

The Way Forward

Coral Reefs, Climate and Coral Bleaching Workshop

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We have some champions!

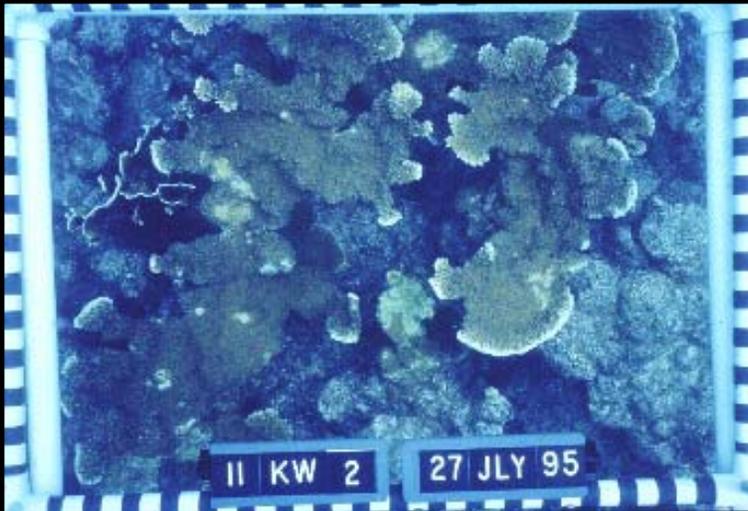
“The communities of the Pacific, Caribbean, and Indian Oceans are considered among the most vulnerable because our economies are so dependent on climate-sensitive resources and industries. Building resilience in the face of climate variability and change is a matter of long-term development and security for us.”

..... Senator Daniel K. Inouye

Coral Reefs are an Indicator Ecosystem



They are responding on a global scale to



stress levels not previously exceeded in recorded time.



**Now is the time to take
action!**

**We heard that we will
continue to loose more
of our coral reefs to
bleaching and diseases.**

**This doesn't mean we
sit back and not take
action!**

The way forward in managing coral reefs, as they relate to climate and coral bleaching, has been given a boost over the past three days!!

We have heard some excellent presentations and dialogue between scientists and managers.



Over the last three days we have heard some great news!

Mary Glackin referred to the “synergies in the National Climate and coral programs” for the United States

..... And she said “Global climate change is a capstone program.”



Mary referred to the “US Climate Change Science Program as a capstone issue for our generation.”

- **Major new technology needed**
- **More complete understanding of the science is required**
- **Accelerate the application of basic climate science**

Four Point Focus:

- 1. Science**
- 2. Observation & data**
- 3. Decision support resources**
- 4. Communication & education**



**Climate is a key part
of NOAA's Strategic
Plan**

**Yet, we continue to have our
work cut-out for ourselves!**

**Look up an article in today's newspaper
"The Honolulu Advertiser" (page A 11)
titled: "EPA Criticizes Rewrite of Report"**

**I am not pointing this out to be negative
..... but rather suggest the “scientific
bar” has been raised to another level!!**

**It’s a wake-up call that our science has to
include the socioeconomic sciences ... and
must consider the economic consequences
for not taking action!!**

Remember Kacky Andrew’s reality check of yesterday!

We need some waterfront spokespersons!

In hindsight, perhaps ... the waterfront community should have a role in future Workshops such as this one.

A lesson that I have learned is that they make a formidable ally when we all share the same concerns and issues!!

“Buying time” for our coral reefs



Terry Done did an excellent job of explaining the importance of the design of good MPA networks in the management; fostering resilience; and reduction of threats on coral reefs.

We heard from Ove Hoegh-Guldberg:

“Reasons behind current change in reef health include a complex cocktail of direct and indirect factors.”

In his discussion of the physiology of thermal stress he described the concept of “series of thresholds” - at the coral colony level.

Acclimation and Adaptation



As scientists have documented the levels for “thermal stress” from the

**cellular  tissue 
colony  community**

**I feel there is evidence for
“thermal stress thresholds”**

**being exceeded on hemisphere scales
and now a Global scale**

Rather than quote salient points from each talk and each author, I have captured some of the “tools” that managers now have available to them.

We are so much better prepared today than we were 12 years ago when the Workshop was held in Miami.

First of all.....

We have a much larger and higher level audience, who are paying attention to the coral reef, climate change, and coral bleaching

And, our number of

Coral Bleaching Groupies is growing upward in numbers and downward in age this is good!!

