Oceans and Human Health: Through a Marine Mammal Lens

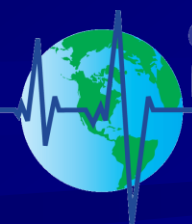
May 7, 2014

Marine Mammal Commission Annual Meeting

Paul A. Sandifer, Ph.D., NOAA

Oceans and Human Health (OHH) "Meta-discipline"

- Includes elements of oceanography, marine biology/ecology, biomedical science, medicine, environmental and public health
- Focuses principally on water- and food-borne causes of human and animal illnesses associated with ocean and coastal systems and on health benefits of seafood and other marine products
- Integrates information across multiple disciplines to better understand health risks and benefits for improved public health protection and management

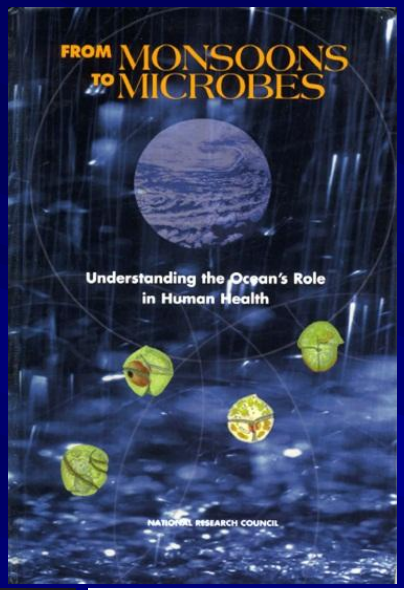


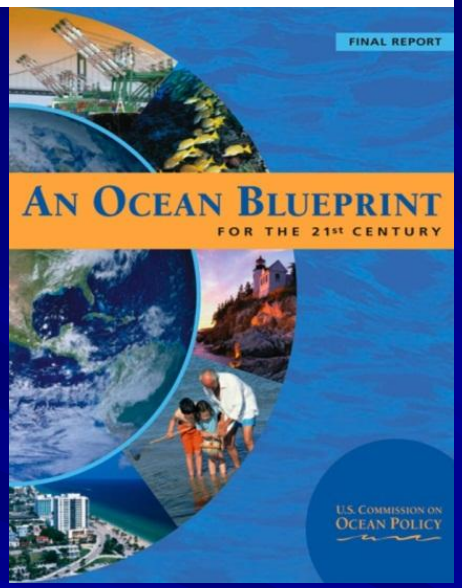
OCEANS & HUMAN HEALTH INITIATIVE

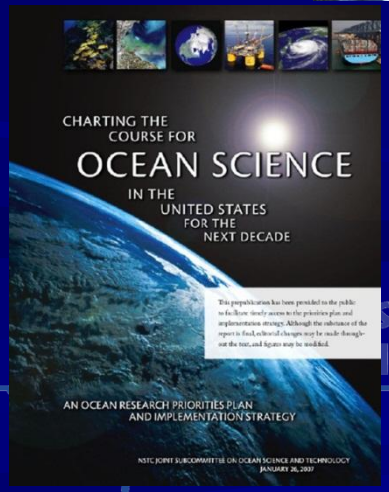
H.R.4818

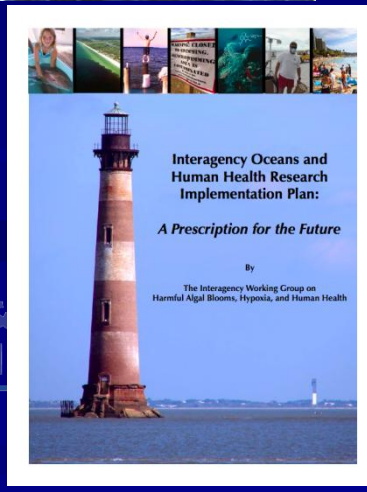
Consolidated Appropriations Act, 2005 (Enrolled as Agreed to or Passed by Both House and Senate)

