

Reduce Impacts of Pollution and Coral Disease



Program Review
NOAA Coral Reef Conservation Program
September 25th, 2007

Overview

Rationale:

Pollution and Disease jeopardize the very health, vitality and sustainability of reef organisms. The strategies to meet these threats are:

- Reducing **known** threats with established management actions;
- Elucidating how **suspected** causative agents compromise reef health to guide appropriate mitigation actions; and
- Addressing the **unknown** by understanding physical, chemical and biological processes governing coral health and ecosystem condition to detect new threats and establish causal links with compromised health

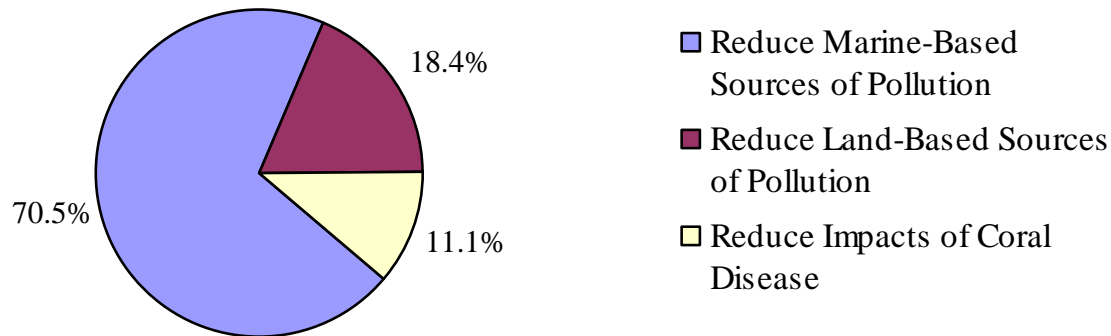
This strategy will provide essential information for successful intervention and mitigation tactics for effective, proactive management actions, that are vital to achieving coral reef conservation.

Overview (cont.)

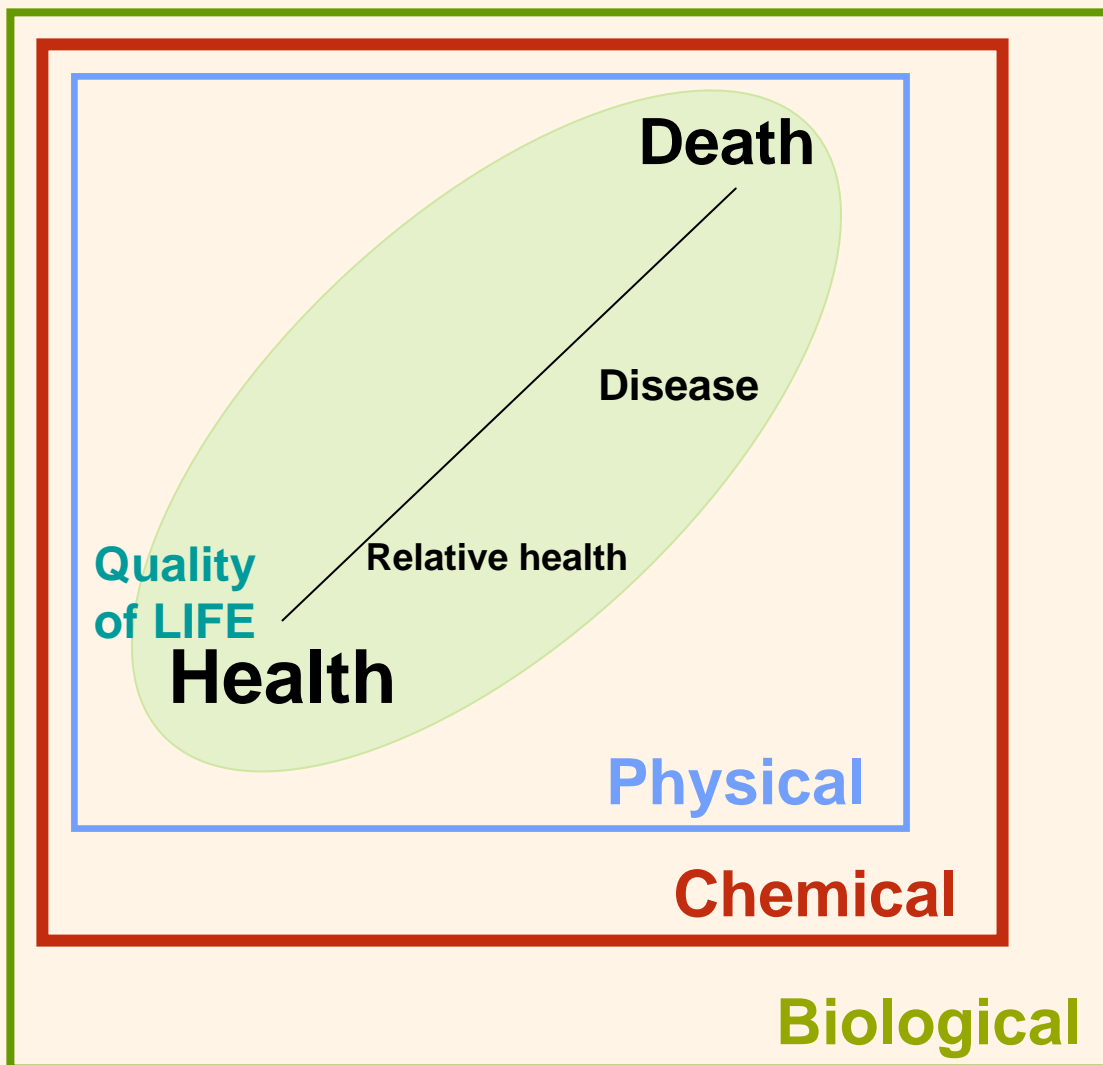
- Funding: \$16.4 M (13% total CRCCP)
- Projects: 126 (10% total CRCCP)
- Major tools: 75% funding in direct management implementation, another 10% ecosystem research

Subcategories

Reduce Impacts of Pollution and Coral Disease: Investments in Subcategories



1. Reduce Marine-based Sources of Pollution
2. Reduce Land-based Sources of Pollution
3. Reduce Impacts of Coral Disease



Why is marine debris so bad?