On Wednesday ... we heard from the scientists about the tremendous scientific advancements in our understanding of the responses of corals to bleaching:

- Physiological responses**
- Zooxanthellae and their mysteries**
- U/V and its influence on corals**

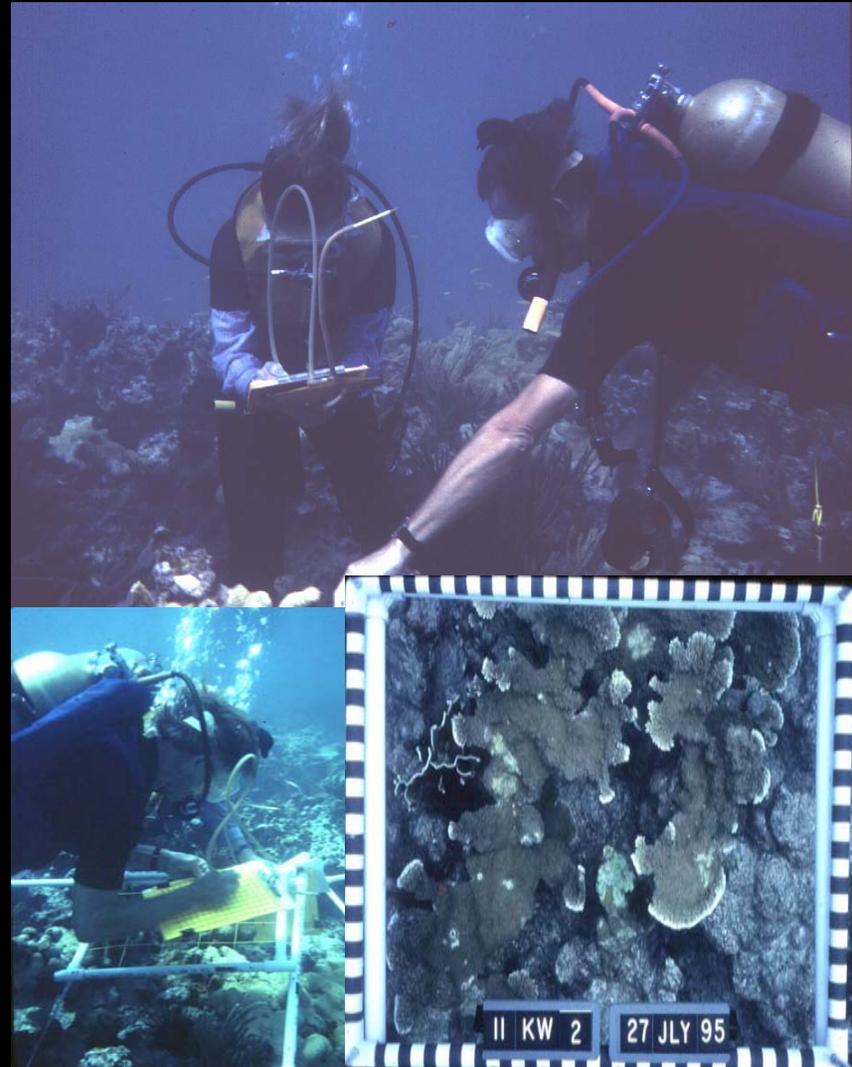
Then we heard from some of my personal heroes the remote sensing folks like Al Strong and Jim Hendee

- We learned of the tremendous advancements in technology**
- Remember ... the Internet was just coming into use at our workshop 12 years ago**

Research and Monitoring are necessary tools for helping managers address climate change and coral bleaching issues.

Today we can monitor coral bleaching events at a range of spatial and temporal scales:

- **Cellular & tissue level**
- ***In situ* or at the reef scale**
- **Local and nearshore**
- **CREWS - technology**
- **Coral Reef Watch**
- **CoRIS - web-enabled, GIS-enhanced info system**



**However, a message that I heard
loud and clear from some of the
Managers Is that we need to
apply these more comprehensively
to other coral reef areas Where
these tools do not currently exist!**

**We learned about
the role of changing
water chemistry on
corals**



**And some
excellent work
On:**

- **Paleo Record**
- **Bioinformatics**

Ernesto gave us a very informative Yet, sobering lesson on coral disease in the Caribbean.



And... there was some mention of the coral diseases that are now being observed in the Pacific.