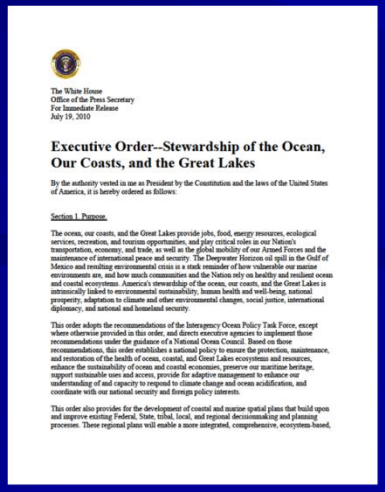
TITLE IX--OCEANS AND HUMAN HEALTH ACT











The White House
Office of the Press Secretary
For Immediate Release
July 19, 2010

Executive Order--Stewardship of the Ocean, Our Coasts, and the Great Lakes

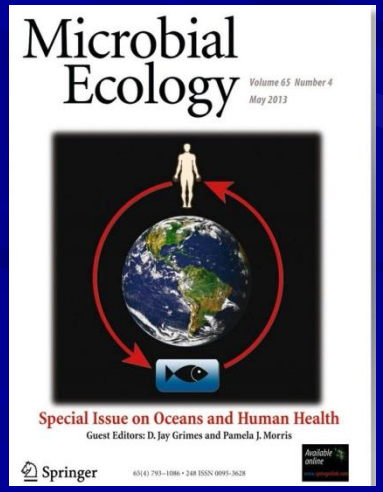
By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

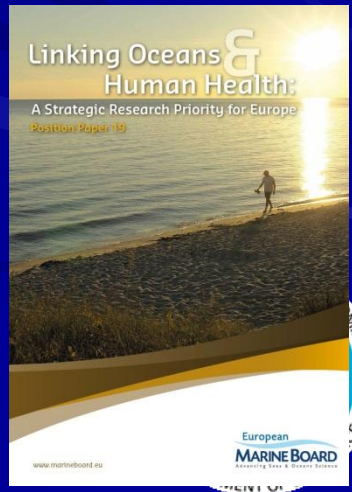
Section 1. Purpose.

The ocean, our coasts, and the Great Lakes provide jobs, food, energy resources, ecological services, recreation, and tourism opportunities, and play critical roles in our Nation's transportation, economy, and trade, as well as the global mobility of our Armed Forces and the maintenance of international peace and security. The Deepwater Horizon oil spill in the Gulf of Mexico and resulting environmental crisis is a stark reminder of how vulnerable our marine environments are, and how much communities and the Nation rely on healthy and resilient ocean and coastal ecosystems. America's stewardship of the ocean, our coasts, and the Great Lakes is intrinsically linked to environmental sustainability, human health and well-being, national prosperity, adaptation to climate and other environmental changes, social justice, international diplomacy, and national and homeland security.

This order adopts the recommendations of the Interagency Ocean Policy Task Force, except where otherwise provided in this order, and directs executive agencies to implement those recommendations under the guidance of a National Ocean Council. Based on those recommendations, this order establishes a national policy to ensure the protection, maintenance, and restoration of the health of ocean, coastal, and Great Lakes ecosystems and resources, enhance the sustainability of ocean and coastal economies, preserve our maritime heritage, support sustainable uses and access, provide for adaptive management to enhance our understanding of and capacity to respond to climate change and ocean acidification, and coordinate with our national security and foreign policy interests.

