http://www.noaa.gov

Effective Monitoring to Evaluate Ecological Restoration in the Gulf of Mexico
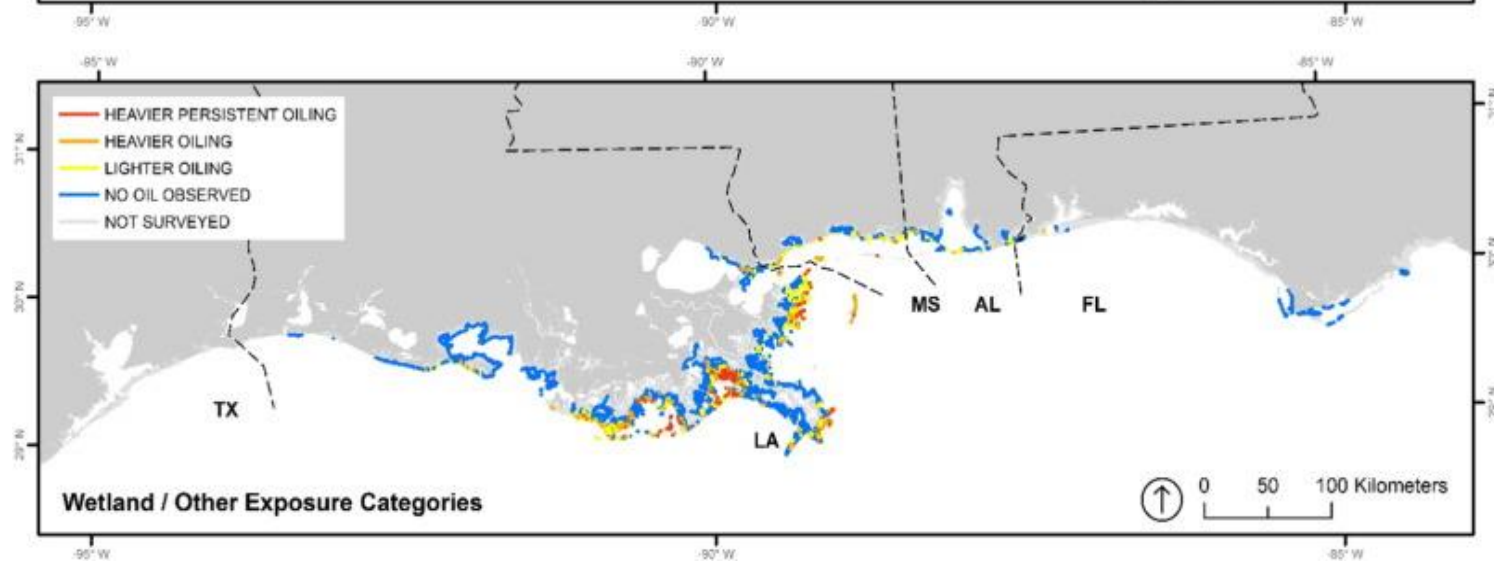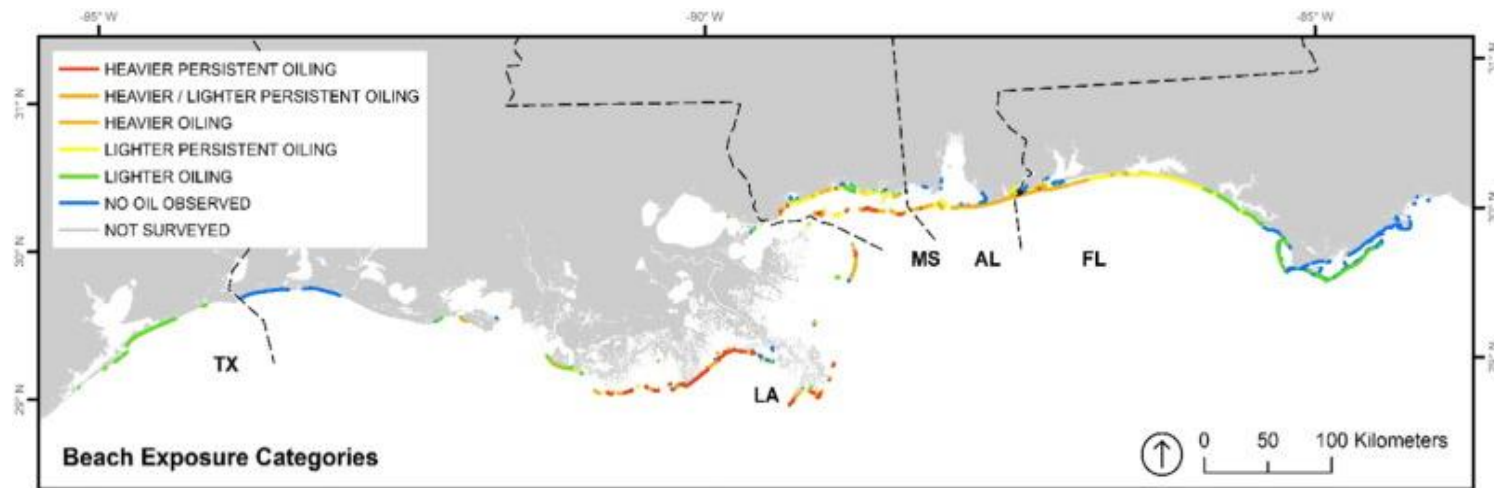
Briefing: July 26, 2016

