

Oil/Dispersant Impacts and Mitigation on Living Marine Resources

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A year ago…..Long-term Ecosystems Effects: Science priorities (+Response & NRDA)

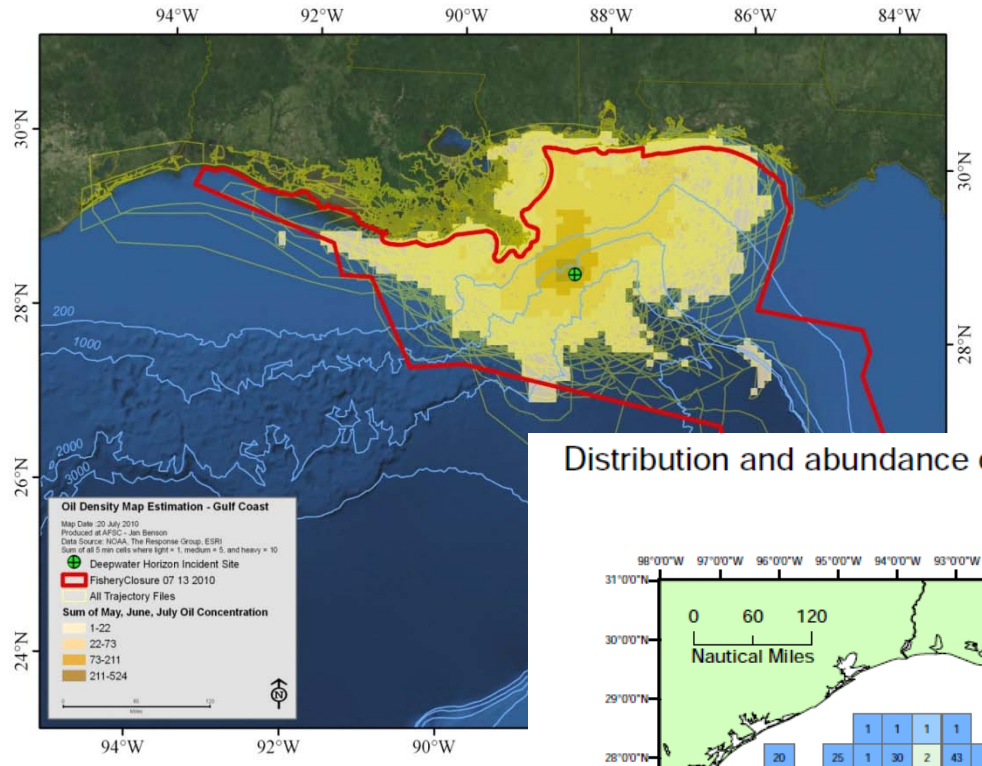
Scientific needs to assess the full impacts of DWH on Gulf of Mexico ecosystems:

- Plankton assessments
- Microbial-driven oil biodegradation rates
- Lab exposure studies of oil and dispersants
- Protected species (turtles, birds, & mammals)
- Fisheries abundance and distribution
- Wetlands impacts & nursery areas
- Hypoxia & carbon loading
- Socio-economic impacts
- Integrated ecosystem assessments

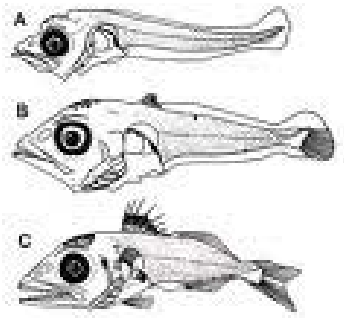
Coordinating Among Various LMR Efforts…..

- Ongoing natural resource management & monitoring efforts by states and federal agencies – fisheries, wildlife, public safety, environmental quality sampling
- Natural Resources Damage Assessment (NRDA) activities among NOAA, DOI and the 5 state Trustees – 20+ Technical Working Groups (TWGs) – data to be released at some point, interpretation forms the basis of ongoing interactions with the RP – tremendous source of data
- GMRI - Gulf of Mexico Research Initiative, $500 m over 10 years, broad research program on DWH and the Gulf ecosystem (LMR portfolio?)
- National Academy of Sciences, Ocean Studies Board study on Loss of Ecosystem Services in the Gulf – expect an interim report – valuation studies
- Gulf of Mexico Restoration Task Force – focus on the big picture of habitat resiliency – need a robust monitoring program and assessments of the impacts of proposed restoration activities
- LMRs are the key “so what” question for understanding and justifying mitigation programs
- Need an holistic understanding of science being undertaken for each of these elements

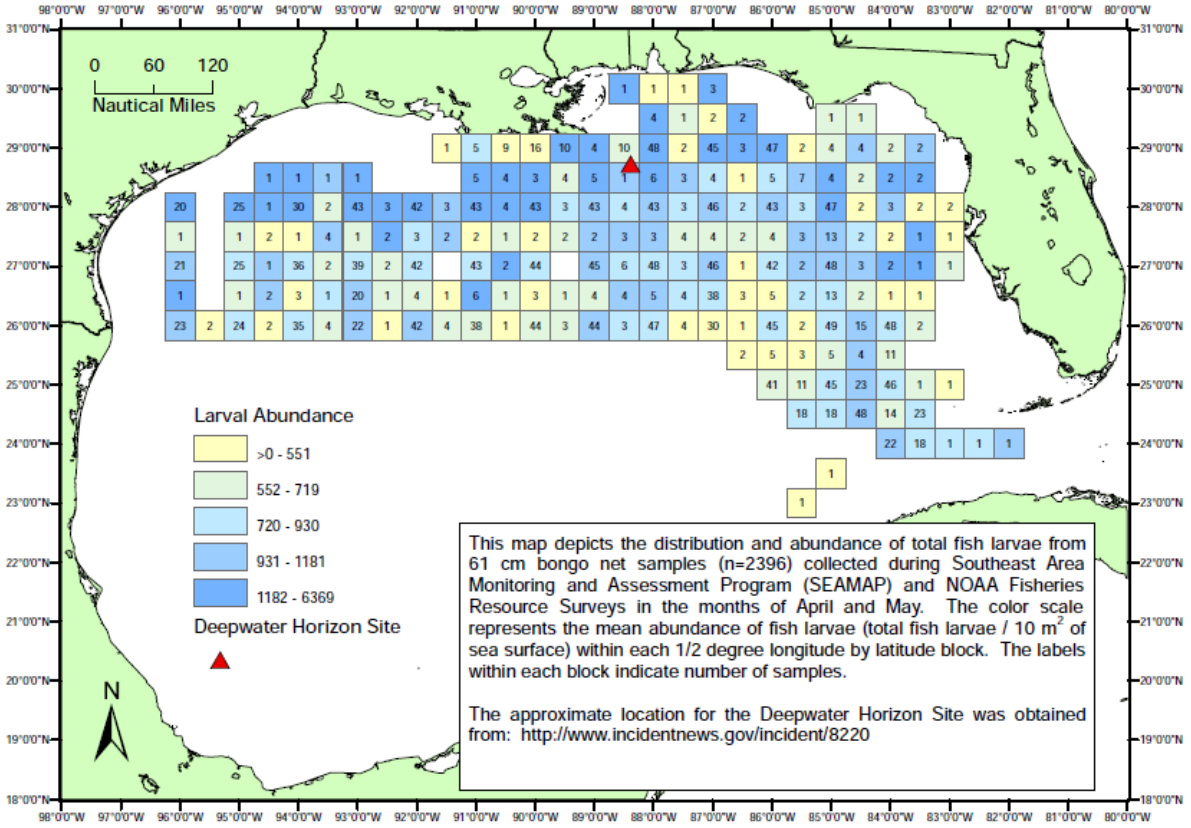
Impacts of DWH on Fish Reproduction – Potentially Significant To Gulf fisheries

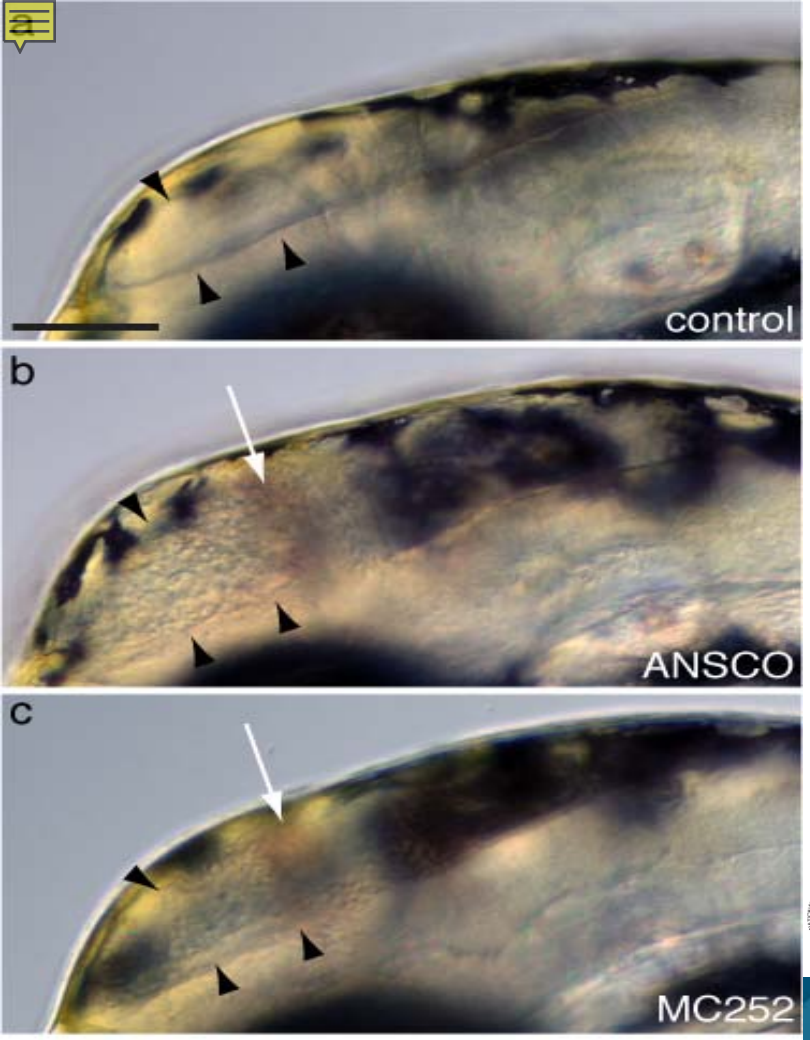


"Oil Days" Density Map from overflight data

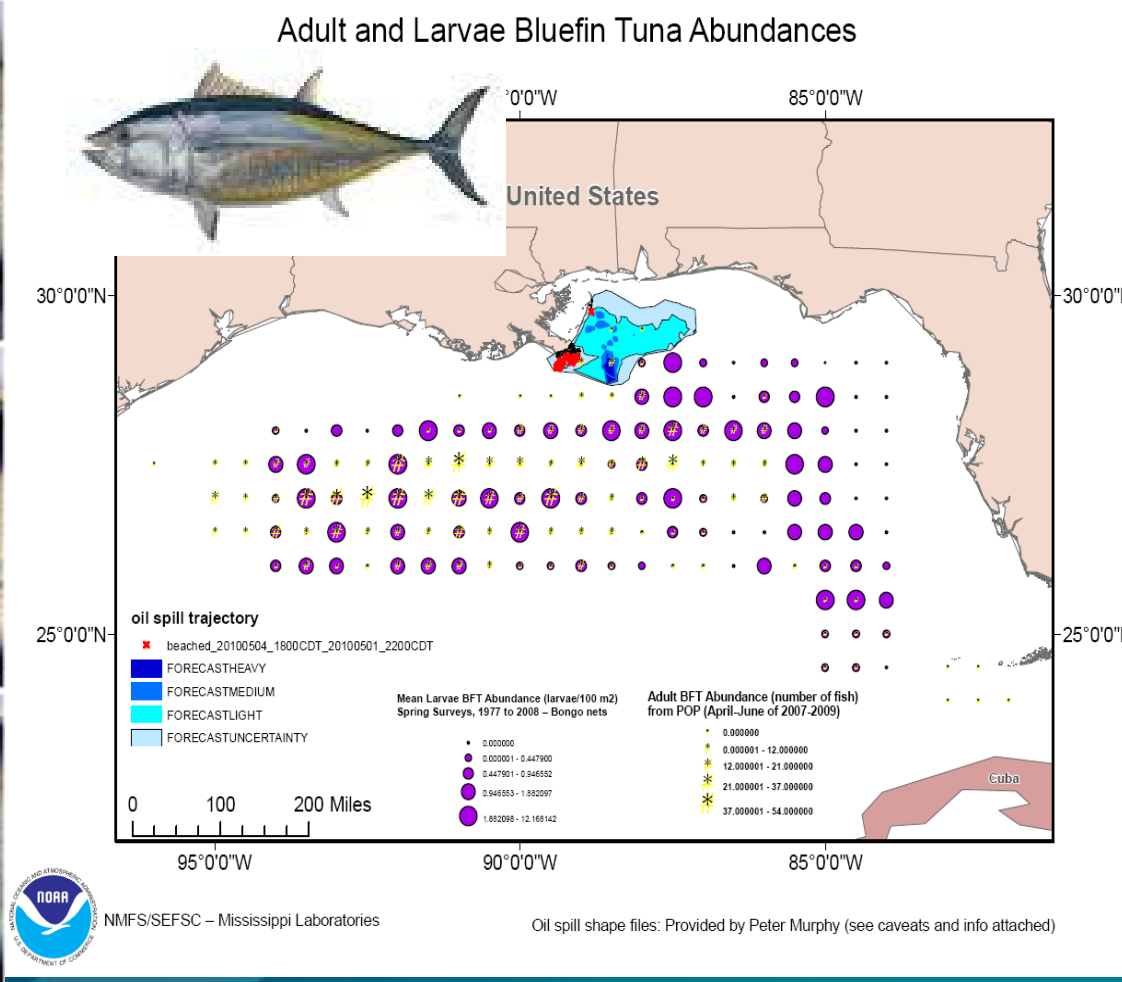


Distribution and abundance of total fish larvae from bongo net samples collected during April and May (1982 to 2008)



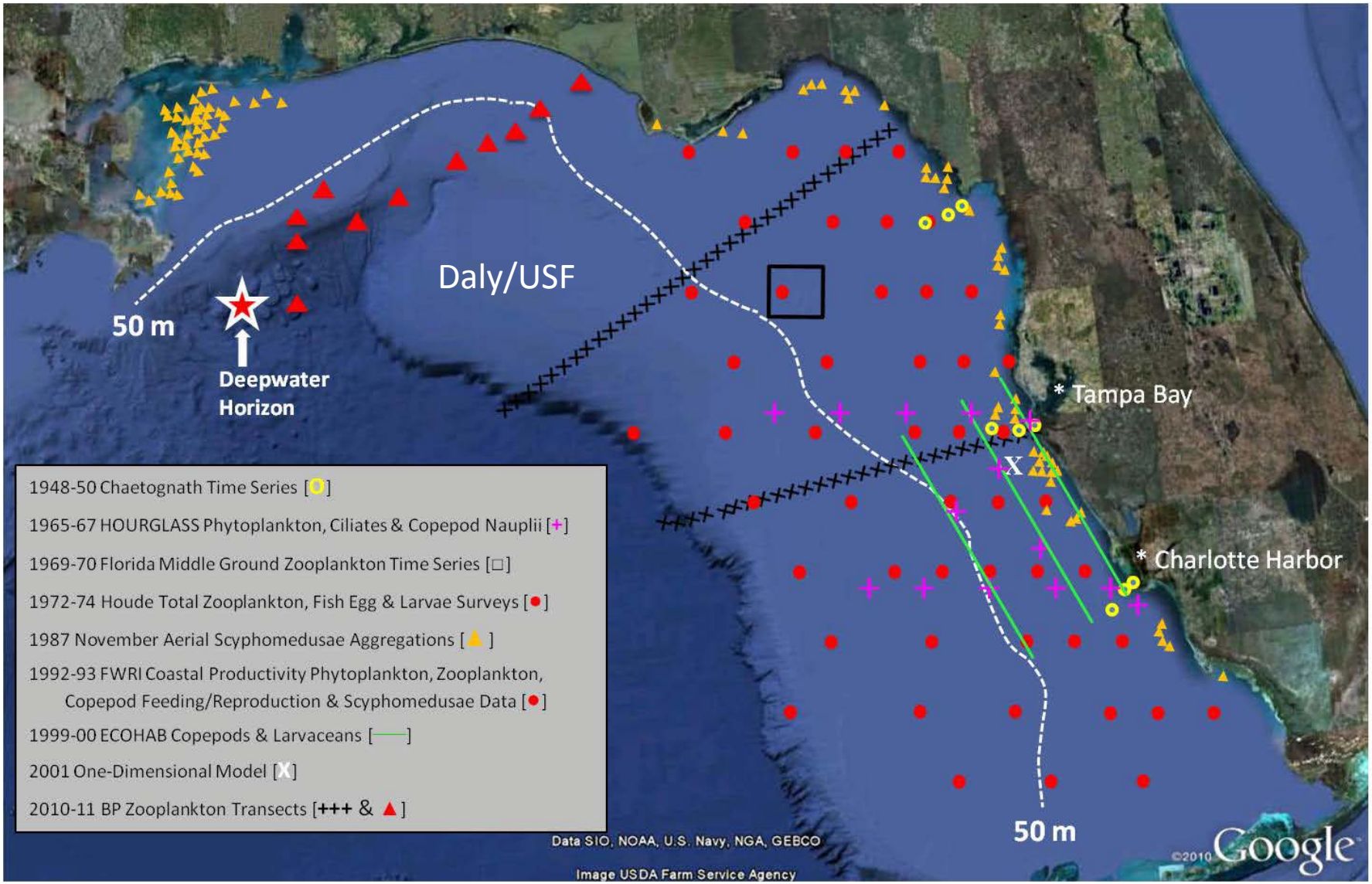


Intracranial hemorrhage of larval fish following crude oil exposure.