- Habitat destruction
- Entanglement hazard
- Navigation hazard
- Ingestion
- Invasive species
- Unattractive

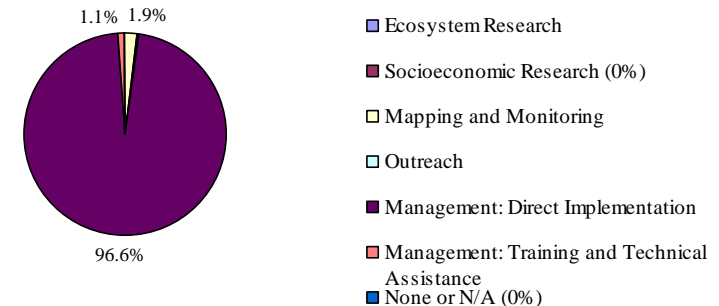


Reduce Marine-Based Sources of Pollution

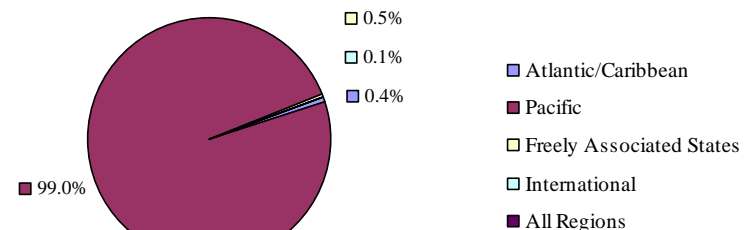
- Addressed via direct management implementation
- Vast majority of funds directed to removal of marine debris in NWHI

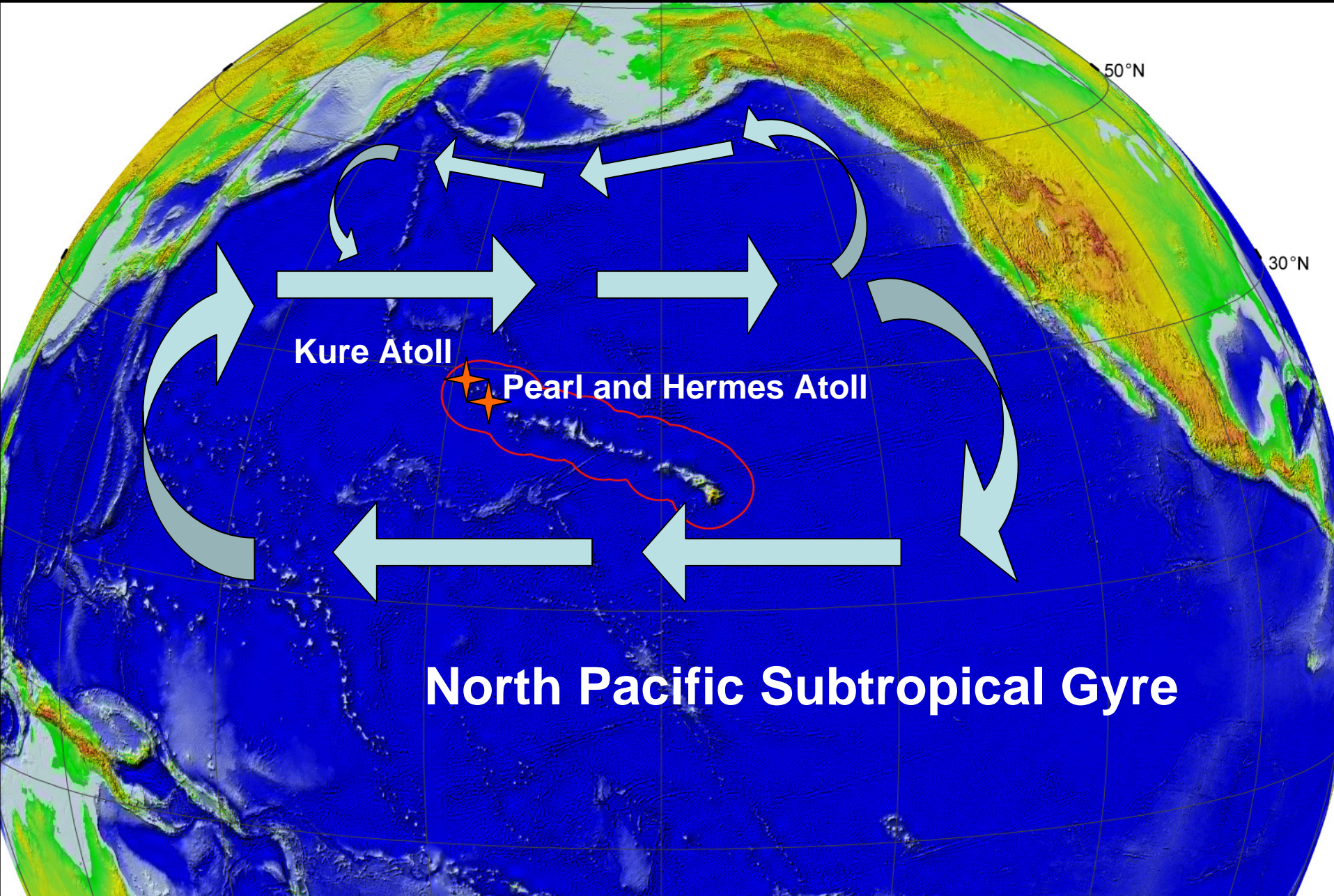


Reduce Marine-Based Sources of Pollution:
Investment by Tool



Reduce Marine-Based Sources of Pollution:
Investment by Region





Kure Atoll

Pearl and Hermes Atoll

North Pacific Subtropical Gyre



What have we done about it?