Dr. Frank Davis, Committee Chair
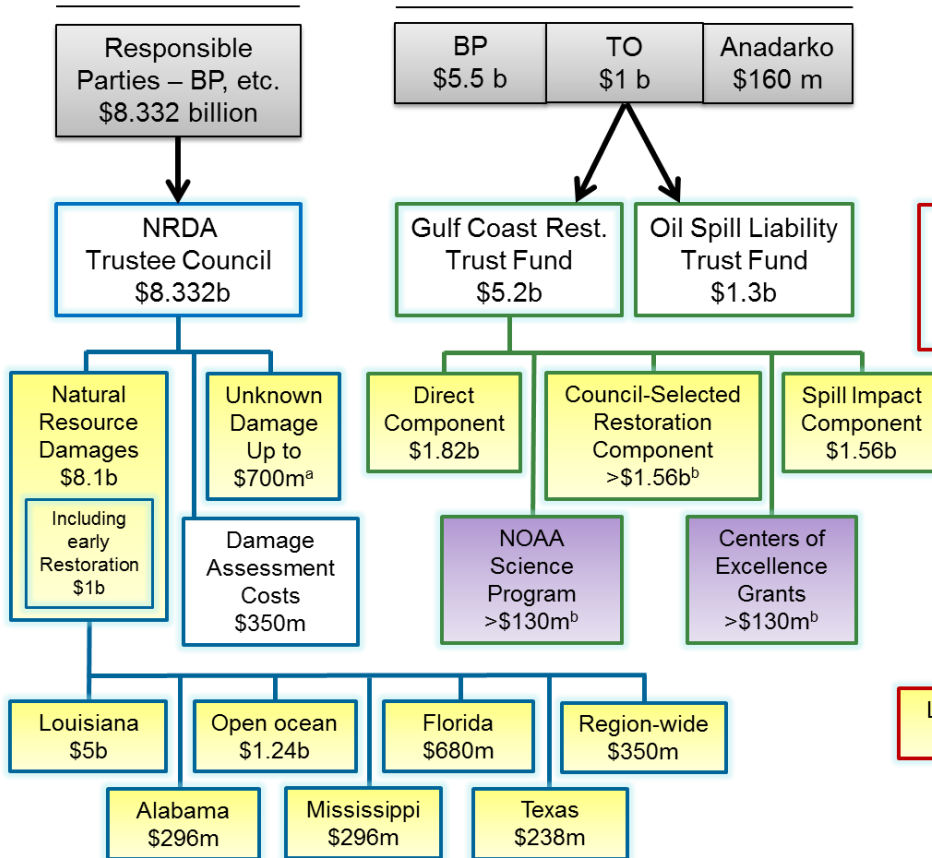Dr. Eric Smith, Committee Member
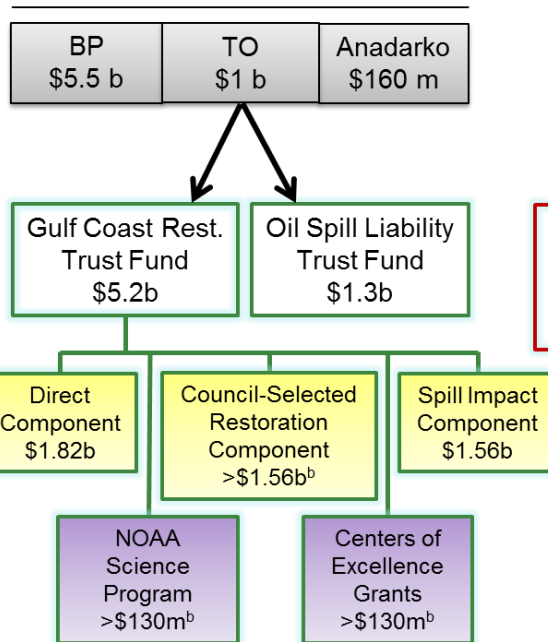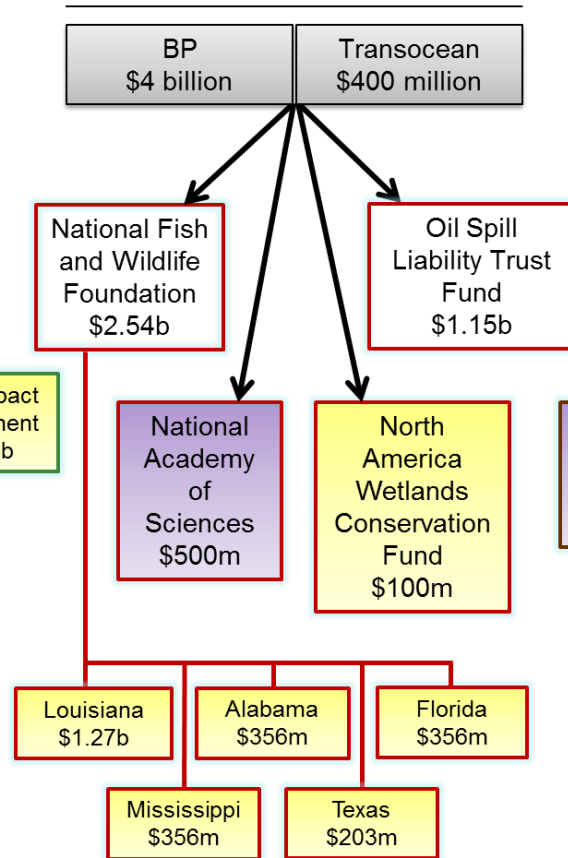Dr. Mark Woodrey, Committee Member

