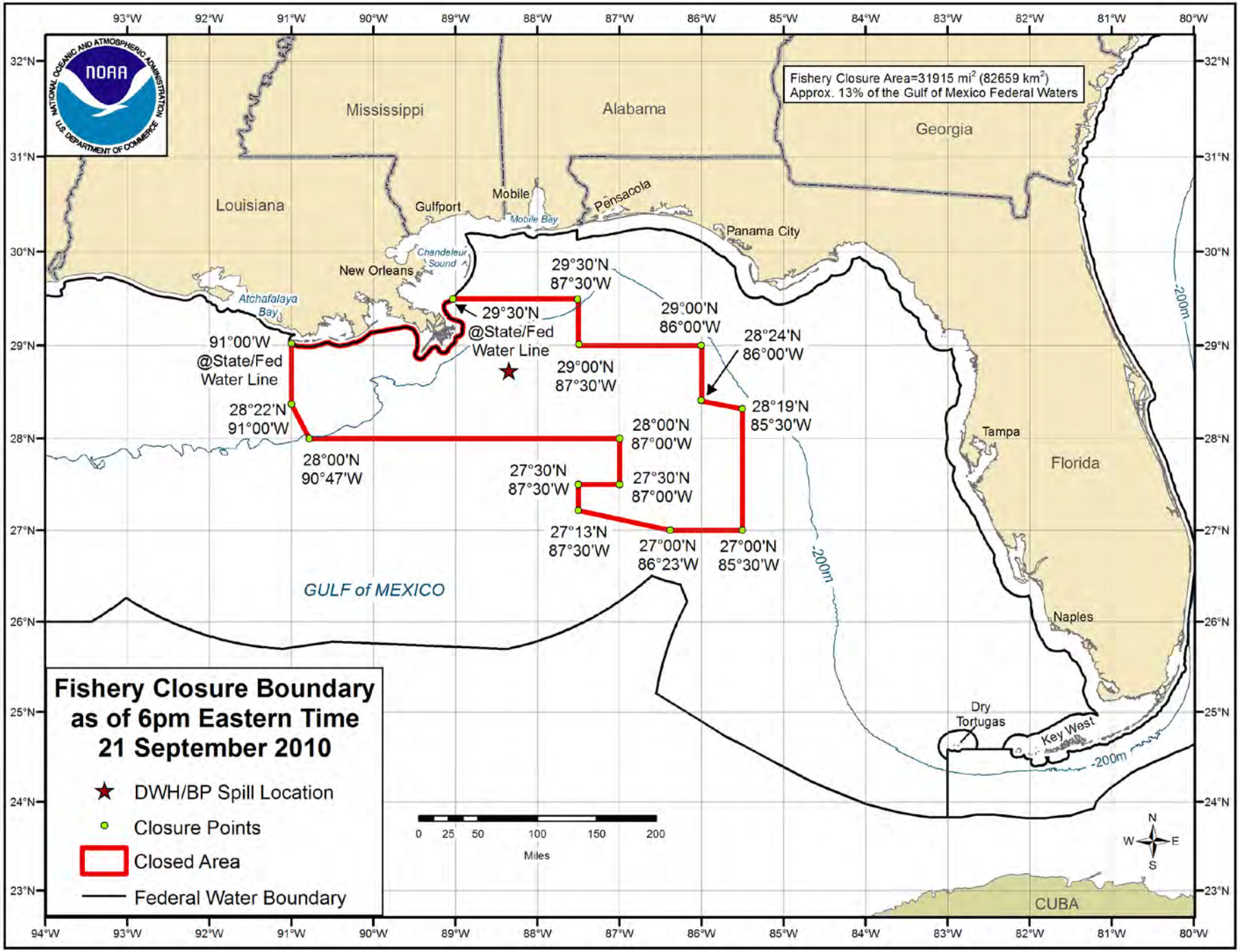
- Monitoring and enforcing requirements

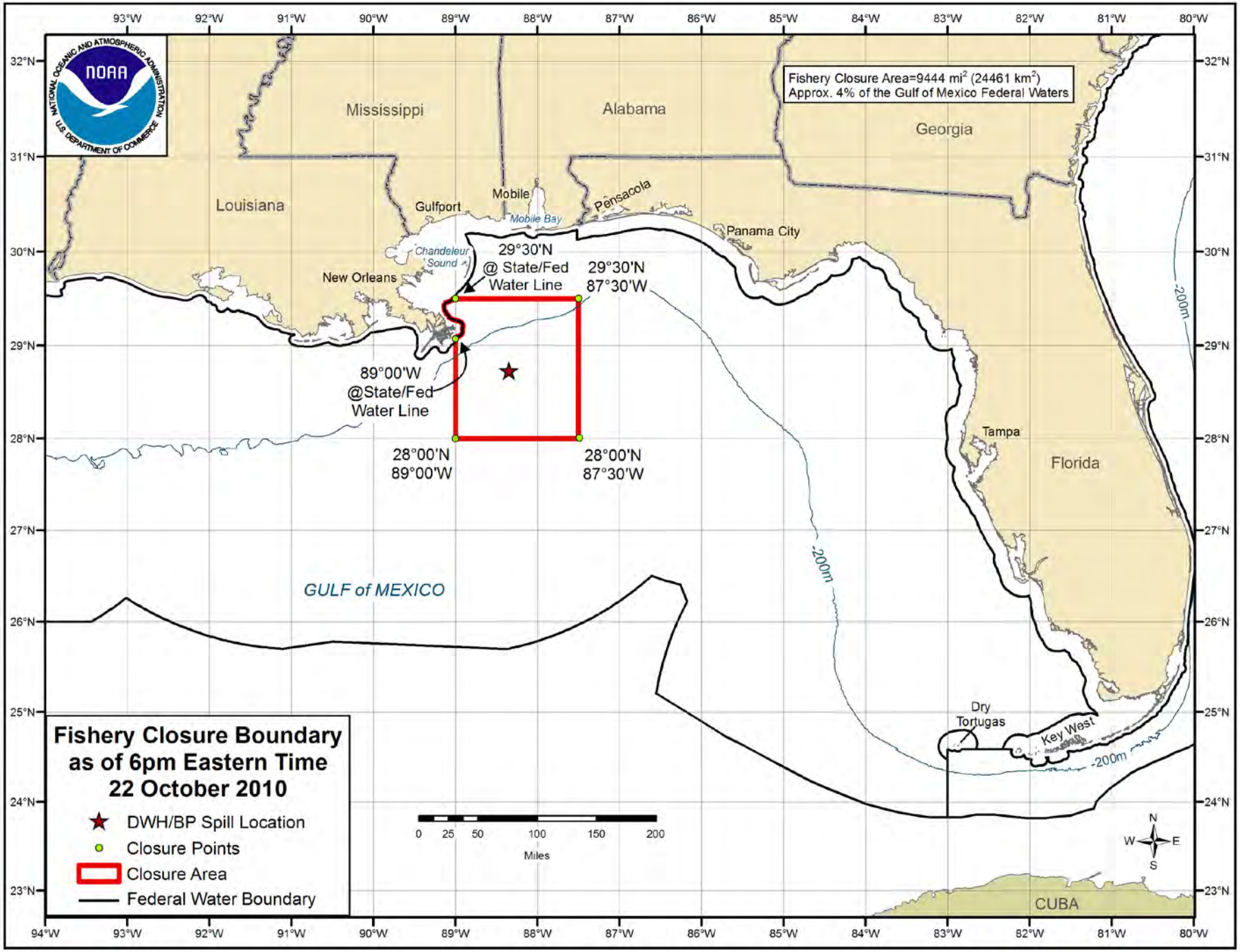

DWH Fishing closures
Mississippi
Alabama
Georgia
Louisiana
Florida
Tampa
Key West
Dry Tortugas
CUBA
GULF of MEXICO
-200m
Fishery Closure Boundary
7 May 2010
DWH/BP Spill Location
Closure Points
Closed Area
Federal Water Boundary
0 25 50 100 150 200
Miles
N
W
E
S


Fishery Closure Area=61854 mi² (160200 km²)
Approx. 26% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Chandeleur Sound
New Orleans
Morgan City
Atchafalaya Bay
Apalachicola
Tampa
Naples
Key West
-200m
GULF of MEXICO
87°51'W @ State/Fed Water Line
29°50'N 87°28'W
29°50'N 87°51'W
29°27'N 86°31'W
28°48'N 87°00'W
27°55'N 84°46'W
25°42'N 84°23'W
25°13'N @Outer Federal Water Boundary
86°16'W @Outer Federal Water Boundary
26°48'N 86°20'W
27°35'N 88°14'W
27°35'N 91°20'20"W
91°20'20"W @State/Fed Water Line
Fishery Closure Boundary as of 6pm Eastern Time 31 May 2010
DWH/BP Incident Location
Closure Points
Closure Area
Federal Water Boundary
0 30 60 120 180 240
Miles
N
W
E
S


Fishery Closure Area=83927 mi² (217371km²)
Approx. 35% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Panama City
Cape San Blas
New Orleans
Vermilion Bay
Chandeleur Sound
Tampa
