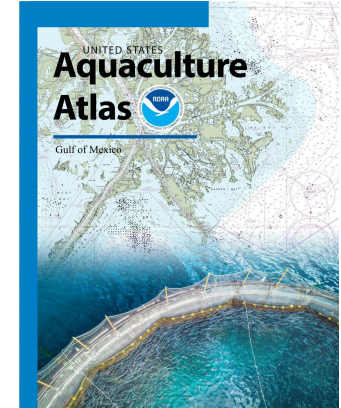
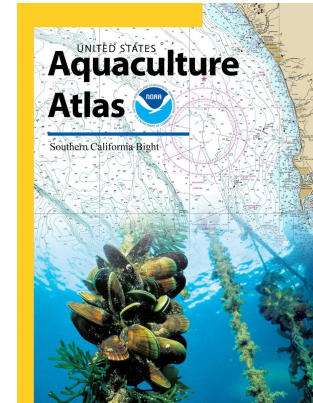


Aquaculture Opportunity Areas Atlases: A comprehensive regional marine spatial analysis to inform AOA development

Marine Spatial Ecology Division
National Centers for Coastal Ocean Science
National Ocean Service



Marine Spatial Ecology Division

Informing Conservation, Management, and Industry

Wind Energy and Aquaculture Siting:

How can we balance ocean uses + conservation?

Mapping Habitat and Species Distributions:

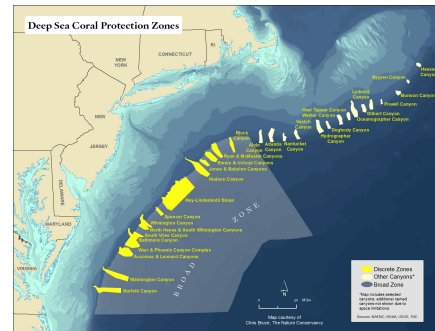
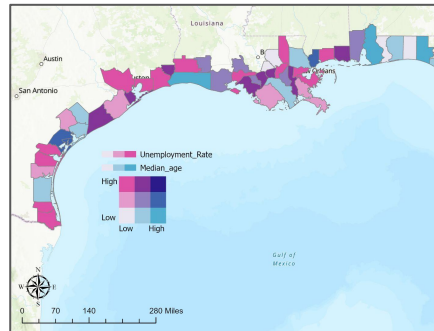
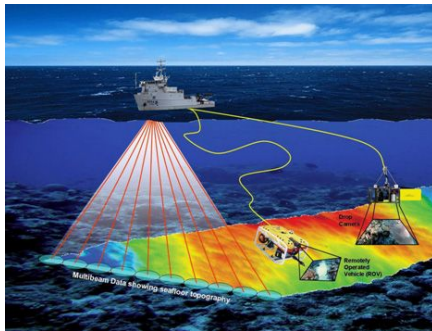
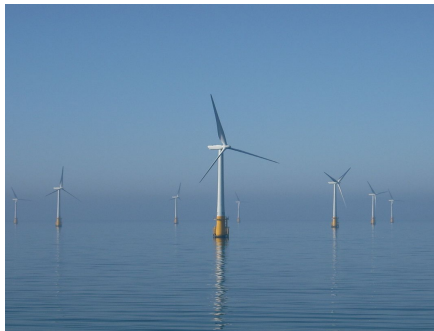
How many fish and where?

Sanctuary Boundary Expansion:

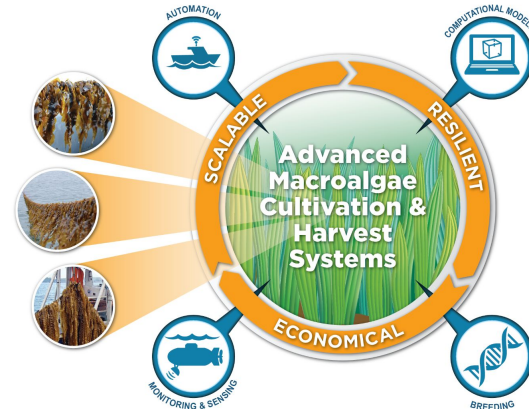
How should we change the Sanctuary boundaries?

Informing Fisheries Management Council Decisions:

Where and how should we protect marine resources?



Support provided by.....



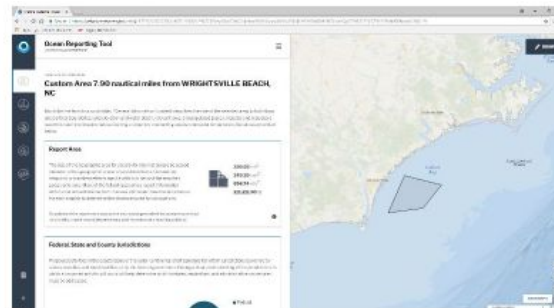
Macroalgae Biomass:
No Land
No Freshwater
No Fertilizer

MARINER creates new biomass production opportunities for the vast ocean resources of the United States.

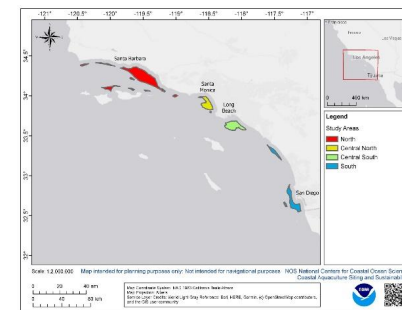
Photos copyright (due to bottom):
Doris Barbusch/National Geographic, The Island Institute, Jean Smith/Huffington Post

NOAA Has Built Significant National Spatial Planning Infrastructure!

Marine Spatial Data



Aquaculture Areas



All Ocean Pioneers Will Benefit

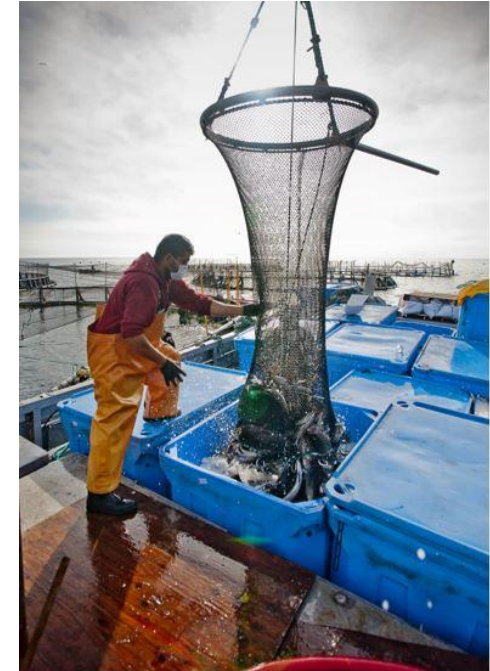
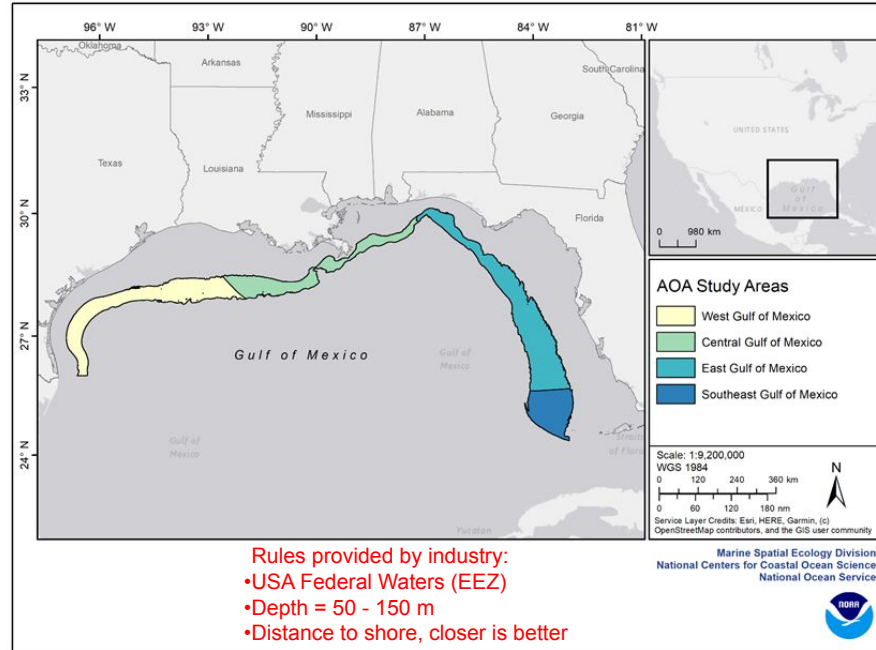
MarineCadastre.gov

An Ocean of Information

A joint BOEM and NOAA initiative providing authoritative data to meet the needs of the offshore energy and marine planning communities.



Gulf of Mexico Study Areas

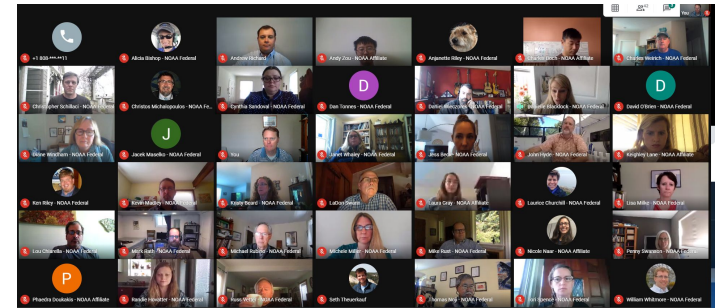


All types of aquaculture including shellfish, finfish, and algae.

Atlas Story - Stakeholder engagement

Stakeholder meetings		
Gulf of Mexico and Southern California	Number	Attendees
Military	40	161
Natural Resources	157	787
Regional Planning Bodies	24	302
Industries	42	134
Navigation	12	45
Governance & Boundaries	66	256
Social & Cultural	14	50
Research Community	10	19
ENGOS	7	15
Human Health	23	79
Totals	395	1,848

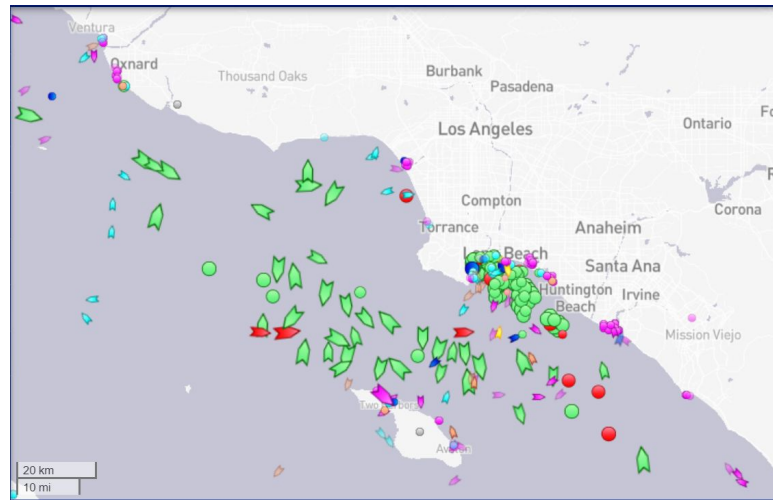
Public meetings	Date
National AOA public listening session #1	11/5/20
Southern CA AOA listening session	11/12/20
Gulf of Mexico listening session	11/17/20
National AOA public listening session #2	11/19/20
Gulf of Mexico listening session (Fishing Stakeholders)	12/3/20



Atlas Story - Ship Parking Lots

A record number of cargo ships are stuck outside LA. What's happening?

Port complex of Los Angeles and Long Beach, already the busiest in the US, has seen major traffic this week as imports boom



What we learned....