Context

Context

The National Academies of SCIENCES · ENGINEERING · MEDICINE

Natural Resource Damages

Responsible Parties – BP, etc. $8.332 billion

NRDA Trustee Council $8.332b

Natural Resource Damages $8.1b
Including early Restoration $1b

Unknown Damage Up to $700m[a]

Damage Assessment Costs $350m

Louisiana $5b
Open ocean $1.24b
Florida $680m
Region-wide $350m
Alabama $296m
Mississippi $296m
Texas $238m

Civil Penalties

BP $5.5 b
TO $1 b
Anadarko $160 m

Gulf Coast Rest. Trust Fund $5.2b
Oil Spill Liability Trust Fund $1.3b

Direct Component $1.82b
Council-Selected Restoration Component >$1.56b[b]
Spill Impact Component $1.56b

NOAA Science Program >$130m[b]
Centers of Excellence Grants >$130m[b]

Criminal Penalties

BP $4 billion
Transocean $400 million

National Fish and Wildlife Foundation $2.54b
Oil Spill Liability Trust Fund $1.15b

National Academy of Sciences $500m
North America Wetlands Conservation Fund $100m

Louisiana $1.27b
Alabama $356m
Florida $356m
Mississippi $356m
Texas $203m

Others

BP $500 million

Gulf of Mexico Research Initiative $500m

3

Statement of Task

Identify best practices for monitoring and evaluating restoration activities to improve the performance of restoration programs and increase the effectiveness and longevity of restoration projects, and identify:

- Essential elements of a long-term monitoring framework;
- Effective approaches for developing initial and long-term monitoring goals and methods;
- Essential baseline data needs;
- Novel approaches; and
- How monitoring could be used cumulatively to provide insights and track effectiveness on larger spatial and longer temporal scales.