NOAA Pacific Islands Fisheries Science Center (PIFSC) began vessel-based removal in 1996

- Opportunistic removals - no dedicated funding

In 2001, NOAA Coral Reef Conservation Program began supporting 5-year, large-scale removal effort aimed at reducing historical accumulation of debris.

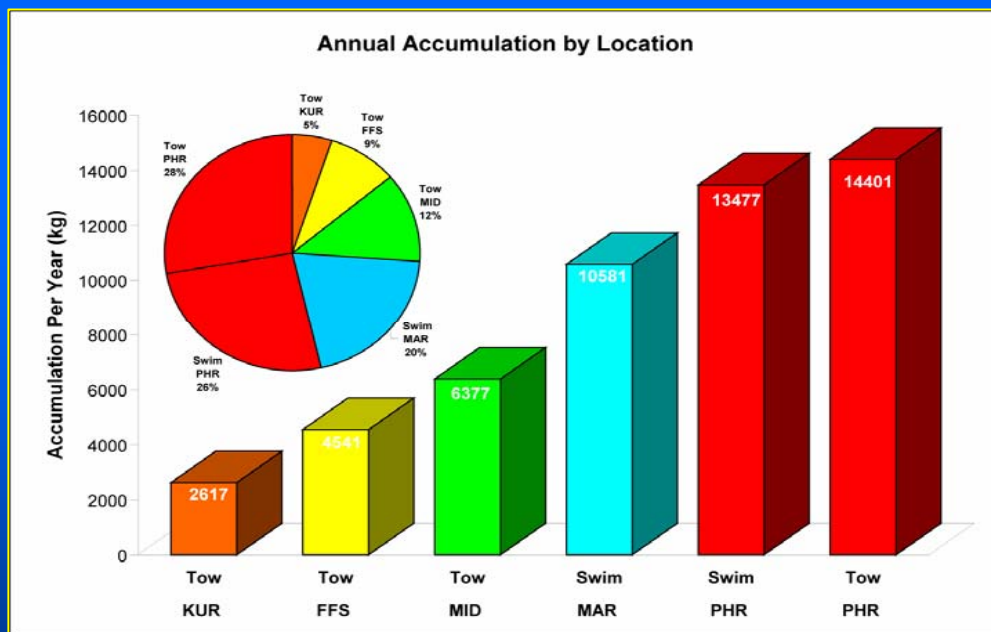
- Successful multi-agency partnership (academic, industry, NGO) - operations led by PIFSC
- Additional support from NOAA Marine Debris Program

Marine Debris Research, Prevention, and Reduction Act

Debris Removed

Since 2006, PIFSC operating in maintenance mode.

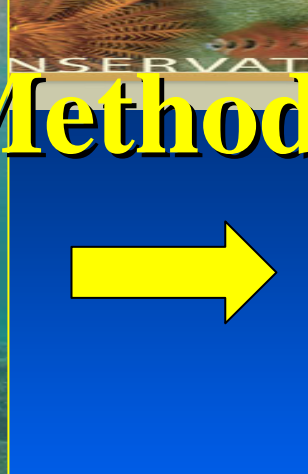
- Over 511 metric tons removed between 1996 – 2006



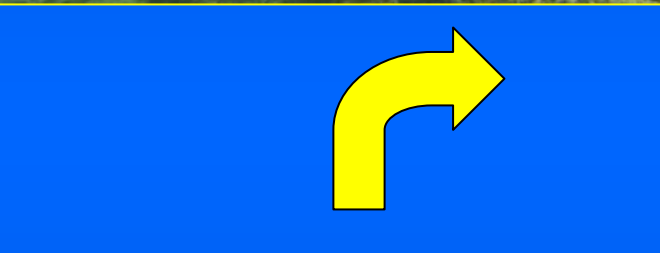
Methods



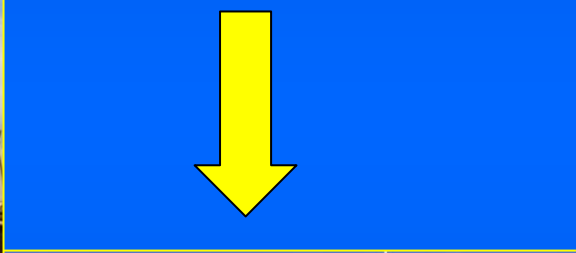
Tow Survey



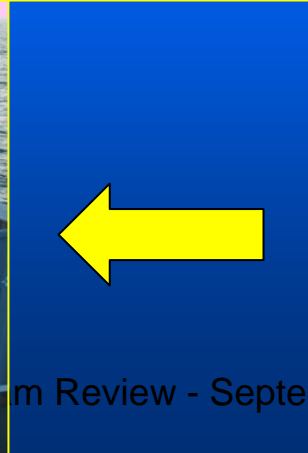
Net Removal



Recycle



Offloading



Net Haul

Continuing and Next Steps.....

- Maintenance Level Removal Operations in the NWHI
 - Closing the gap between estimated annual accumulation rate (52 MT) and maintenance mode collection (FY06 – 19MT)
- At-sea Detection and Removal (GhostNet)



- Targeted Research (e.g., invasive species)

Other Marine Based Pollution Projects

Predictive Tools:

- ESI Maps – Pacific
- Oil spill modeling
- Oil and Sea Turtles:

Biology, Planning and Response (2003)



Puerto Rico removal and public awareness efforts

Reduce Land-Based Sources of Pollution

Mandates / authorities to address LBSP

- EPA
- USDA
- DOI
- States & Territories

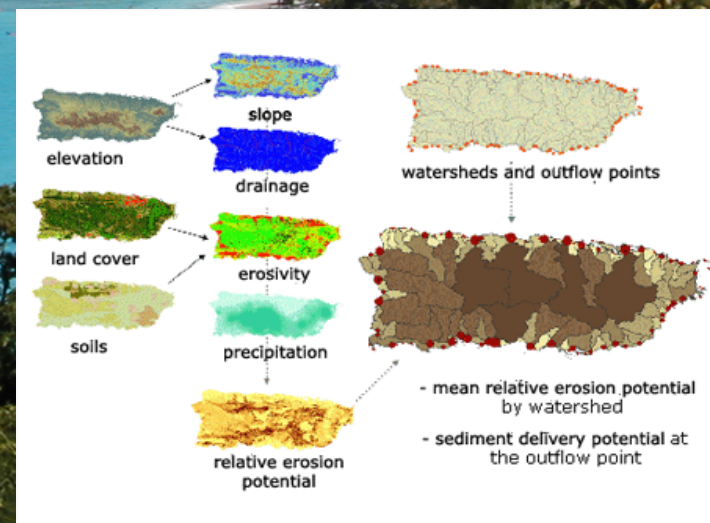
NOAA's focus:

- Scientific expertise
 - Assessments
 - Tools
 - Studies linking pollution to coral reef degradation
- Capacity building
 - Technical knowledge
 - Effective management
 - Programmatic hurdles



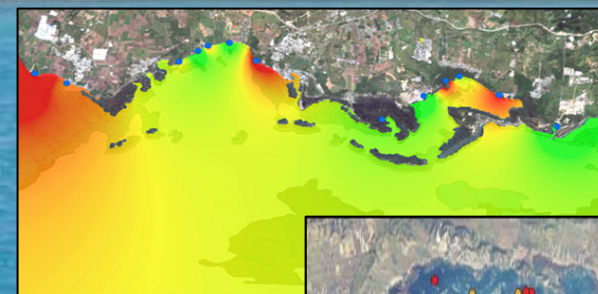
Summit to Seas / Reefs at Risk

- GIS Tool to provide spatial information on watershed-based threats to coral reefs
- NOAA, WRI and many other partners
- Helps users analyze land-based threats to prioritize areas for management



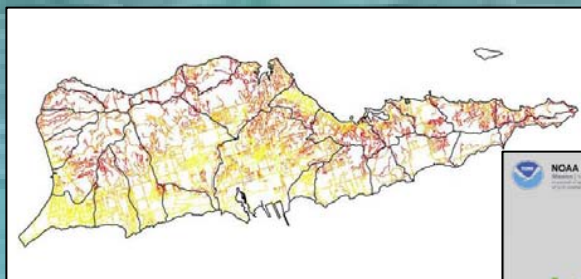
Chemical Contaminant Characterization

- Characterize chemical contaminants in the marine sediments and coral reefs of SW Puerto Rico
- Assessment framework to determine linkages between contaminant stressors and coral health
- Found a negative association between certain chemical contaminants in sediments and coral species richness



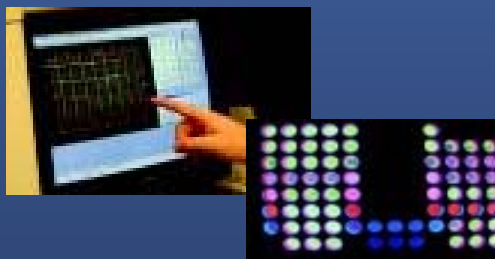
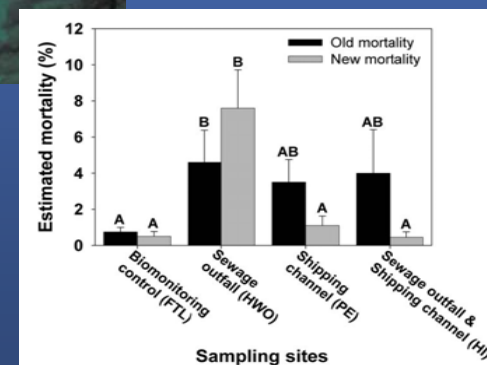
Conservation Effects Assessment Watershed Project

- 2007 Project to assess the effects of conservation practices in Jobos Bay, Puerto Rico
- Includes water quality, sediment, and estuary monitoring to track possible changes over time
- Goal is to identify innovative conservation and management practices that protect water quality



Florida Biomarker Study

- Link land-based sources of pollution to coral reef degradation
- Cellular diagnostic techniques to measure stress levels in corals
- Correlate coral tissue damage to specific contaminants



State & Territory Capacity Building and Planning Assistance

- Watershed protection practices adapted for island environments
- Outcomes:
 - Stormwater ordinances
 - Streamlined permitting
 - Concept designs
 - Construction site inspection
- Follow-up watershed pilot projects and additional workshops & demonstration projects in 2007-2009



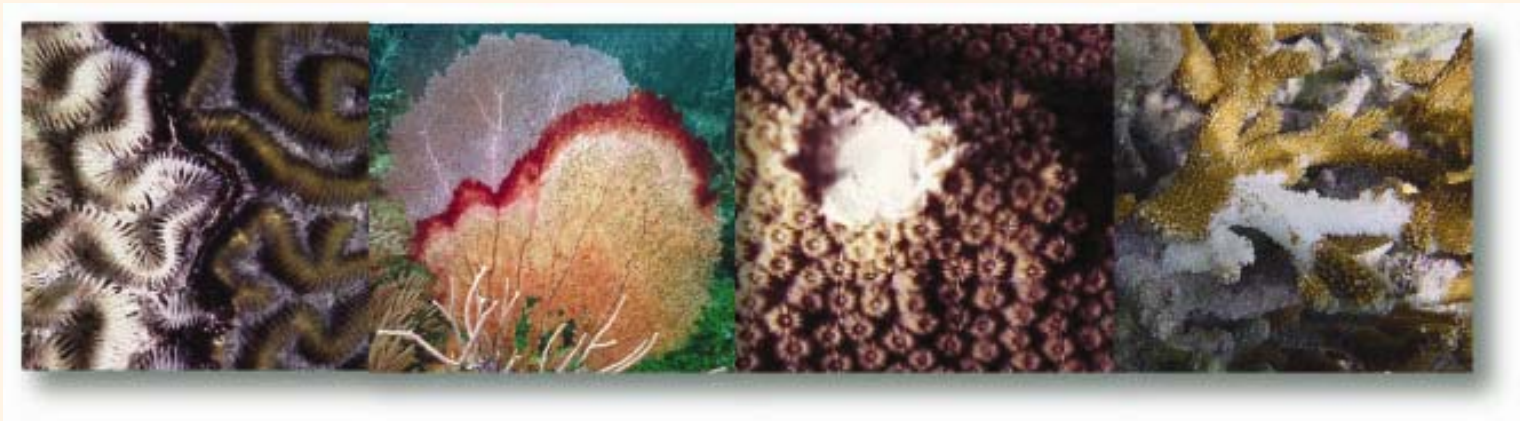
LBSP – Challenges/Future directions

- Increase work and funding in partnership with other Federal and local agencies to comprehensively address LBSP through a ridge to reef watershed approach
 - Studies to definitively link specific environmental stressors to coral health
 - Move from management planning, project design, and tool development to implementation of watershed action plans