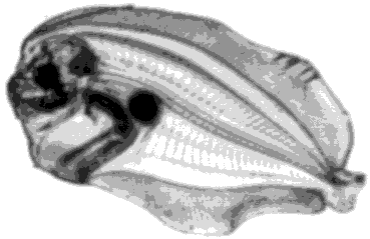


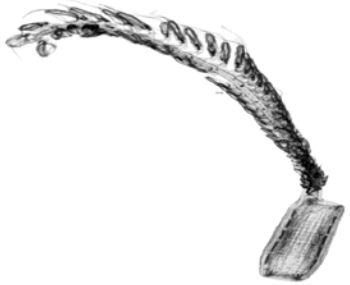
- Potential Impacts on ichthyoplankton
- BFT spawning in the region offshore from the spill from April-June

Plankton Community Responses to DWH
What is the background against which we are measuring potential impacts?

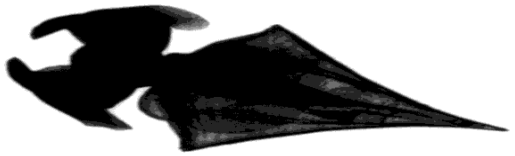


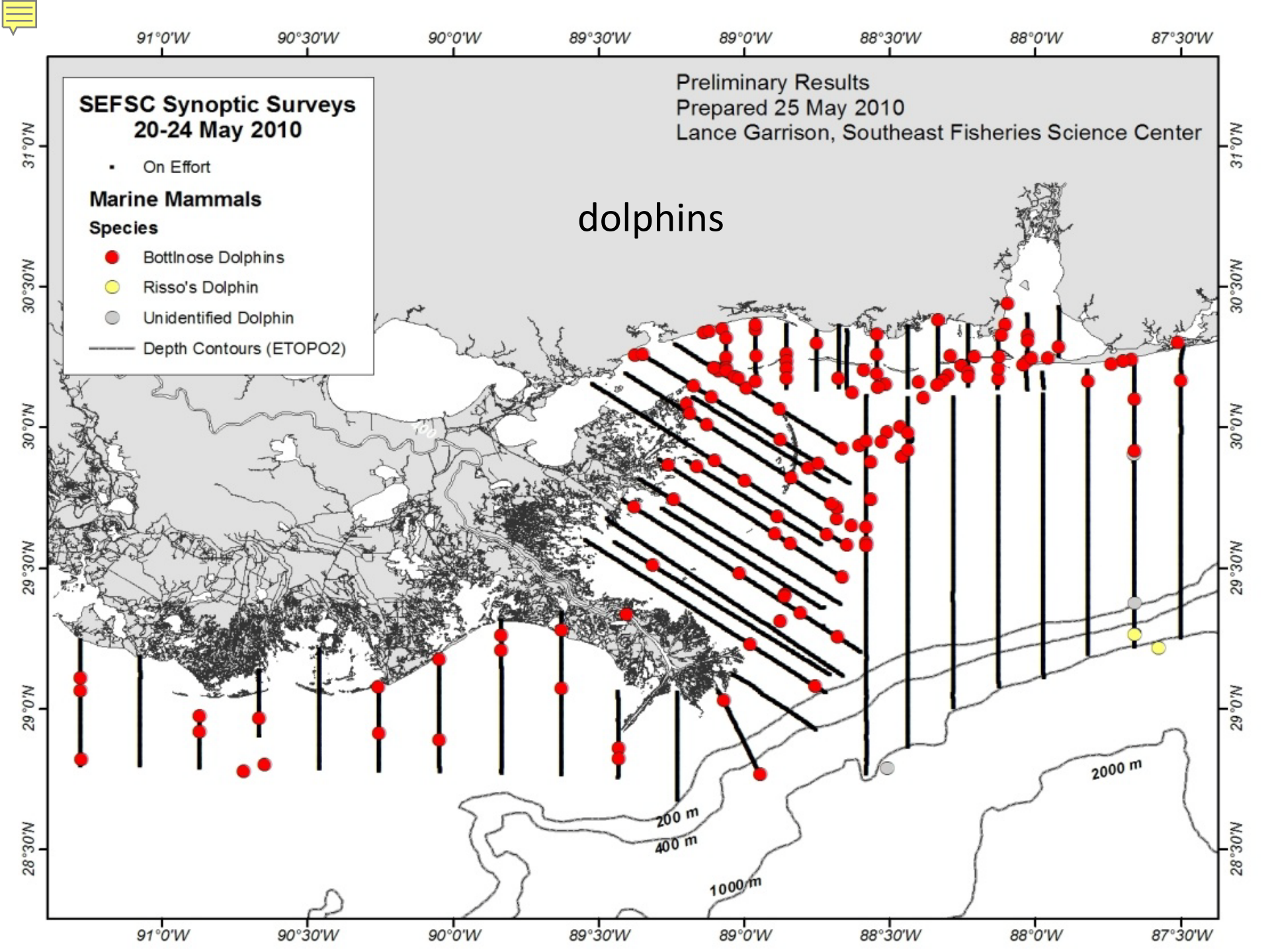
SIPPER Imaging System Deployment





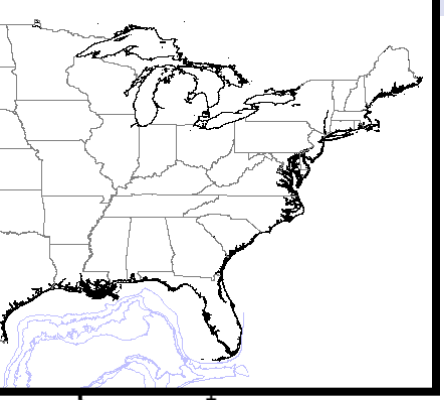
Daly/USF




SEFSC Synoptic Surveys
20-24 May 2010
On Effort
Marine Mammals
Species
Bottlnose Dolphins
Risso's Dolphin
Unidentified Dolphin
Depth Contours (ETOPO2)
Preliminary Results
Prepared 25 May 2010
Lance Garrison, Southeast Fisheries Science Center
dolphins
91°0'W
90°30'W
90°0'W
89°30'W
89°0'W
88°30'W
88°0'W
87°30'W
31°0'N
30°30'N
30°0'N
29°30'N
29°0'N
28°30'N
200 m
400 m
1000 m
2000 m