Committee

Frank W. Davis, *Chair*, University of Santa Barbara, California
David M. Burdick, University of New Hampshire
Loren D. Coen, Florida Atlantic University
Peter Doering, South Florida Water Management District
Frances Gulland, Marine Mammal Center
Kenneth L. Heck, Dauphin Island Sea Laboratory
Matthew K. Howard, Texas A&M University
Michael S. Kearney, University of Maryland
Paul A. Montagna, Harte Research Institute
Pamela T. Plotkin, Texas A&M University
Kenneth A. Rose, Louisiana State University
Eric P. Smith, Virginia Polytechnic Institute and State University
Heather M. Tallis, The Nature Conservancy
Ronald Thom, Pacific Northwest National Laboratory
Mark S. Woodrey, Mississippi State University

Topics not addressed

http://www.gulfmex.org/7196/post/

http://www.noaa.gov

www.rand.org

Selected habitats

http://www.gulfspillrestoration.noaa.gov

http://www.gulfmex.org/archive/crp/3006.html

www.dep.state.fl.us

Selected taxa

www.nmfs.noaa.gov

gulfcoast.resiliencesystem.org

http://www.noaa.gov

What is the purpose of monitoring?

Construction Monitoring: To assess whether projects are built or implemented and are initially functioning as designed.

Performance Monitoring: To assess whether restoration goals and objectives have been or are being met.

Monitoring for Adaptive Management: to inform restoration adaptive management, to improve design of future restoration efforts, and to increase ecosystem understanding.

Hypothetical example of performance monitoring data
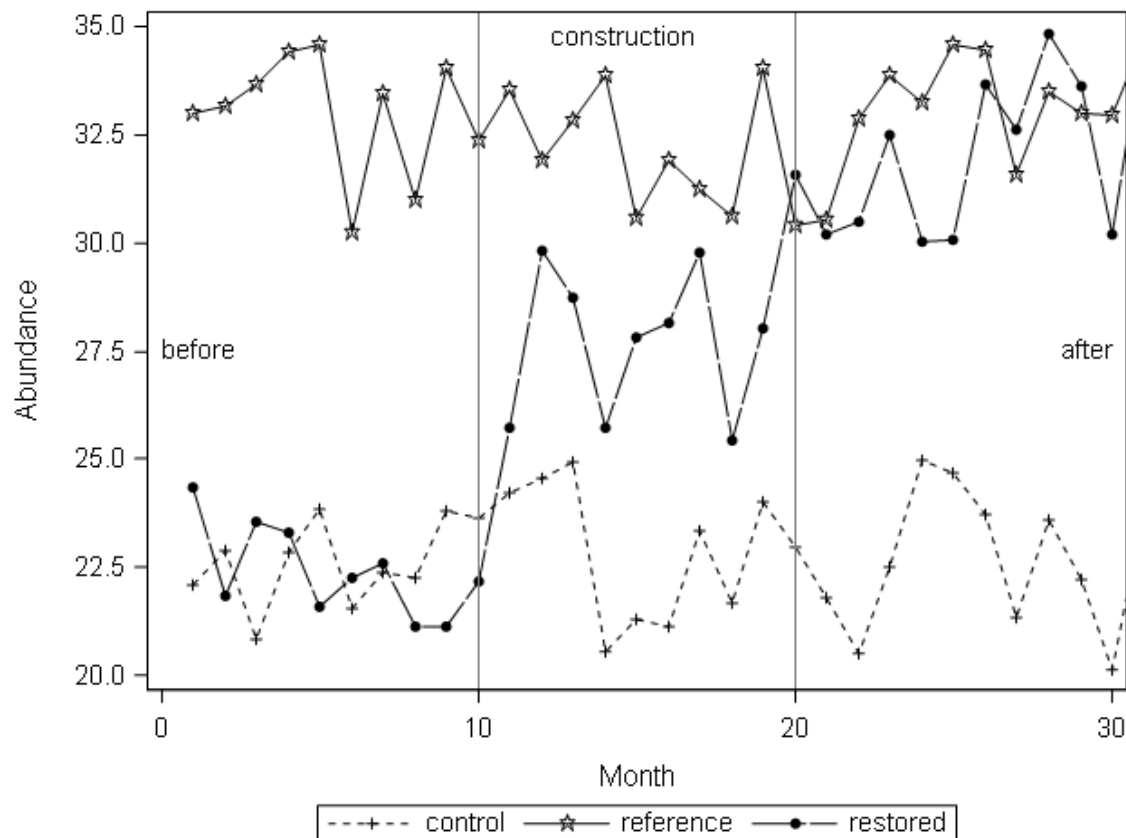
Lessons Learned - Restoration Monitoring Is Rarely Rigorous:

- Lack of political will or sufficient funding
- Unclear or untestable project objectives
- Inadequate monitoring designs
- Insufficient ecological process understanding
- Poor data management
- Lack of analysis and synthesis
- Inadequate program guidance, management project oversight, and accountability

How to overcome these issues?

