THE EFFECTS OF CLIMATE CHANGE ON FLORIDA'S OCEAN AND COASTAL RESOURCES

A Special Report to the Florida Energy & Climate Commission and the People of Florida

January 26, 2009

Florida Oceans and Coastal Council

- **Created by the Legislature in 2005**
- **Oceans and Coastal Resources Act**
- **15 Appointed Members**
  - **State and federal agencies & programs**
  - **Public and private academic institutions**
  - **NGO research and advocacy groups**
  - **Florida business and corporate sectors**

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Ex-Officio Members

- **<u>Department of Environmental Protection</u>**
- ***Co-chair:*** **Mike Sole, Secretary**
- ***Designee:*** **Bob Ballard, Deputy Secretary, Land and Recreation**

- ***Administration:*** **Lee Edmiston, Director, FDEP Office of Coastal and Aquatic Managed Areas**
- ***Council Staff:*** **Becky Prado, CAMA Program Administrator**

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- **<u>Fish and Wildlife Conservation Commission</u>**
- ***Co-chair:*** **Ken Haddad, Executive Director**
- ***Designee:*** **Gil McRae, Director, Fish and Wildlife Research Institute**

- **<u>Department of Agriculture and Consumer Services</u>**
- ***Co-chair:*** **Charles Bronson, Commissioner**
- ***Designee:*** **Sherman Wilhelm, Director, Division of Aquaculture**

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FOCC Progress to Date

- Create an annual science plan to guide state research priorities
- Building a web-based resource assessment tool for citizens, research institutions and agencies
- Enhanced state's ocean observing capabilities
- Determined the value of state's ocean economy

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Florida's Ocean and Coastal Economy 2008

Based on two studies conducted by the National Ocean Economics Program

Some Key Results

- **Florida's ocean economy contributes $25 billion in revenue***
- **Florida's coastal economy contributes over $562 billion in revenue***
- **Florida's coastal counties contribute about 79% of the state's economic productivity**

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* 2006 GSP includes multiplier effect

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Florida's 2005 Ocean Economy

- **511,000 jobs**
- **$13.5 billion in wages**

Florida's ocean economy ranks 2nd in the nation to California

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Florida's 2006 Coastal Economy

- **$562 billion in GSP**
- **$226 billion in wages**
- **5.8 million jobs**

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Seeking to Understand

- **12 American reports on climate change in the past 13 months**

- **Including 5 Florida reports on climate, energy, effects, and resources in the past 8 months**

plus summits, conferences, workshops

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Florida Climate Action Team Adaptation Report 2008

- **ADP-3: Protection of Ecosystems and Biodiversity**

"Florida's ecosystems should be managed for resiliency by enhancing their ability to naturally adapt to *the stresses of climate change*…"

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"Adapt to what?"

Approach

….this report carefully identifies what is known-- and with what level of certainty --about each of the drivers of climate change and describes its effects on Florida's ocean and coastal resources in terms of

what is currently known,

what is probable,

and what is possible.

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4 Drivers of Climate Change

- **Increased greenhouse gases**
- **Increased air temperature and water vapor**
- **Increased water temperature**
- **Increased sea level**

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17 Categories of Florida Effects

- Ocean acidification
- Altered rainfall/runoff
- Tropical storms and hurricanes
- Coral bleaching
- Coral and fish diseases
- Loss of sessile marine life
- Decreases in biodiversity
- Range changes
- Exotic/nuisance species
- Altered rates of nutrient cycling
- HABs, hypoxia, and human diseases
- Tidal wetland losses
- Coastal geomorphology changes
- Beach loss

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Driver Example: Sea Level Rise

WHAT WE KNOW

Around Florida, relative sea level has been rising at a relatively slow but constant rate, generally less than an inch per decade.

WHAT IS PROBABLE

In time, the rate of absolute sea level rise will accelerate because of ocean warming and contributions from land-based ice melt from areas such as Greenland and Antarctica.

WHAT IS POSSIBLE

Major inputs of water from high latitude and high altitude ice reservoirs could cause catastrophic rises in sea level.

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Effects Examples: Sea Level Rise

WHAT WE KNOW

Many tidal wetlands are keeping pace with sea level changes. Some are accreting vertically, migrating up-slope, or both.

Wetlands elsewhere are perishing as estuarine and coastal forests and swamps are retreating, replaced by marsh vegetation.

Even at constant rates of sea level rise, some tidal wetlands will eventually "pinch out" at upland defenses such as seawalls.

Effects Example: Sea Level Rise

WHAT IS PROBABLE

More lowland coastal forests will be lost during the next one to three centuries as tidal wetlands expand across low-lying coastal areas.

Plant communities along tidal rivers and estuarine shores will be lost, increasing sedimentation to local waters.

Most tidal wetlands in areas with low freshwater and sediment supplies will "drown" if sea level rise outpaces their ability to accrete vertically.

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Effects Example: Sea Level Rise

WHAT IS POSSIBLE

More than half of the saltmarsh, shoals, and mudflats critical to birds and fishes in Florida estuaries, could be lost during the 21st century.

The loss of tidal wetlands will result in dangerous losses of the coastal systems that buffer storm impacts.

Major redistributions of sediment may have *compensatory or larger benefits* natural systems, but these processes cannot be forecast with existing models.

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Interpreting Climate Reports

	EMPIRICAL DATA? (Past & Present)	**MODELED OUTPUTS?** (Present & Future)
GLOBAL?		
CONTINENTAL OR NATIONAL?		
FLORIDA?		

IPCC (2007)

"Accelerated sea level rise caused by rapid… response of the ice sheets to climate change is very unlikely during the 21st century…

Owing to limited understanding of the relevant… processes, there is presently no consensus on the long-term future of the ice sheet or its contribution to sea level rise."

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Abrupt Climate Change (USGS 2008)

"Inclusion of [nonlinear responses of ice-shelf melting] in models will likely lead to sea-level projections for the end of the 21st century that *substantially exceed* the projections presented in the IPCC… report (0.28 ± 0.10 m to 0.42 ± 0.16 m rise)."

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Responding to Climate Change

Some effects will be *accepted*. This means that no reasonable options will be found to avoid having to accept an undesirable and detrimental effect. For example, Florida may have to accept the loss of its coral reefs.

Other effects will be *mitigated*. This means that in-kind strategies and actions will compensate for some or all of an adverse effect. For example, Florida may set aside low uplands so tidal wetlands can migrate as sea level rises.

Finally, to some effects we will *adapt*, meaning that our ways of life, infrastructure, or economy will change so as to perpetuate Florida's quality of life. For example, homes built to hurricane-resistant standards can eventually eliminate some of the extreme consequences of severe storms.

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What the Ocean Council's Report Does and Offers

-- Extends the Action Team's findings to ocean and coastal resources

-- Speaks directly to Florida stressors and effects

-- Introduces scales of certainty, and potential for benefits, in state climate discussions

-- Provides a template for ocean updates, and a model for other Florida assessments

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What the Ocean Council's Report Does and Offers

-- Contributing to efforts by others

Adaptation Working Group

Florida Sea Grant strategic planning

Gulf of Mexico Alliance priority issue (new)

-- Identifies climate research gaps and priorities for FOCC action

-- Affirms state energy and climate priorities

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THE LONG-TERM SOLUTION

"The long-term extent and severity of oceanic or coastal effects caused by climate change ultimately depend on how rapidly humanity can eliminate human sources of carbon dioxide and other greenhouse gases entering the atmosphere at harmful levels, now and in the future."

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http://www.floridaoceanscouncil.org

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