Study Sites

John Hildebrand/Scripps



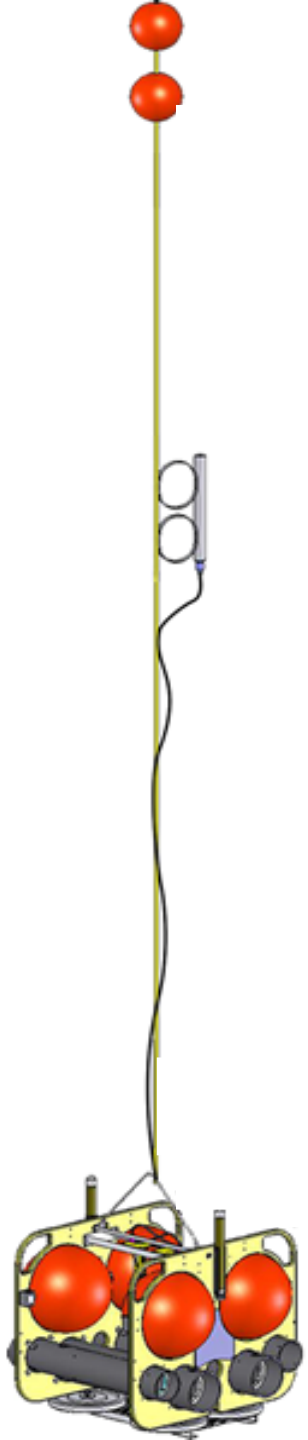
Shelf

Wellhead

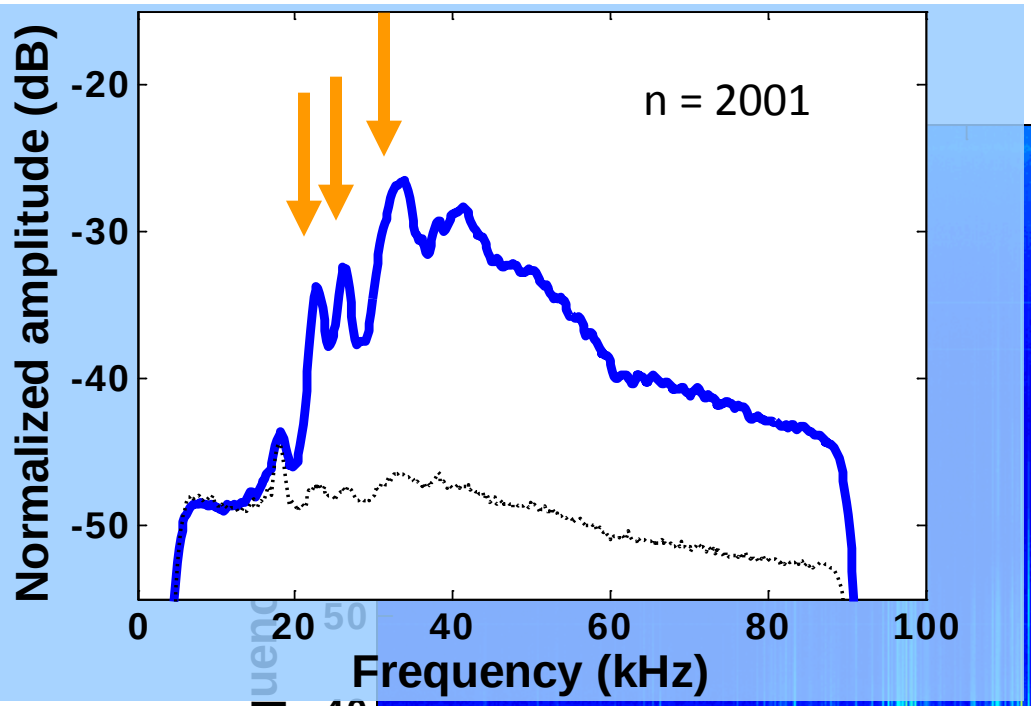
Slope

passive acoustic monitoring of marine mammals in the Gulf of Mexico

200 km

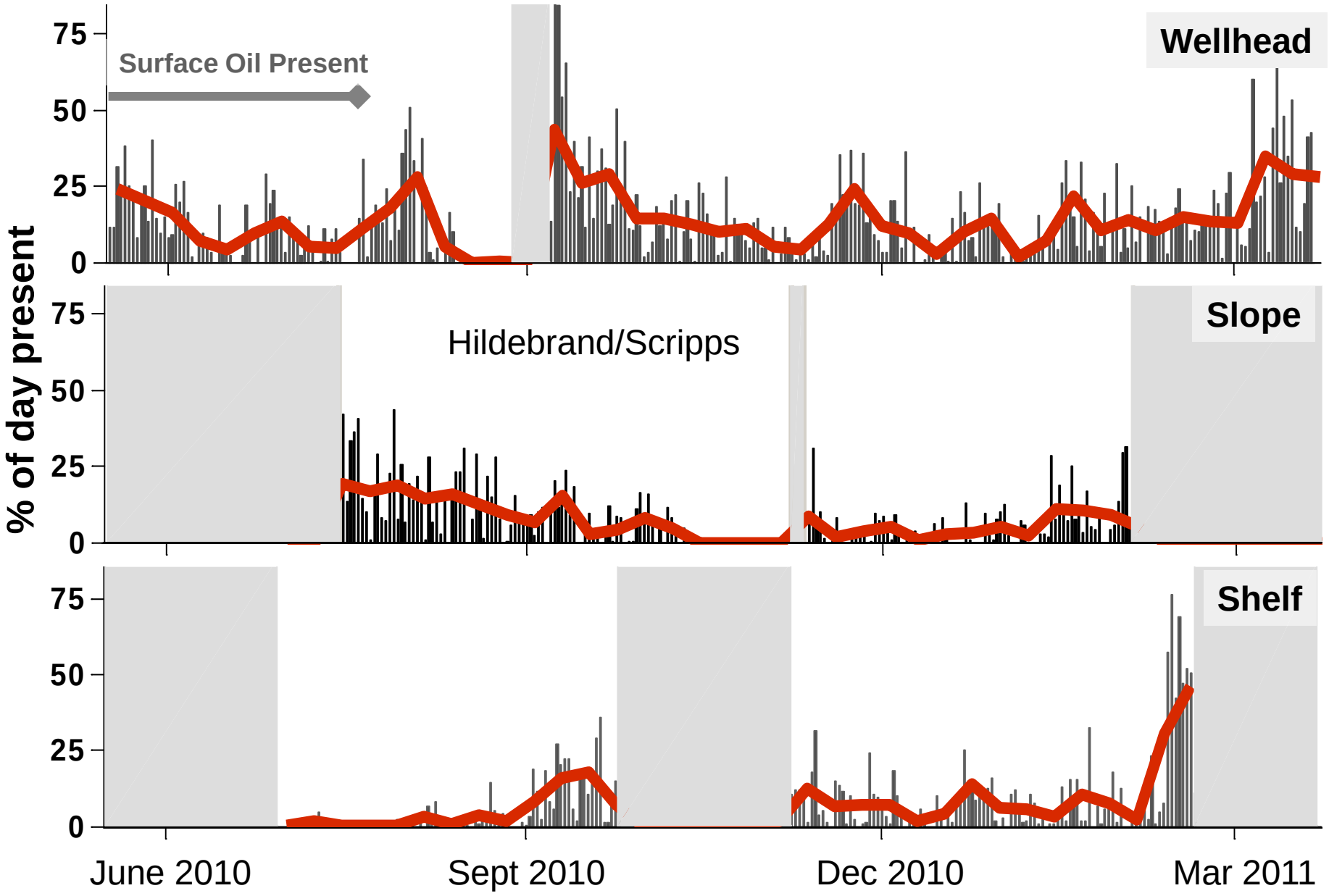


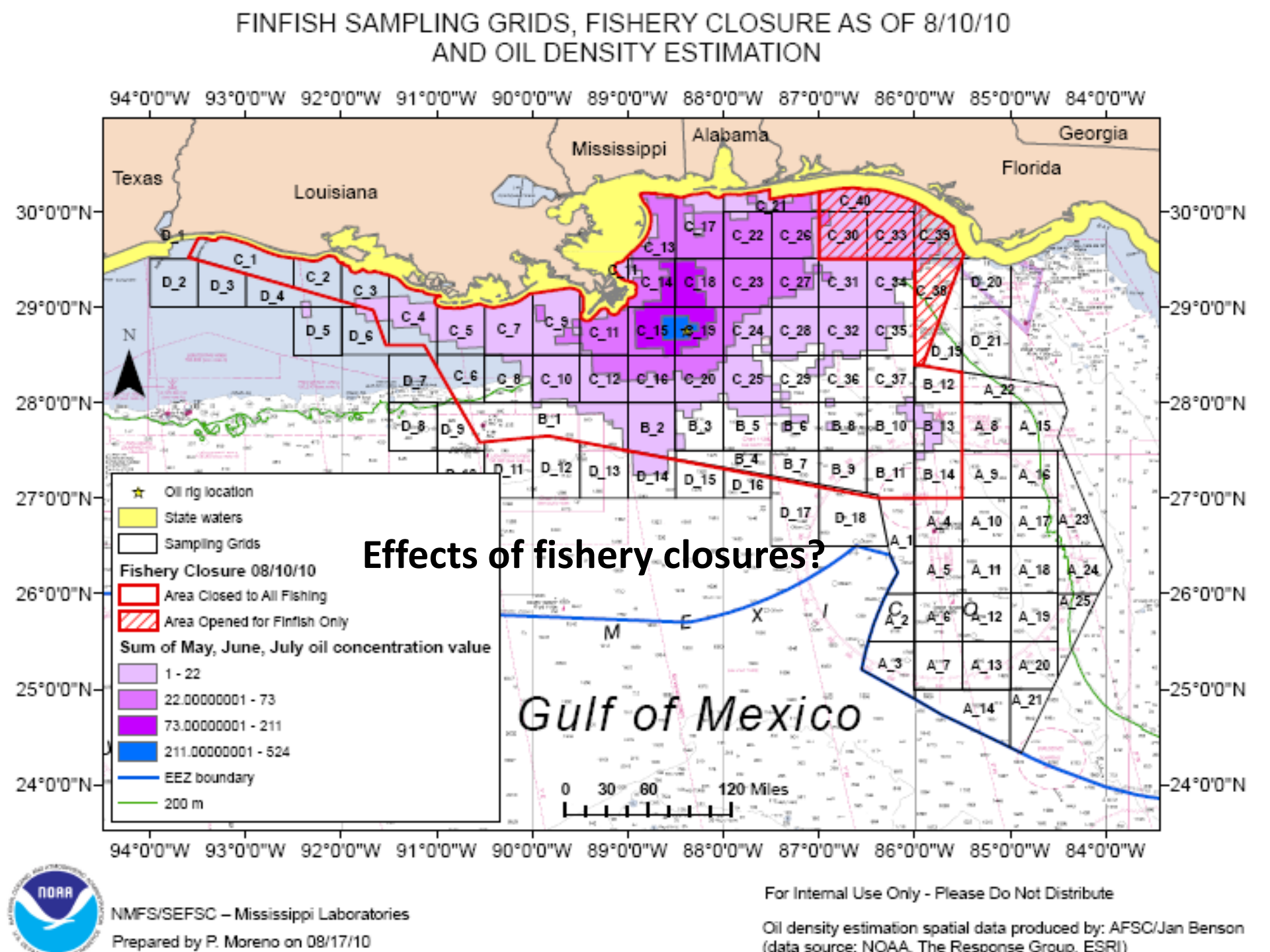
What species are present?

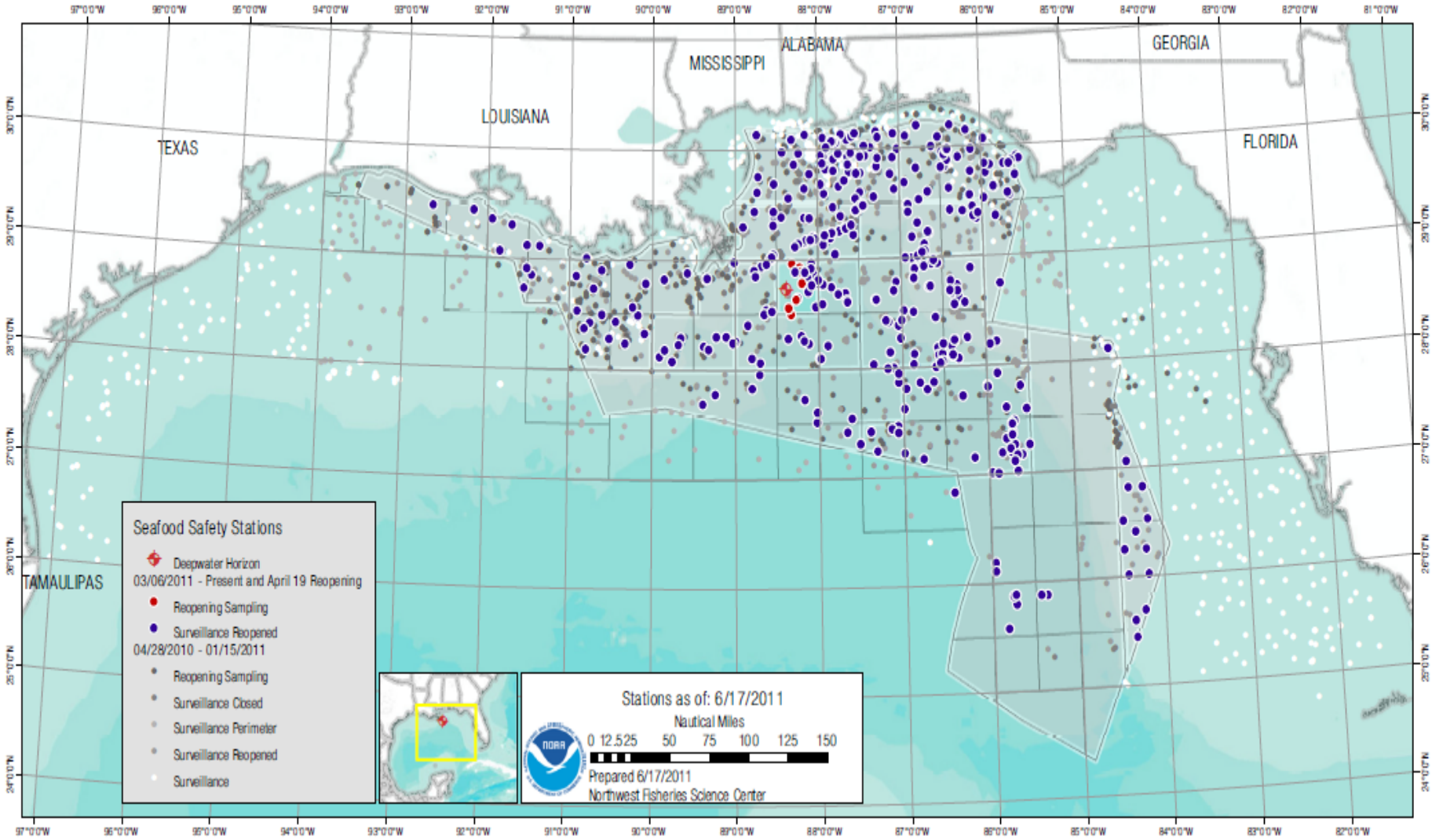


Risso's dolphins

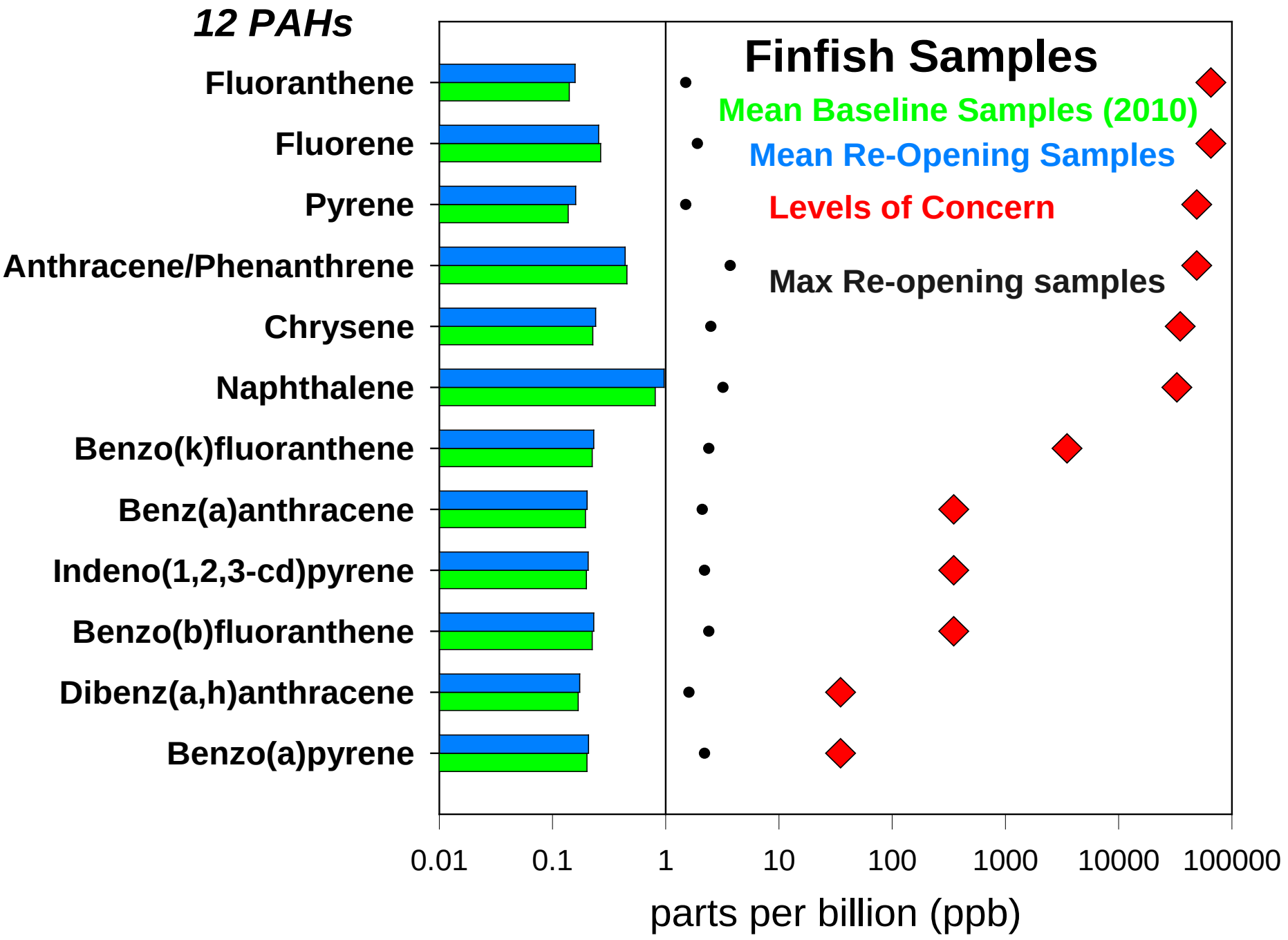
Delphinid Detections Following the Oil Spill




FINFISH SAMPLING GRIDS, FISHERY CLOSURE AS OF 8/10/10
AND OIL DENSITY ESTIMATION
Texas
Louisiana
Mississippi
Alabama
Florida
Georgia
Effects of fishery closures?
Gulf of Mexico
Oil rig location
State waters
Sampling Grids
Fishery Closure 08/10/10
Area Closed to All Fishing
Area Opened for Finfish Only
Sum of May, June, July oil concentration value
1 - 22
22.00000001 - 73
73.00000001 - 211
211.00000001 - 524
EEZ boundary
200 m
0 30 60 120 Miles
NMFS/SEFSC – Mississippi Laboratories
Prepared by P. Moreno on 08/17/10
For Internal Use Only - Please Do Not Distribute
Oil density estimation spatial data produced by: AFSC/Jan Benson
(data source: NOAA, The Response Group, ESRI)



Where has seafood safety monitoring occurred?


12 PAHs
Fluoranthene
Fluorene
Pyrene
Anthracene/Phenanthrene
Chrysene
Naphthalene
Benzo(k)fluoranthene
Benz(a)anthracene
Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene
Dibenz(a,h)anthracene
Benzo(a)pyrene
Finfish Samples
Mean Baseline Samples (2010)
Mean Re-Opening Samples
Levels of Concern
Max Re-opening samples
0.01
0.1
1
10
100
1000
10000
100000
parts per billion (ppb)

Emerging issue: Fish Diseases in the Gulf of Mexico –

…….are they related to DWH?

Teams involved:

(1) Jim Cowan/LSU

(2) Will Patterson/USA

(3) Bob Shipp/Sean Powers/DISL

(4) USF Team

Challenges to Understanding Fish Disease Prevalence and Relationships to Specific Drivers

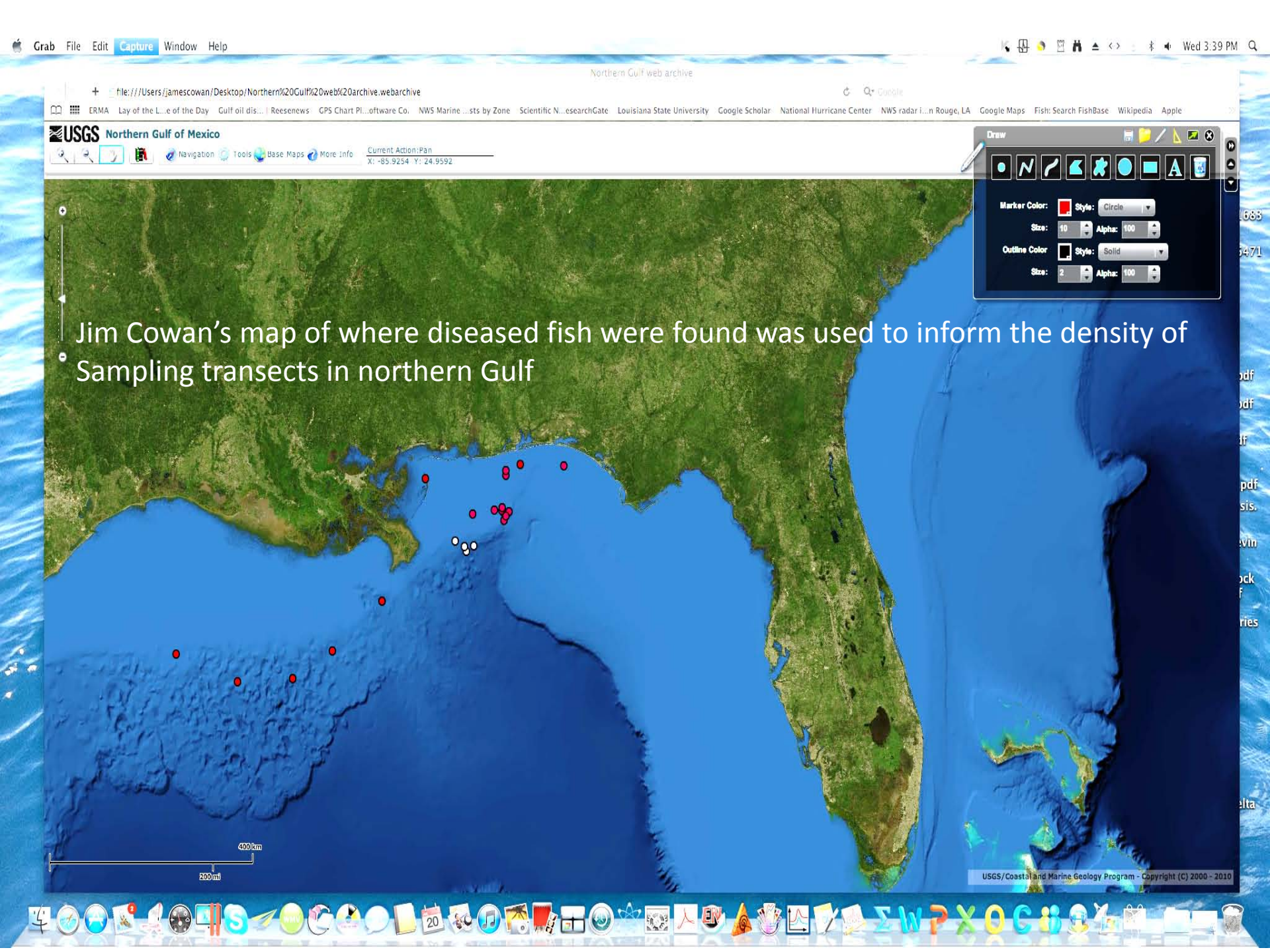
(1) Lack of historical baselines to determine "what's normal? Regional studies are quite variable globally