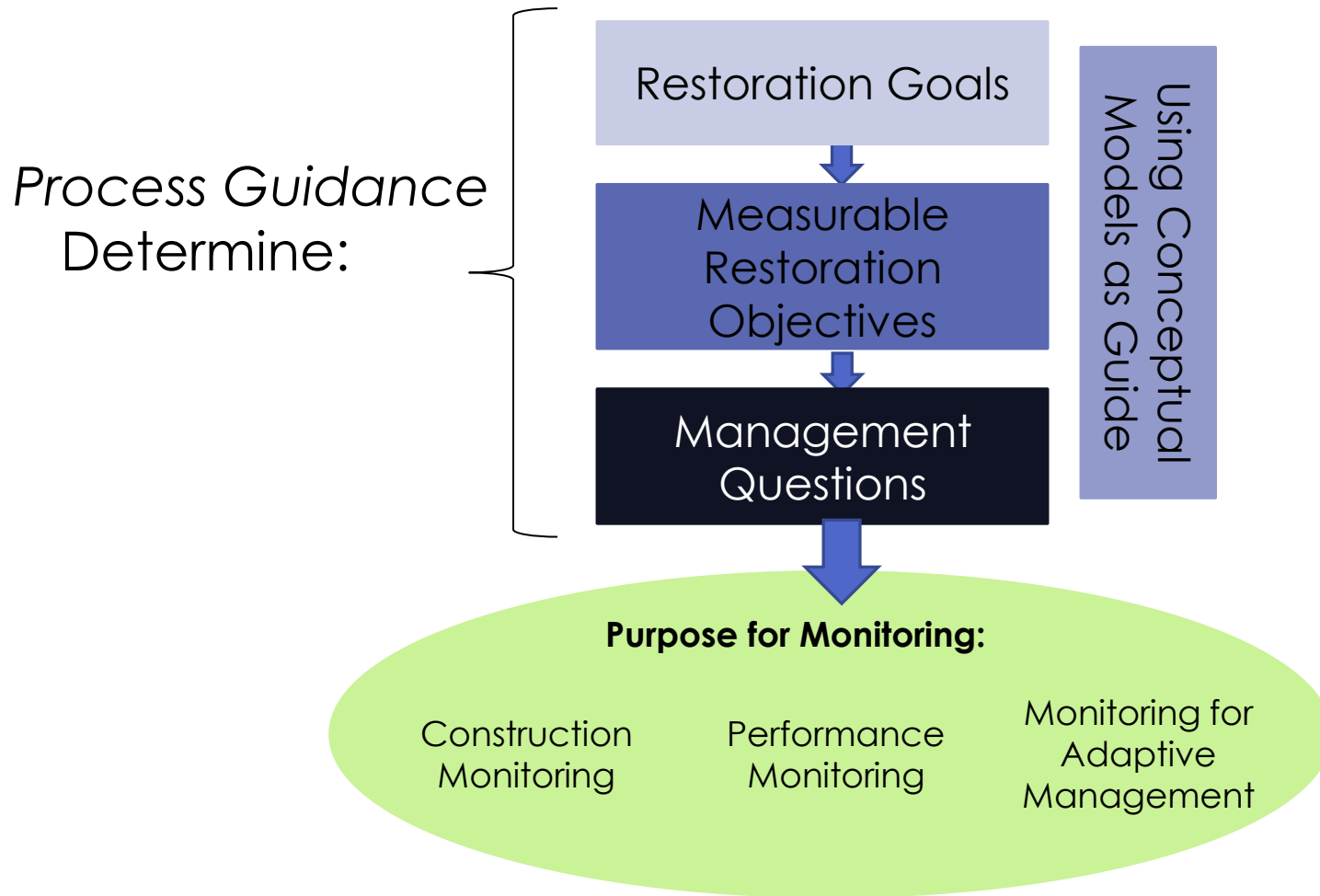**Recommendation #1: Gulf restoration programs need to develop clear goals and measurable objectives.**

