Consortium for Ocean Leadership Welcomes you to the 2016 Public Policy Forum: Science and Solutions for a Resilient Ocean
CONSORTIUM FOR OCEAN LEADERSHIP

Welcomes you

the 2016

Public Policy Forum

SCIENCE AND SOLUTIONS
FOR A RESILIENT OCEAN

Special Thanks To:

MBARI

UCAR

UNIVERSITY OF FLORIDA

College of Liberal Arts and Sciences

USF UNIVERSITY OF SOUTH FLORIDA

COLLEGE OF MARINE SCIENCE

NOAA OCEANOGRAPHIC INSTITUTE

1930
Science Solutions for Resiliency
The 2016 Public Policy Forum
Panel on Science and Solutions for a Resilient Ocean

An Overview of this Afternoon’s first Panel:
A profound transformation of Earth’s environment and its oceans is now apparent, owing not only to the planetary forces of nature, but to the activities and the demographics of its people.

It began several centuries ago with the transformations of global energy, national economic strategies and changes in global population.

Further, over the past few decades, scientific evidence has documented these changes are occurring more rapidly than any time in recorded history, with profound implications for the ocean and the role it plays.

During this Panel, we seek to explore and posit science’s role in strategies and way to enhance the resiliency of the global ocean.

Moderator: Robert W. Corell, Consortium for Ocean Leadership
Panel on Science and Solutions for a Resilient Ocean

Structure of the Panel:

• **Theme I:** *Nature’s Natural Inherent Resiliency, the Capacity to Adapt and Adjust to these External Forces of Change:* Andrea Dutton, Professor, University of Florida

• **Theme II:** *Ecological Perspectives to Enhance the Resiliency of the Ocean:* Nancy N. Rabalais, Professor, Louisiana Universities Marine Consortium

• **Theme II:** *Societal Strategies to Enhance the Resiliency of the Ocean:* David W. Cash, Dean, John W. McCormack Graduate School of Policy and Global Studies, UMass-Boston

• **Theme III:** *Ocean Resiliency, Legislation and Policy Processes:* Scott Rayder, Senior Advisor to the President, University Corporation for Atmospheric Research
Resiliency of the oceans on geologic timescales

Dr. Andrea Dutton
Dept. of Geological Sciences, University of Florida
Resiliency is a quality in objects to hold or recover their shape, or in people to stay intact. This is a kind of strength. If you bend a fork and it bends right back — that's resiliency.

https://www.vocabulary.com/dictionary

The ability to become strong, healthy, or successful again after something bad happens

Merriam-Webster

The capacity to recover quickly from difficulties; toughness

Oxford English Dictionary
Cretaceous Marine Life
Chicxulub
(~ 66 Million yrs. ago)

Credit: Joe Tucciarone
Chicxulub crater

- The crater is 300 km (190 mi) in diameter
- Caused by an asteroid ~10 km (6.2 mi) in diameter
- Energy equivalent of 8 million thermonuclear weapons (2 million times more powerful than a H bomb)
Deccan Traps

Lava flows

Petersen et al. (in review)
Ocean response

• > 75% of marine organisms became extinct
• One-two punch of volcanism and asteroid impact: A *vulnerable ecosystem is more susceptible to collapse.*
• Multiple possible kill mechanisms
• Recovery took millions of years
Paleocene-Eocene boundary
(~ 55 Million yrs. ago)

Paleocene-Eocene thermal maximum (PETM):

- Geologically abrupt pulse of atmospheric CO$_2$
- Led to sudden warming
- Caused widespread ocean acidification

Ocean response:

- Ocean acidification, spike in temperatures
- Abrupt change in sedimentation (loss of carbonate sediments in deep sea)
- Benthic extinction event
- Protracted recovery of ocean-atmosphere-climate system over several hundred thousand years
CO$_2$

carbonic acid

Dark, red-brown ocean PETM sediment layer shows in the cores retrieved by the Ocean Drilling Programe drill ship JOIDES Resolution (right).

Image credit: J. C. ZACHOS.

Acidic layer

PETM start

Calcite layer

Core from Walvis Ridge S. Atlantic 208
Paleocene-Eocene thermal maximum (PETM):

Global temperature is rising much more quickly today than it did during the PETM.

**Modern**: Fueled by high emission rates (up to 25 petagrams of carbon a year), global temperature is rising quickly and will level off only when emissions cease.

**PETM**: Slow but steady emissions (up to 1.7 petagrams of carbon a year) resulted in a more gradual heating of the planet some 56 million years ago.
The capacity to adapt and adjust to forces of change; become strong, healthy, or successful again.

**Resiliency of the oceans**

The oceans can *adapt*; they have the capacity to become strong, healthy and successful again.

But because the timescales of response operate over thousands to millions of years, large and abrupt perturbations to the system can lead to irreversible *transformation* of marine life, which has a cascading effect on other aspects of the system (such as sedimentation, chemistry of seawater, etc.).

Even if a certain amount of change is inevitable, slowing the *rates of change* can enable some compensation to occur relying the natural resiliency of the ocean.
Acknowledgements

For providing unparalleled access to the deep interior of the ocean and offering insight into the ocean’s geological, chemical, physical, and biological history.

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Timescales of response

Clark et al. (2016) Nature Climate Change
Ocean/Coastal Resilience & Science

Nancy N. Rabalais
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• What Have We Done?
• What Can We Do?
• What Will We Do?

March 9, 2016
Nearshore
Ocean
What Have We Done?