Naples
Key West
Dry Tortugas
GULF of MEXICO
93°30'W @State/Fed Water Line
29°31'N 93°36'W
28°58'N 91°40'W
28°36'N 91°32'W
28°36'N 91° 08'W
27°35'N 90°33'W
27°39'N 89°50'W
86°16'W @Outer Federal Water Boundary
85°29'W @ State/Fed Water Line
28°23'N 85°55'W
28°10'N 84°30'W
27°55'N 84°24'W
27°38'N 84°30'W
27°02'N 86°23'W
26°17'N 83°56'W
84°53'W @Outer Federal Water Boundary
-200m
Fishery Closure Boundary as of 6pm Eastern Time 13 July 2010
DWH/BP Incident Location
Closure Points
Closure Area
Federal Water Boundary
0 35 70 140 210 280
Miles
N
W
E
S


Fishery Closure Area=57539 mi² (149026 km²)
Approx. 24% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Georgia
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Panama City
Cape San Blas
Chandeleur Sound
New Orleans
Morgan City
Vermilion Bay
Tampa
Naples
Key West
Dry Tortugas
CUBA
GULF of MEXICO
-200m
93°30'W @State/Fed Water Line
29°31'N 93°36'W
28°58'N 91°40'W
28°36'N 91°32'W
28°36'N 91°08'W
27°35'N 90°33'W
27°39'N 89°50'W
27°00'N 86°23'W
27°00'N 85°30'W
28°23'N 85°55'W
28°19'N 85°30'W
85°29'W @ State/Fed Water Line
Fishery Closure Boundary as of 6pm Eastern Time 22 July 2010
DWH/BP Incident Location
Closure Points
Closure Area
Federal Water Boundary
0 25 50 100 150 200
Miles
N
W
E
S