To assess progress, the Gulf restoration efforts need specific measurable objectives against which restoration progress can be assessed.
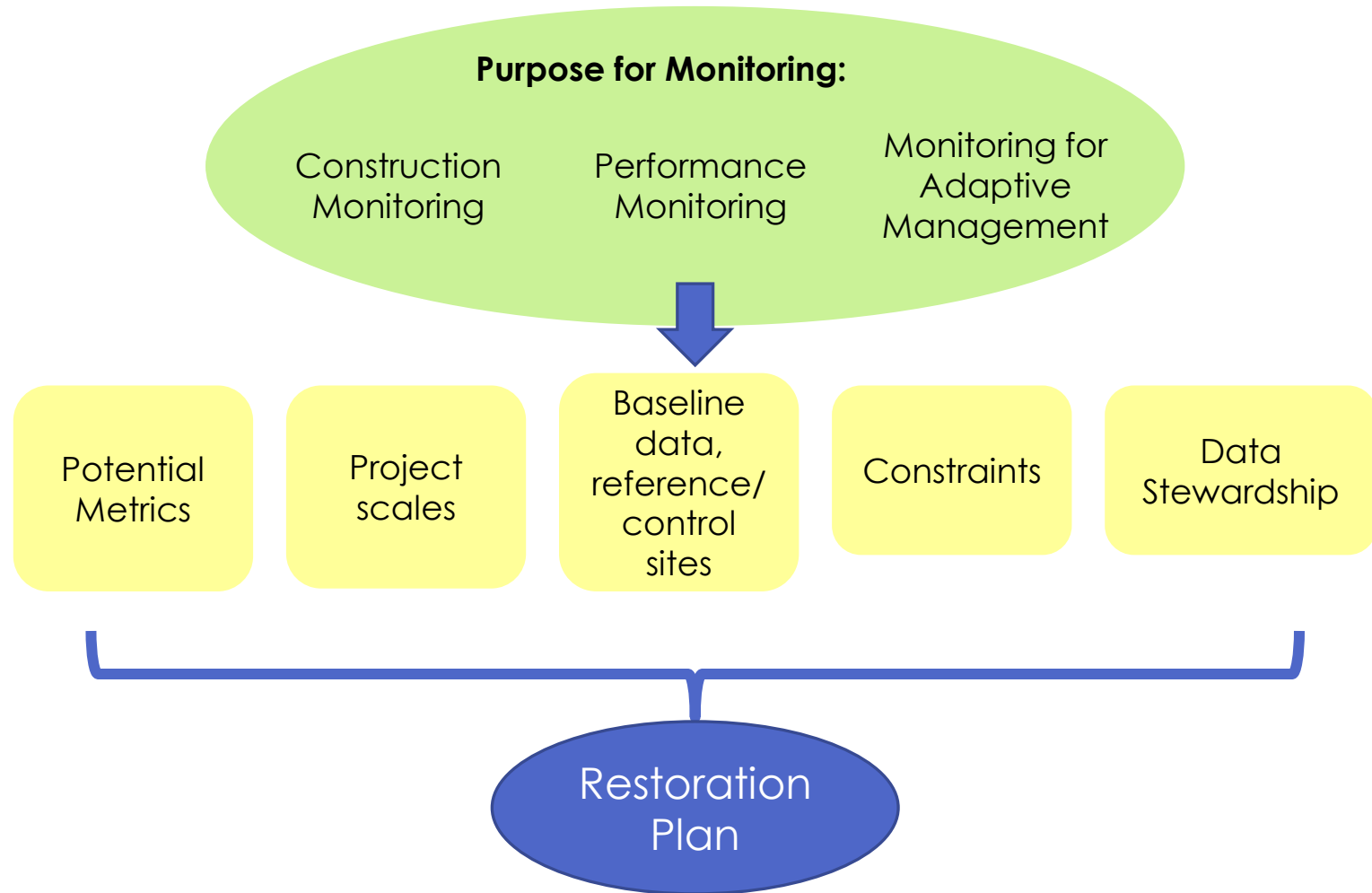
Monitoring is an Integral Part of Restoration

Recommendation #2: All restoration projects should be accompanied by a strategic monitoring effort, described in a monitoring plan, that enables an assessment of progress relative to the restoration goals and objectives.

At a minimum, <u>all restoration projects should include construction and performance monitoring</u>.