This order also provides for the development of coastal and marine spatial plans that build upon and improve existing Federal, State, tribal, local, and regional decisionmaking and planning processes. These regional plans will enable a more integrated, comprehensive, ecosystem-based,





Focus on Health Risks and Benefits

Contaminated Beaches and Closures

Ailing Sentinel Species and Habitats

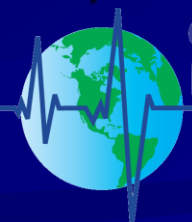
Seafood and Drinking Water Contamination

Discovery of New Drugs and Products

Coastal Inundation and Extreme Weather Events

Major Impacts of OHH Programs in the United States

1) A national and international focus on OHH;
2) Sustained science collaborations;
3) Enhanced interagency cooperation;
4) Richer knowledge of ocean-human linkages;
5) Community of practice;
6) Event response capabilities;
7) Understanding of what drives health threats;
8) New product discovery;
9) Broad communication about OHH to the public; and
10) Implementation of ocean health early warning systems



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One Planet, One Ocean, One Health

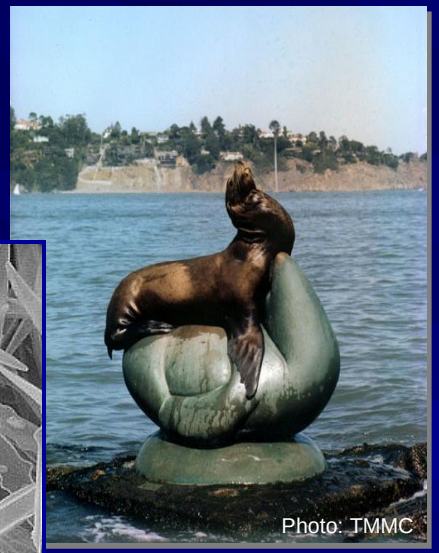
- Ocean health, marine animal health, and human health are inextricably linked
- Requires interdisciplinary collaboration and communication
- Studying/monitoring sentinels:
  - Provides early warning of emerging health threats
  - Helps understand exposure pathways, potential health effects, and toxic mechanisms

Oceans & Human Health Initiative

NOAA
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

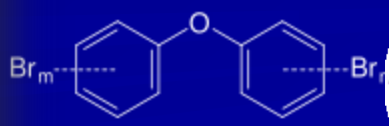
Marine Mammals Provide Insights into Human Health Threats from the Sea

Marine Toxins



Zoonotic Pathogens

Environmental Contaminants



NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

California Sea Lions as Sentinels of Health Effects

- Cancer found in 18% of stranded sea lions[a]
- Urogenital carcinoma associated with Otarine Herpesvirus-1[b]
- Association with PCBs & DDT[c]
- Also potential genetic co-factor[d]

[a]Gulland et al. 1996 J Wildlife Disease
[b]Buckles et al 2007, J Comparative Pathology
[c]Ylitalo et al., 2005, Marine Pollution Bulletin
[d]Acevedo-Whitehouse et. al. 2003, Nature

Direct Exposures & Health Threats

- 60% of EIDs are zoonoses; 72% of these originate from wildlife[a]
- Marine mammals and birds are potential reservoirs for zoonotic pathogens[b]
  - 45% of stranded animals
  - 73% bacteria w/antibiotic resistance