Subcategory 3

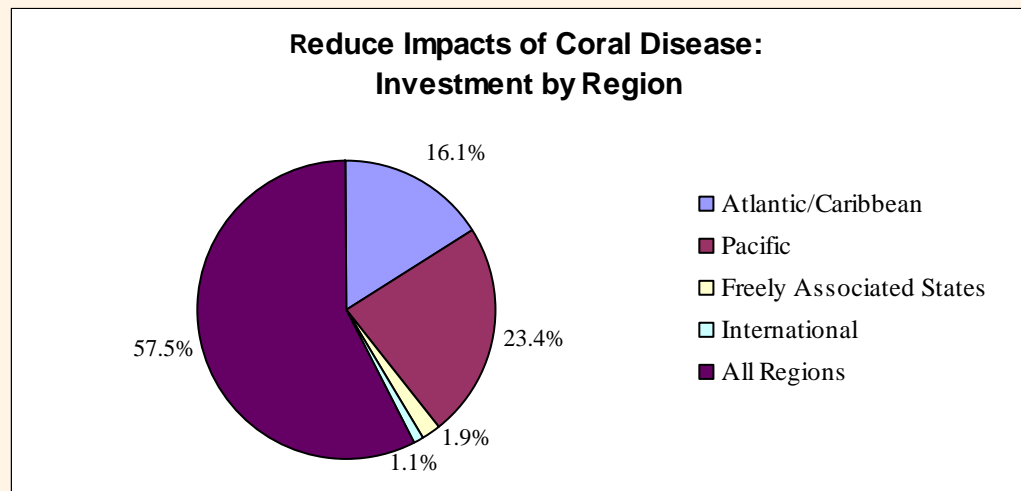
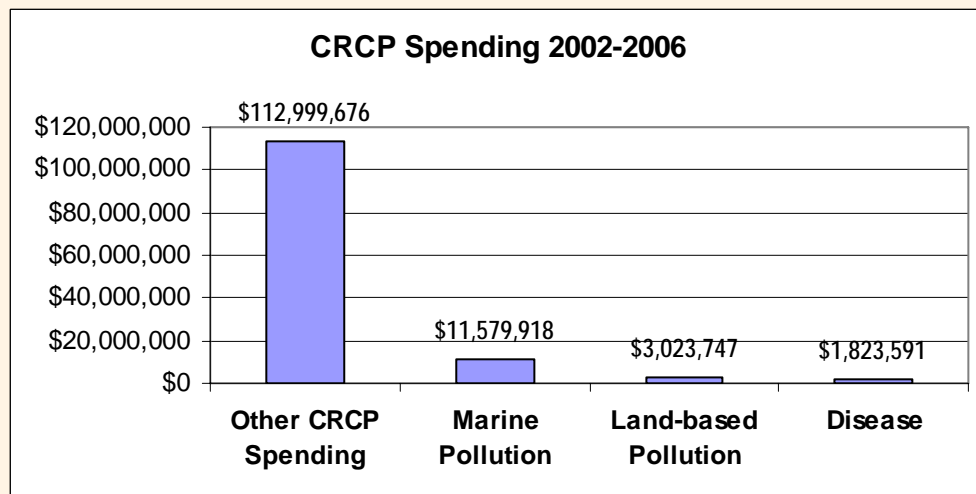
Reduce Impacts of Coral Disease