Corals Reefs, Climate & Coral Bleaching

Day Two – Management

Key Themes

Management – Key Themes

- Building Trust; Sustaining Partnerships
 - Among disciplines
 - Across timescales
 - wx-climate-variability-climate change
 - episodic events-*thresholds*-cumulative impacts
 - near-term and long-term solutions
 - Local↔national↔regional↔international
 - Multiple, interacting stresses—climate & bleaching *in context*
 - Integrating management decisions (upstream-downstream)
 - Science↔management↔policy↔public
 - Climate-society-environment
 - Demonstrating management improvements

Management—Key Themes

- **Building *resilience* of reef ecosystems, natural resources and coastal communities**
- **Reduce local stresses**
- **Role of marine reserves/protected areas**
- **Importance of continuous monitoring and sustained assessment programs**
- **Adaptive management *and* adaptive science**
 - Rapid response a particular challenge/opportunity
- ***Effective* communication; sustained, interactive dialogue**

Management-Key Themes

- **Role (significance?) of extreme events**
- **Establishing/understanding historical context**
- **Disease-*mortality*-bleaching relationships**
- **Understanding (& facilitating?) *recovery***
- **Integrating local knowledge**
- **Building (& sustaining) local expertise**
- **Stakeholder engagement**
- **Education-outreach-public engagement**
- **Challenges of monitoring and managing in remote areas**

Management—Key Themes

- **Standardizing terminology, methodology and protocols (science “best practices”)—”Toolkit”**
- **Share experiences & lessons learned (management “best practices”) – “Toolkit”**
- **Reducing overall stress/enhancing resilience by targeting “controllable” management opportunities:**
 - **overfishing**
 - **land-based pollution**
 - **access/uses**
 - **habitat degradation**
 - **protecting biodiversity**
 - **invasive species**
 - **water quality**
 - **Others?**

Management—Key Themes

- **Need to understand the decision-making context and address critical information needs defined in/by that management framework**
 - **Management informing science**
 - **Evaluating management options/actions**
 - **Expanding available management options**

Management—Panel Discussion

- **Implications of science & management under uncertainty—requires an adaptive approach to both with continuous assessment**
- **Developing a shared (science-management) vocabulary**
- **Engagement of stakeholders in the process of both science and management**
- **Using climate concerns to reinforce other management actions**
- **Multiple stress context for both science & management – e.g., watershed approach**
- **Shared (science/management) responsibility for communication with (& engagement of) the public**
- ***Shared responsibility* for both science (monitoring, research, assessment) and management—creates *shared opportunities***



**Science and Management cannot
function independent of one another....
yet, they often do!**

Our best management decisions are only as good as the best science we managers can apply.





- **In lieu of available science - management decisions still have to be made by managers.**
- **Managers have to use the best available science with which to make those decisions.**

It is essential that managers and scientists communicate on a regular basis.



One approach is for managers to pose the questions or issues and scientists supply the answers.



Collaborative Process

Ideally, however, it is better if the managers and scientists agree on both the questions and the answers in a clear, collaborative process.



Bottomline:

- **It is essential that both resource managers and scientists have opportunities to discuss and debate the issues and possible solutions to the resource concerns.**
- **Communication needs to be two-way.**

- **Scientists may have a difference of opinion that is part of the scientific process..... however,**
- **Extreme differences in scientific opinion creates a gap - during which it becomes easy for decision-makers to not make decisions.**





- **Scientific debate is necessary and is an important part of the scientific process.**
- **However, that debate needs to take place in forums like this conference or in a referred scientific process - not in the newspapers.**



- **Managers must respect the scientific process and the importance of hypothesis driven science....**
- **Conversely scientists need to respect the need for managers to periodically take action without all the data.**



Our goal in resource management is to use the best available science to make decisions.

.... However, without the answers, Political Science may become the driving force...not the natural or social sciences.

**Now, after having said all of this,
I am becoming convinced that we
need a “Paradigm Shift” in resource
Management.**

**We need to shift to the:
“Cause no harm paradigm”where
the burden of proof is shifted from the
manager to those proposing or conducting
potentially harmful activities.**

We need to engage the waterfront community

Make those who
earn their living on
the water ... our
spokespersons!





**We need
Community
Leaders helping
carry our
messages**



Concluding thoughts:

- **Address the climate change and coral bleaching issues at the local, regional and global scales - target the audience**
- **Don't present a hopeless scenario**
- **Keep economics - livelihoods, cultures and people in the discussion**
- **Biodiversity is important to us But!**

Concluding thoughts: (continued)