Fishery Closure Area=31915 mi² (82659 km²)
Approx. 13% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Georgia
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Panama City
New Orleans
Chandeleur Sound
Atchafalaya Bay
Tampa
Naples
Dry Tortugas
Key West
CUBA
GULF of MEXICO
-200m
29°30'N 87°30'W
29°30'N @State/Fed Water Line
91°00'W @State/Fed Water Line
29°00'N 86°00'W
28°24'N 86°00'W
29°00'N 87°30'W
28°19'N 85°30'W
28°22'N 91°00'W
28°00'N 87°00'W
28°00'N 90°47'W
27°30'N 87°30'W
27°30'N 87°00'W
27°13'N 87°30'W
27°00'N 86°23'W
27°00'N 85°30'W
Fishery Closure Boundary as of 6pm Eastern Time 21 September 2010
DWH/BP Spill Location
Closure Points
Closed Area
Federal Water Boundary
0 25 50 100 150 200
Miles
N
W
E
S


Fishery Closure Area=9444 mi² (24461 km²)
Approx. 4% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Georgia
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Panama City
Chandeleur Sound
New Orleans
Tampa
29°30'N
@ State/Fed
Water Line
29°30'N
87°30'W
89°00'W
@State/Fed
Water Line
28°00'N
89°00'W
28°00'N
87°30'W
GULF of MEXICO
-200m
Dry Tortugas
Key West
CUBA
0 25 50 100 150 200
Miles
N
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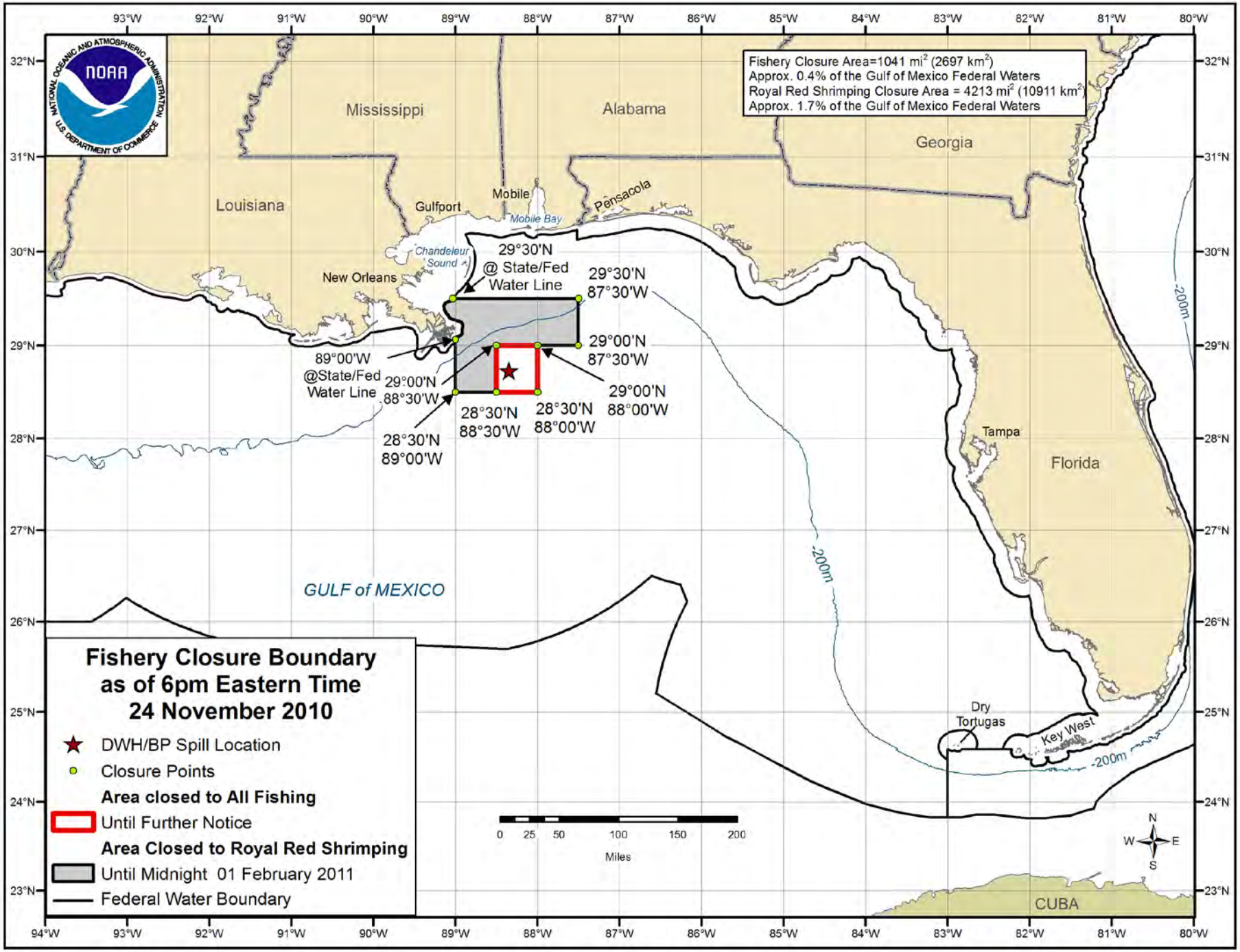
S
Fishery Closure Boundary
as of 6pm Eastern Time
22 October 2010
DWH/BP Spill Location
Closure Points
Closure Area
Federal Water Boundary