- Overflow parking lots for ships may not be charted!
- Covid related supply chain backup issues
- Worked with NOAA Office of Coast Survey to chart
- Incorporated buffer areas in AOA analyses

Atlas Story - Fishing Data

- Deep collaboration with NMFS Sustainable Fisheries, Highly Migratory Species, Fishery Management Councils, State Agencies, Industry
- Assessed relative suitability based on fishing effort
- California model included 23 fisheries; 3 aquaculture operations
- Gulf of Mexico model included 6 fisheries; 1 aquaculture operation



...we found that the analytical approach to spatial planning applied by the National Ocean Service (NOS) in that AOA initiative to be the most useful tool for supporting this critical decision-making. - SSA



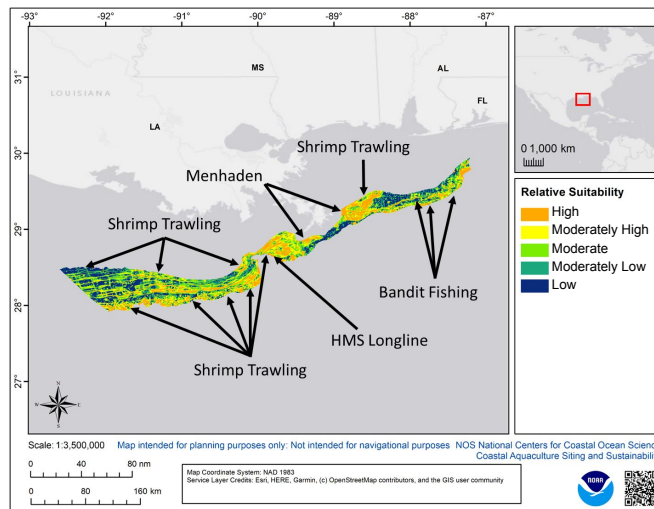
Southern Shrimp Alliance
P.O. Box 1577 Tarpon Springs, FL 34688
955 E. MLK Dr. Suite D Tarpon Springs, FL 34689
727-934-5090 Fax 727-934-5362

September 28, 2021

The Honorable Richard W. Spinrad
Administrator
National Oceanic and Atmospheric Administration
1401 Constitution Avenue, NW
Washington, D.C. 20230

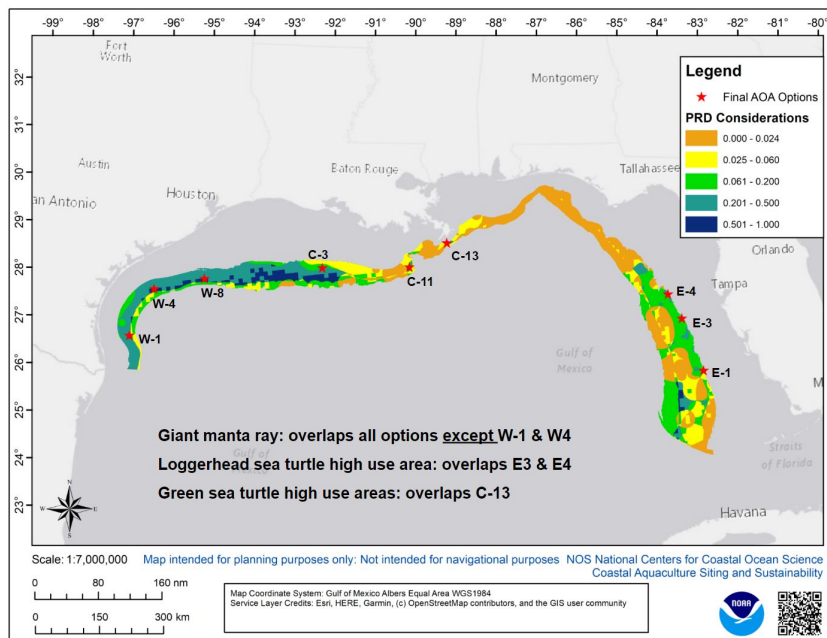
Dear Administrator Spinrad,

The Southern Shrimp Alliance (SSA) would like to draw your attention to what we believe is the critical role the National Oceanic and Atmospheric Administration (NOAA) must play in the development of offshore wind energy in the Gulf of Mexico (GOM) as part of the Biden Administration's commitment to advancing clean, renewable energy in the United States.



Atlas Story - Protected Resources

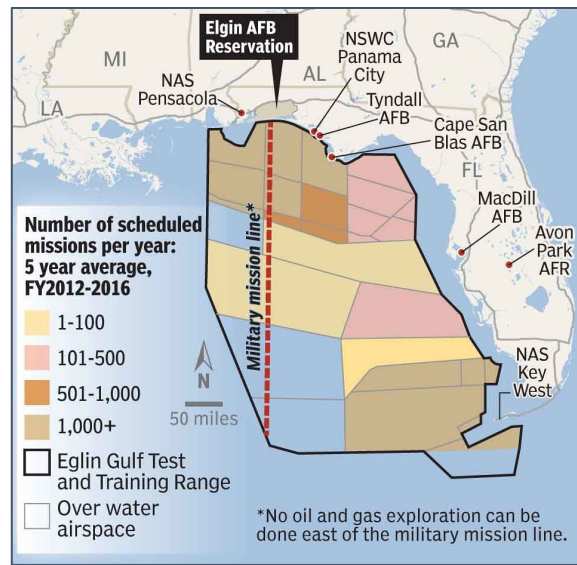
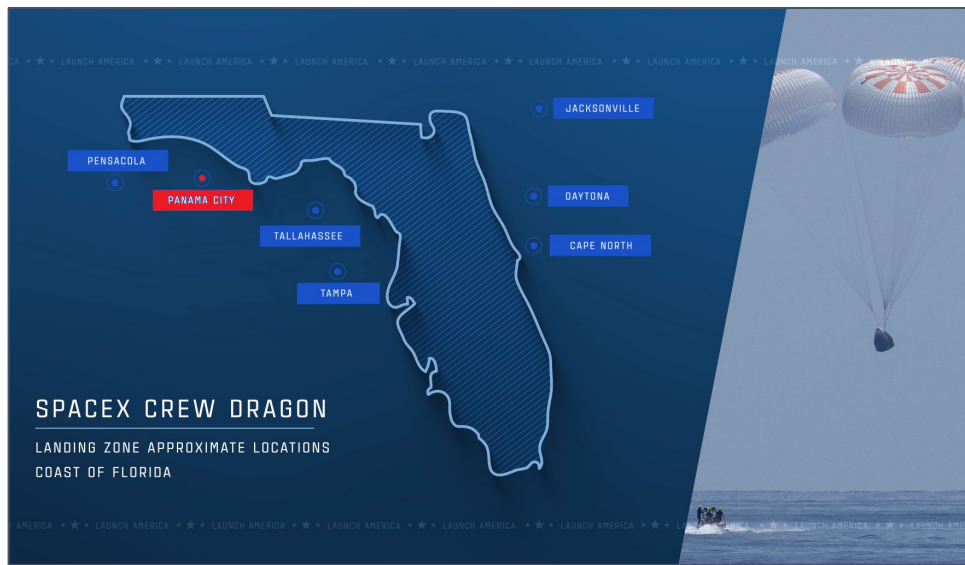
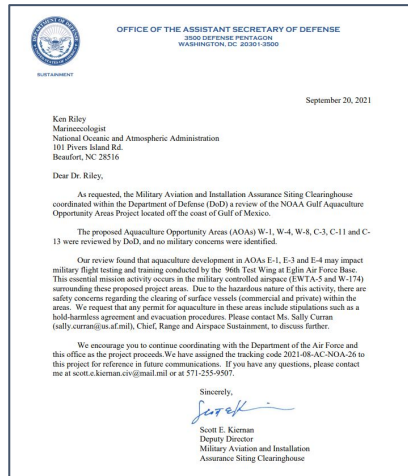
- Developed novel scoring approach based on status and trends
- California model included 3 large whale species
- Gulf of Mexico included 8 species (whales, turtles, fish)



Status	Trend	Score	Converted scores for model
Endangered	declining, small population ² or both	9	0.10
Endangered	stable or unknown	8	0.20
Endangered	increasing	7	0.30
Threatened	Declining or unknown	6	0.40
Threatened	stable or increasing	5	0.50
Strategic MMPA Stock	declining or unknown	3	0.60
MMPA Stock	small population	2	0.70
MMPA Stock	large population	1	0.80

Atlas Story - Preserving National Security

- Collaborated with DOD HQ and Regional Leadership, and the Military Aviation and Installation Assurance Siting Clearinghouse
- Included coordination with USCG, Space Force, NASA, SpaceX
- Established framework for handling sensitive data in spatial planning
- Analyses considered risks to national security, impacts to military operations, and identified mitigation strategies



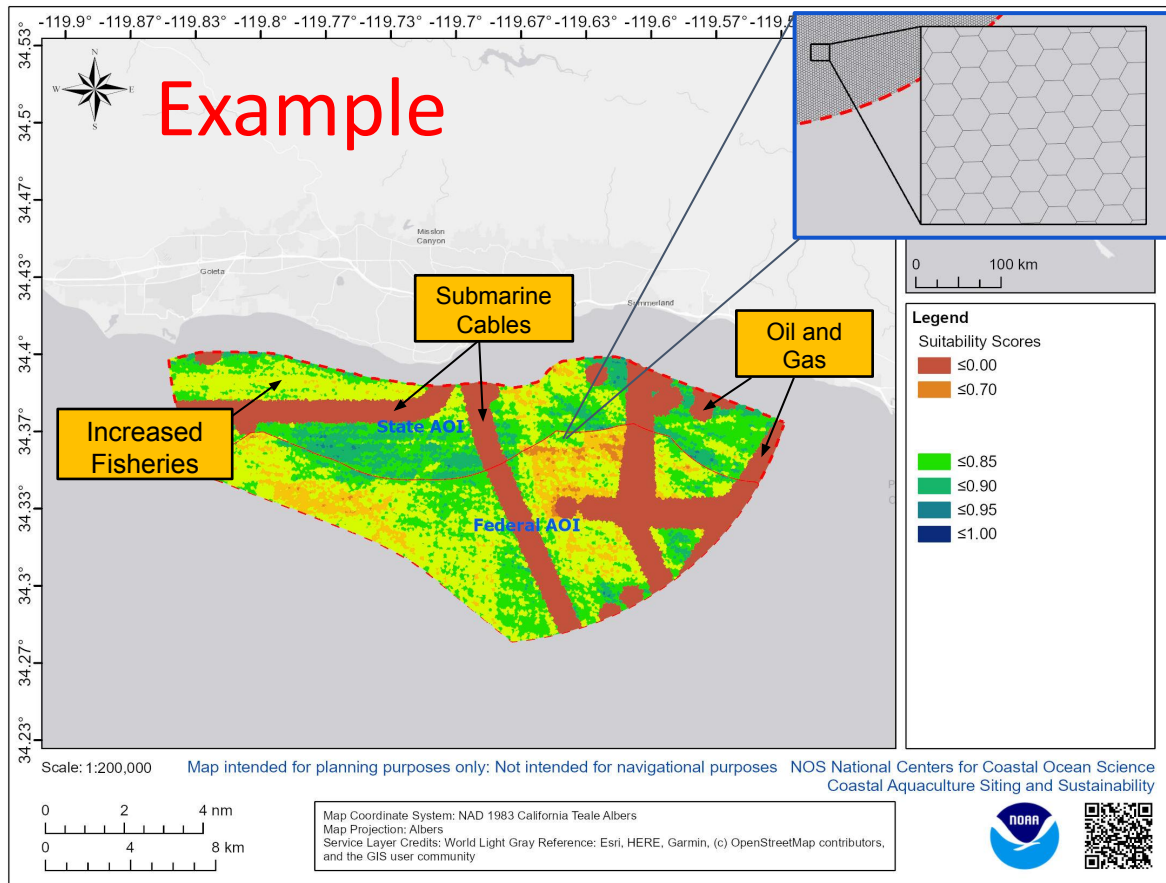
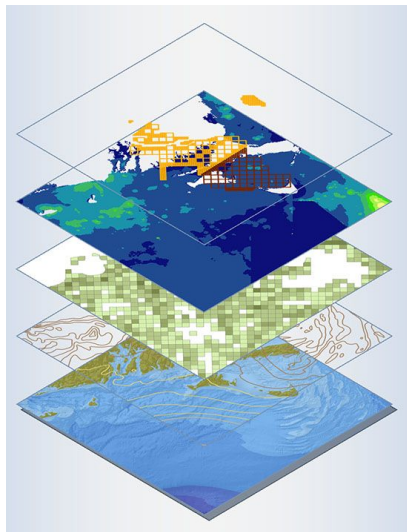
Data inventory results

Data Layers	GoMex
National Security	54
Natural Resources	92
Industry, Navigation, and Transportation	60
Fishing and Aquaculture	14
Total layers	220



Suitability modeling

We identify areas of **highest opportunity** for aquaculture. Areas that provide highest conservation and lowest conflict with other users.

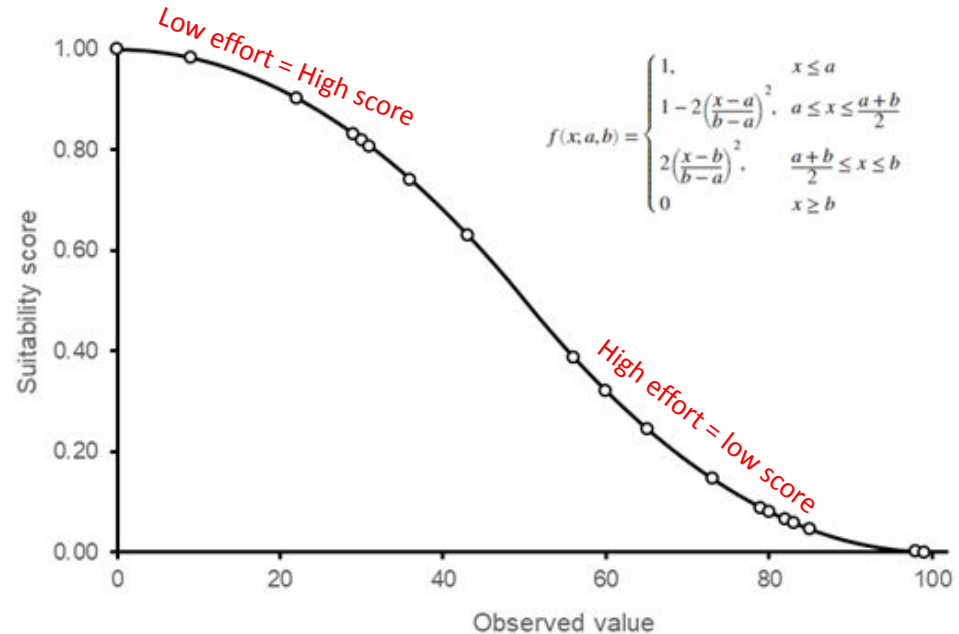


Categorical data

Data	Example	Score
Hard Bottom Habitat		0
Marine Protected Areas & Preserves		0.5
Habitat Area of Particular Concern		0.5
Deep sea corals		0
Oil and Gas Pipelines (500 m buffer)		0
Oil and Gas Wells (500 m buffer)		0
Shipwrecks (500 m buffer)		0
Unexploded Ordnance		0.5
Wastewater Discharge (500 m buffer)		0