Subcategory 3

Reduce Impacts of Coral Disease



Disease



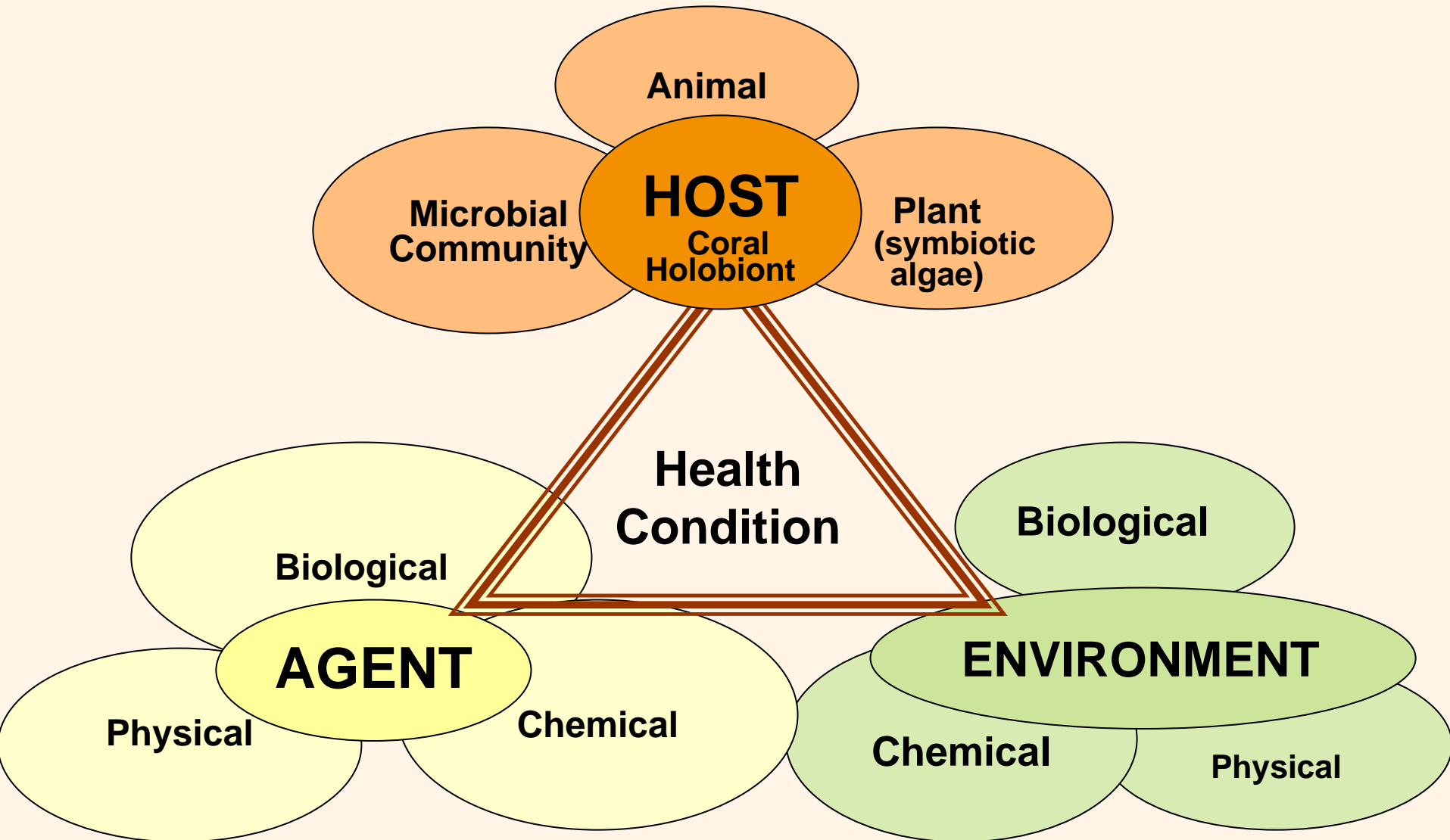
Impairment that interferes with or modifies the performance of an individual's normal functions

due to:

- **nutrition**
- **toxicants**
- **climate**
- **infectious agents**
- **genetic defect**
- **or combinations of these factors**

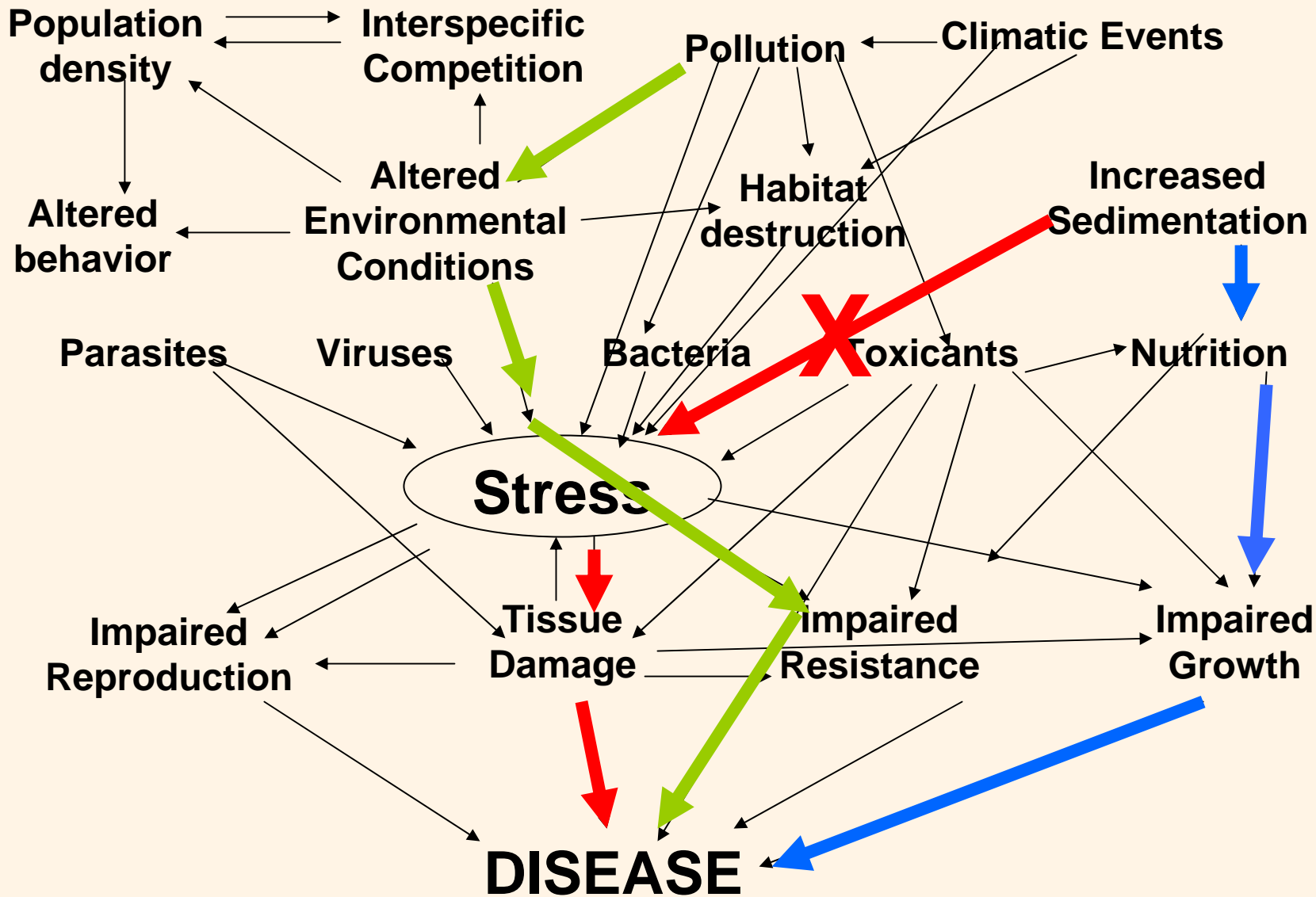


Classic Disease Model





Web of Causation



Veterinary Medicine Perspective

Coral



**Free-ranging
terrestrial wildlife**



**Avian
Exotic**



**Equine
Food**



**Dog
cat**



**Rodent
Human**



Middle Ages



21st Century

Challenges

- **Unifying a fragmented research community**
- **Creating standards**
 - **Nomenclature**
 - **Methodologies**
 - **Guidelines for communication, consistency and integrity of data.**
- **Equipping the small cadre of scientists with the specialized training and tools to combat this type of threat**
- **Developing an adequate knowledge-base of normal coral biology to inform pathology**
 - **Cellular Physiology, Biochemistry, Molecular Genetics, Histology**
 - **Immunology, Microbiology**
 - **Bioinformatics, Epidemiology, Wildlife Health Management**