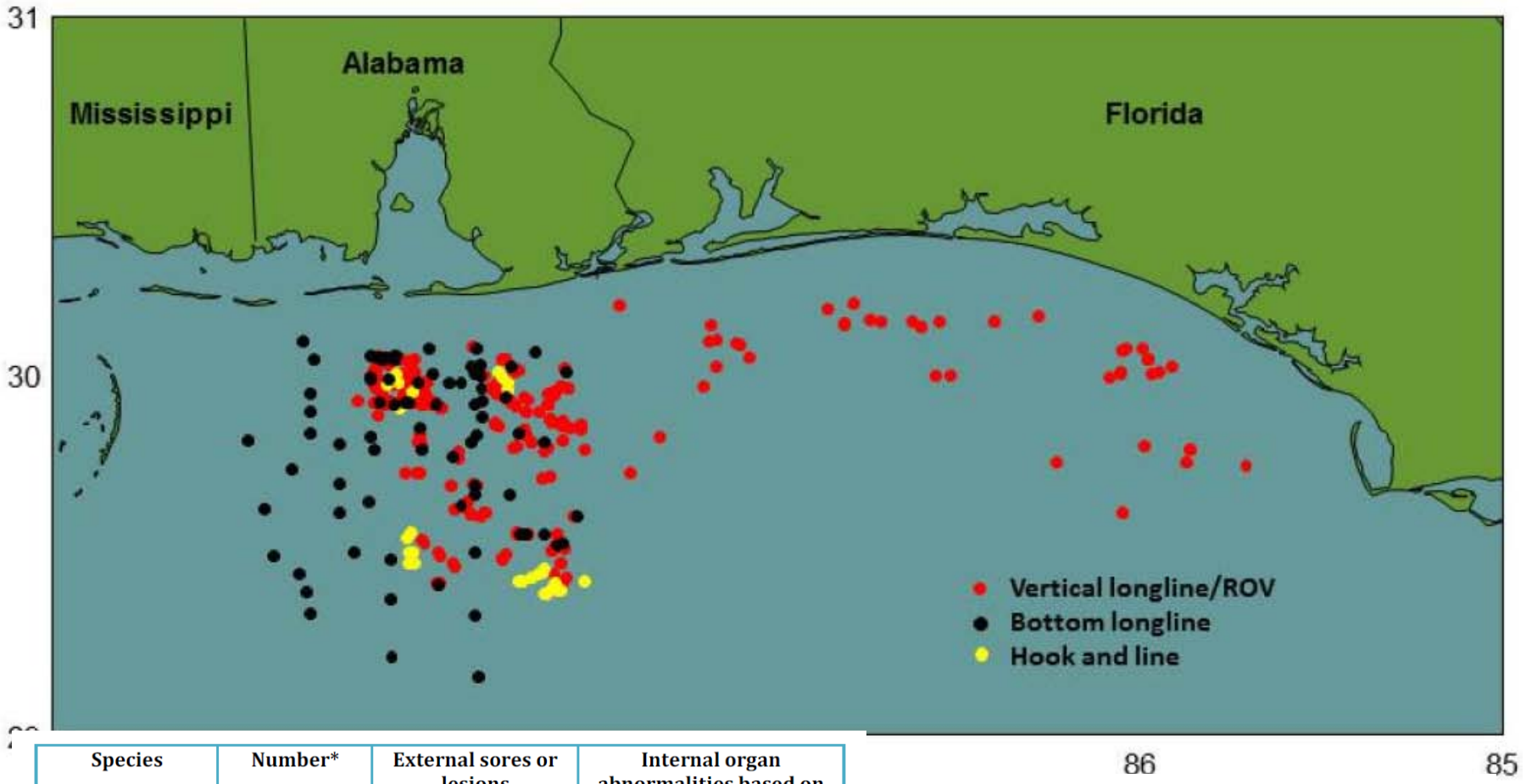
(2) How does the prevalence of fish diseases vary by location, species, depth, proximity to DWH, individual exposure history of individual species

(3) Is there an exposure scenario that leads to increased disease frequency (e.g., immune system response)?

(4) So what? Does this result in lower population sizes through increased mortality? Reproductive output? Need IBM-type modeling

(5) What long-term monitoring should be conducted to allow fish health to comprise an element of "ecosystem health"?


Grab File Edit Capture Window Help
Wed 3:39 PM
Northern Gulf web archive
file:///Users/jamescowan/Desktop/Northern%20Gulf%20web%20archive.webarchive
USGS Northern Gulf of Mexico
Navigation Tools Base Maps More Info
Current Action:Pan
X: -85.9254 Y: 24.9592
Draw
Marker Color:
Style: Circle
Size: 10
Alpha: 100
Outline Color
Style: Solid
Size: 2
Alpha: 100
Jim Cowan's map of where diseased fish were found was used to inform the density of Sampling transects in northern Gulf
400 km
200 mi
USGS/Coastal and Marine Geology Program - Copyright (C) 2000 - 2010



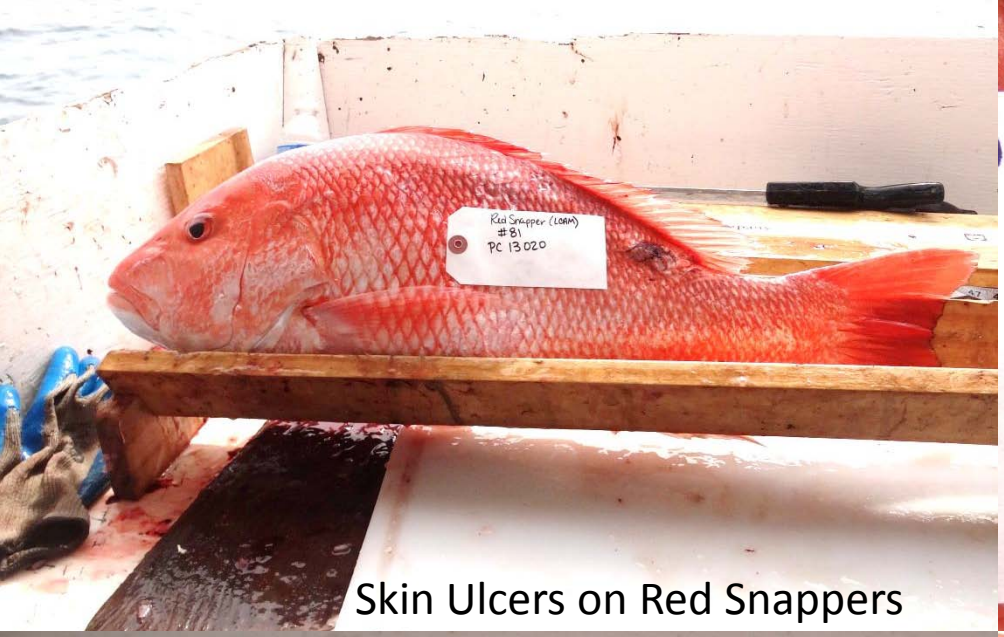
Species	Number*	External sores or lesions	Internal organ abnormalities based on gross examination
Red snapper	2,778	1**	0
Gray triggerfish	90	0	0
Red drum	102	0	0
Vermilion snapper	93	0	0
Grouper/Scamp	24	0	0

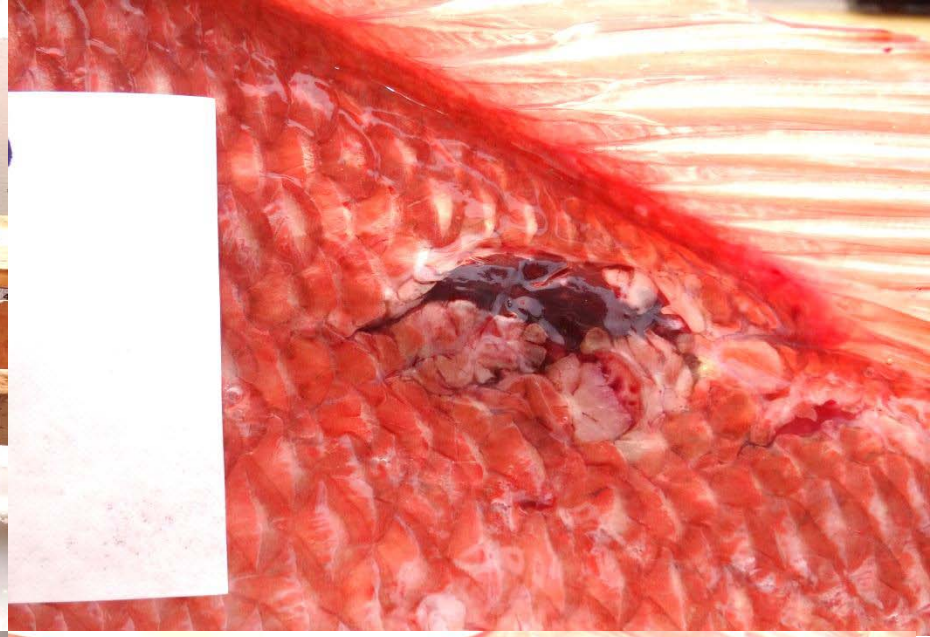
*Approximately 700 fish were sampled in late May and June of 2011.

Second Supplemental Report to Alabama Marine Resource Division

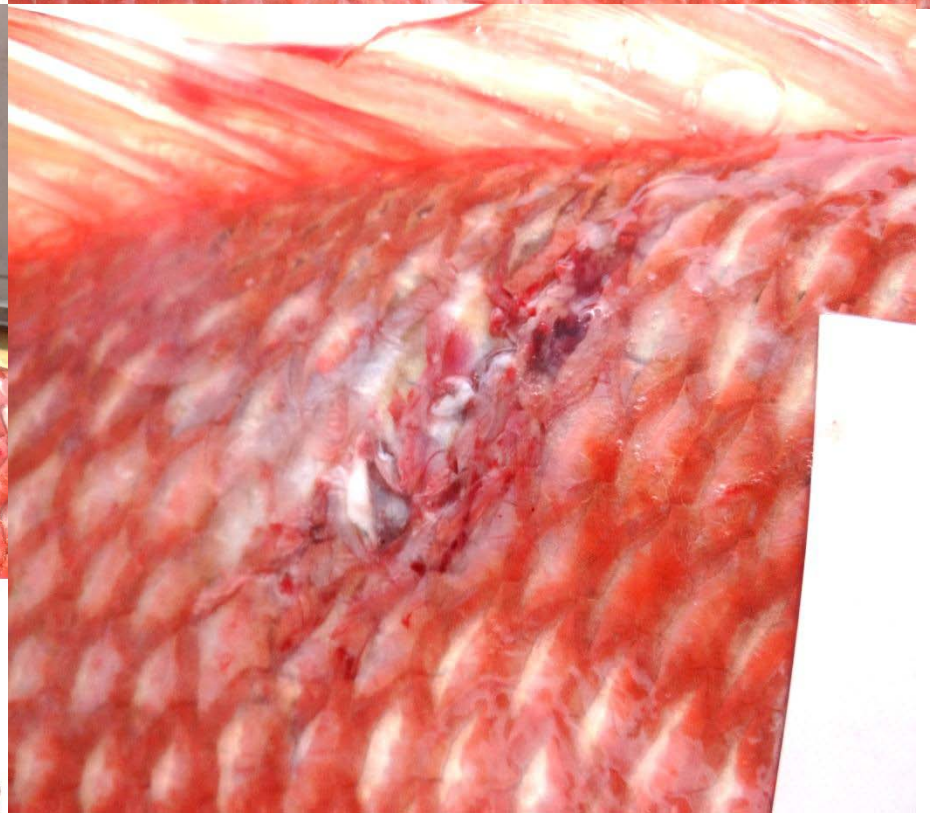
Sean Powers' and Robert Shipp's Work off inshore Alabama and western Florida were largely negative

June 9, 2011

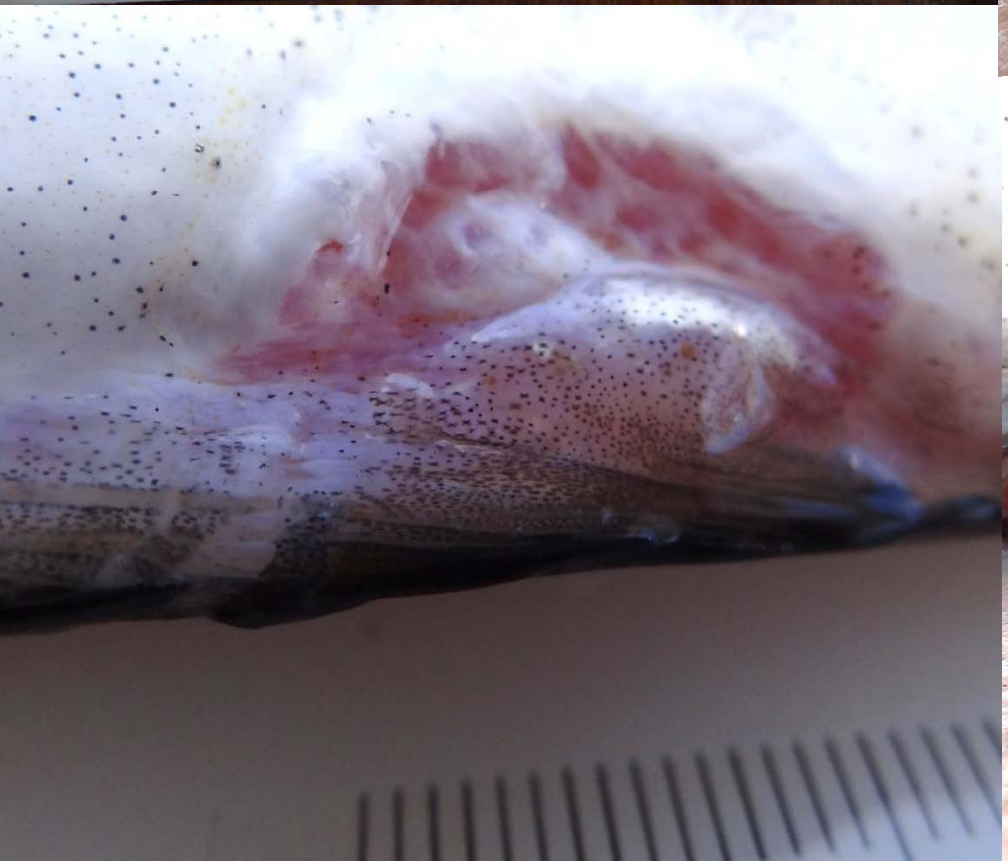




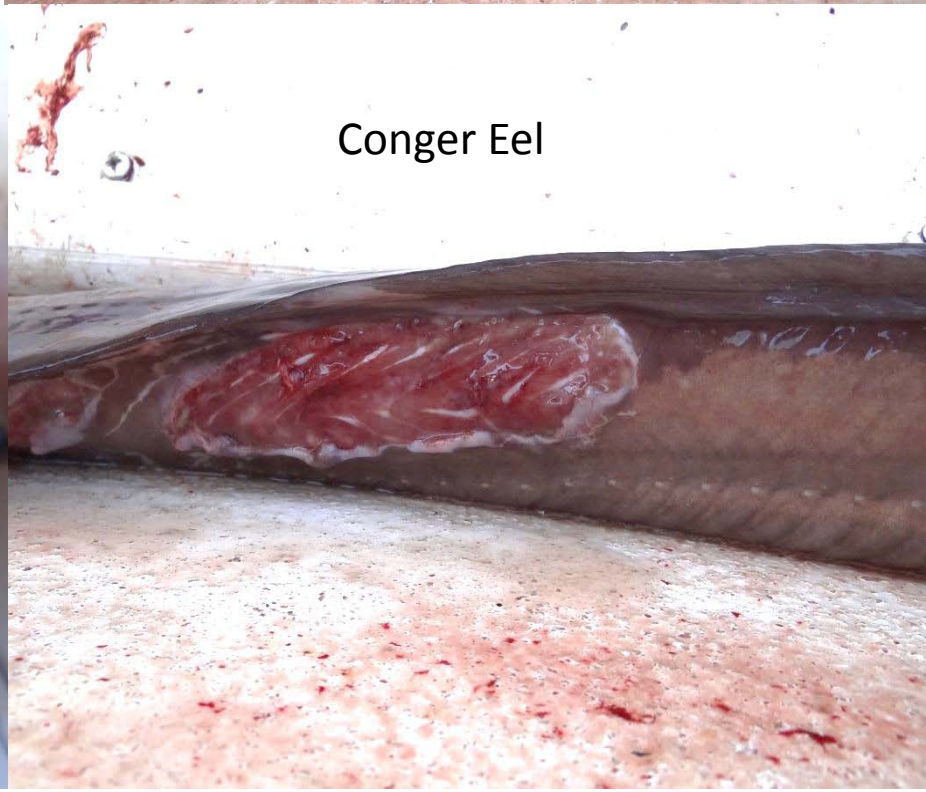
Skin Ulcers on Red Snappers



Southern Hake



Conger Eel



Mahi mahi
(dolphinfish)