Fishery Closure Area=1041 mi² (2697 km²)
Approx. 0.4% of the Gulf of Mexico Federal Waters
Royal Red Shrimping Closure Area = 4213 mi² (10911 km²)
Approx. 1.7% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Georgia
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Chandeleur Sound
New Orleans
Tampa
Dry Tortugas
Key West
CUBA
GULF of MEXICO
-200m
29°30'N @ State/Fed Water Line
29°30'N 87°30'W
29°00'N 87°30'W
89°00'W @State/Fed Water Line
29°00'N 88°30'W
29°00'N 88°00'W
28°30'N 88°30'W
28°30'N 88°00'W
28°30'N 89°00'W
Fishery Closure Boundary as of 6pm Eastern Time 24 November 2010
DWH/BP Spill Location
Closure Points
Area closed to All Fishing
Until Further Notice
Area Closed to Royal Red Shrimping
Until Midnight 01 February 2011
Federal Water Boundary
0 25 50 100 150 200
Miles
N
W
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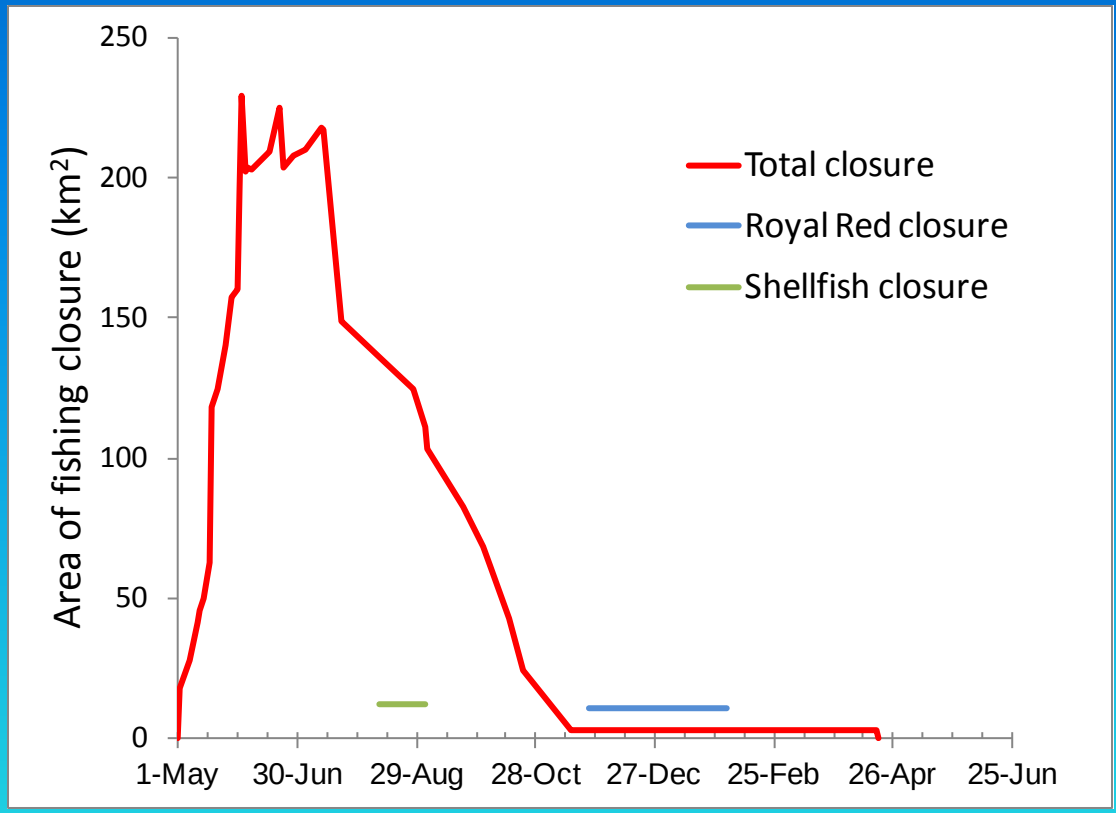
S

Summary of fishing closures

- Highly dynamic closure:
  - Changed boundaries every few days/weeks
  - Ranged from 2,697 km^2 to 229,270 km^2 (35% of GOM federal waters)
  - Started in early May 2010 ended mid April 2011
- There were also closures of state waters



Resources affected

Federally managed stocks in the GOM

(GMFMC)

- mackerels (3)
- snappers (14)
- groupers (15)
- tilefish (5)
- jacks (4)
- sand perches (2)
- triggerfish
- hogfish

- shrimp (4)
- lobsters (2)
- crabs (2)

(HMS)

- Tunas (8)
- Billfish (6)
- Dolphinfish
- Wahoo
- Sharks and rays (72)