Continuous data

E.g., Fishing data, Vessel traffic, Wave climate

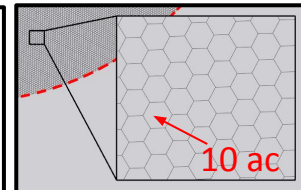


Cell scoring

Layer = not compatible = 0

Layer = may not be compatible = 0.5

No layer = 1

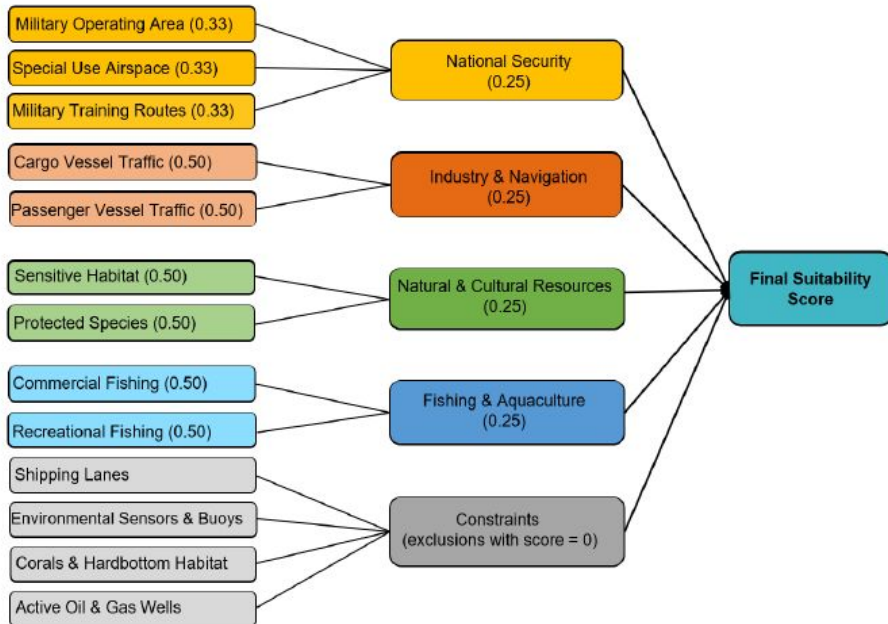


Modeling process

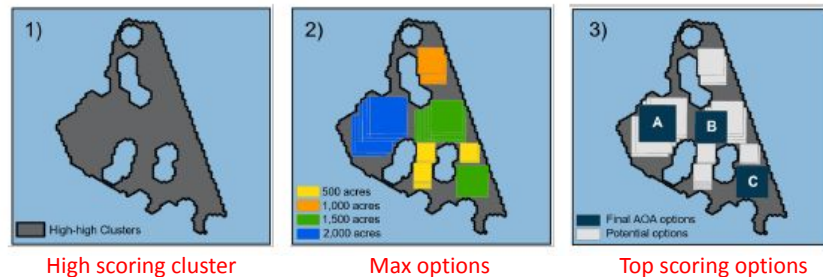
Suitability Model

Examples of Equally-weighted Data Layers within a Submodel

Submodels with Equal Weights



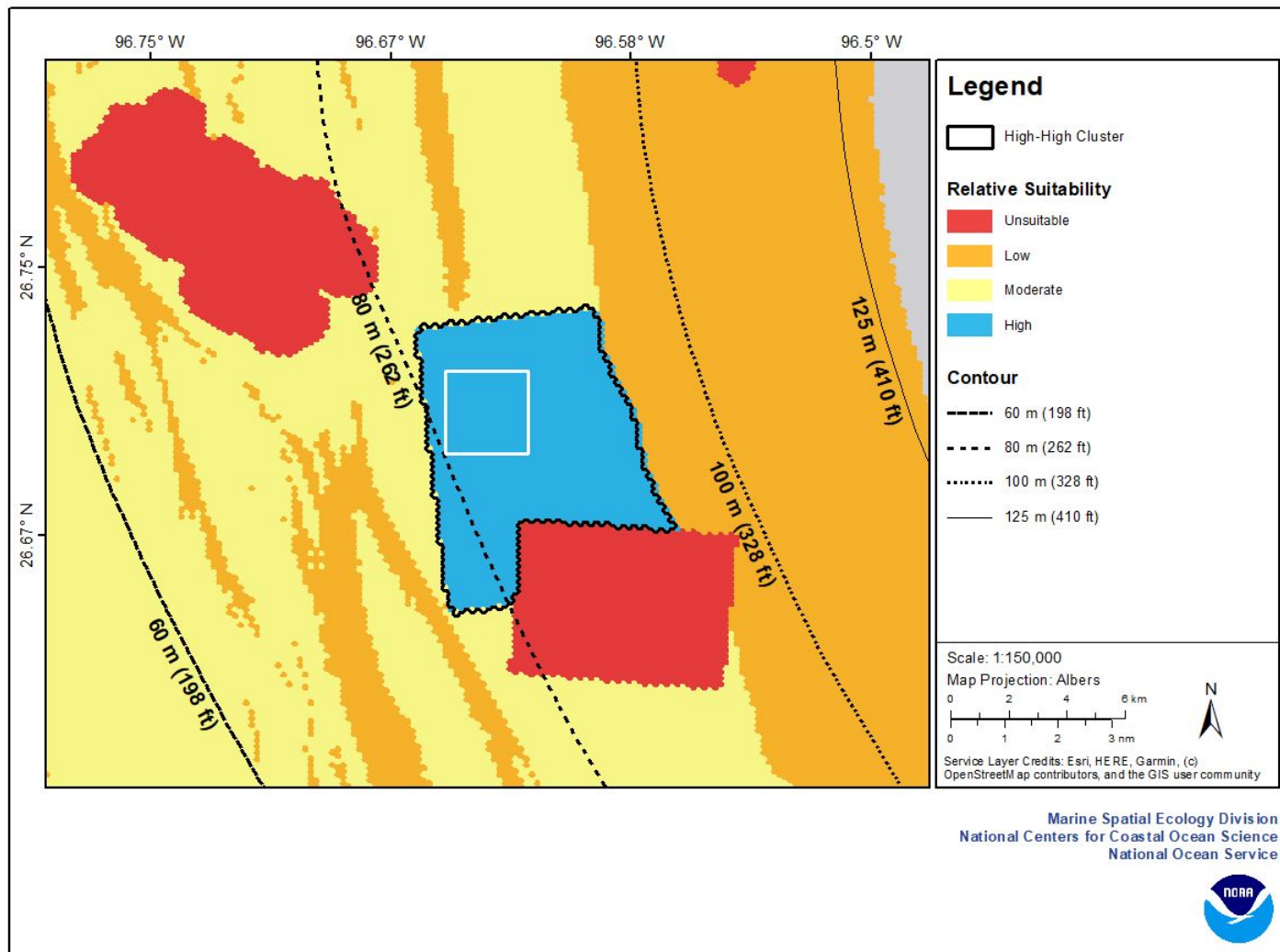
Cluster Analysis and Precision Siting Model



Precision Siting Analysis

Example of how the precision siting model seeks to optimally site a potential AOA

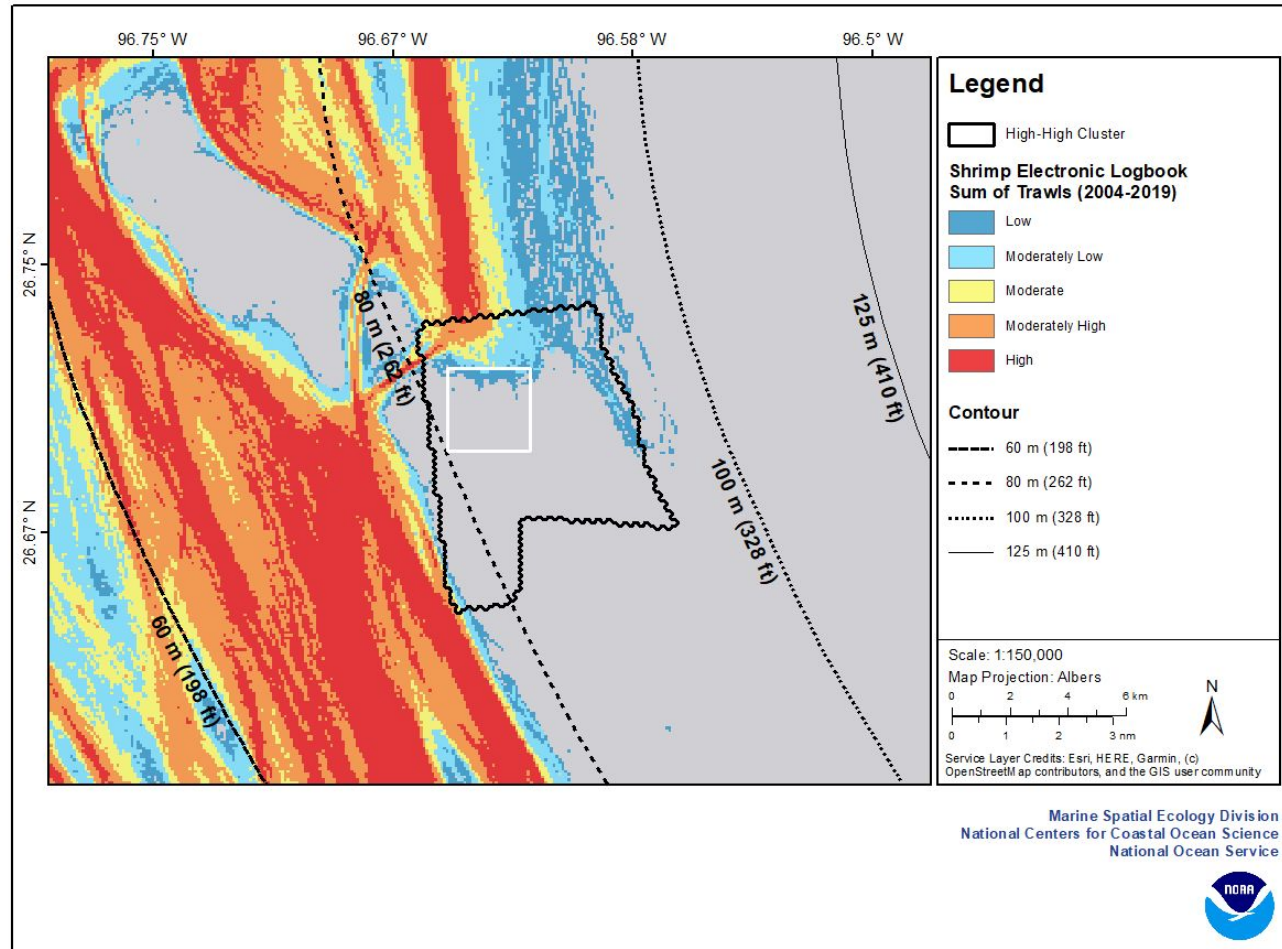
White box is a 2000 acre site



Precision Siting Analysis

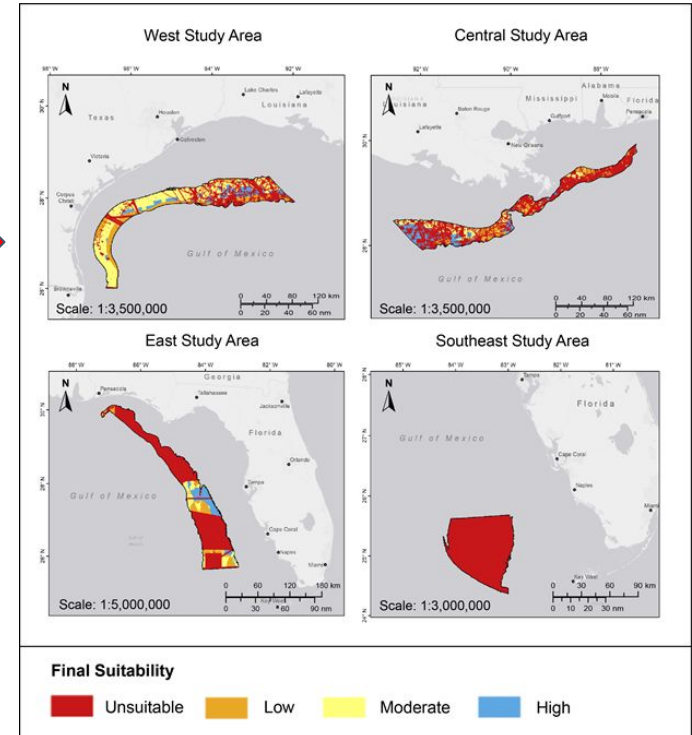
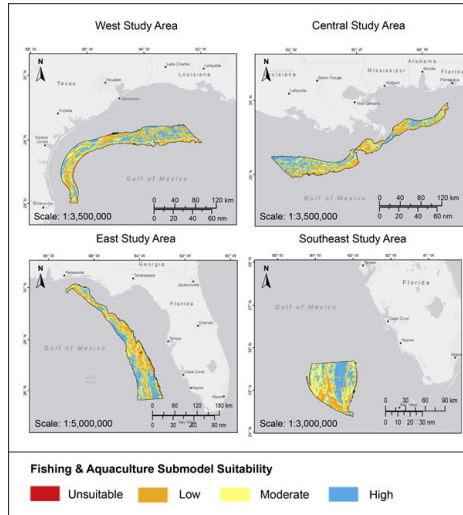
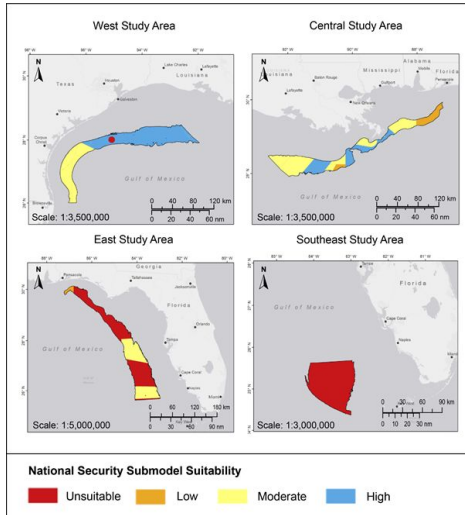
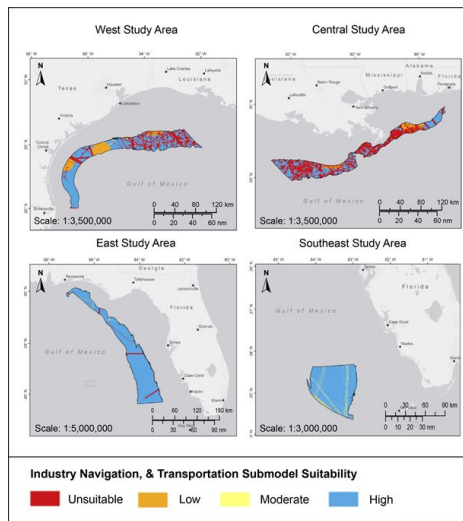
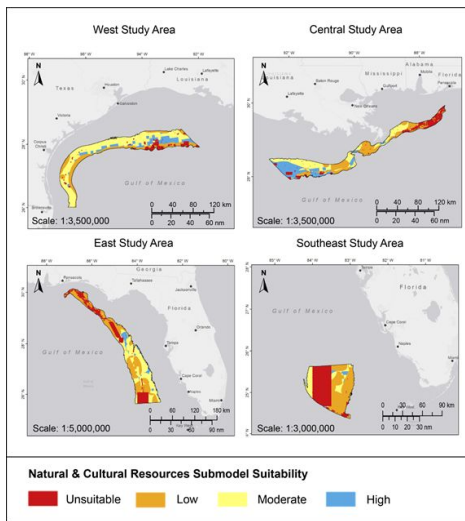
Example of how the precision siting model seeks to minimize interactions with shrimp trawling