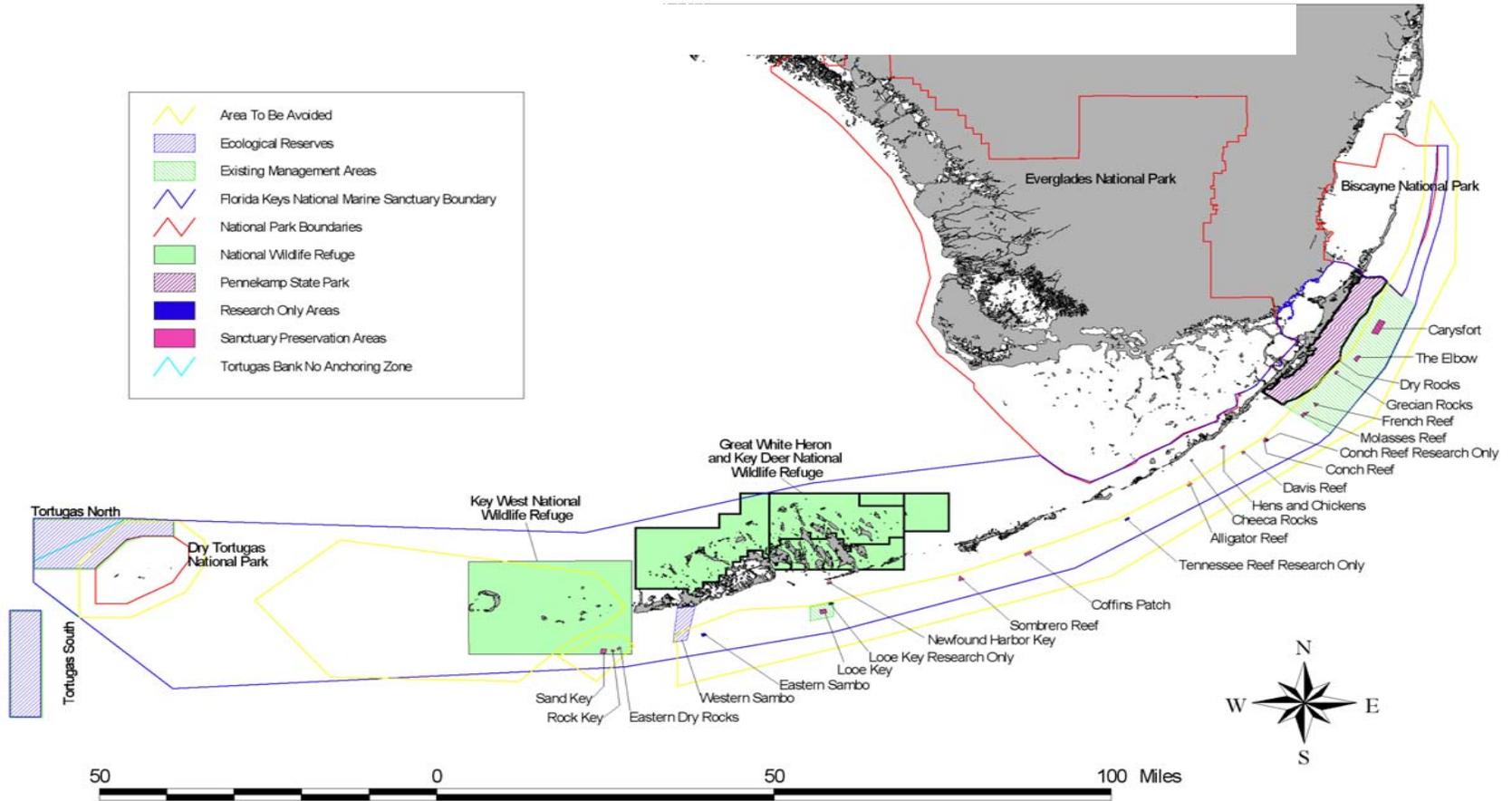
- Educate, educate, educate! We need to foster an Ocean Literate Society with an Ocean Ethic ... that truly understand what sustainability means.**
- More practically ... we need to take full advantage of the agreement between NOAA and the GBRMPA and integrate our technology, science and management lessons-learned into global actions.**

We have some champions!

But clearly We need more!!!

**Thank you for an excellent
workshop!**

Florida Keys National Marine Sanctuary





I want to offer my sincere thanks to the workshop sponsors for hosting this extremely important meeting!

Science Drives Our Management

Decisions:

I frequently say “Science drives our management decisions in the Florida Keys National Marine Sanctuary.”

Full-Range of Habitats



And All of the Marinelife





Science Advisory Panel

- **Another method for managers to hear from scientists**
- **December 2000**



- **Independent review panel**
- **Listened to an overview of the FKNMS WQPP monitoring and research projects**
- **Provided recommendations**



Special Studies:

- **EPA, NURC and Sanctuary Friends of the Florida Keys are funding research**
- **Investigate the cause and effect questions related to the steady decline of corals**



Sherwood Forest