State managed species

- snook
- tarpon
- seatrout
- bonefish

- menhaden
- oysters

Fleets affected

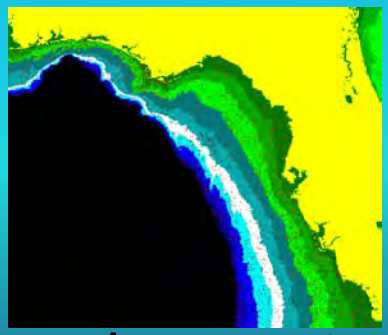
- Shrimp trawl
- Menhaden purse seine
- Reef fish longline
- Reef fish handline
- Coastal gillnet
- Pelagic longline
- Oyster dredge
- Lobster/crab trap
- Estuarine recreational

- Rod and reel reef fish
- Rod and reel estuary
- Rod and reel pelagic

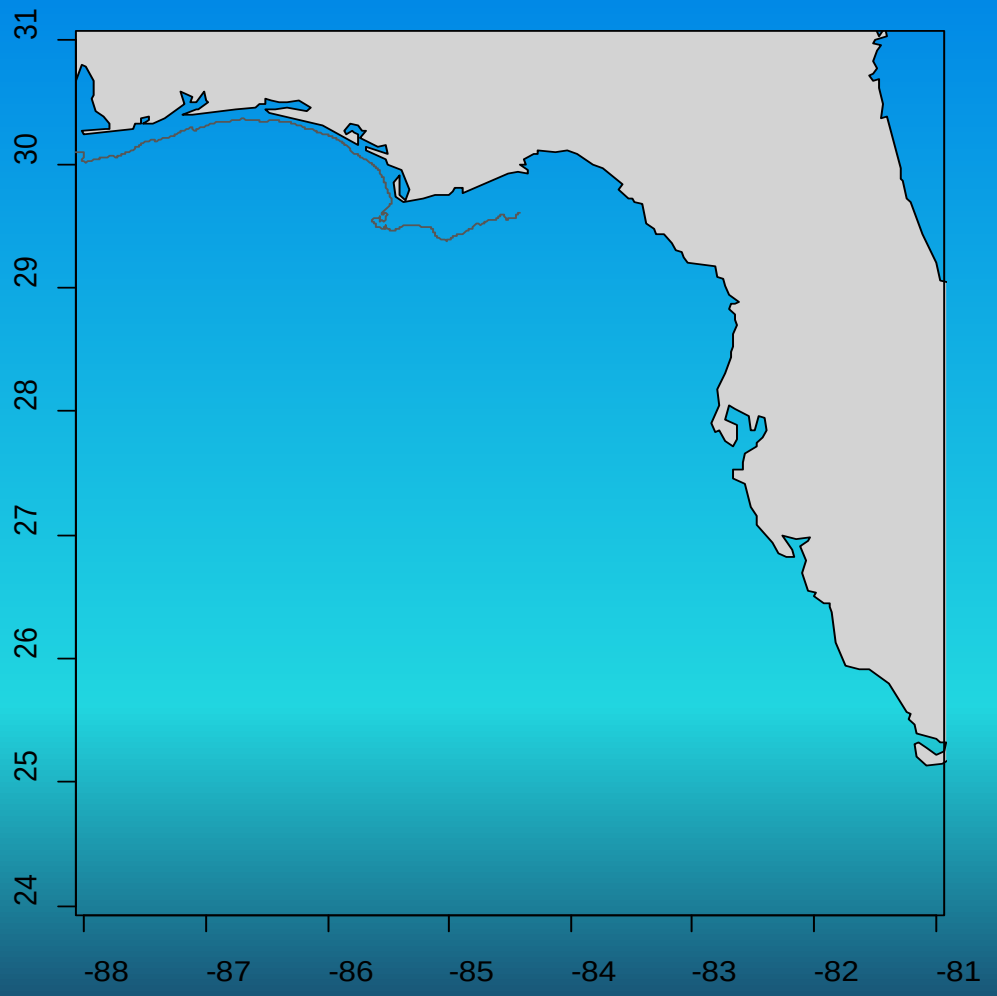
Spatial reef fish model of West Florida Shelf

Goal: Represent fish/fleet dynamics to evaluate methods to estimate stock dynamics from fishery observations

- Simulate spatial reef fish abundance distribution using geostatistics and spatial indexes of abundance
- Represent fish life history characteristics (i.e. growth, maturity, ontogenetic migration)
- Characterize fishing behavior using discrete choice models