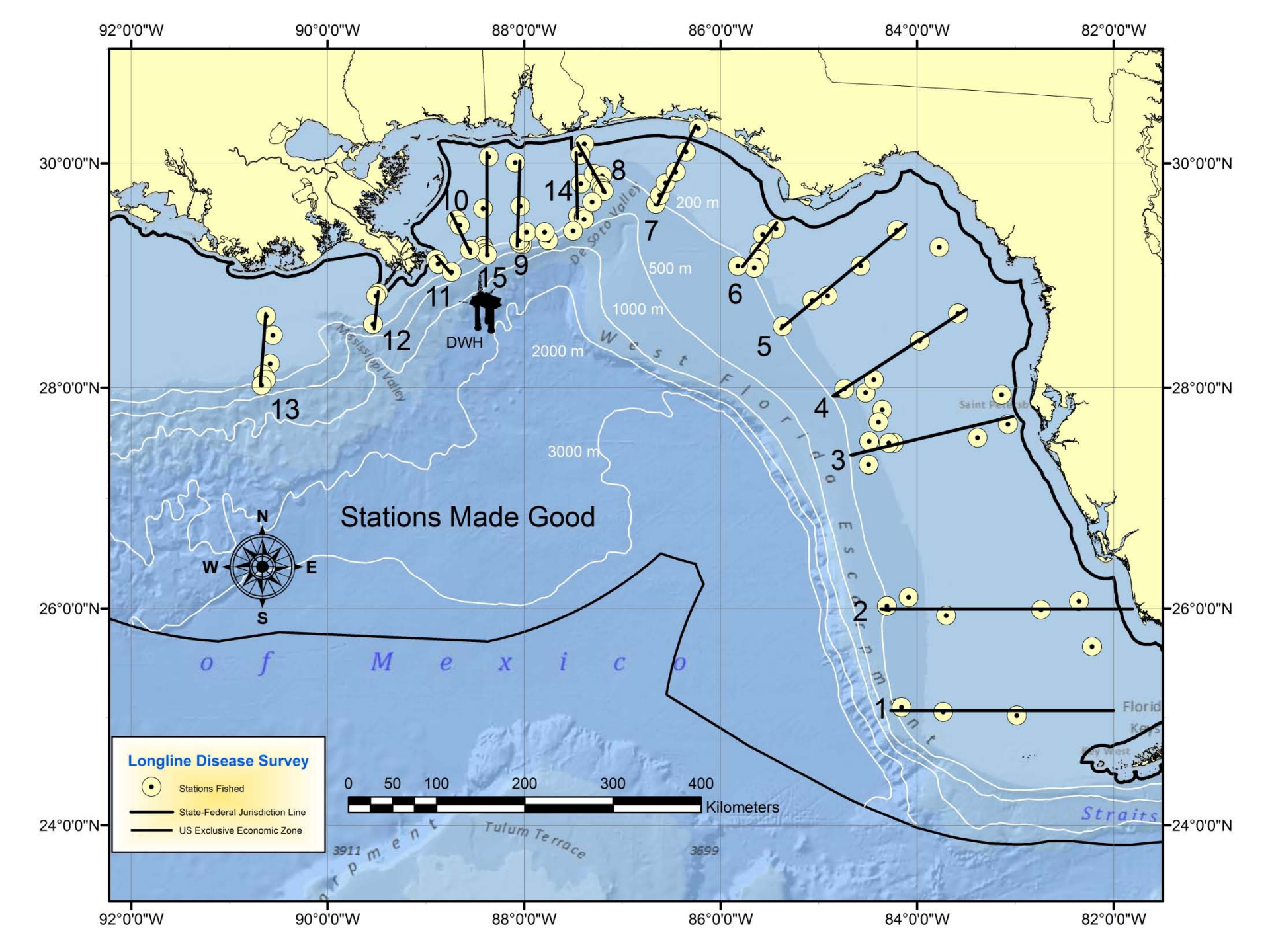
Fin Rot Disease Red Grouper

Scamp, snowy grouper, wb porgy
digenean parasites

F/V PISCES
Panama City, Florida
Capt. John Anderson
St. Andrews Marina

F/V Sea Fox
Owner: Bob Spaeth
Maderia Beach, FL

F/V Brandy
Maderia Beach, FL.
Capt. Randy Lauser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DWH
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9
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12
13
14
15
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500 m
1000 m
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De Soto Canyon
Mississippi Valley
West Florida Escarpment
Tulum Terrace
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Longline Disease Survey
Stations Fished
State-Federal Jurisdiction Line
US Exclusive Economic Zone
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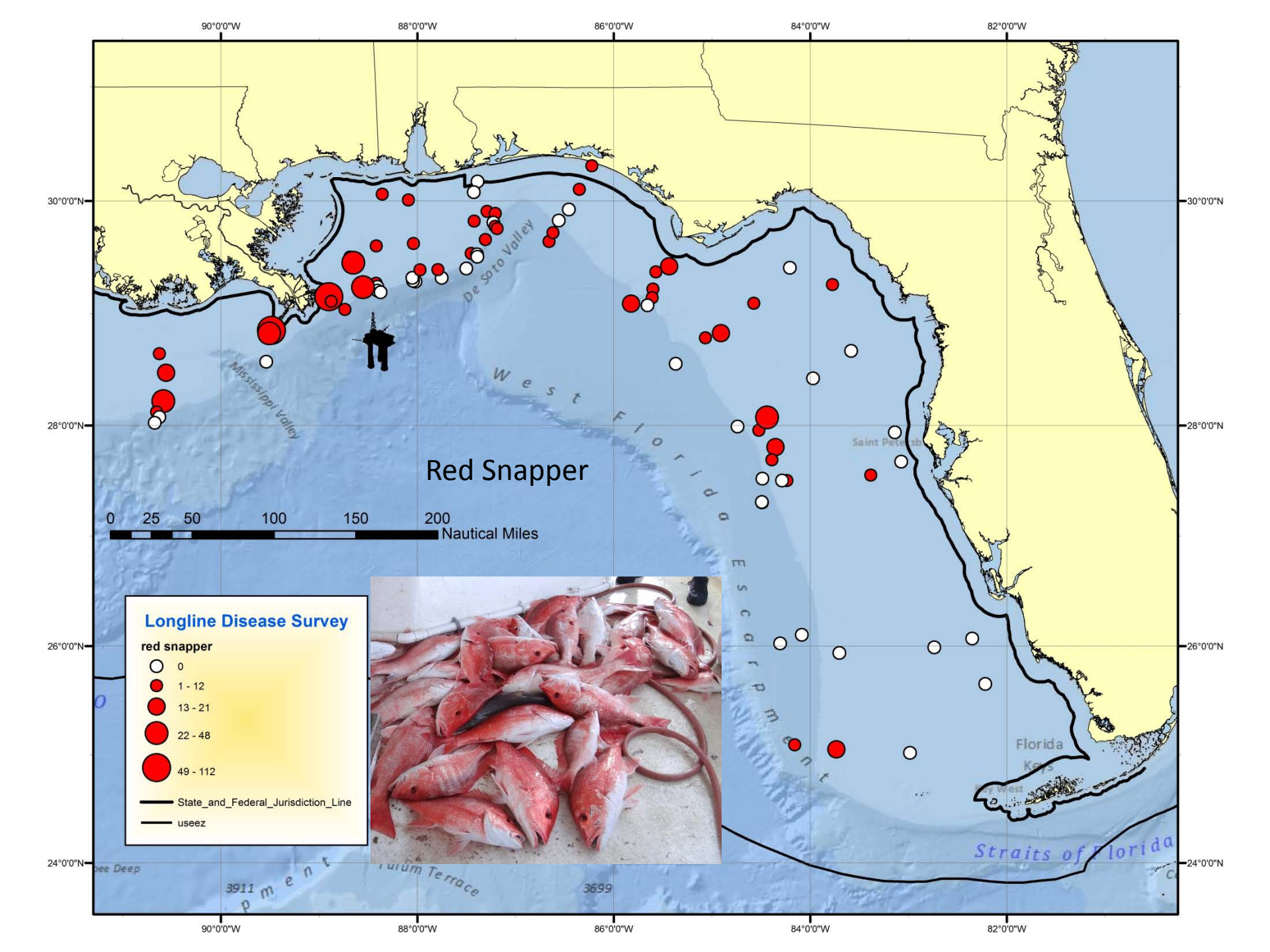
Kilometers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Red Snapper
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Nautical Miles
Longline Disease Survey
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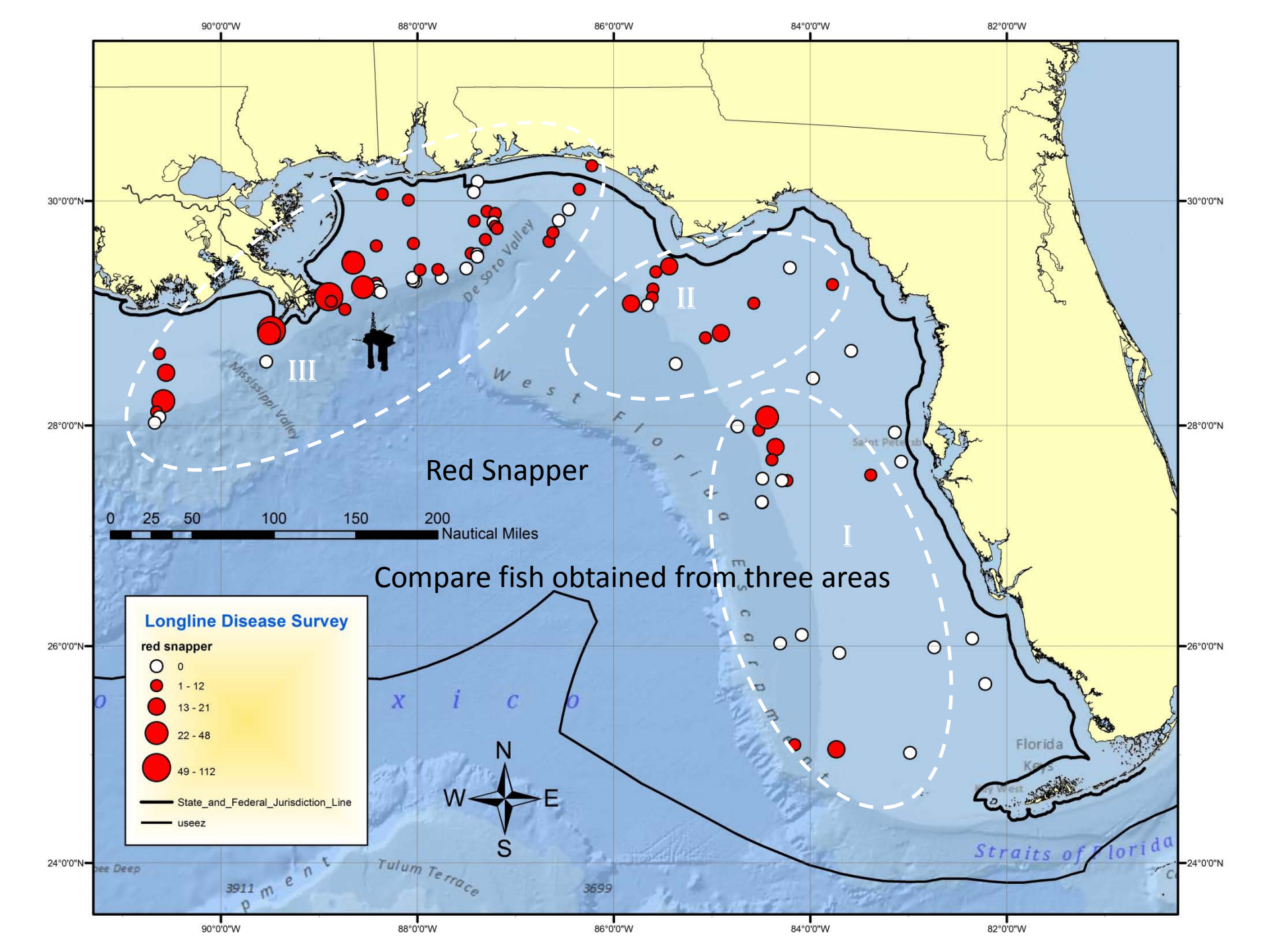
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Red Snapper
0 25 50 100 150 200
Nautical Miles
Compare fish obtained from three areas
I
II
III
Longline Disease Survey
red snapper
0
1 - 12
13 - 21
22 - 48
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Florida Keys
Straits of Florida
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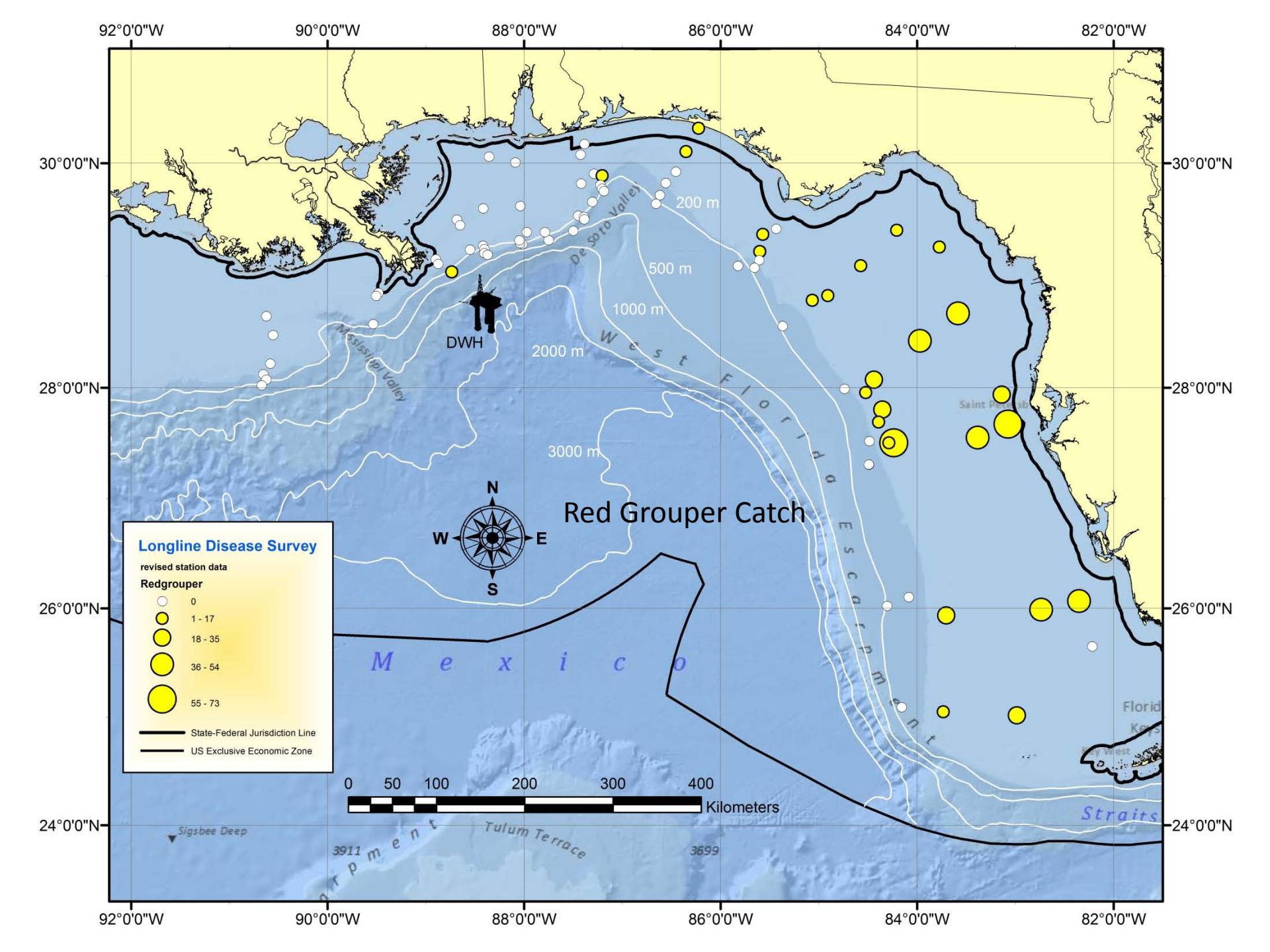
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Red Grouper Catch
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revised station data
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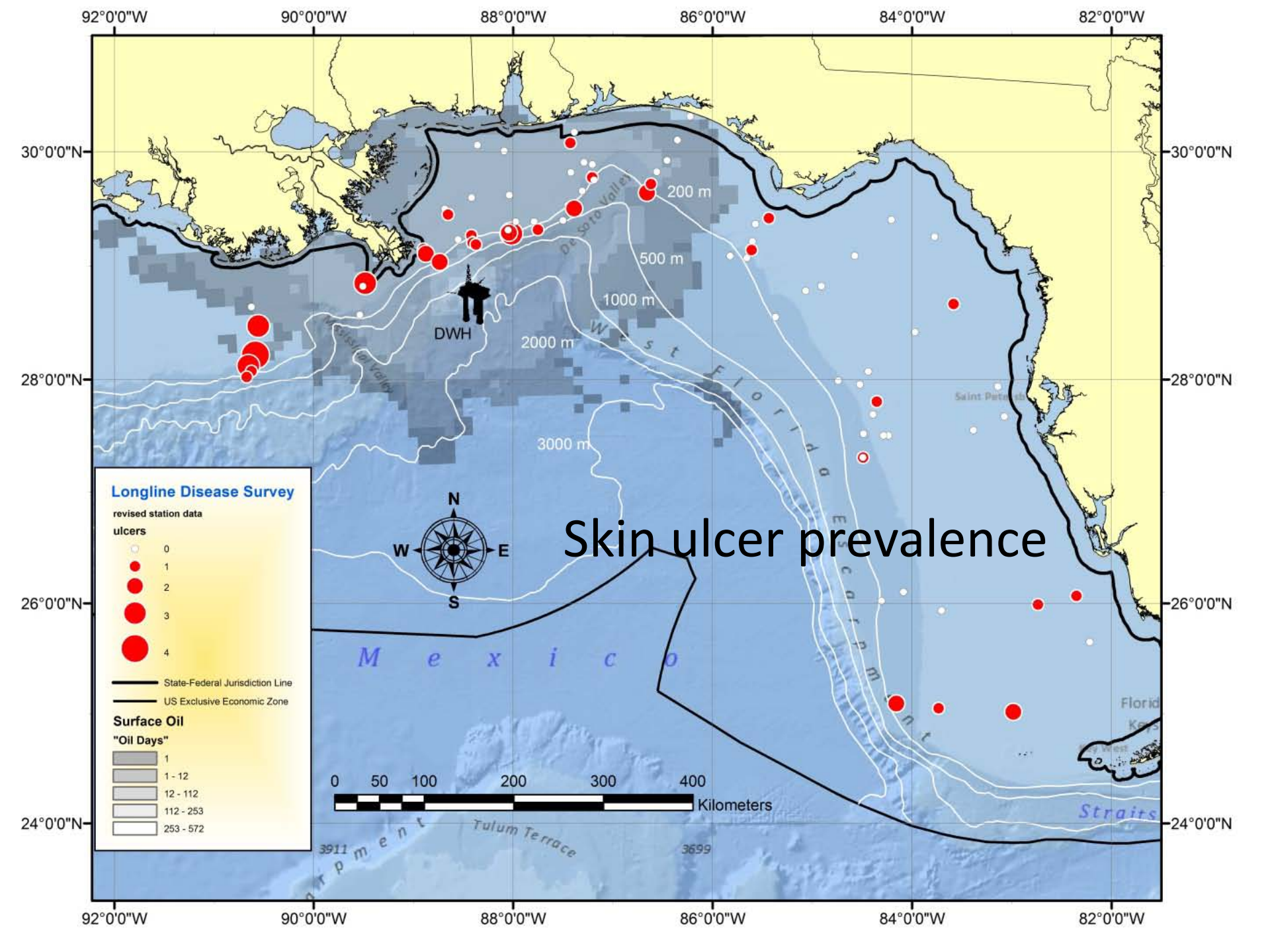
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West Florida Escarpment
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112 - 253
253 - 572
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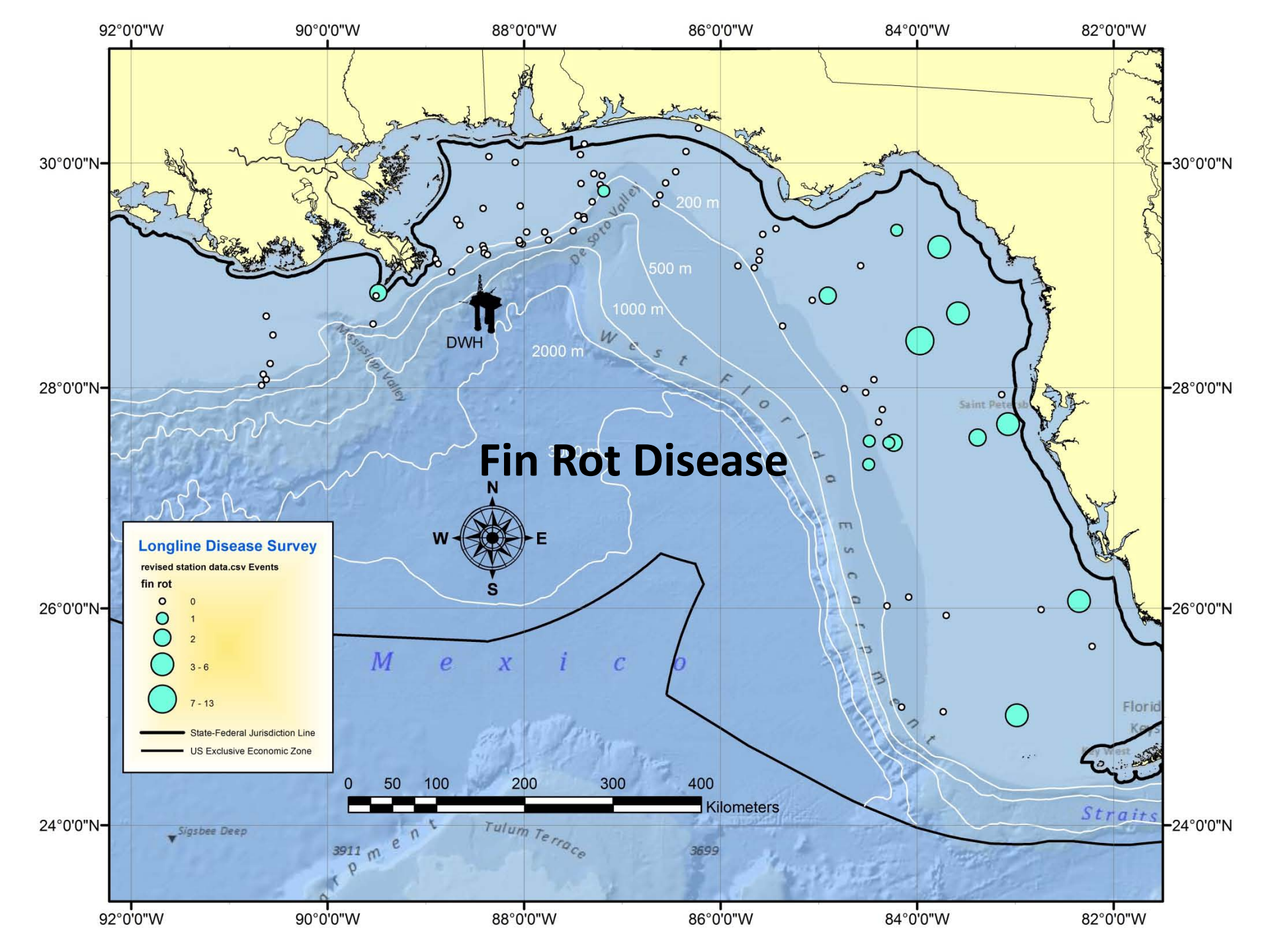
Kilometers