Project-Level Monitoring Plan

Process Guidance
Determine:

Restoration Goals

↓

Measurable Restoration Objectives

↓

Management Questions

Using Conceptual Models as Guide

Purpose for Monitoring:

Construction Monitoring

Performance Monitoring

Monitoring for Adaptive Management

Project-Level Monitoring Plan

Purpose for Monitoring:

Construction Monitoring

Performance Monitoring

Monitoring for Adaptive Management

Potential Metrics

Project scales

Baseline data, reference/ control sites

Constraints

Data Stewardship

Restoration Plan

Elements of a project monitoring plan (I):

- Measurable restoration objectives

- Well-articulated management questions

- Appropriate metrics, targets, and criteria for addressing management questions

- Plan for baseline data

- Appropriate sampling and analysis designs

Elements of a project monitoring plan (II):

- Well-documented and, where possible, standardized sampling protocols

- Rigorous data management plan

- Anticipated methods for data analysis and evaluation

- Realistic project budgets and staffing

- Program management plan

# What is the required rigor to address the management questions?

Level of Confidence	Sample Statement	Required Monitoring Design
Certain	The project increased recreation activity at this site by 25% over a 2-year period relative to a control site.	Highest rigor required; BACI design; randomized control.
Somewhat certain	Recreation activity at the project site has increased by 25% over a 2-year period. Increased visitation may be related to other factors such as decreased rain.	Less rigor; Control-impact design; Before-after design; Trend assessment.
Cautious, anecdotal	People in the project area have seen more people recreating; and they think it's because of the restoration project.	Lowest rigor; construction monitoring only; sampling one time only.

Beyond the project-scale:

Identify strategic opportunities to maximize the effectiveness and utility of monitoring beyond the project scale.

For example:

- Reference sites network
- Pairing restoration projects with restoration ecologists to study restoration effectiveness

http://oceanservice.noaa.gov/sentinelsites/gomex.html

http://lacoast.gov/crms2/home.aspx
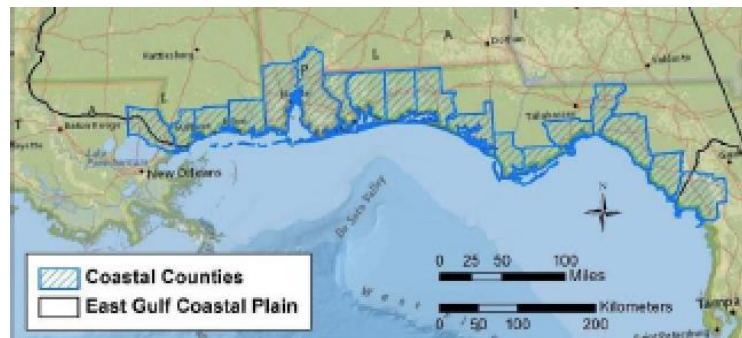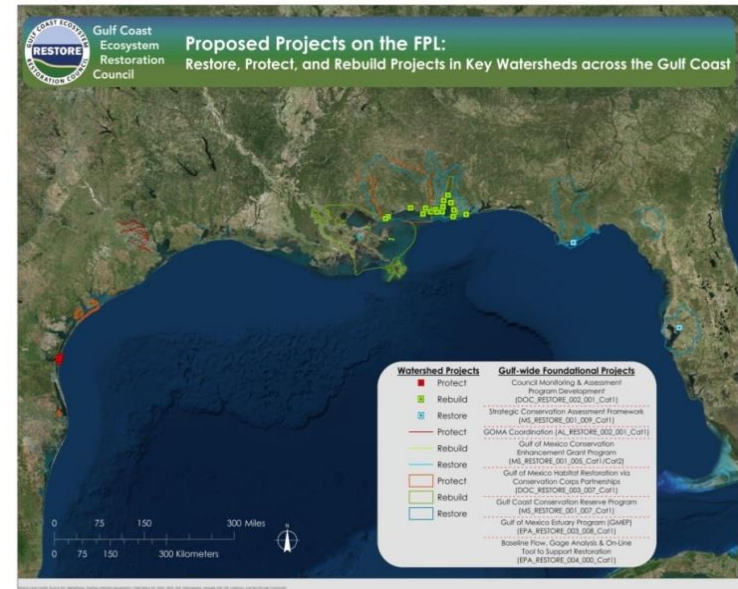
Consistent and Comparable Monitoring for Restoration

Recommendation #3: Monitoring data should be as consistent and comparable as possible across the Gulf.

- Assemble teams of restoration scientists, managers, and practitioners that will identify critical subsets of metrics and protocols that should be standardized for a given restoration type.

- Coordinate with existing or related environmental monitoring efforts to establish or expand existing reference monitoring networks.

Data Stewardship

Recommendation #4: A written data management plan with deliverables should be a contractual requirement in restoration projects.

Need clear policies to ensure that monitoring data is archived with a digital repository that has long-term support and can be trusted to provide open data-access for the next decades.