White box is a 2000 acre site



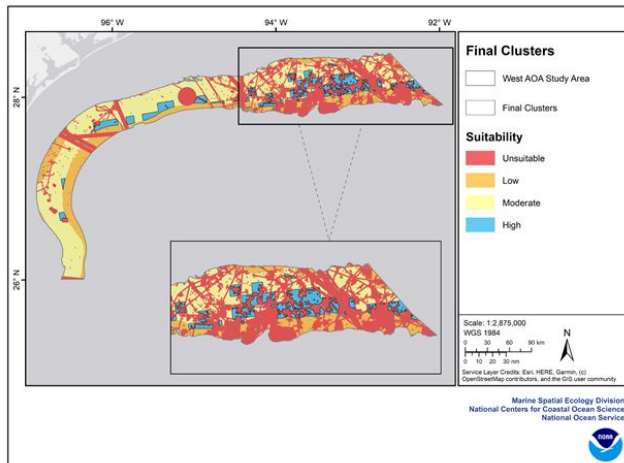
Gulf of Mexico

Final Suitability



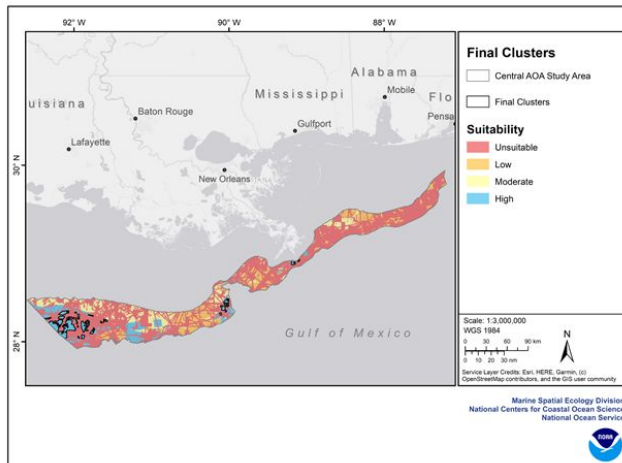
Cluster analysis

West Region



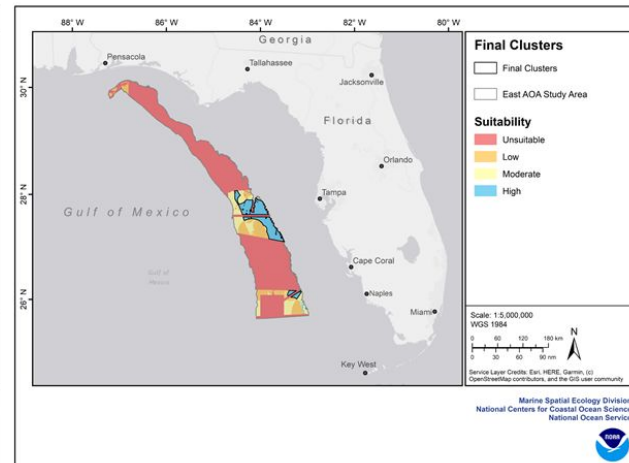
43 clusters
5,033 AOA options
339,755 acres

Central Region



13 clusters
1,056 AOA options
93,220 acres

East Region



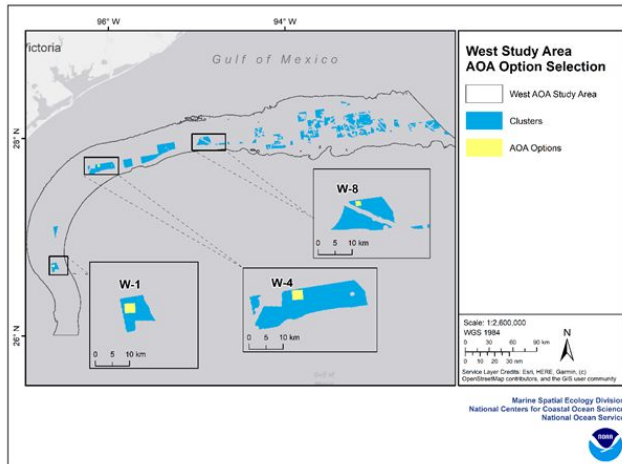
4 clusters
23,750 AOA options
722,900 acres

60 clusters
29,839 AOA Options Considered

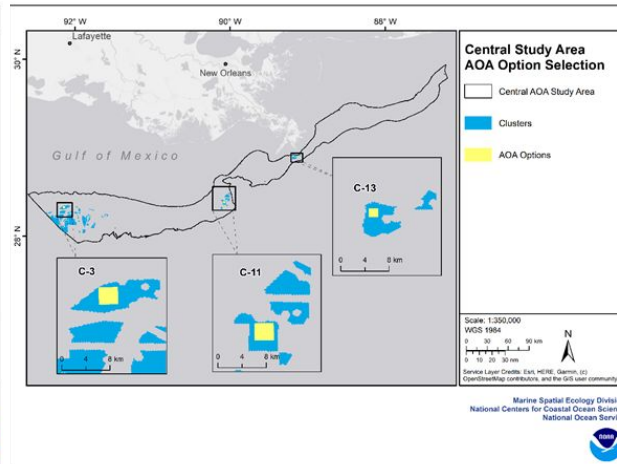
Precision Siting Model

Top 9 AOA options identified
A 30-nm dispersion rule applied to avoid overlap
13,500 acres

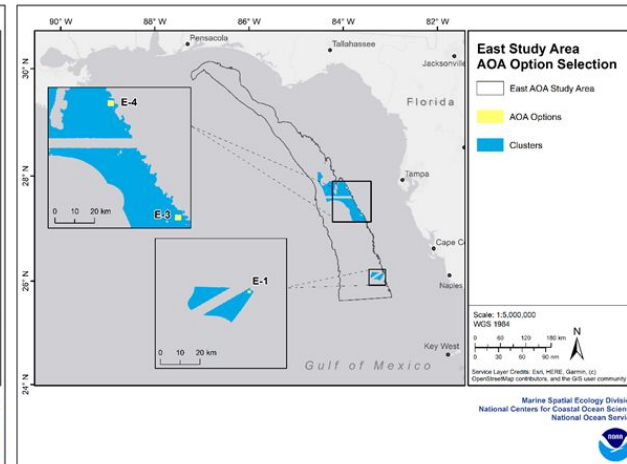
West Region



Central Region



East Region



Site	Size (acres)	Depth Average (m)	Closest Inlet (nm)
W-1	2,000	91	35
W-4	2,000	84	42
W-8	500	81	58

Site	Size (acres)	Depth Average (m)	Closest Inlet (nm)
C-3	2,000	61	72
C-11	2,000	82	41
C-13	500	62	5

Site	Size (acres)	Depth Average (m)	Closest Inlet (nm)
E-4	2,000	51	58
E-3	2,000	51	48
E-1	500	51	56



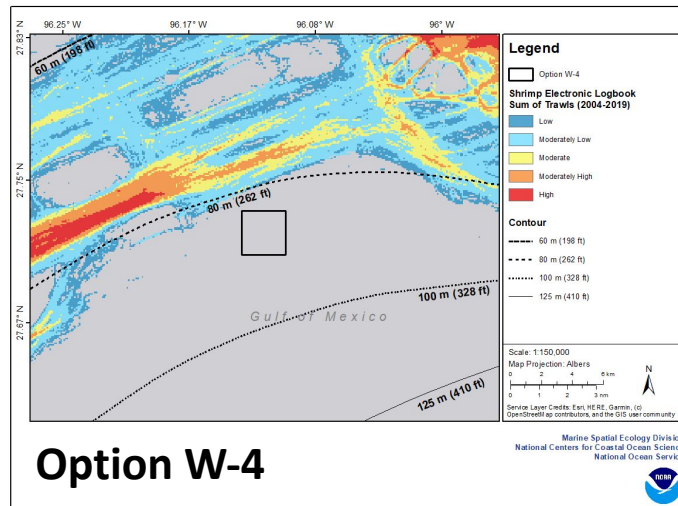
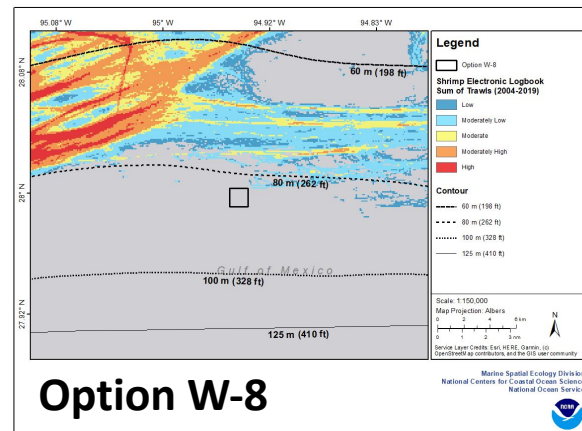
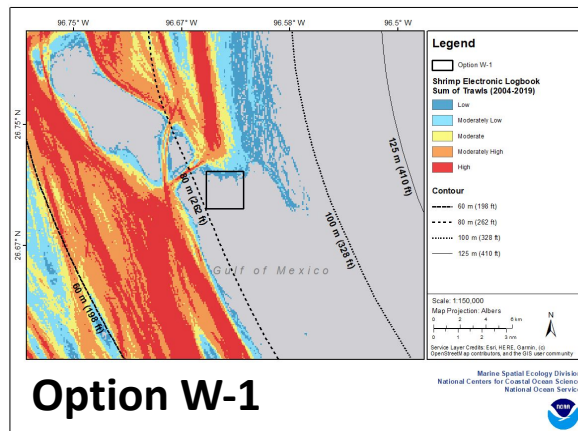
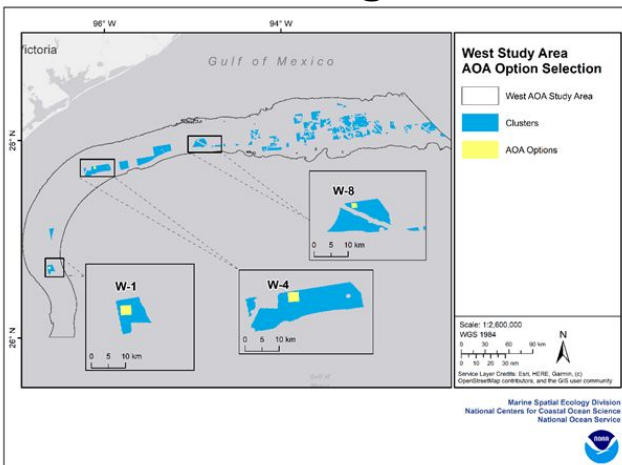
Characterization Summary

Description	Value
General Characteristics	
Corner Coordinates (latitude, longitude) (decimal degrees)	-96.12292, 27.71421
	-96.12469, 27.73983
	-96.09588, 27.74139
	-96.09412, 27.71577
Size (ac)	2,000
Closest inlet (km)	78.7
Depth (m) (minimum, mean, maximum)	(80.6, 84.1, 88.4)
National Security	
Military Operating Areas (MOA)	Overlaps MOA Corpus Christi
Special Use Airspace (SUA)	Overlaps SUA W228D
Transportation (AIS mean vessel transits per 500 ac)	
Cargo Vessels 2015 - 2019	0.45
Fishing Vessels 2015 - 2019	0.30
Military Vessels 2015 - 2019	0
Other Vessels 2015 - 2019	1.25
Passenger Vessels 2015 - 2019	1.00
Pleasure and Sailing Vessels 2015 - 2019	0.20
Tanker Vessels 2015 - 2019	1.05
Tug and Tow Vessels 2015 - 2019	0.80
Metocean Characteristics	
Wind Speed % > 10.28 m/s (%)	7.11
Surface Current Speed % > 1.0 m/s (%)	0.06
Significant Wave Height % > 1.75 m (%)	20.0