Fin Rot Disease
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88°0'0"W
86°0'0"W
84°0'0"W
82°0'0"W
30°0'0"N
28°0'0"N
26°0'0"N
24°0'0"N
DWH
200 m
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De Soto Valley
Mississippi Valley
West Florida Escarpment
Mexico
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Tulum Terrace
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Longline Disease Survey
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State-Federal Jurisdiction Line
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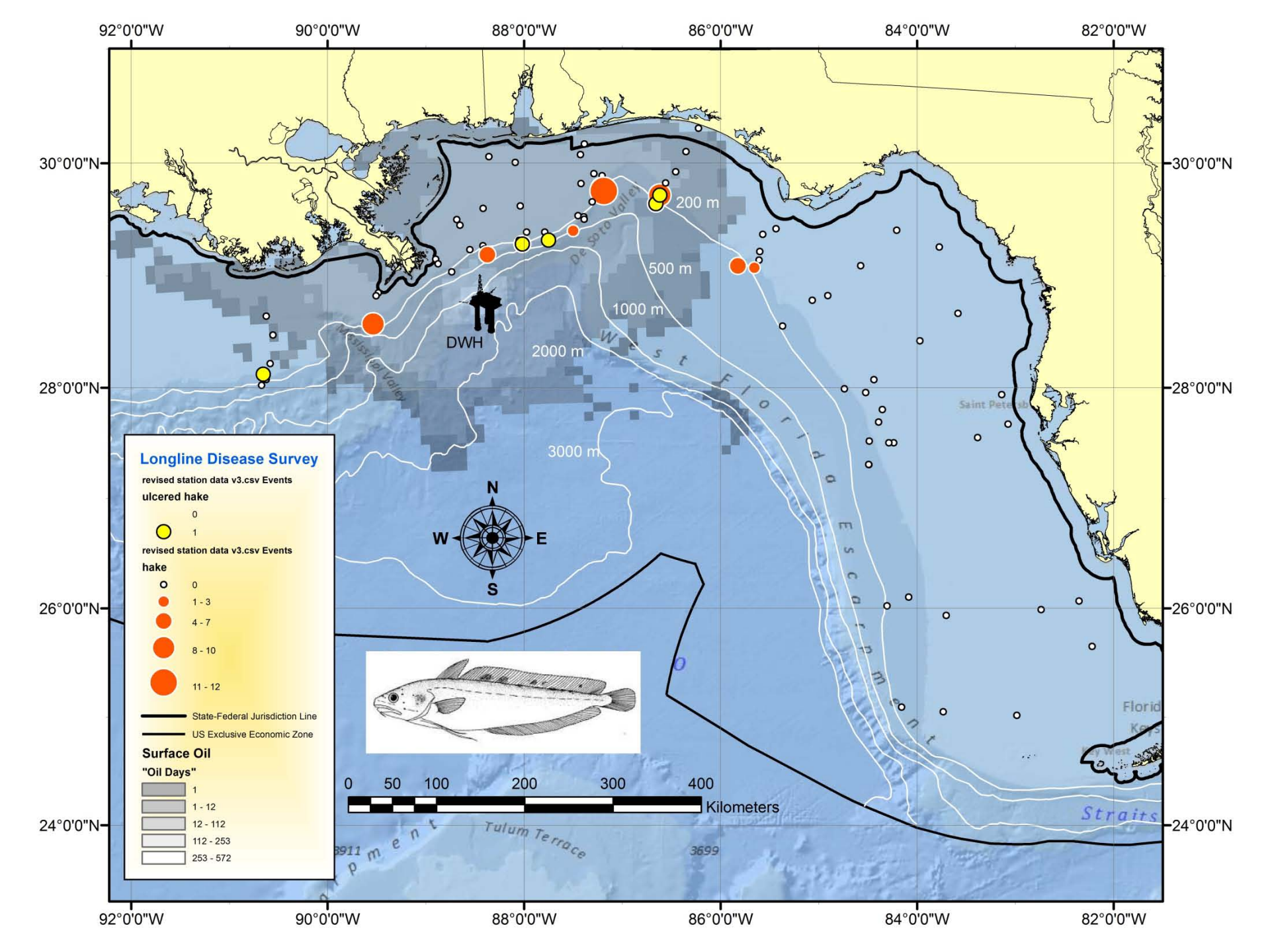
Kilometers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11 - 12
State-Federal Jurisdiction Line
US Exclusive Economic Zone
Surface Oil
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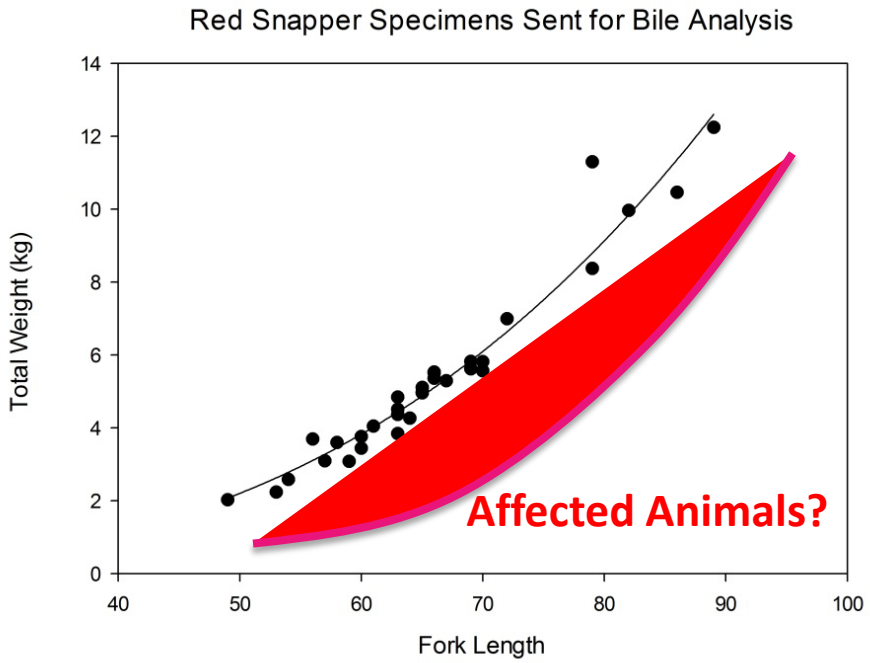
0 50 100 200 300 400
Kilometers



Analyses of Collected Materials:

Question: Are diseased fish "skinnier" than healthy animals?