Data Stewardship Plans

- Identify roles and responsibilities
- QA/QC plans or procedures
- Identify appropriate community standards for metadata content and controlled vocabularies
- Identify one or more portals to serve data to the broader community
- Identify appropriate long-term trusted digital repositories where data and metadata will be submitted

Synthesis and Evaluation

Recommendation #5: Gulf restoration programs should consider creating a specific, dedicated enterprise for synthesis activities in support of Gulf restoration.

Synthesis and meta-analysis of restoration monitoring data necessary for :

- Wide-ranging species;
- Understanding large-scale effects of restoration on the Gulf; and
- Enhancing opportunities for learning.

Adaptive Management

Recommendation #6: Where appropriate, Gulf restoration programs should implement adaptive management to improve restoration effectiveness.

Adaptive management provides a **structured process** by which knowledge gained from monitoring restoration efforts can be **used to reduce critical uncertainties and enhance ongoing or future restoration decision making**.
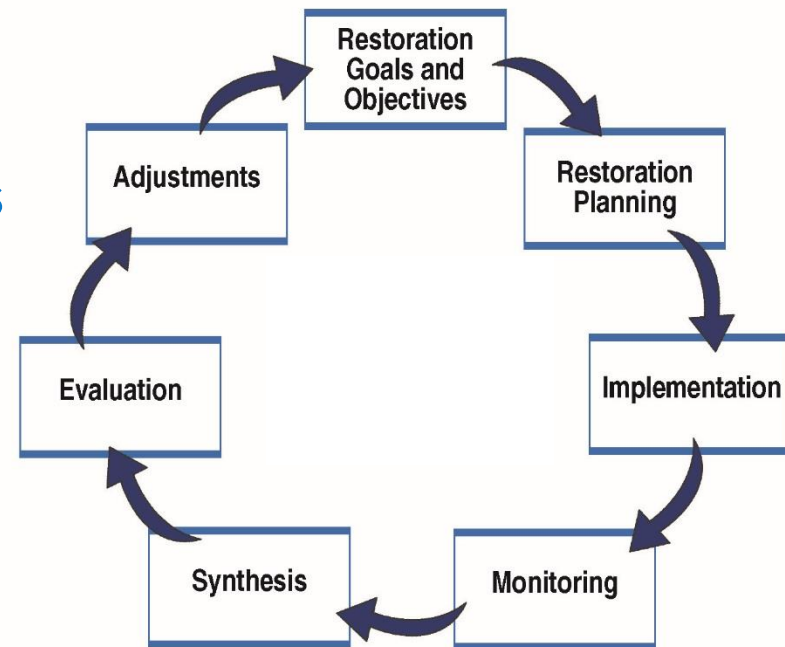
Adaptive Management

To implement adaptive management programs need:

- Careful determination of the most critical uncertainties;
- Project-level adaptive management plans that formalize the key steps and responsible parties;
- A clear financial and procedural commitment;
- Institutional support for synthesis and evaluation in support of decision making; and
- Development of a decision-making process in advance.

Part II: Good Monitoring Practices for Select Habitats and Taxa

- Oyster reefs
- Tidal wetlands
- Seagrass

- Sea turtles
- Birds
- Marine mammals

Habitat or Taxa Sections include:
- Examples of restoration objectives
- **Identifies decision-critical uncertainties**
- Suggests suitable response metrics
- Discussion topics:
    - control/reference site issues
    - sampling design considerations
    - **importance of standard data collection protocols**

Part II: Example – Bird Restoration Monitoring

- **Sample objective**: "Restore habitat to increase wintering habitat for [X] number of wintering piping plovers."

- **Construction monitoring**: (1) to ascertain specific quantitative recommendations available in the literature with regards to substrate composition, presence/absence of vegetation, vegetation species composition, vegetation height, elevation, slope, etc.

- **Performance monitoring**: efforts to assess progress towards these objectives focus on three broad categories of information needs: (1) abundance, (2) community composition, and/or (3) demographic parameters.

In Summary
Key Recommendations:

1. **Establish measurable objectives.**
2. **Require rigorous monitoring plans as integral part of the restoration project.**
3. **Make data consistent and comparable, ideally using standard monitoring protocols.**
4. **Ensure data and associated metadata are archived and openly accessible.**
5. **Support a specific enterprise for synthesis.**
6. **Implement adaptive management, where appropriate, to enhance future decision making and improve restoration outcomes.**

Questions?

Report available as a pre-publication pdf now: http://www.nap.edu/

Final print version available in the fall

Please contact cmengelt@nas.edu if you would like to schedule additional briefings