Description	Value
Natural and Cultural Resources (within 3 km of option)	
Habitat - Distance to hardbottom and other sensitive habitats	Coral9 (Harte Bank)
Habitat - Distance to deep-sea coral observations	None within reporting range
Important Bird Areas	None within reporting range
Protected Areas	None within reporting range
Artificial Reefs	None within reporting range
Cultural Resources	None within reporting range
NMFS Protected Resources Combined Data Layer	No overlap with ESA species (Appendix B)
Industry and Navigation (within 3 km of option, but outside option)	
Oil and Gas Platforms	None within reporting range
Oil and Gas Boreholes	None within reporting range
Oil and Gas Active Lease Blocks	None within reporting range
Oil and Gas Pipelines	None within reporting range
Seabed Mining	None within reporting range
Aquaculture	None within reporting range
Water Quality	
Water Temperature (°C) at 5-m depth (mean)	24.1
Salinity (PSU) at 5-m depth (mean)	34.2
Nutrients (nitrate, phosphate, silicate) (µmol/L) – 5 m depth (mean)	(0.13, 0.07, 1.05)
Mean Aragonite Saturation State (Ω)	3.8
Governance	
Agency boundary (USACE Districts)	Galveston District
Agency boundary (USCG Sectors)	Sector Corpus Christi; District 8
Agency boundary (USEPA Regions)	Region 6
Agency boundary (USFWS)	Southwest Region
Agency boundary (BOEM)	West Gulf of Mexico

Shrimp Trawling

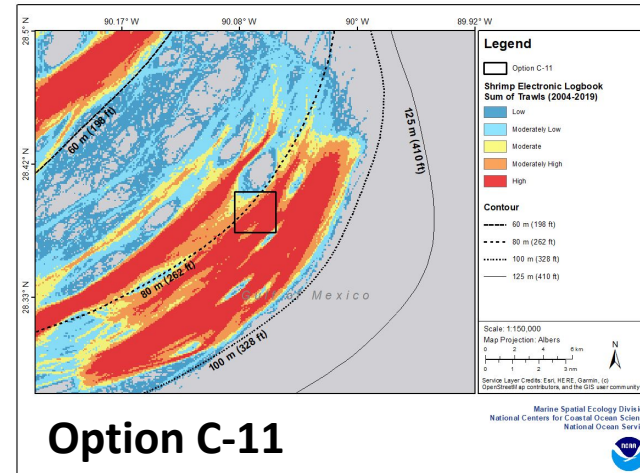
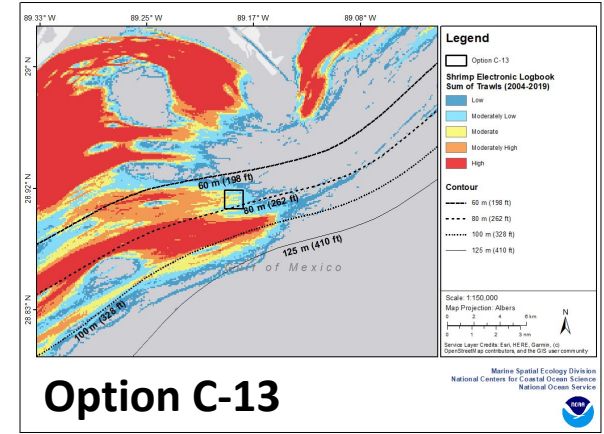
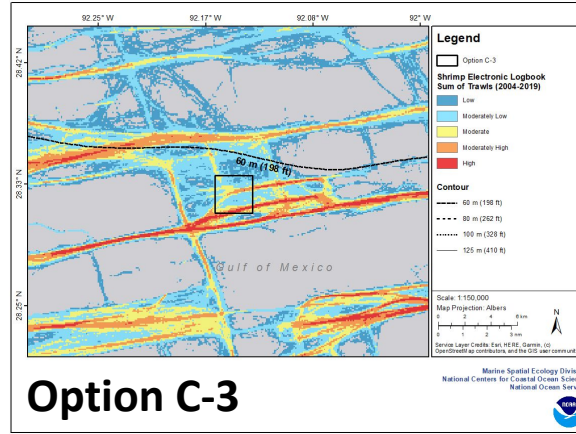
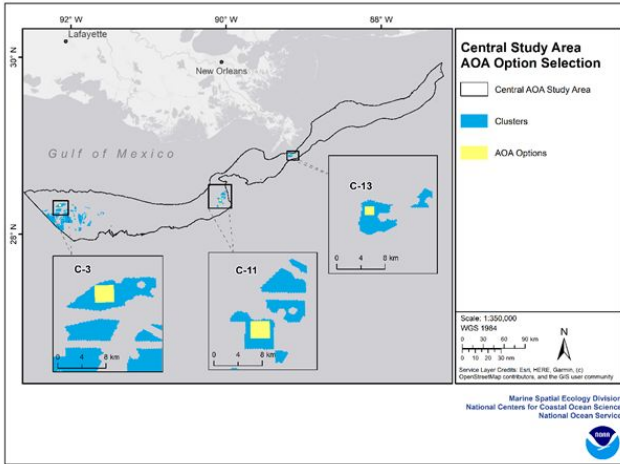
West Region



Site	Size (acres)	Depth Average (m)	Closest Inlet (nm)
W-1	2,000	91	35
W-4	2,000	84	42
W-8	500	81	58

Shrimp Trawling

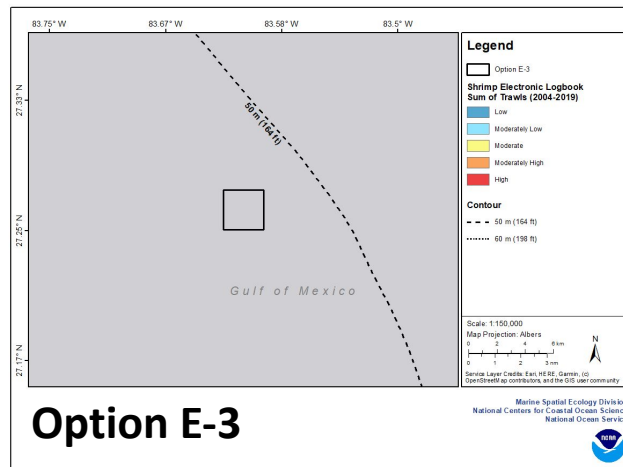
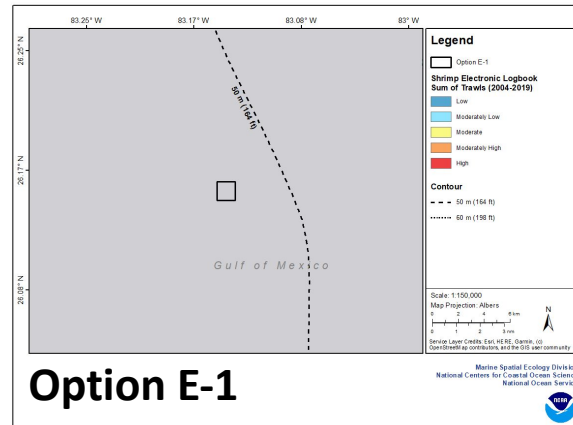
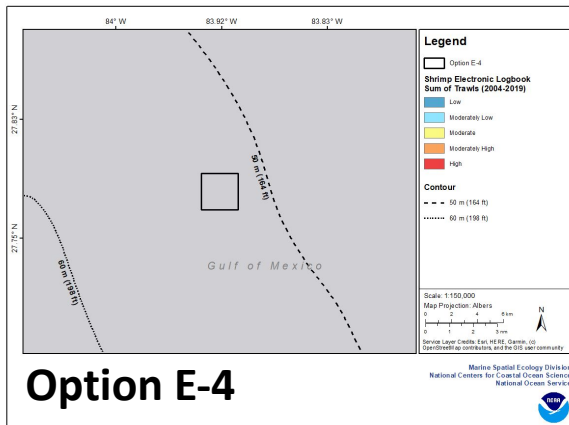
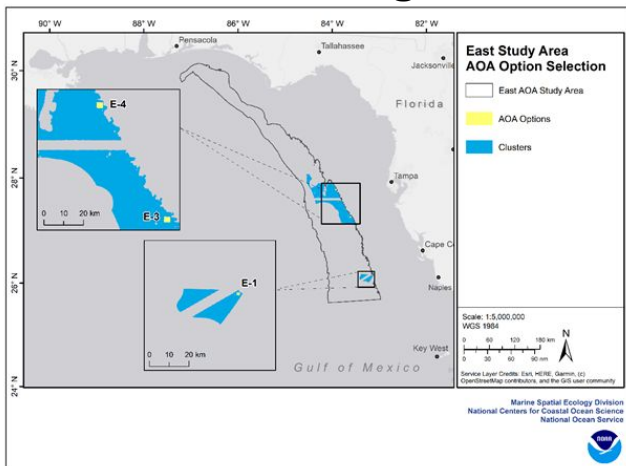
Central Region



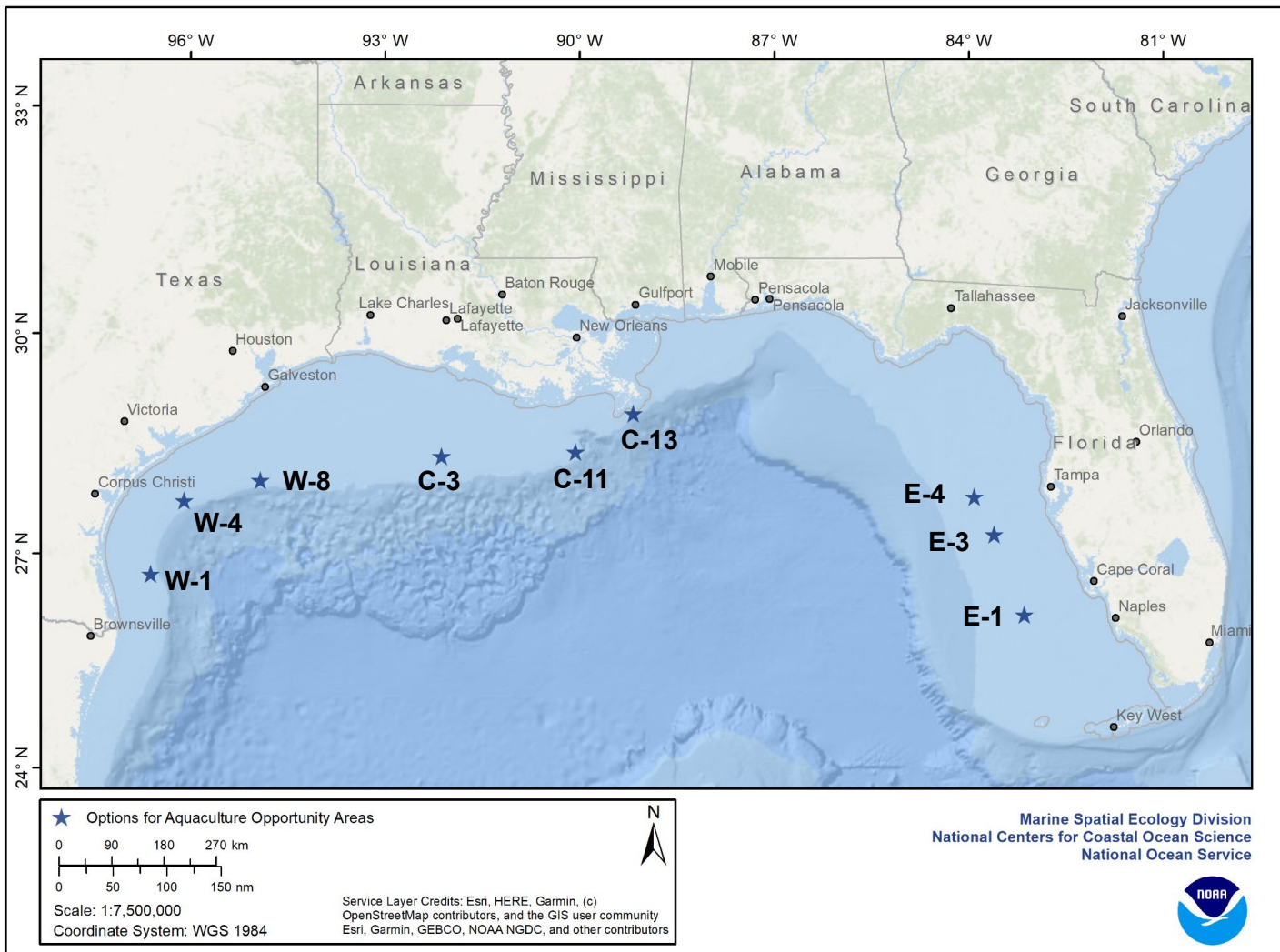
Site	Size (acres)	Depth Average (m)	Closest Inlet (nm)
C-3	2,000	61	72
C-11	2,000	82	41
C-13	500	62	5

Shrimp Trawling

East Region



Site	Size (acres)	Depth Average (m)	Closest Inlet (nm)
E-4	2,000	51	58
E-3	2,000	51	48
E-1	500	51	56



Center for Independent Experts

- Reviewers were highly skilled in marine spatial science
- Reviews were very comprehensive (>300 comments)
- No major flaws were identified
- Reviewers praised the work as “*robust*” and “*state-of-the-art*”

