On August 3, 2015 the Environmental Protection Agency finalized the Clean Power Plan, to reduce CO$_2$ emissions from existing coal power plants by 30% below 2005 levels by 2030
Contrasting futures for ocean and society from different anthropogenic CO₂ emissions scenarios
2°C/3.6°F Increase

### Low CO₂ emissions (RCP2.6)
- ΔT: +1.2°C
- ΔpH: -0.14 units
- SLR: +0.60 m

### Business-as-usual (RCP8.5)
- ΔT: +3.2°C
- ΔpH: -0.4 units
- SLR: +0.86 m

#### Seagrass (m)
- Mitigate

#### Mangroves
- Adapt

#### Warm-water corals
- Protect

#### Pteropods (h)
- Repair

#### Bivalves (m)
- Open ocean carbon uptake
  - Coastal protection
  - Coral reef recreation

#### Krill (h)

#### Fin fish

#### Bivalve fisheries, aquaculture (m)

#### Fin fish fisheries (l)

#### Fin fish fisheries (m,h)

<table>
<thead>
<tr>
<th>Management options</th>
<th>Less efficient</th>
<th>More efficient</th>
<th>Risk of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Undetectable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Very high</td>
</tr>
</tbody>
</table>
Climate Change Threatens the Survival of Coral Reefs

If average global surface temperatures increase by 2°C or more, relative to the pre-industrial period, the resultant ocean warming, along with acidification, will lead to continued widespread destruction of coral reef ecosystems over the next few decades.

The emission reduction pledges submitted to date by the international community fall well short of what is required needed to avoid this biodiversity catastrophe.

_ISRS Consensus Statement on Climate Change and Coral Bleaching, October 2015_
2014-16? Coral Bleaching Event

Dr. C. Mark Eakin
NOAA Coral Reef Watch
http://coralreefwatch.noaa.gov
2014 Severe Bleaching

NOAA Coral Reef Watch Annual Maximum Satellite Coral Bleaching Alert Area 2014

No Stress

Watch

Warning

Alert Level 1

Alert Level 2

Florida Department of Environmental Protection
Coral Reef Conservation Program
SEAFAN BleachWatch Program
Current Conditions Report #20140902
September 2, 2014

Summary: Based on climate predictions and field observations, the threat for mass coral bleaching in southeast Florida, between Miami-Dade and Martin counties, is currently HIGH.

Environmental Monitoring

The latest CRW experimental 5 kilometer (km) Daily Coral Bleaching Alert Area (Figure 1) indicates that southeast Florida is presently experiencing a moderate to high level of thermal stress, with an Alert Level 1 or Bleaching Warning present throughout the region. This indicates that bleaching is likely in southeast Florida and additional alerts are possible if current conditions continue or worsen.

NOAA’s Bleaching Hotspot Map compares current SST to the maximum monthly mean, which is the average temperature during the
Severe Bleaching Jan-June 2015

NOAA Coral Reef Watch Annual Maximum Satellite Coral Bleaching Alert Area 2015

No Stress
Watch
Warning
Alert Level 1
Alert Level 2

PNG and Solomon
Kiribati
Galápagos
Samoas
Fiji
American Samoa
Pete Mumby
U. Queensland
XL Catlin Seaview Survey
2015 Hawaii Bleaching
2015 Caribbean Bleaching

2015 Bleaching in:
- Florida
- Cuba
- Bahamas
- Turks & Caicos
- Cayman Islands
- Dominican Republic
- Haiti

NOAA CRW 5-km Night-Only Bleaching Alert Area Year-to-date Maximum 26 Oct 2015

Maps show bleaching severity with color coding:
- Low Stress
- Watch
- Warning
- Alert Level 1
- Alert Level 2

Images of bleached coral reefs are shown on the left side of the page.
Scientists say a dramatic worldwide coral bleaching event is now underway
Which Reefs are at Risk for Bleaching Now?

NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only Bleaching Alert Area 7d Max 26 Oct 2015

http://coralreefwatch.noaa.gov
June 2014-December 2015 Thermal Stress

Global Reefs:
• 30% exposed to Alert Level 1 or 2
• 99% stressed

US Reefs:
• 70% exposed to Alert Level 1 or 2
• 100% stressed

http://coralreefwatch.noaa.gov
Which Reefs are at Risk of Bleaching Soon?

2015 Oct 27 NOAA Coral Reef Watch 60% Probability Coral Bleaching Thermal Stress for Nov–Feb 2016
Experimental, v3.0, CFSv2–based, 28–member Ensemble Forecast

Potential Stress Level:  
- Watch
- Warning
- Alert Level 1
- Alert Level 2

http://coralreefwatch.noaa.gov
Which Reefs are at Risk of Bleaching Soon?

2015 Oct 27 NOAA 60% Probability Coral Bleaching Thermal Stress for Nov–Feb 2016
Experimental, v3.0, CFSv2–based, 28–member Ensemble Forecast

Potential Stress Level:
- Watch
- Warning
- Alert Level 1
- Alert Level 2
Which Reefs are at Risk of Bleaching Soon?

2015 Oct 27 NOAA Coral Reef Watch 60% Probability Coral Bleaching Thermal Stress for Nov–Feb 2016
Experimental, v3.0, CFSv2–based, 28–member Ensemble Forecast

Potential Stress Level: Watch, Warning, Alert Level 1, Alert Level 2
Bleaching Expected to Continue through 2016
Likely to Return to Caribbean

2015 Oct 27 NOAA Coral Reef Watch 60% Probability Coral Bleaching Thermal Stress for Mar-May 2016

Potential Stress Level:  
- Watch
- Warning
- Alert Level 1
- Alert Level 2

http://coralreefwatch.noaa.gov