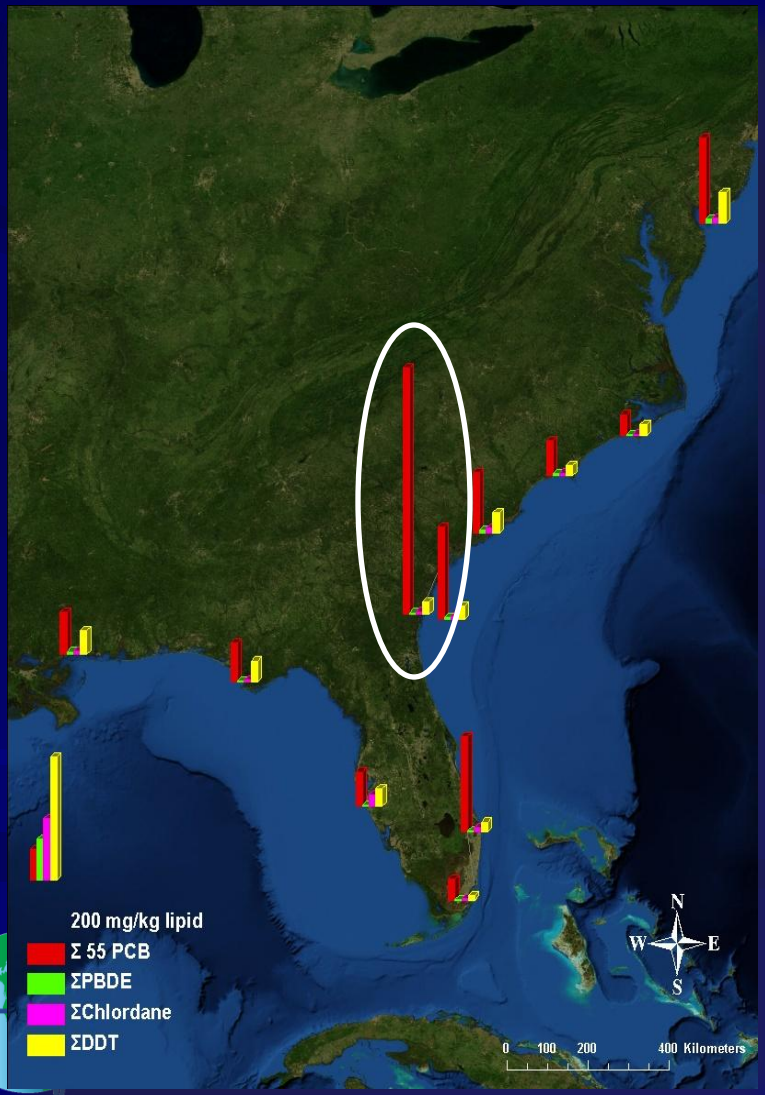
[a]Jones et al. 2008, Nature
[b]Bogomolni et al.,2008 Diseases of Aquatic Organisms

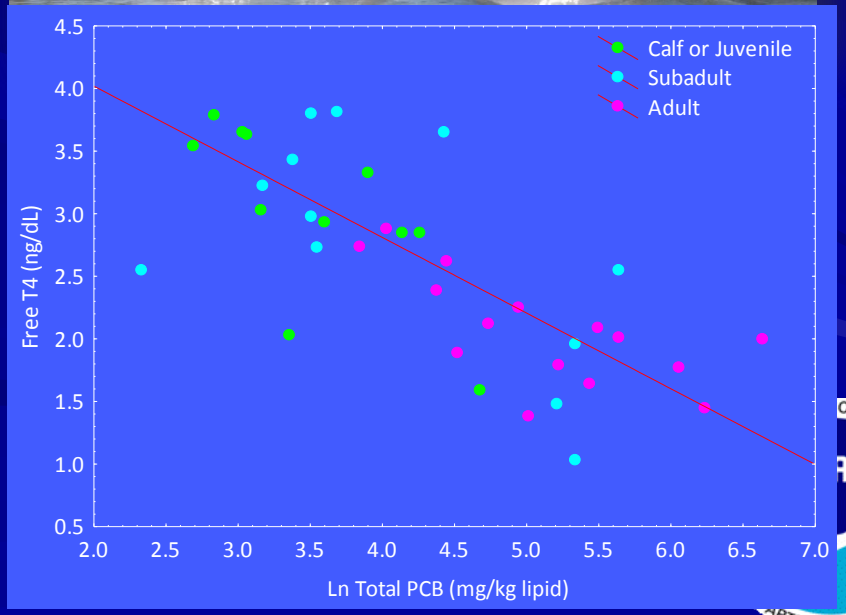
Avian Influenza in Harbor Seals

- Fall 2011: 162 New England harbor seals died from pneumonia.
- Postmortem examination found Avian flu virus similar to one known from NA waterfowl.
- Anthony et al. 2012 stated: **"This outbreak is particularly significant …because the virus has naturally acquired mutations that are known to increase transmissibility and virulence in mammals."**