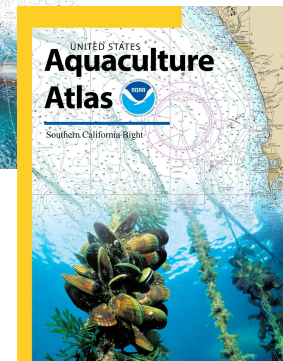
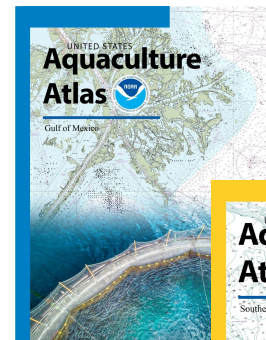
“The methodological workflow is robust, and the application of geospatial instruments is well advanced...” -Depellegrin

“...the amount of data layers is impressive, and it suggests that the authors carried out an excellent and thorough search.” - Filgueira

“...the work described in both reports is of high scientific and technical quality and fulfils the goals that were set out.” -Galparsoro

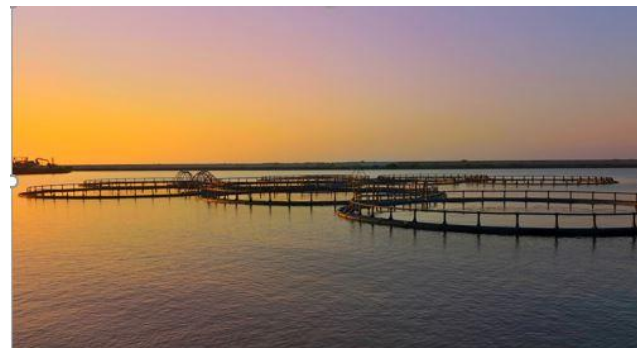
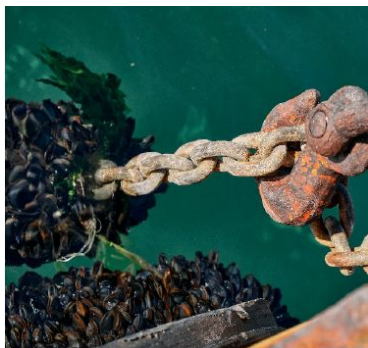
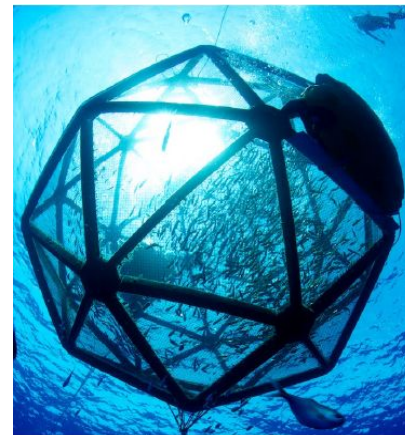
Recommendations

- Add some detail to methods
- Further discuss assumptions and limitations
- Incorporate uncertainty analyses
- Address metadata structure and compliances
- Clarify this work as MSP in the sense of spatial analytics. It is not allocating space for aquaculture or ocean uses as is often observed with other countries.



Atlases at a Glance

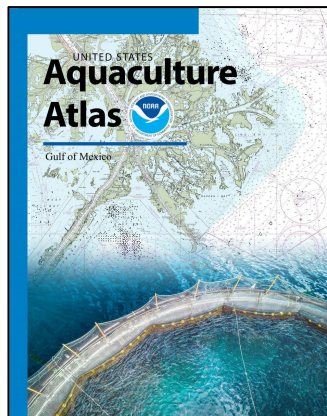
- Most comprehensive regional MSP ever conducted for US federal waters
- More than 200 data layers utilized in each atlas
- Over 150 maps in each atlas that describe the ocean in new and unique ways
- Comprehensive stakeholder engagement
- Built new relationships and trust for NOAA science
- Created a framework for future AOAs and other ocean pioneering industries



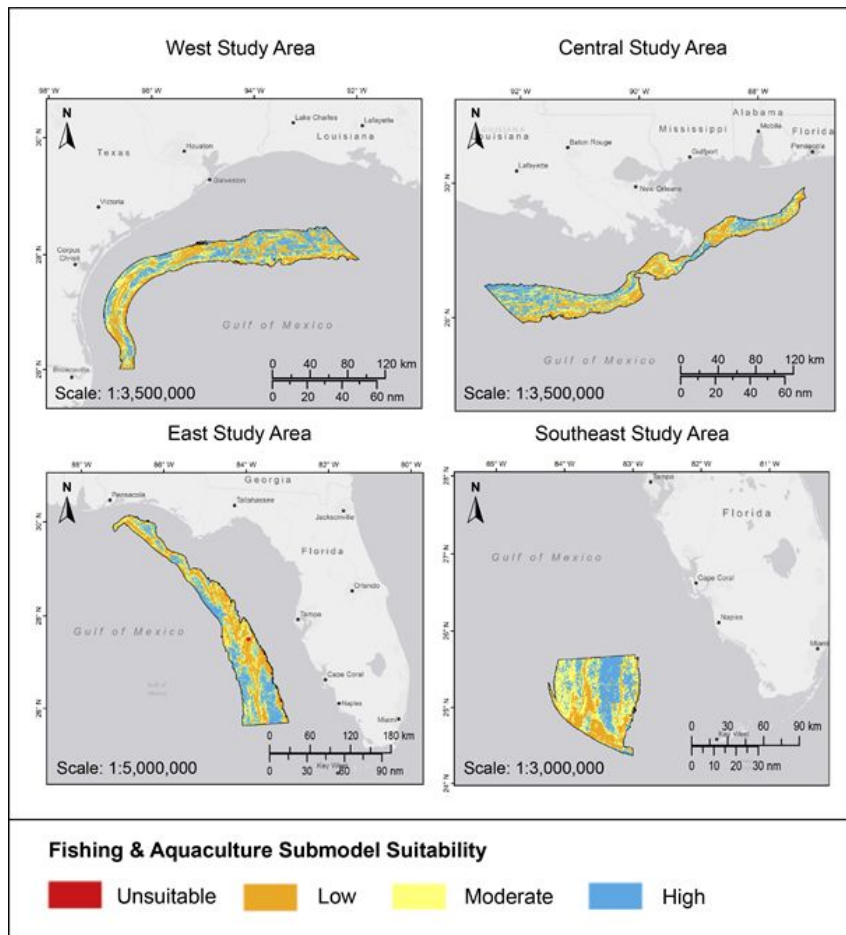
Thanks!



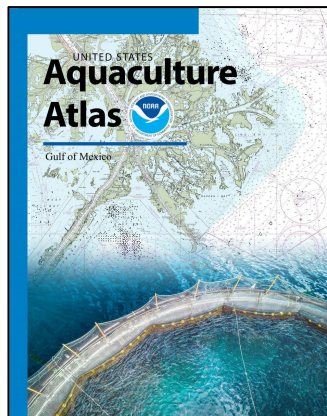
Fishing and Aquaculture



Check out these sections
Methods (pp 44 - 47)
Results (pp 109 - 115)



Fishing and Aquaculture



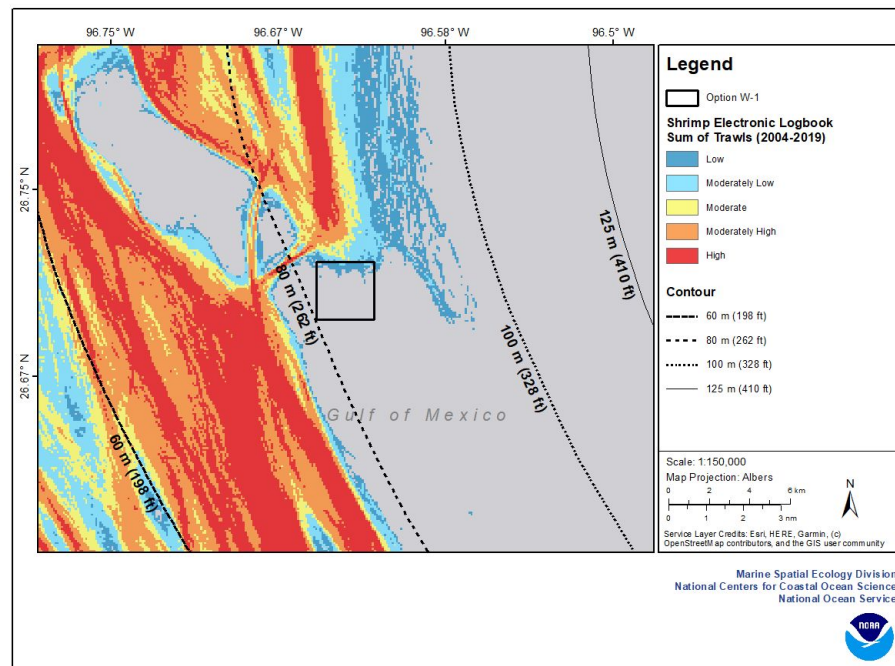
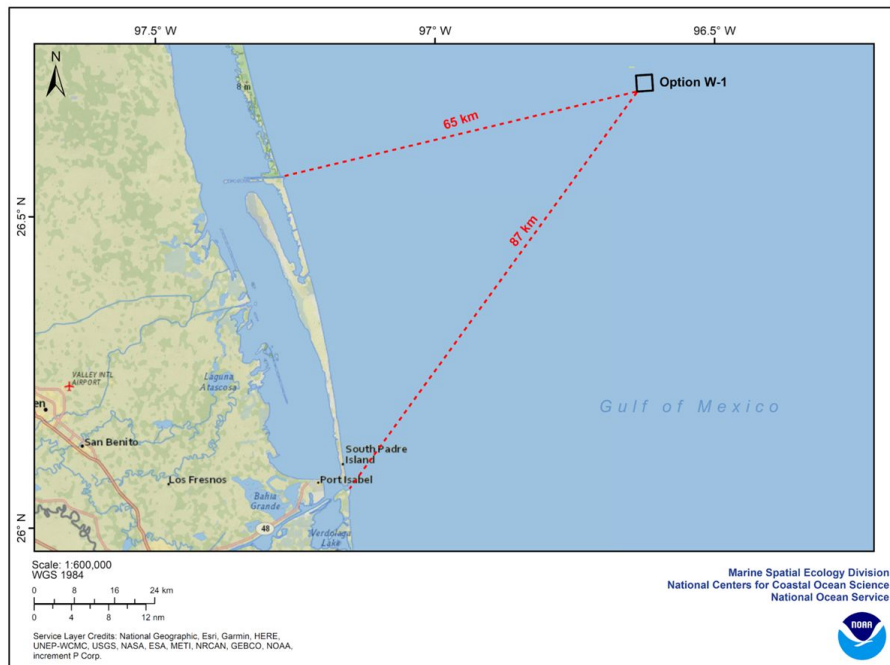
Dataset	Percent Overlap or Intersection			
	W	C	E	SE
Commercial Shrimp Electronic Logbook Data (2004 - 2019)	62.2%	61.6%	0.9%	6.2%
Highly Migratory Species Pelagic Longline Gear Observer Data (1993 - 2019)	0.04%	0.3%	-	0.2%
Menhaden Fishery Data (2000 - 2016)	-	0.6%	-	-
Reef Fish Bandit Gear Fishing Data (2007 - 2019)	41.5%	64.6%	60.6%	36.4%
Reef Fish Longline Gear Fishing Data (2007 - 2019)	22.6%	28.4%	62.3%	58.4%
Southeast Region Headboat Survey Data (2014 - 2020)	12.5%	5.5%	5.7%	2.4%
Live Rock Aquaculture with 500-m setback	-	-	0.003%	-

Check out these sections

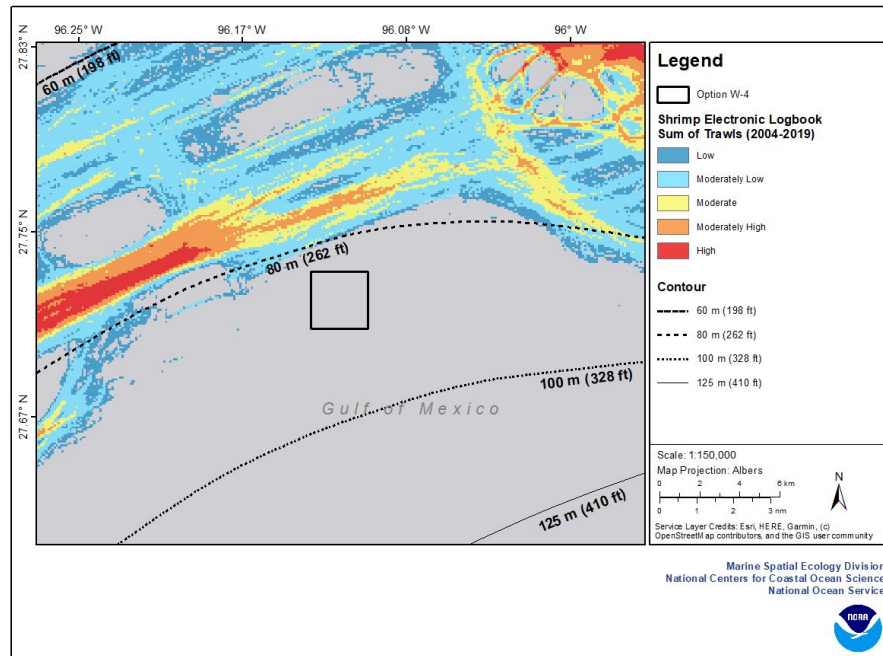
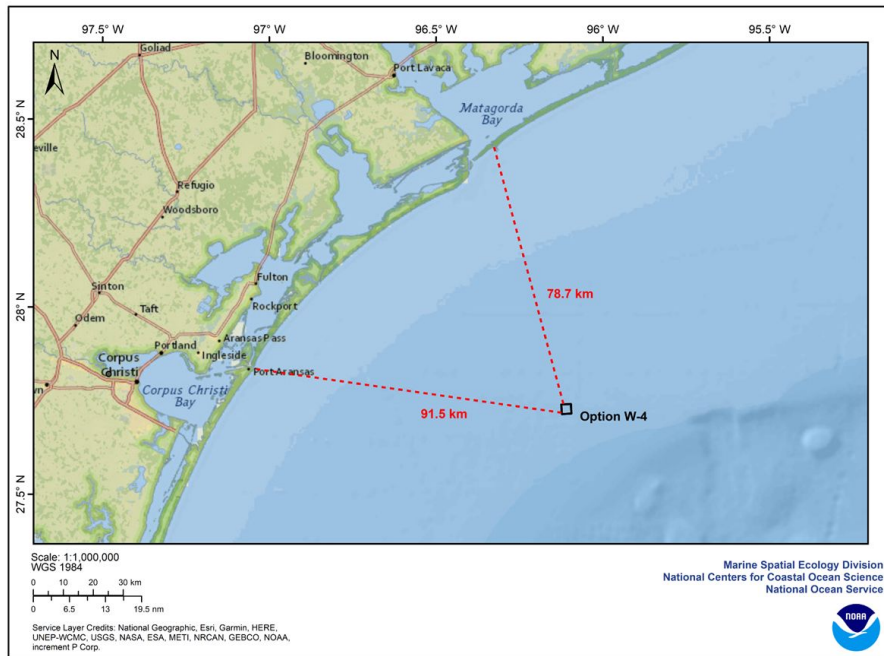
Methods (pp 44 - 47)