- Study how fish/fleet interact to generate observations


31
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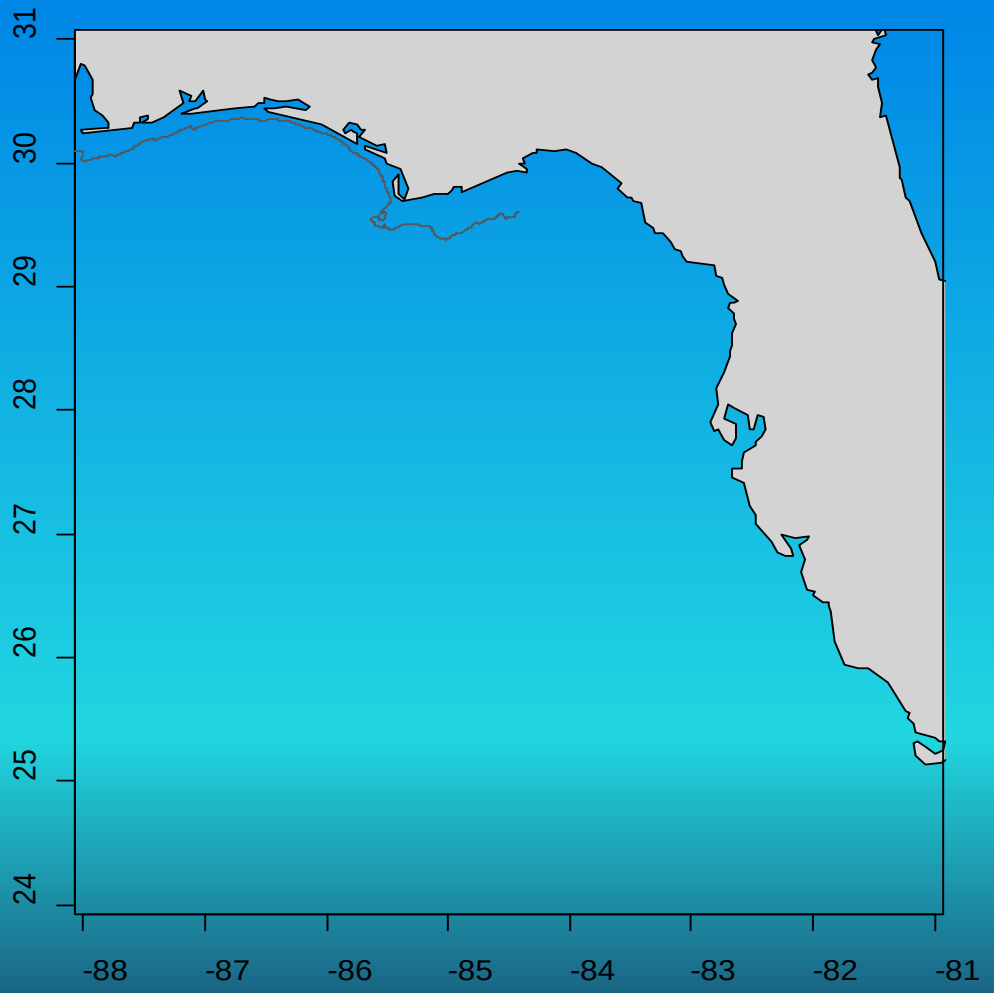
-88
-87
-86
-85
-84
-83
-82
-81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-85
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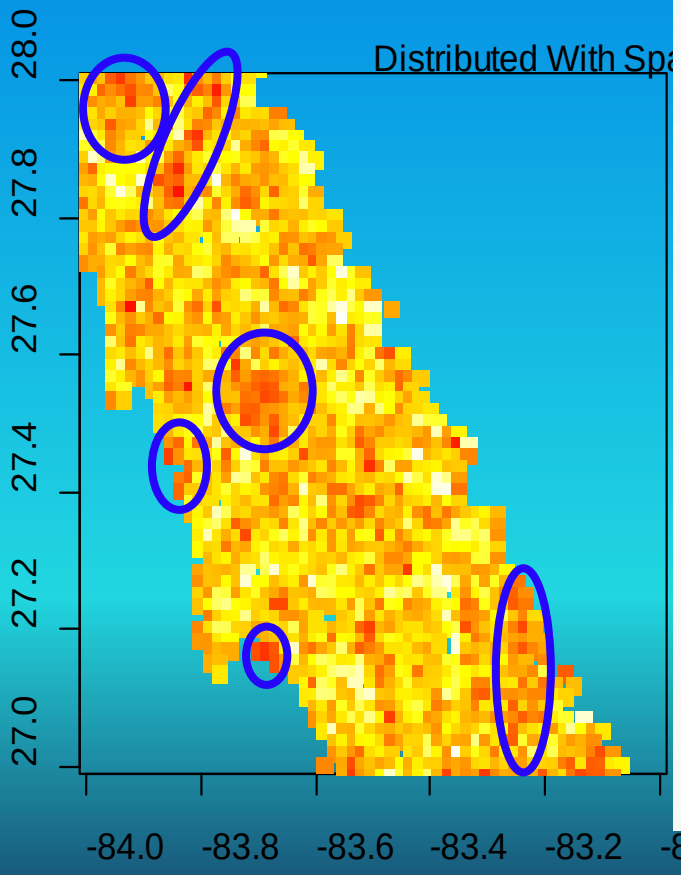
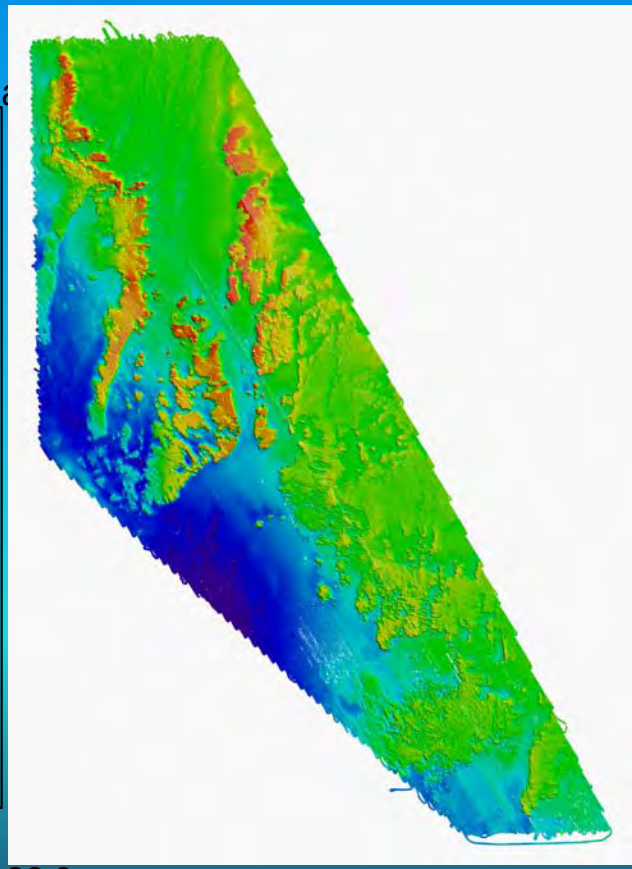
-82
-81