- Warmer Skies
- Warmer Water
- Disappearing Deltas
- Sea Level Rise
- Noxious & Toxic Algal Blooms
- Deoxygenation & Acidification
- Bleached Corals
- Overharvesting
- Pollution
NO ALTERATION IS INDEPENDENT of ALL THE OTHERS
Sea Level Rise
Disappearing Deltas
Warming, Deoxygenation, Acidification
Eutrophication, Noxious and Harmful Algal Blooms, Hypoxia (or ‘Dead Zones’)

$n \text{ now } > 550$

Data from Water Resources Inst.
Warming Sea Temperatures and Coral Bleaching
Loss of Biodiversity, Ecosystem Services
How Have We Done This? And, How to Reverse

Course of change, post industrial revolution and accelerating post green revolution. Human activities in landscape, human activities in general increasing C and N footprint.

Destructive Food and Fuel Policies
What Can We Do?

• Do NOT Wait to Respond to the Next Crisis

• Economic and Sustainable Agriculture

• Mitigate Sea Level Rise

• Be prepared to dike, and move people, pets and plants

• Education, although it seems slow, for policy reasons and needs of maintaining a level of economic stability as we now know it.
More Solutions

David Cash
Strategies and Action Tools (Not Just THOUGHTS!)
It is not down in any map; true places never are:*

Science, Society and Oceans

March 9, 2016

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*Herman Melville, Moby Dick; or, The Whale
The Three Pillars of Knowledge for Action

- Salience
- Credibility
- Legitimacy
Patrick seeks $3.2 million for groundfish study

Two months after visiting New Bedford to talk with troubled groundfishermen, Gov. Deval Patrick is requesting $3.2 million in federal funding to support a cooperative research study of key groundfish stocks.

June 17, 2009
SMAST scientists worked with the mayor's council and the state Division of Marine Fisheries to develop the research proposal, which calls for partnering with the National Oceanic and Atmospheric Administration's Fisheries Service to accomplish five tasks:

1. review the winter flounder stock assessment conducted by NOAA's Northeast Fisheries Science Center;
2. describe changes to current fishing boundaries that would allow fishermen more opportunities to target healthy stocks;
3. examine alternative fishing strategies and gear designs that would minimize the catch of winter flounder;
4. develop a winter flounder survey and monitoring program that would involve fishing vessels;
5. and design a fishery management and information system.
January 10, 2010
NOAA Rejects Requests for Funds for Cooperative Assessment
New call for outside review of NOAA assessments
Gloucester Times
May 22, 2015
Massachusetts Oceans Management Plan

- Initiated by Oceans Management Act of 2008
- 1.5 year Process
- 18 public meetings
- 90 stakeholder consultations
- 5 Month period of public review,
- >300 written comments
- 5 five public hearings
- 25 informational meetings
- Ocean Advisory Commission
- Science Advisory Council
The Result of a Process Attuned to Salience, Credibility and Legitimacy:

- Science that is broadly trusted;
- Decision options that are less contested, and when contested, contested on merits;
- Little obstruction;
- Decision options that balance multiple inputs;
- More robust decisions
Figure 28. Preliminary areas for offshore wind transmission cable corridors
Thank you!

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Ocean Resiliency and Legislation

Scott Rayder
Senior Advisor to the President

Ocean Leadership Public Policy Forum
March 9, 2016
Oceanic and Atmospheric Resiliency

REMEMBER: “ONE LIQUID, TWO DENSITIES”

1. Natural Resiliency of Oceans

2. Human capacity to understand and enhance resiliency of the Oceans

3. Explaining Resiliency to Congress and implications for Policy

4. ADM Watkins; “Oceanography Won the Cold War”
Relationships between global and regional assessments and Role of Congress

Living Resiliency in Legislation
1976 Magnuson-Stevens Act

1976: Enacted to promote the U.S. fishing industry's optimal exploitation of coastal fisheries by "consolidating control over territorial waters" and establishing eight regional councils to manage fish stocks.

2006: 7 Goals:
1. Acting to conserve fishery resources
2. Supporting enforcement of international fishing agreements
3. Promoting fishing in line with conservation principles
4. Providing for the implementation of fishery management plans (FMPs) which achieve optimal yield
5. Establishing Regional Fishery Management Councils to steward fishery resources through the preparation, monitoring, and revising of plans which (A) enable stakeholders to participate in the administration of fisheries and (B) consider social and economic needs of states.
6. Developing underutilized fisheries
7. Protecting essential fish habitats

WHAT HAPPENED IN 30 YEARS???
Living Resiliency in Legislation
2006 Magnuson-Stevens Act

“To achieve the goal of ending overfishing ... Congress strengthened the role of science in the fishery management process and required fishery managers to establish science based annual catch limits (ACLs) and accountability measures (AMs) for all US fisheries with a deadline of 2010 for all stocks subject to overfishing... The new fisheries law requires the councils’ science advisors, the scientific and statistical committees to make recommendations for ‘acceptable biological catch’ (ABC) which managers may not exceed...”

The ACL is the centerpiece of the report which is supplemented by other mechanisms regulating the types of gear used, licensing vessels, and using of observers on fishing boats. In section 303 b, the Act enumerates the types of actions authorized for use by councils to achieve optimal catch goals.

Including:
Permitting vessels or operators
Designating Zones and periods where fishing is limited
Limiting sale, catch or transport of certain fish
Regulating types of fishing equipment
Requiring observers onboard vessels
Science Solutions for Resiliency