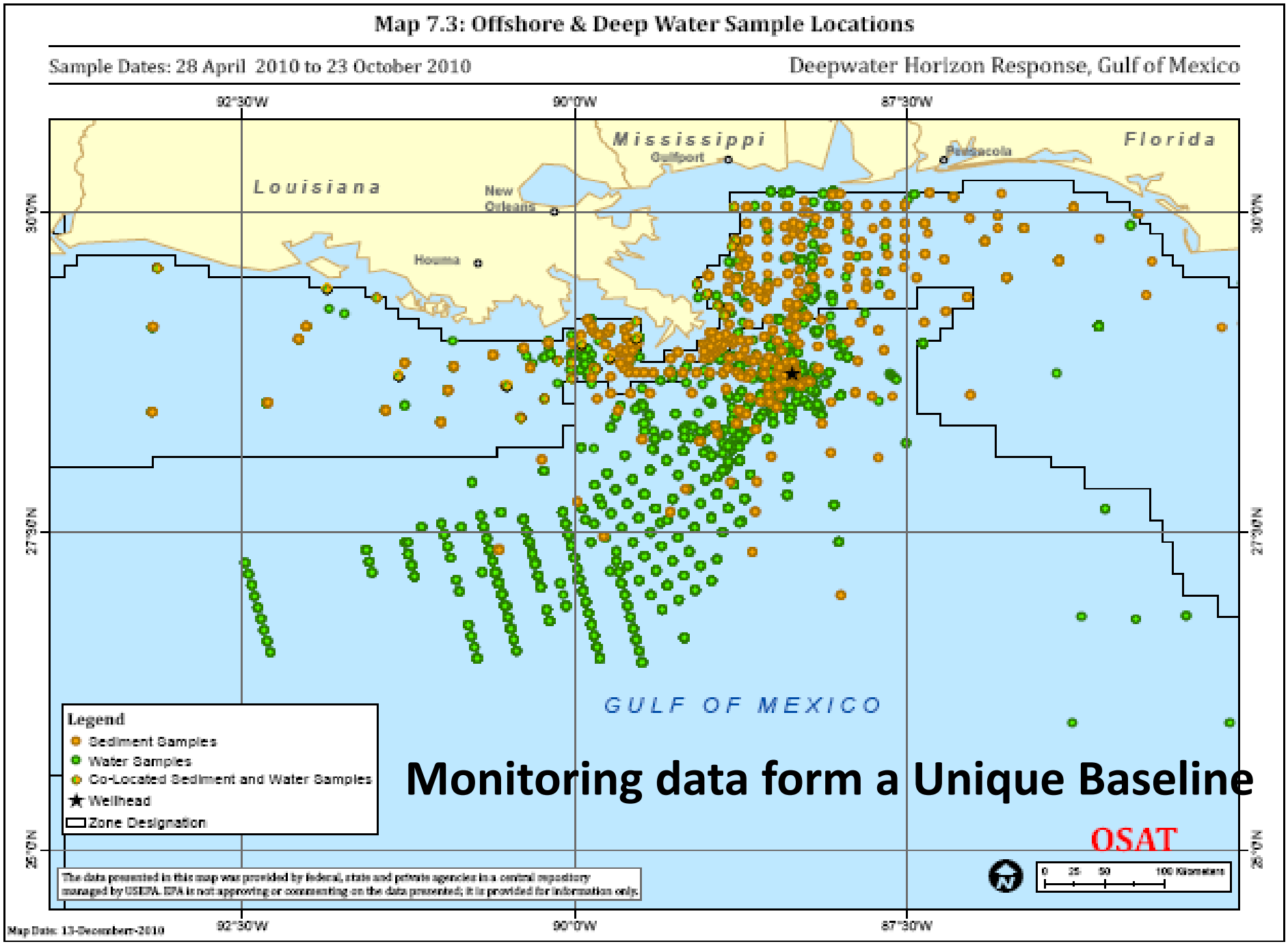
- Compare "Condition Factors" among diseased and healthy groups
- $CF = W/L^{\beta}$
- Use total body weights, liver weights, and body weights minus gonad and GI tract weights

Question: Are fish diseases associated with weakened immune system or reproductive function?

- *fertility potential assays* using ELISA's
- *immune function assays* using Luminex technology
- *Comet assays* to quantify DNA damage and repair

Wetzel/Mote

King Snake Eel – higher PAH (napthalene) in body than liver


Map 7.3: Offshore & Deep Water Sample Locations
Sample Dates: 28 April 2010 to 23 October 2010
Deepwater Horizon Response, Gulf of Mexico
92°30'W
90°0'W
87°30'W
30°0'N
27°30'N
25°0'N
Louisiana
Mississippi
Florida
New Orleans
Houma
Gulfport
Pensacola
GULF OF MEXICO
Legend
Sediment Samples
Water Samples
Co-Located Sediment and Water Samples
Wellhead
Zone Designation
Monitoring data form a Unique Baseline
OSAT
0 25 50 100 Kilometers
The data presented in this map was provided by federal, state and private agencies in a central repository managed by USEPA. EPA is not approving or commenting on the data presented; it is provided for information only.
Map Date: 13-December-2010

Some Important Restoration Questions……

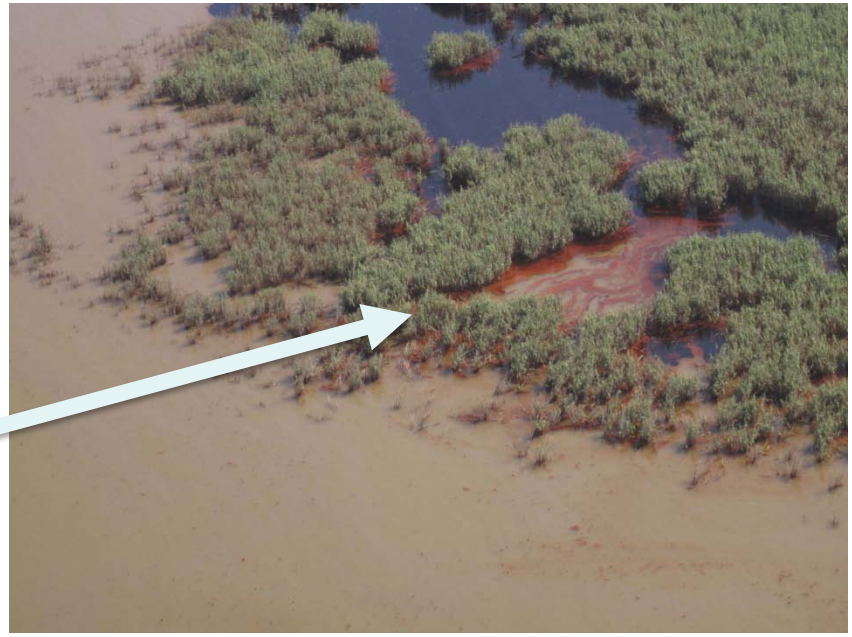
- What are the potential impacts of wetlands and barrier beach/island reconstruction on habitats, species productivity, storm surge protection and sea level rise? Which are more cost effective?
- What part of our restoration funding should be used to protect intact but threatened ecosystem components?
- What nitrogen abatement strategies will reduce the flux of nutrients into oceanic parts of the Gulf of Mexico? How do these interact with sediment strategies?
- What is the impact of compensatory recovery strategies (e.g., mangroves, MPAs in oceanic waters, etc.)?
- What were the impacts of the oil spill and how quickly will the Gulf recover? Given the background variability in the Gulf, how can we collect and use baselines to measure the effect of oil spill recovery efforts?
- How do fishery management policies (annual catch limits, closed areas, effort trends recreational and commercial fisheries) influence the abundance and productivity of managed species relative to habitat improvements under the recovery plans?
- How do we establish specific restoration targets, given the inherent tradeoffs that multiple potentially inconsistent objectives entail? How will decisions be made under conflicting objectives?

Marsh “Regrowth”:

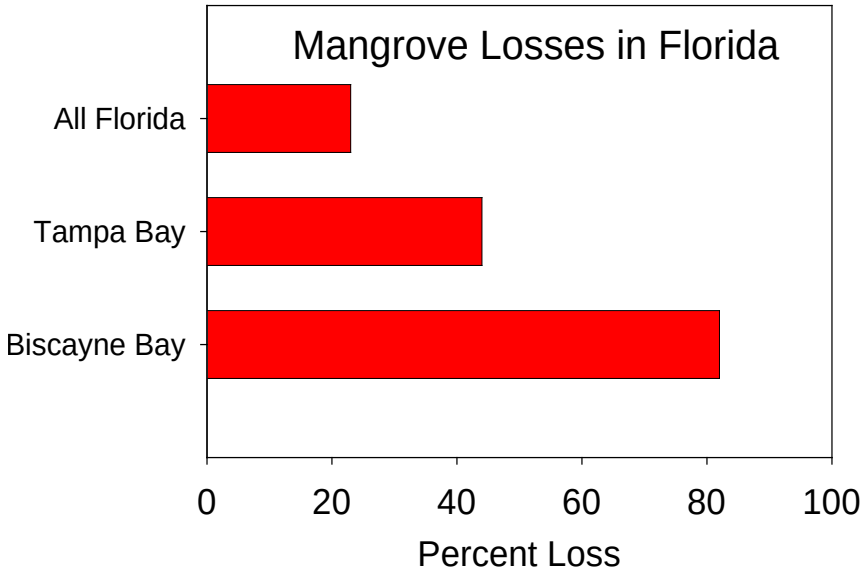
Recovery of the living structural component of marsh habitat (includes marsh grasses and mangroves) after exposure to oil:

1. Oiling was identified over a large area of the Gulf Coast
2. **Impacts to vegetation were observed**

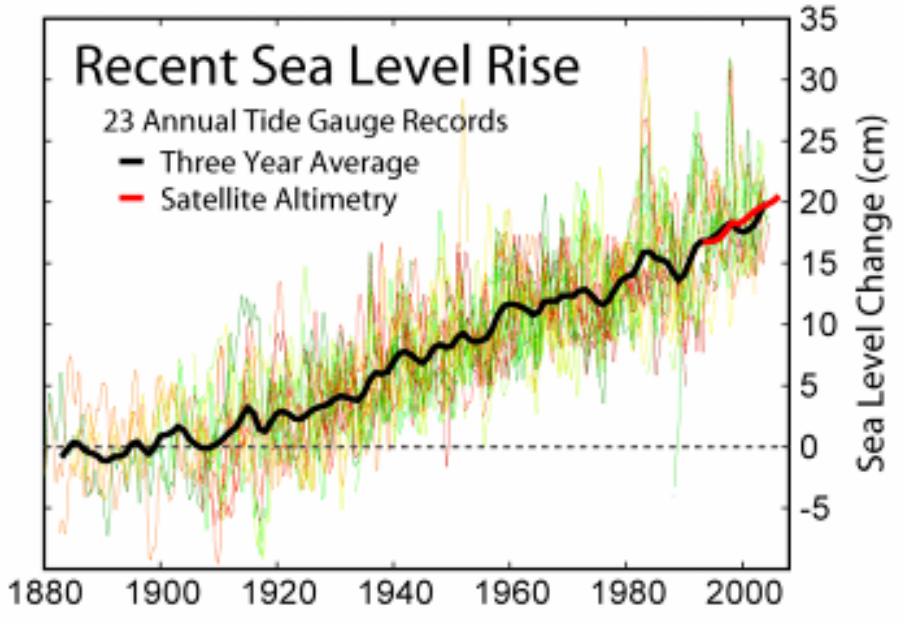
The impacts of oil on marshes include not only those to the plant community but also to organisms that live in the sediments. This briefing will focus on recovery scenarios for the vegetation.

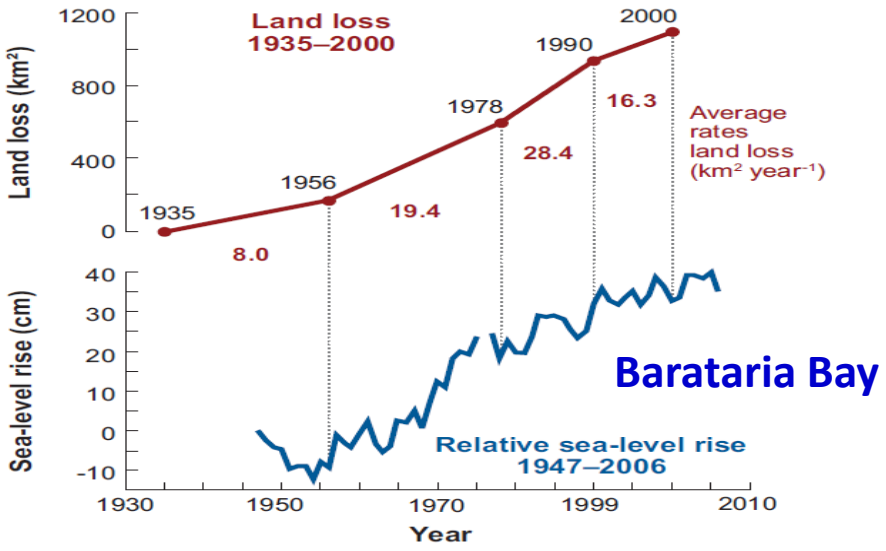


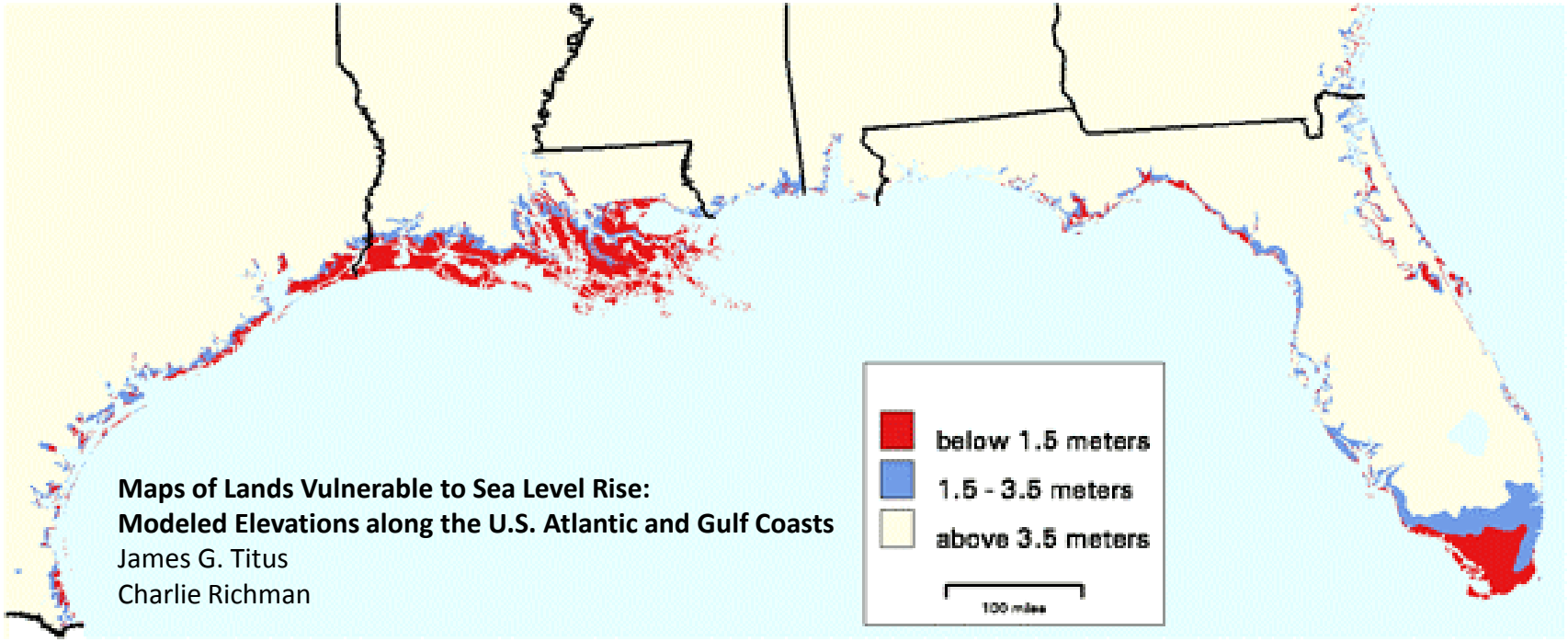
Mangrove ecosystems are a major nursery area for a wide array of biota and a carbon sink



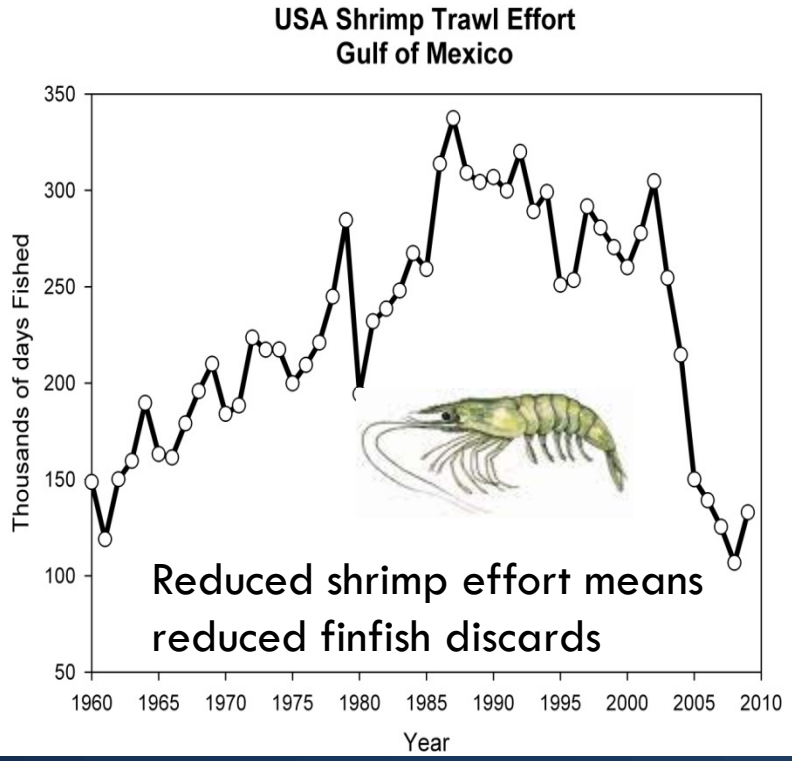
Much of west Florida's mangroves have been Lost, but can be restored using salt marsh restoration first as "nurseries"