Distribution of Abundance

- Abundance assigned using spatial statistics to estimate variograms and simulate patchiness from fishery independent data

- Results validated using multibeam information from known mapped areas of the Gulf of Mexico

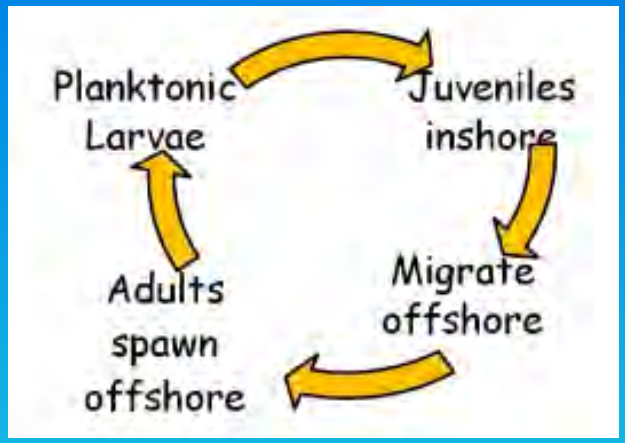


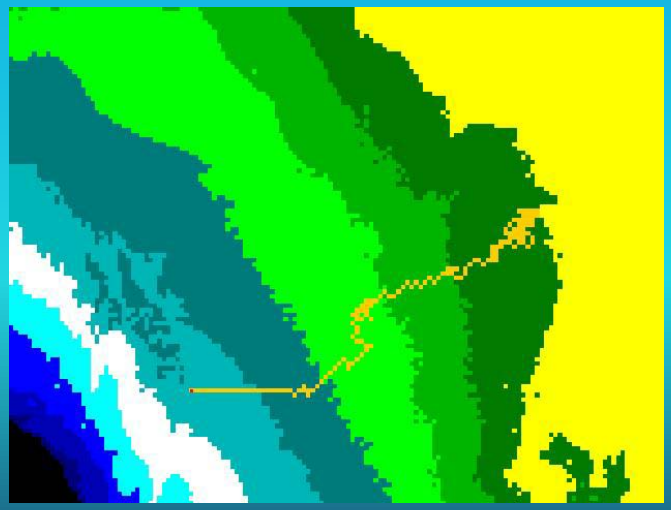


Modeling reef fish dynamics

Life History

- Juveniles recruit to nursery, mature, and migrate to adult habitat using biased random walk.
  - Parameterized using tagging data
  - Adult habitat settlement location determined at time of birth.
- Life history parameters obtained from most recent stock assessment





Dynamic of fishing fleets of West Florida Shelf: **Discrete Choice Models**

- Modeling efforts focused on three decisions:
  - When to fish
  - Where to fish
  - When to return to port
- Assume three independent decisions

- Two binomial conditional logit models: when to fish and when to return to port
- One multinomial mixed model: where to fish

Fisher Survey

- Obtain information on factors vessel captains consider when making decisions
- Surveys disseminated to captains via participating fish houses (n =40)
- Results used to determine how to structure each choice model

Data Used to Fit Models

- Trip Observations: NOAA Logbook Data, 2005 and 2006
- Vessel Characteristics: Vessel Operating Unit Data
- Landing Sites and Ports: NOAA Dealer Data
- Daily Wind Speed: NOAA National Data Buoy Center
- Weekly Fuel Price: State of Florida
- Daily Price of Fish: NOAA Accumulated Landings Data
- Regulations: SEDAR Stock Assessment Reports

Discrete Choice Model

- Fishing locations identified as the intersection of NMFS statistical grids and 20 meter depth contours

- Fishing ports identified from dealer information in the commercial logbook data