Anthony et al. 2012. mBio 3(4): doi:10.1128/mBio.00166-12.full.html

Dolphins Provide Early Warning of Chemicals in Coastal Food Web





Effects of Oil Pollution

Environmental Science & Technology

Article

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Health of Common Bottlenose Dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, Following the *Deepwater Horizon* Oil Spill

Lori H. Schwacke,[†,*] Cynthia R. Smith,[‡] Forrest I. Townsend,[§] Randall S. Wells,[∥] Leslie B. Hart,[†] Brian C. Balmer,[∥] Tracy K. Collier,[⊥] Sylvain De Guise,[#] Michael M. Fry,[▽] Louis J. Guillette, Jr.,[○] Stephen V. Lamb,[♦] Suzanne M. Lane,[†] Wayne E. McFee,[†] Ned J. Place,[♦] Mandy C. Tumlin,[¶] Gina M. Ylitalo,[+] Eric S. Zolman,[†] and Teresa K. Rowles[★]

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Supporting Information

ABSTRACT: The oil spill resulting from the explosion of the *Deepwater Horizon* drilling platform initiated immediate concern for marine wildlife, including common bottlenose dolphins in sensitive coastal habitats. To evaluate potential sublethal effects on dolphins, health assessments were conducted in Barataria Bay, Louisiana, an area that received heavy and prolonged oiling, and in a reference site, Sarasota Bay, Florida, where oil was not observed. Dolphins were temporarily captured, received a veterinary examination, and were then released. Dolphins sampled in Barataria Bay showed evidence of hypoadrenocorticism, consistent with adrenal toxicity as previously reported for laboratory mammals exposed to oil. Barataria Bay dolphins were 5 times more likely to have moderate–severe lung disease, generally characterized by significant alveolar interstitial syndrome, lung masses, and pulmonary consolidation. Of 29 dolphins evaluated from Barataria Bay, 48% were given a guarded or worse prognosis, and 17% were considered poor or grave, indicating that they were not expected to survive. Disease conditions in Barataria Bay dolphins were significantly greater in prevalence and severity than those in Sarasota Bay dolphins, as well as those previously reported in other wild dolphin populations. Many disease conditions observed in Barataria Bay dolphins are uncommon but consistent with petroleum hydrocarbon exposure and toxicity.