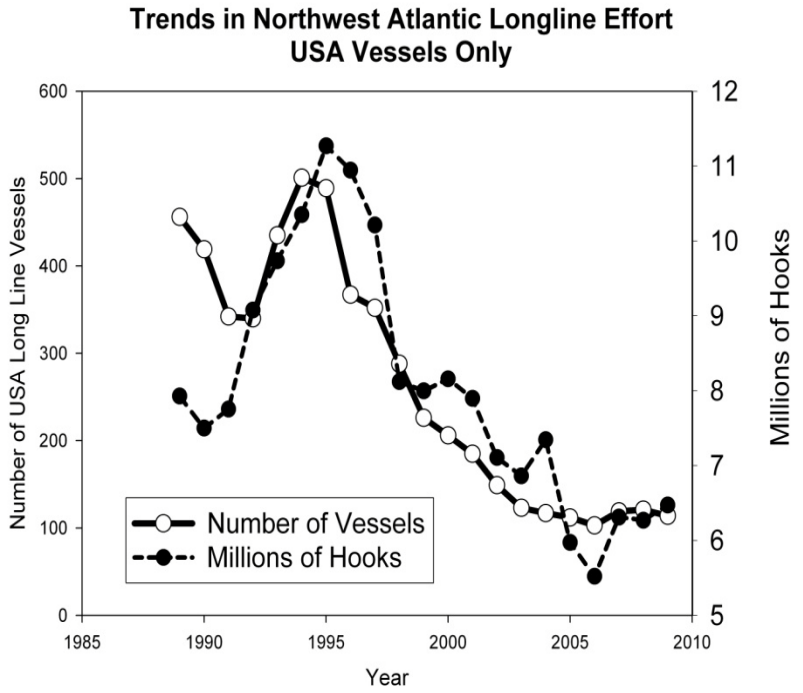






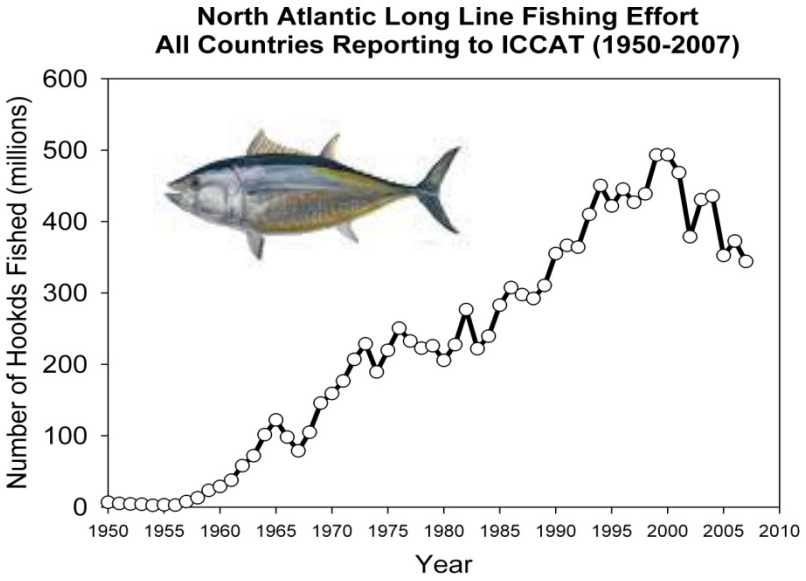
Maps of Lands Vulnerable to Sea Level Rise:
Modeled Elevations along the U.S. Atlantic and Gulf Coasts
James G. Titus
Charlie Richman



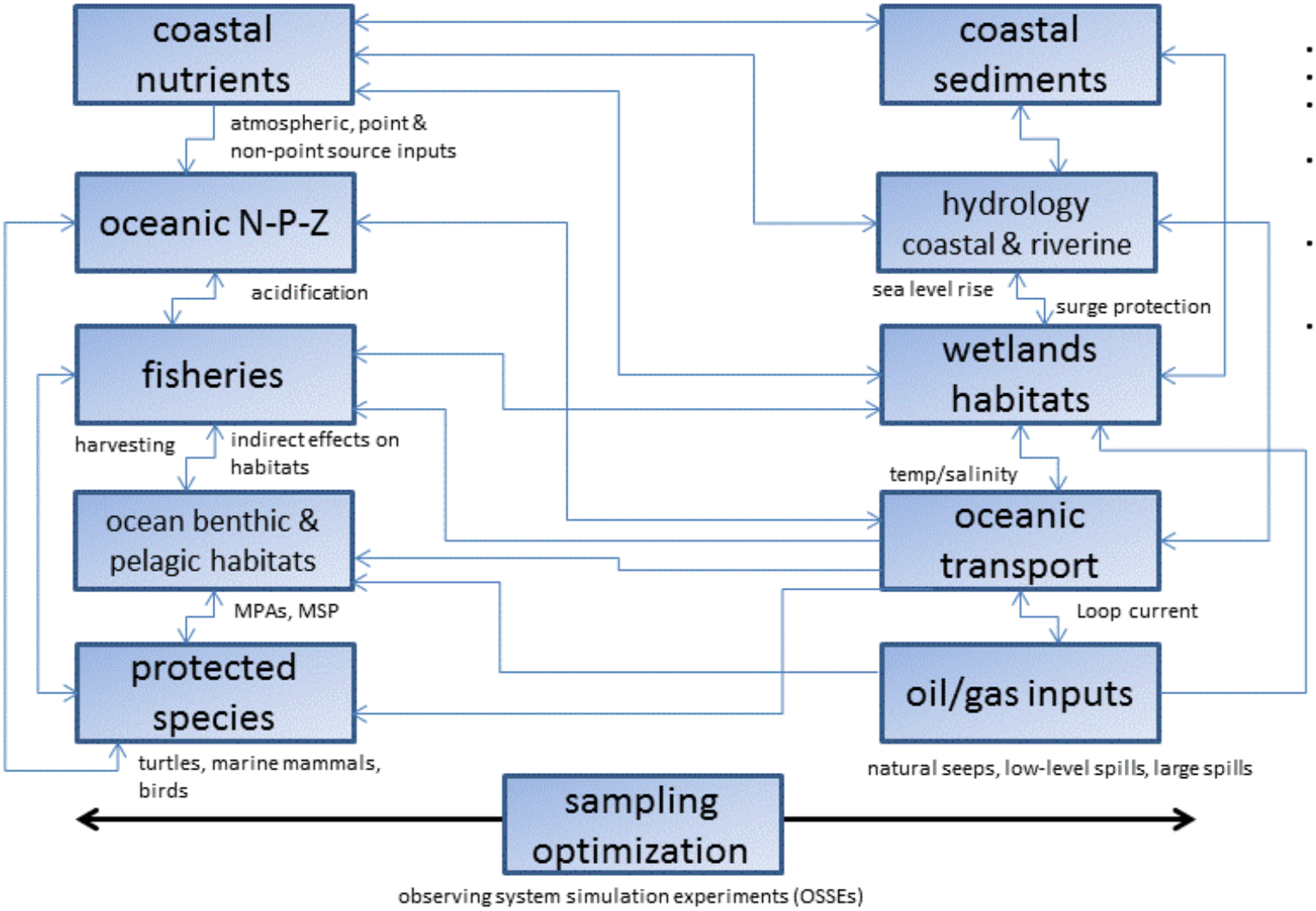


With fishing effort declining, how will changes in resources be attributed to varius drivers?

Important Gulf of Mexico Fisheries:
Reef fishes
Large pelagics
Nearshore predators
Crustaceans; oysters



Conceptual Gulf of Mexico Ecosystem Model supporting Long-Term Restoration Activities

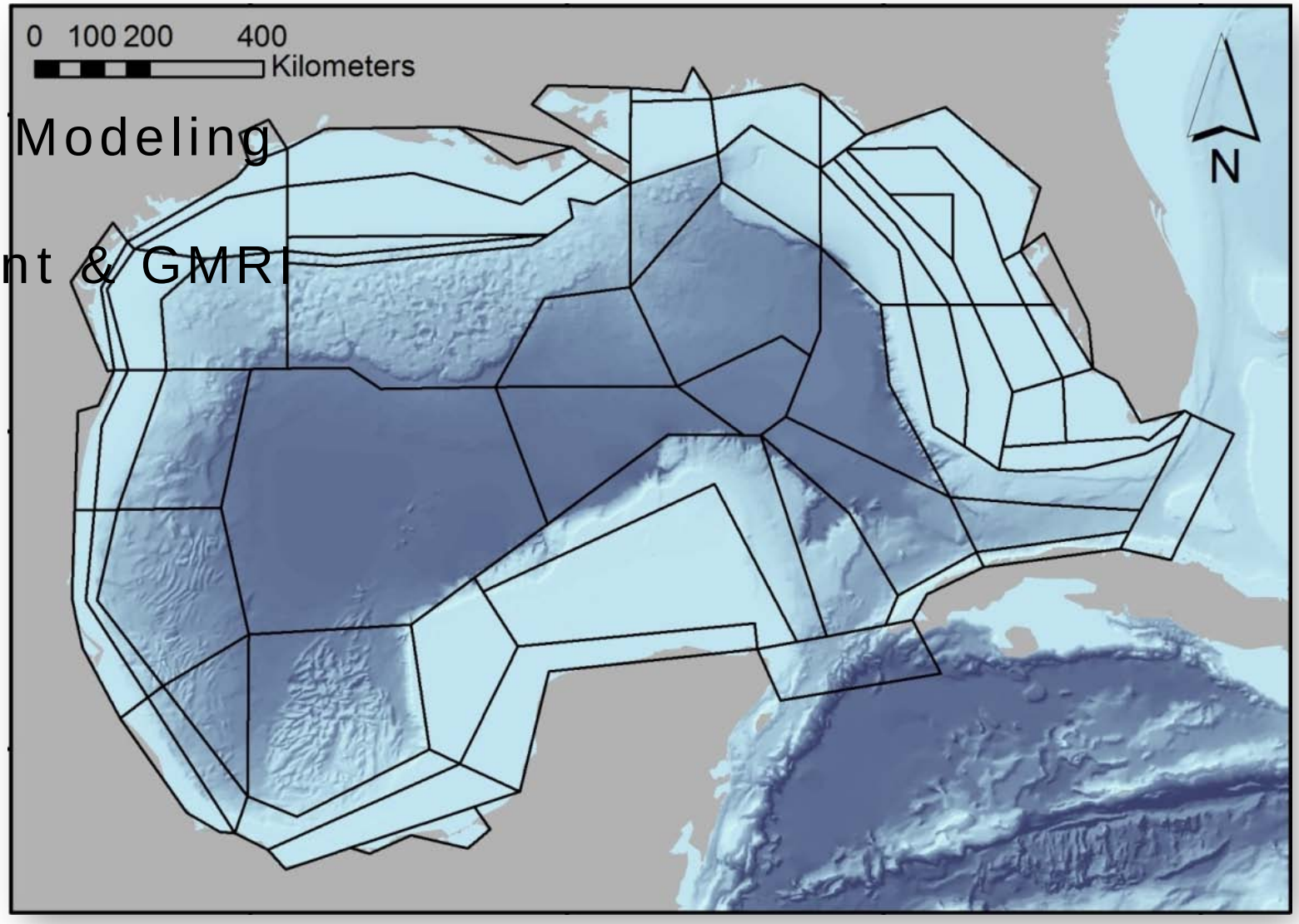


Modeling Foci:

- Hydrodynamic transport
- Sources and sinks
- Fate and effects
- Spatial planning & connectivity
- Food webs & species interactions
- Time & space scales of natural variability
- Ecosystem services & human dimensions

Atlantis Modeling

Sea Grant & GMRI



An ‘end-to-end’ ecosystem model

- Biology, physics & chemistry
- Predator-prey dynamics
- Fisheries impacts
- Scenario analysis

Cam Ainsworth/USF
Mike Schrippa/NOAA

Atlantis

Synthesizes project outputs

Population dynamics

- Effect of fisheries closures (cascades)
- Benthic/pelagic pathways
- Recovery time

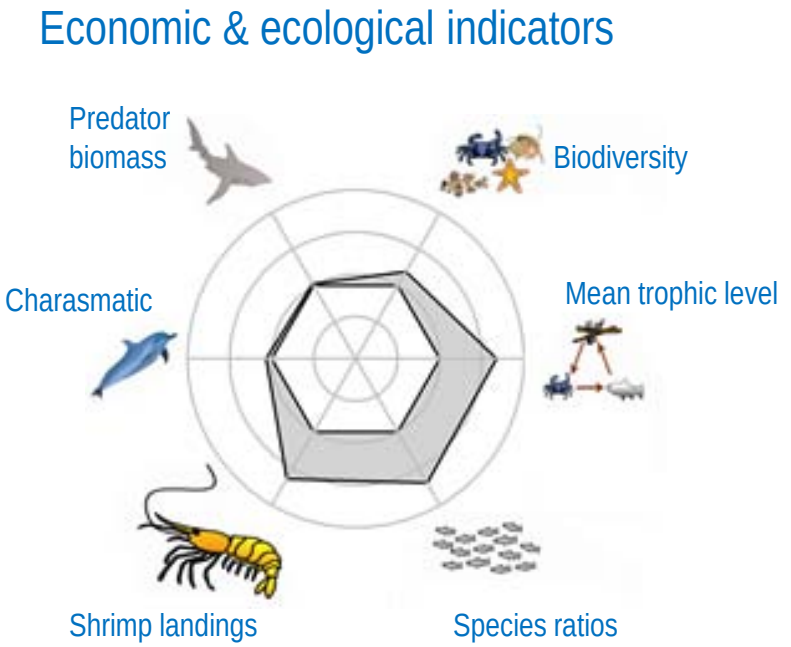
Oil-related effects

- Direct exposure
- Habitat effects
  (e.g., lagged recruitment failure)

Bioaccumulation

Economic performance

- By fishing fleet/port
- Other resource-dependent activities



Living Marine Resource issues – DWH and Beyond…..

- Considerable opportunities to restore and protect ocean and coastal resources exist that are vital to achievement of a "Healthy Gulf" – LMR metrics are crucial, healthy resources and coastal communities
- LMR science can help restoration planners: (1) set achievable goals for restoration actions, (2) monitor progress in recovery efforts towards long-term goals, (3) help prioritize restoration efforts based on where the greatest potentials for recovery lie, and (4) provide ecosystem-level understanding of the linkages among individual restoration activities and the totality of ecosystem services improved through restoration
- Monitoring activities (including the establishment of control areas) need to be incorporated at the outset of restoration planning
- Setting goals for restoration activities should incorporate likely impacts of sea level rise and storm surge on the resiliency of the Gulf of Mexico LME
- Compensatory restoration projects for LMR and their habitats need to be carefully considered relative to their ecological and socio-economic impacts
- Societal goals for LMRs need to be incorporated into restoration planning, priority setting and monitoring through a transparent, credible and adaptive approach
- Merge data sets from federal, state & academic researchers…..

LMR Breakout Group….

- Biodiversity baselines – Fabio Moretzsohn
- Effects of fishery closures – David Die
- NRDA perspectives on assessment – Lisa DiPinto
- Impacts ok kilifish physiology – Fernando Galvez
- Sargassum, fish & invertebrates – Frank Hernandez
- Whale sharks – Eric Hoffmayer
- Bluefin tuna spawning – John Lamkin
- Fish otolith studies – Ernst Peebles
- Genome expression in killifish – Andrew Whitehead