Discrete Choice Models

Handline

Longline

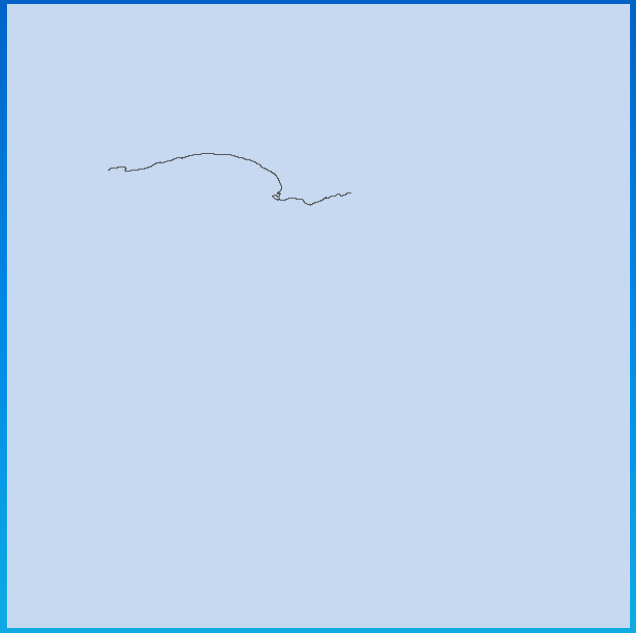
- Assumed multiple gears not rigged on same boat or fished simultaneously
- Models established for each gear type

Discrete choice models: Fishing or not

- Closures influence decisions in both fleets
- Weekends influence fishing decisions
- Fish Price and fuel cost influence decision of when to fish
- Windspeed influences handline

		When to fish		Return to port	
		handline	longline	handline	longline
	Vessel use frequency	***	***		
	Ratio current to past catch			***	***
Closures	Shallow water grouper	***	***	***	**
	Red Snapper	***		**	
	Tile Fish	*			**
	Deep Water Grouper	***			***
Day of week	Monday				
	Tuesday				
	Wednesday				
	Thursday				
	Friday				
	Saturday	*		***	
	Sunday			*	
Price	Red grouper		**		
	Gag grouper		***		
	Red snapper	***	***		
	Mutton snapper			*	
	Vermillion snapper	***			
	Fuel cost	***	**		
	Wind speed	***		***	

Discrete choice models: Where to fish



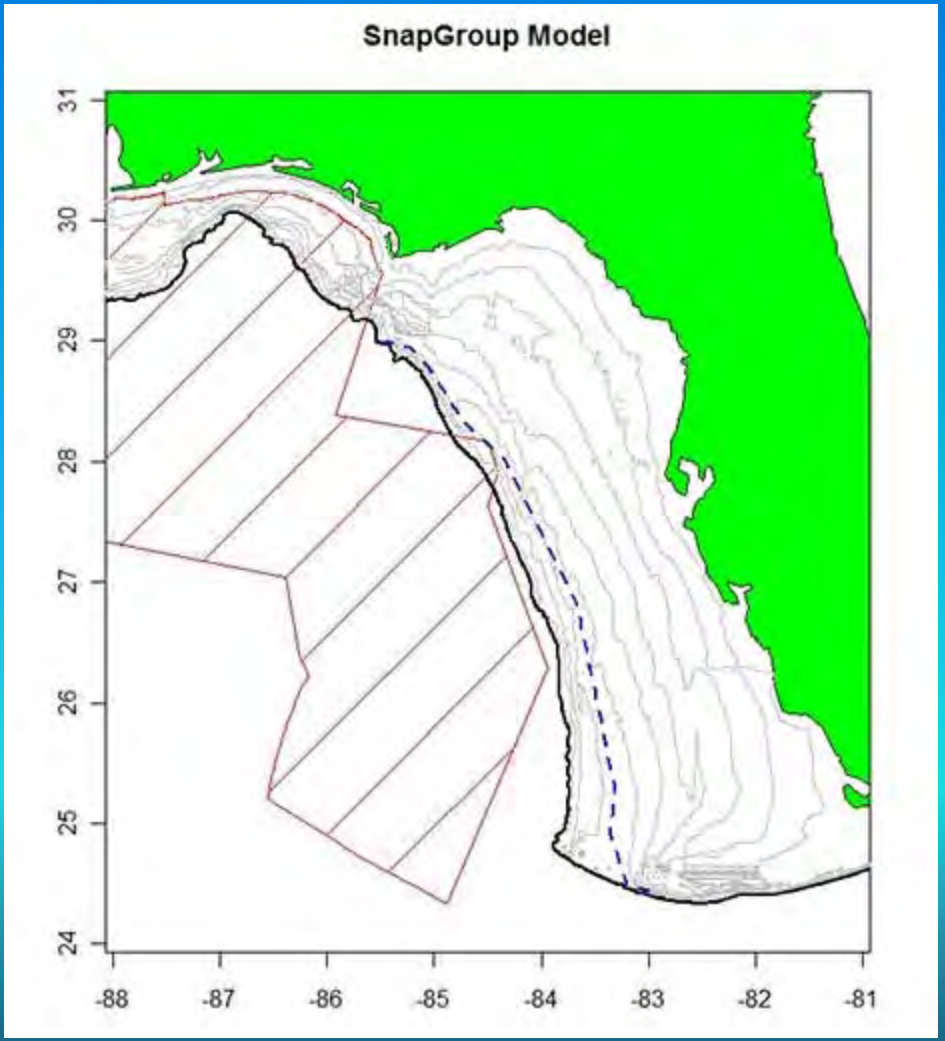
DWH closures impacts on the W Florida Shelf

- Evaluate static biomass for 5 reef fish species within the closure area

- Currently testing fully integrated simulation model performance

- Need to start evaluating actual closure effects on stocks

- Compare predicted fleet behavior with observed (VMS)



Closure related samples