Received: August 14, 2013
Revised: November 27, 2013
Accepted: December 2, 2013

   dx.doi.org/10.1021/es403610f | Environ. Sci. Technol. XXXX, XXX, XXX−XXX

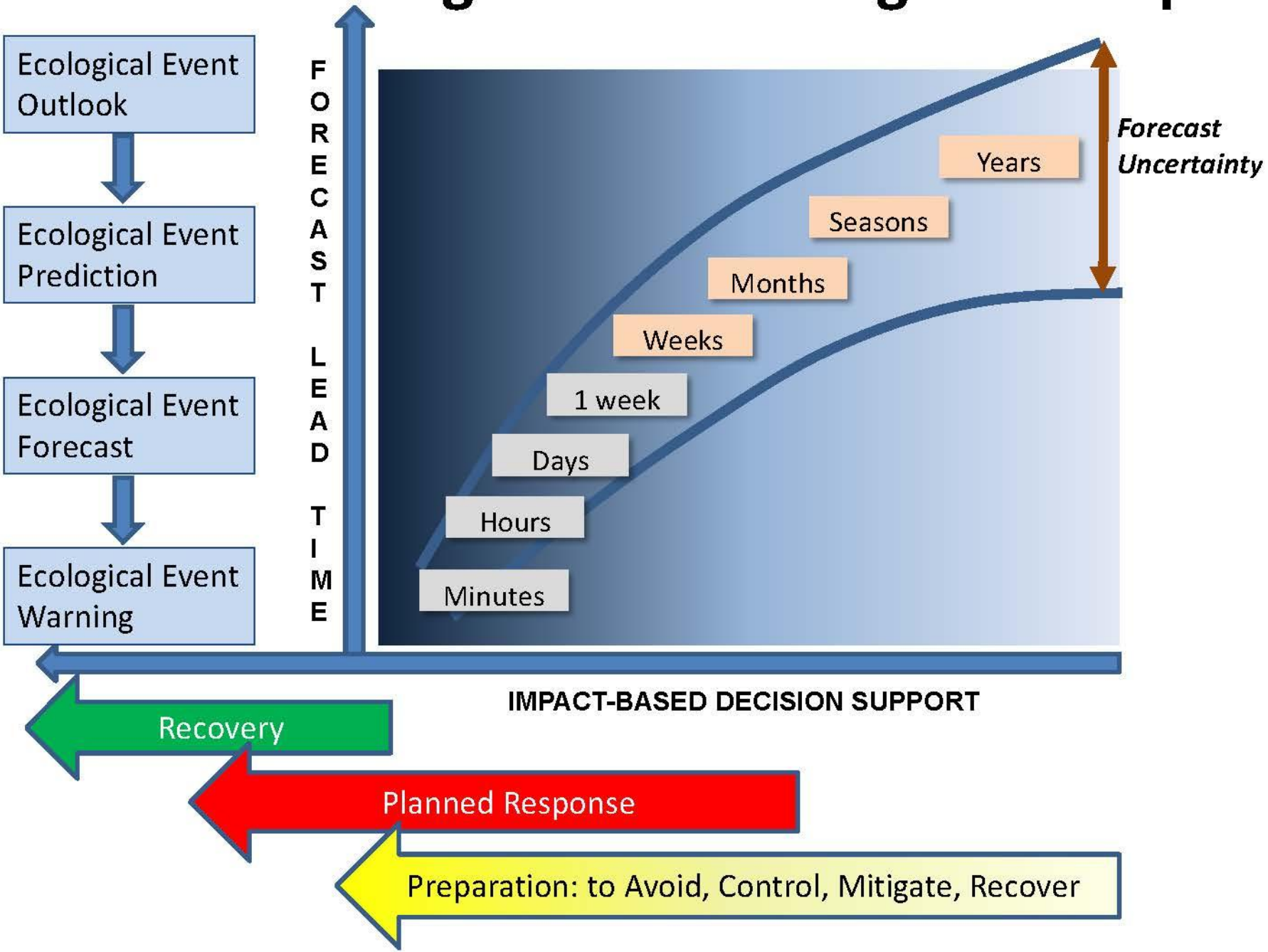
What Are Ecological Forecasts?

- Ecological forecasts predict likely changes in ecosystems in response to environmental drivers and resulting impacts to people, economies and communities.

- Ecological forecasts provide early warnings of the possible effects of ecosystem changes (e.g., harmful algal blooms, hypoxia, pathogens) on coastal systems and human well-being with sufficient lead time to allow for corrective actions.

Photo Credit: NOAA, WHOI, FWC FWRI, Charlotte (FL) Sun Herald

NOAA's Ecological Forecasting Roadmap



An OHH Grand Challenge

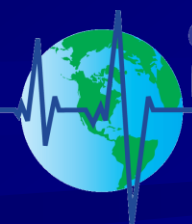
How to link and integrate disparate environmental data streams with all types of biosensor and surveillance data on HABs, biotoxins, pathogens, chemical contaminants, and physiological parameters of humans and animals and use them to forecast the likely occurrence and severity of ocean health threats in specific locations as well as long-term effects of environmental change on such threats.

Oceans & Human Health Initiative

We Need Better Plans!


Questions?
Photo: B. Ba

Discussion Slides



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How Can Marine Mammals Fit Into the EFR?

- Maybe we can ask them to report in!
- Maybe we can remotely & periodically biopsy animals for which we have photo-ID information.
- Maybe we can combine marine mammal health data with human epi data!

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NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

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GULF STUDY

a health study for oil spill clean-up workers and volunteers

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1-855-NIH-GULF (1-855-644-4853)
or visit www.nihgulfstudy.org.

Doc 01, V 2.0 (exp. 12/01/11)