Results (pp 109 - 115)

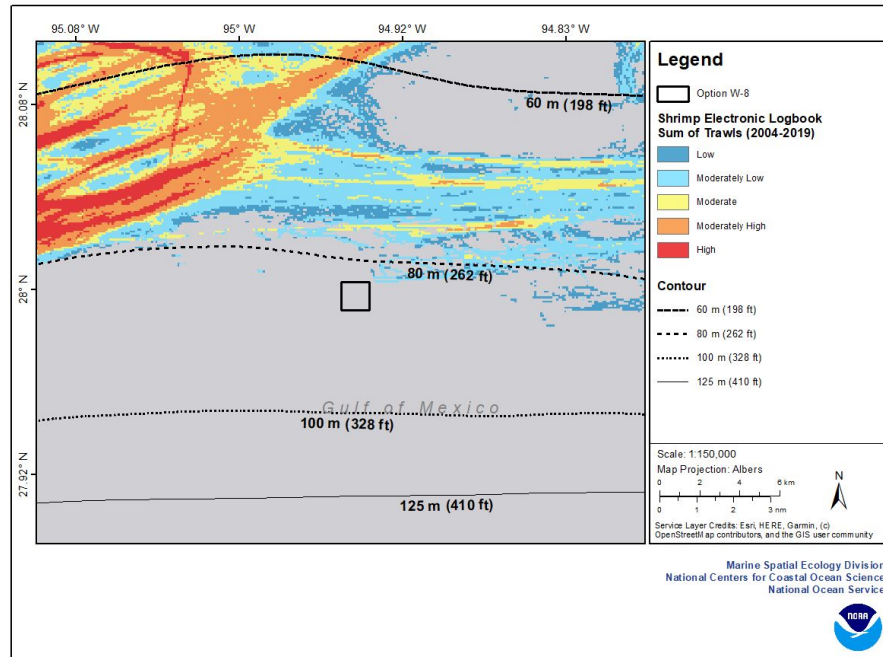
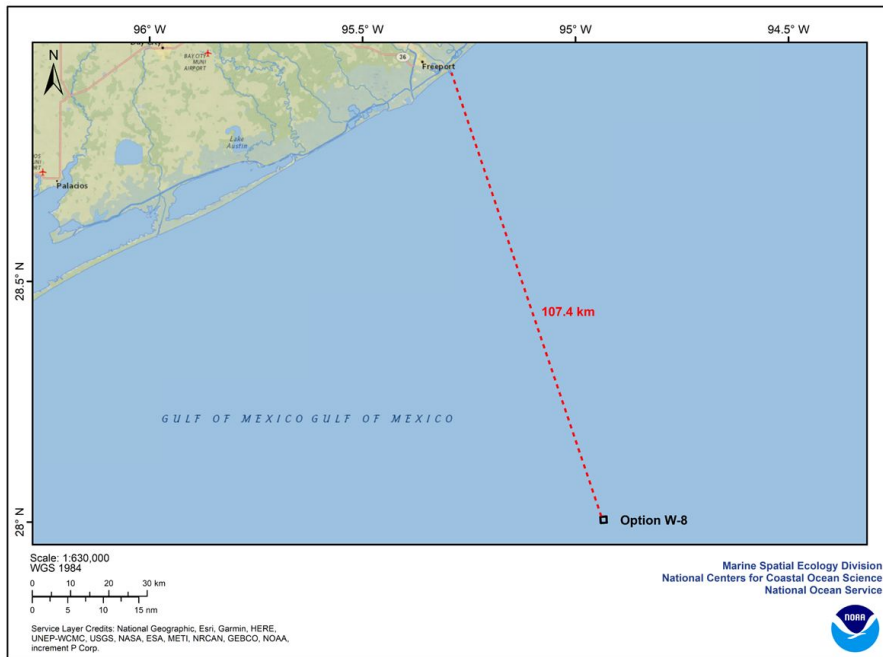
Texas Aquaculture Opportunity Area Option W-1 (2000 acres)



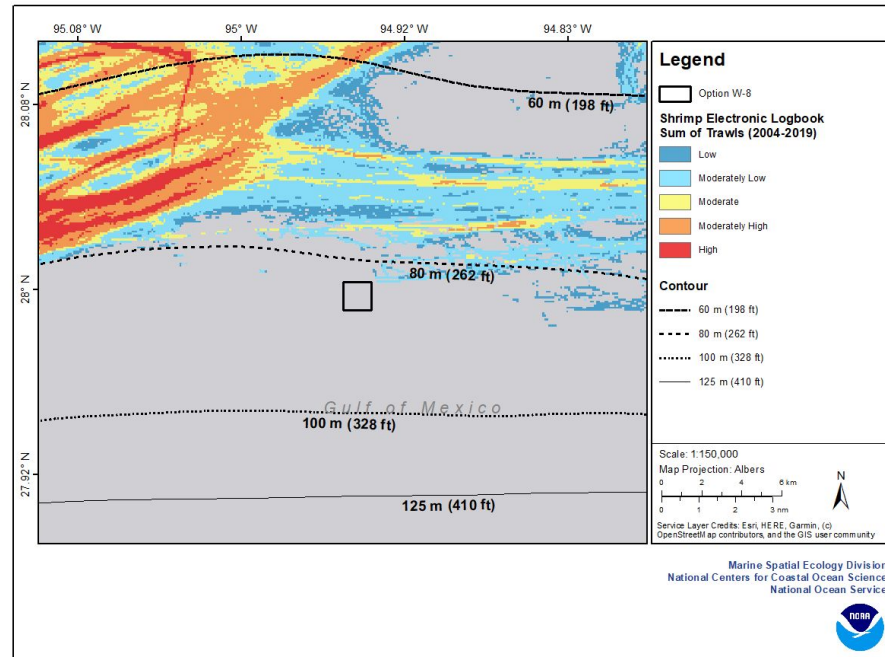
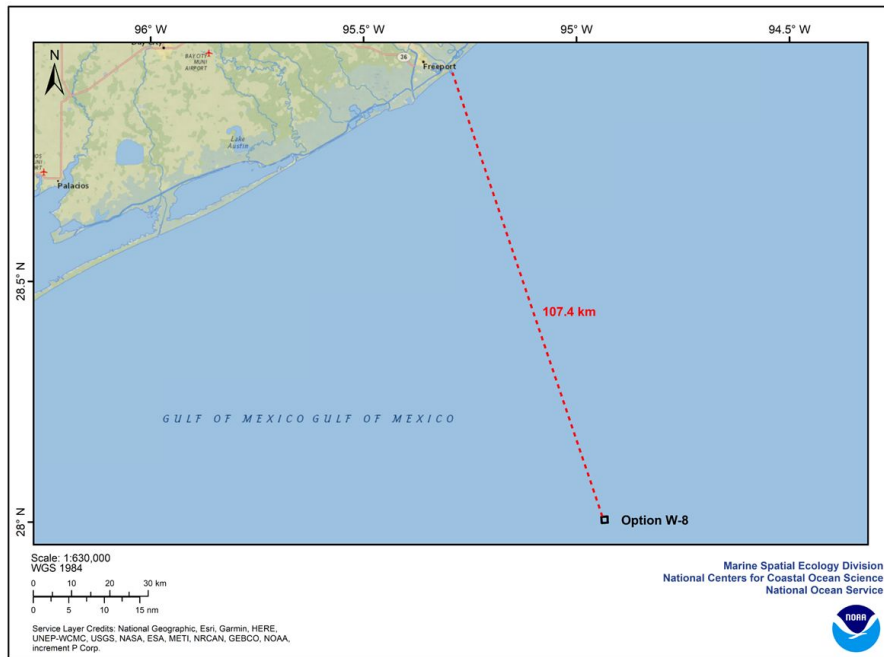
Texas Aquaculture Opportunity Area Option W-4 (2000 acres)



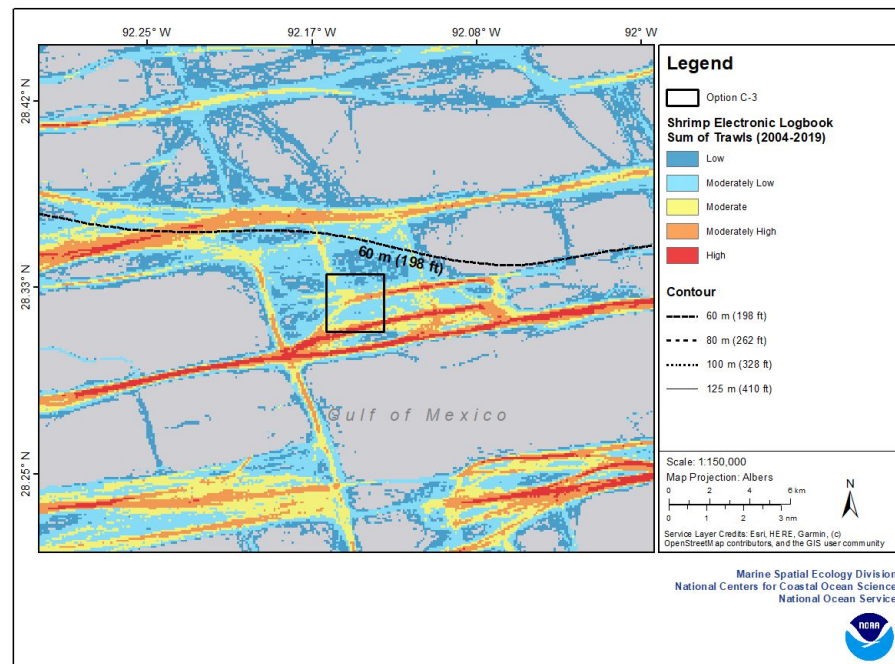
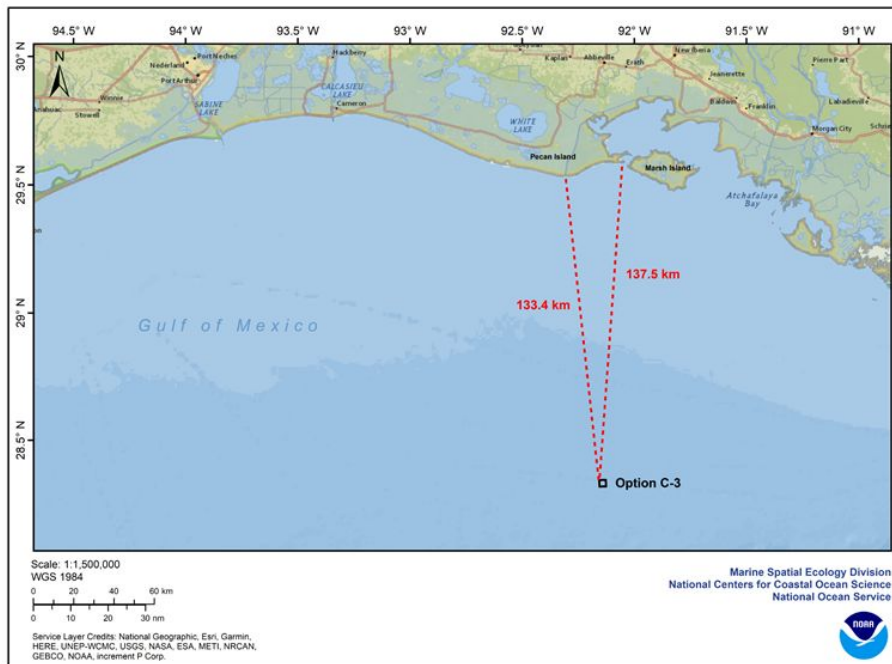
Texas Aquaculture Opportunity Area Option W-8 (500 acres)



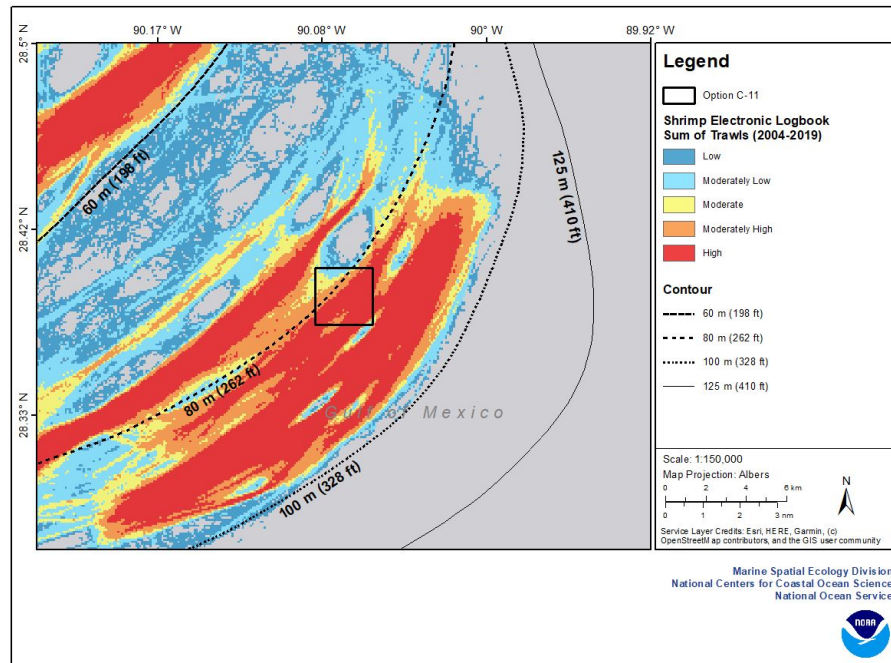
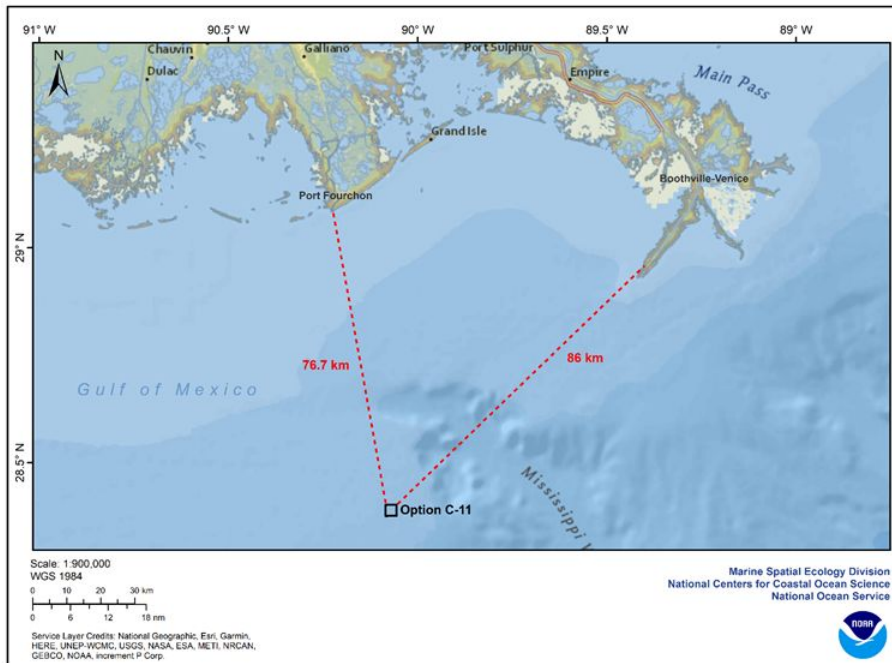
Texas Aquaculture Opportunity Area Option W-8 (2000 acres)



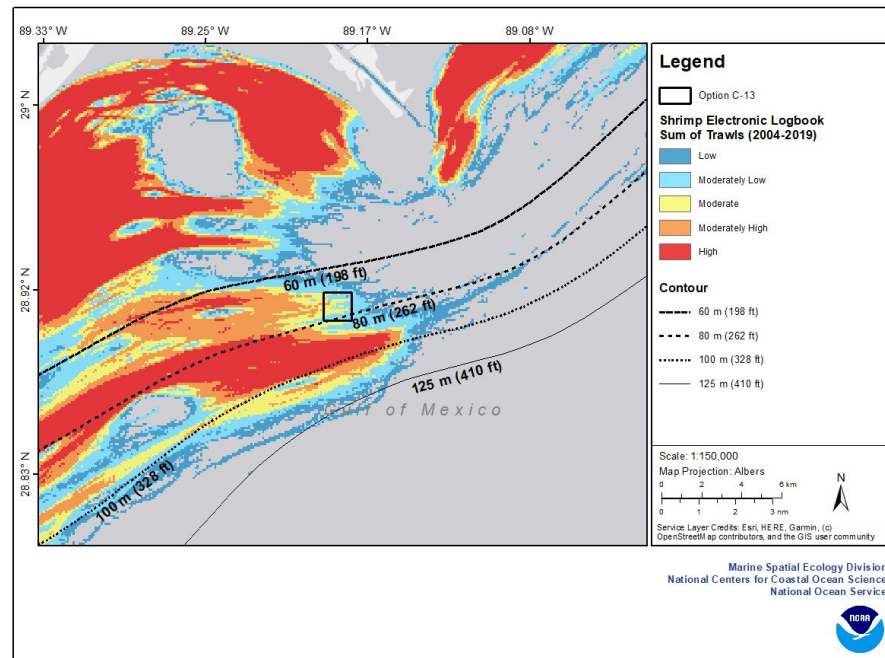
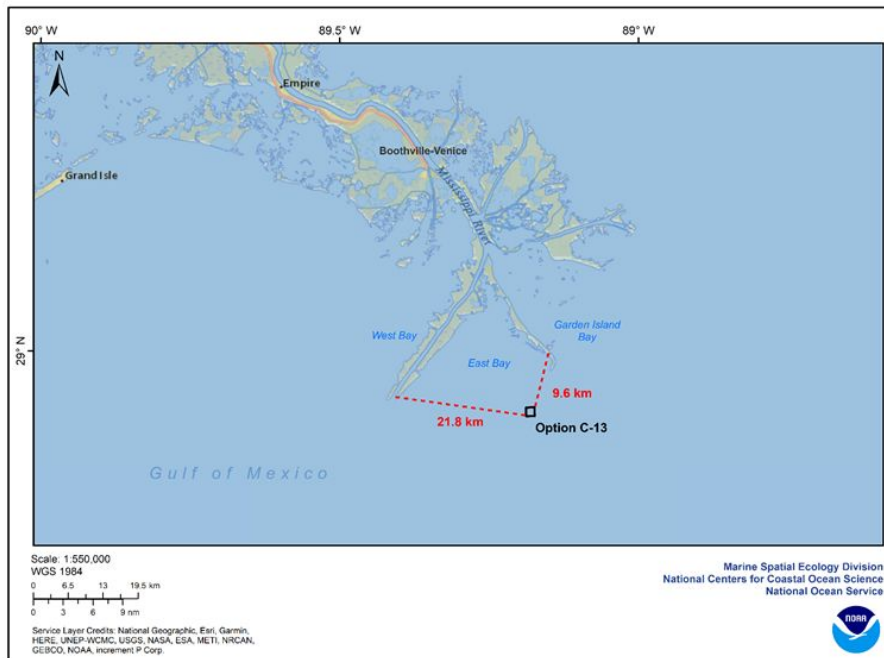
Louisiana Aquaculture Opportunity Area Option C-3 (2000 acres)



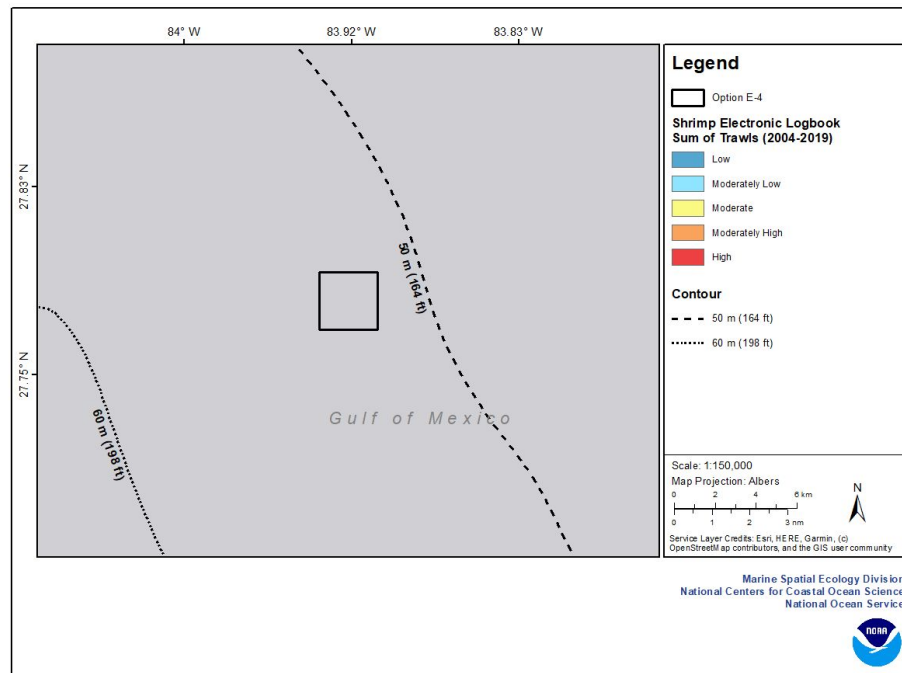
Louisiana Aquaculture Opportunity Area Option C-11 (2000 acres)



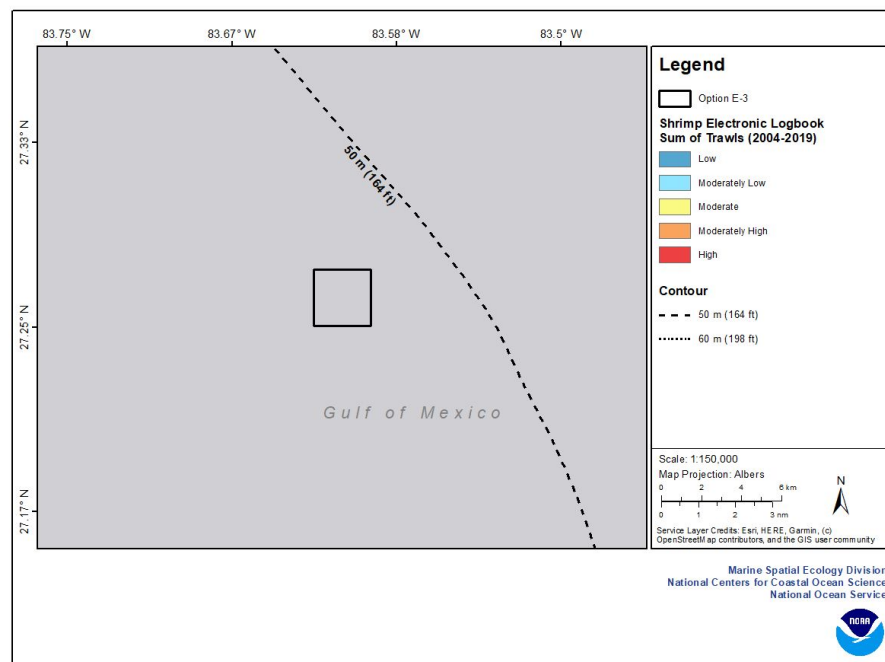
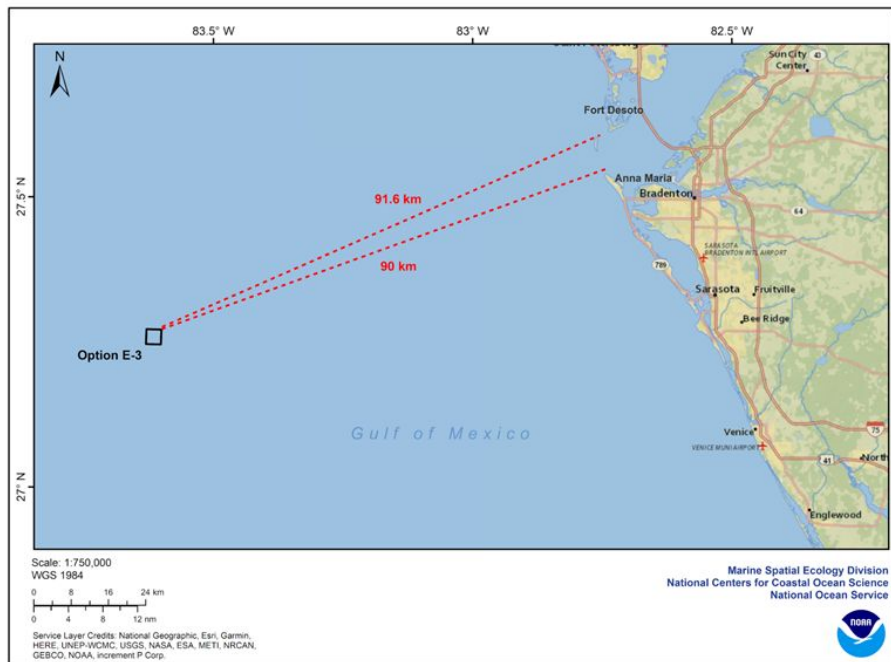
Louisiana Aquaculture Opportunity Area Option C-13 (500 acres)



Florida Aquaculture Opportunity Area Option E-4 (2000 acres)



Florida Aquaculture Opportunity Area Option E-3 (2000 acres)



Florida Aquaculture Opportunity Area Option E-1 (500 acres)