Challenges (cont'd)

- **Making available Community-wide Resources**
 - Voucher samples (IRCP – histology/histopathology)
 - Genome Sequence & EST libraries
 - Laboratory model species
 - Exposure facilities w/ biocontainment
 - Website – tools & information
- **Positioning to take advantage of Epidemiology – descriptive & analytical**
 - Diagnostic tool development for field & lab
 - Outbreak Investigative Response Teams
 - Regional Diagnostic Centers
- **Shifting the paradigm for coral health and disease**
 - Changing the Perception that nothing can be done....

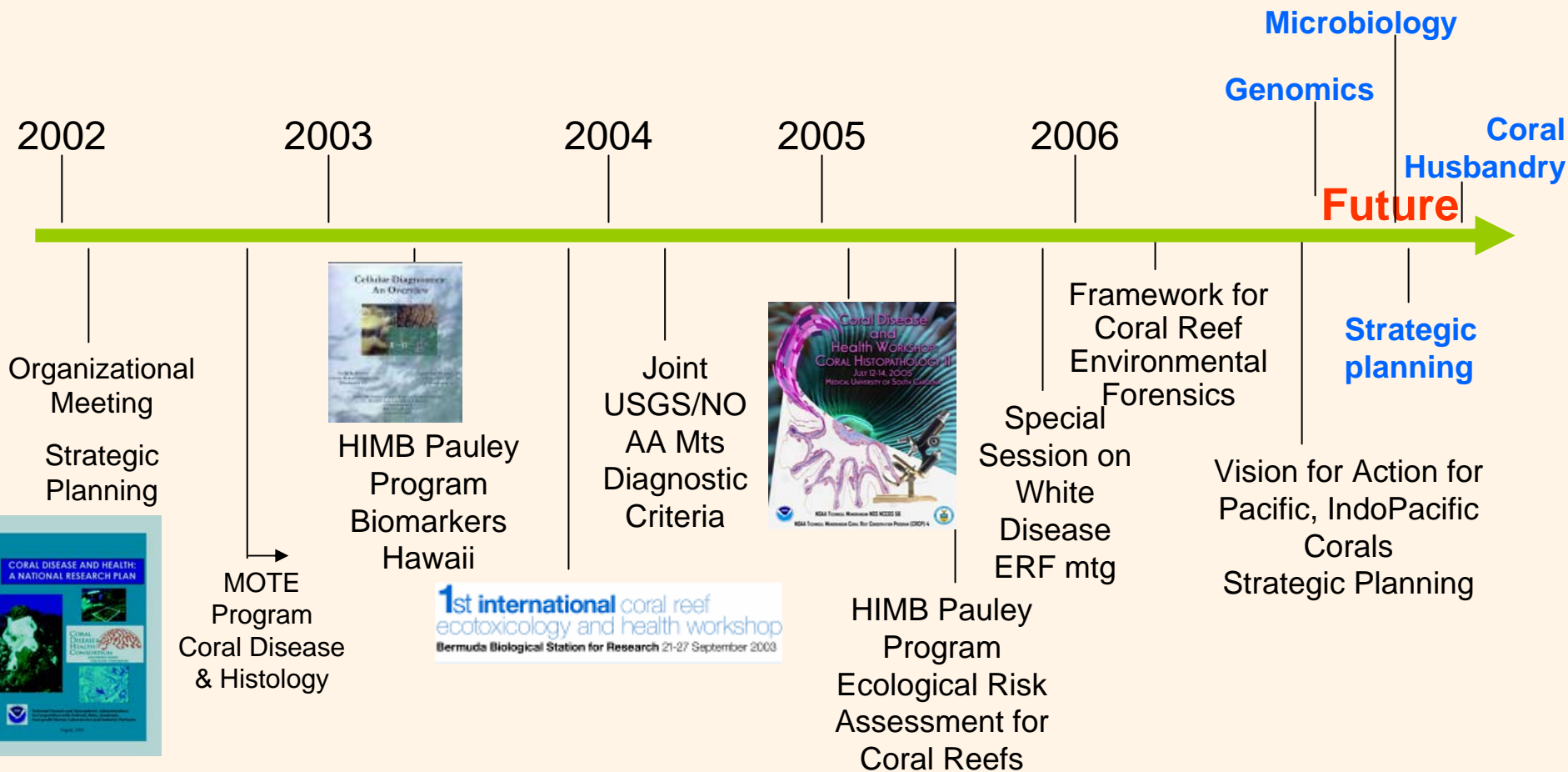


Building Capacity among the Coral Health and Disease Community



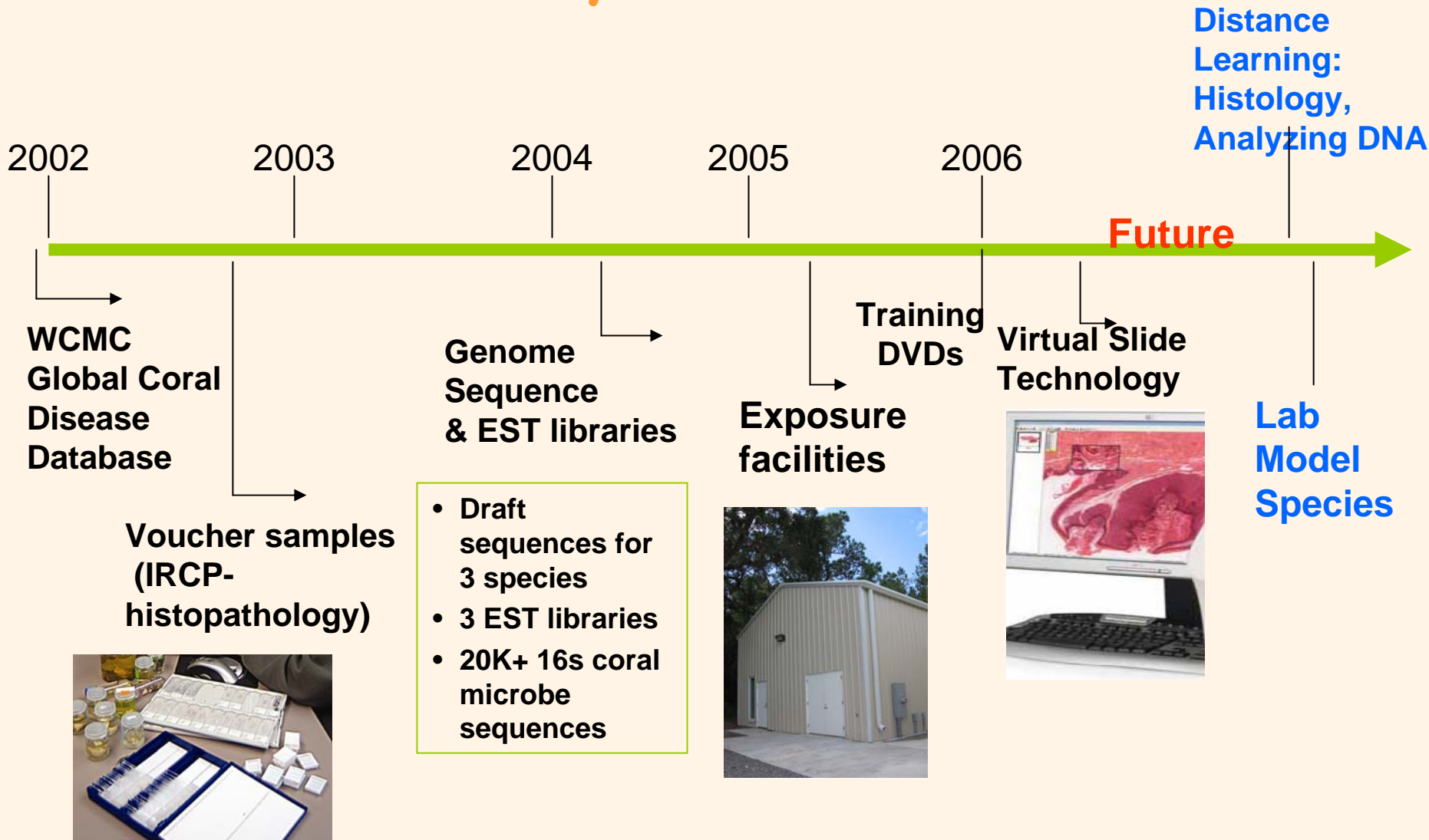


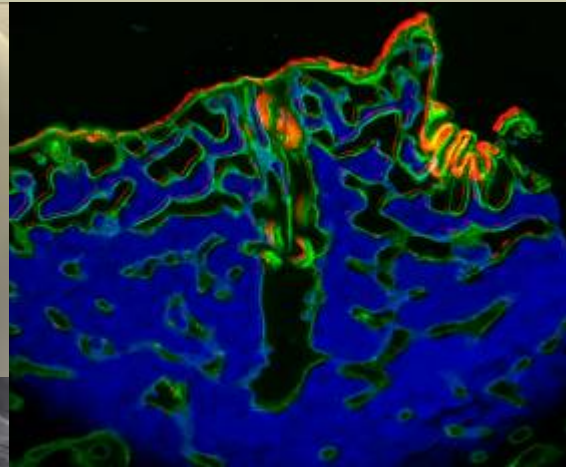
Community Capacity Building



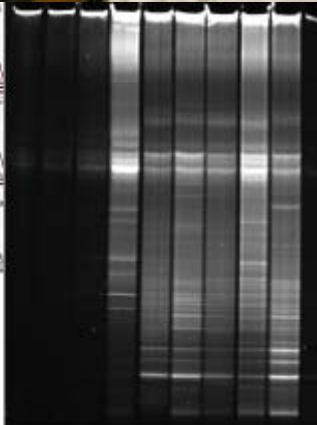
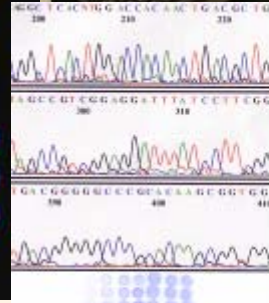
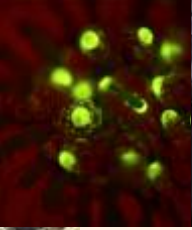
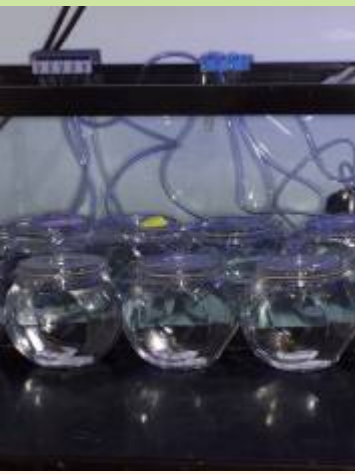


Community-Wide Resources

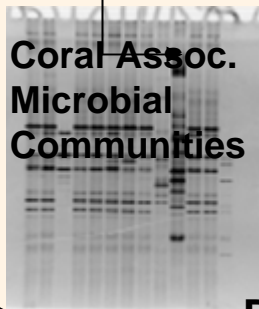
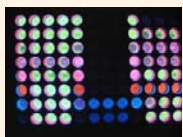
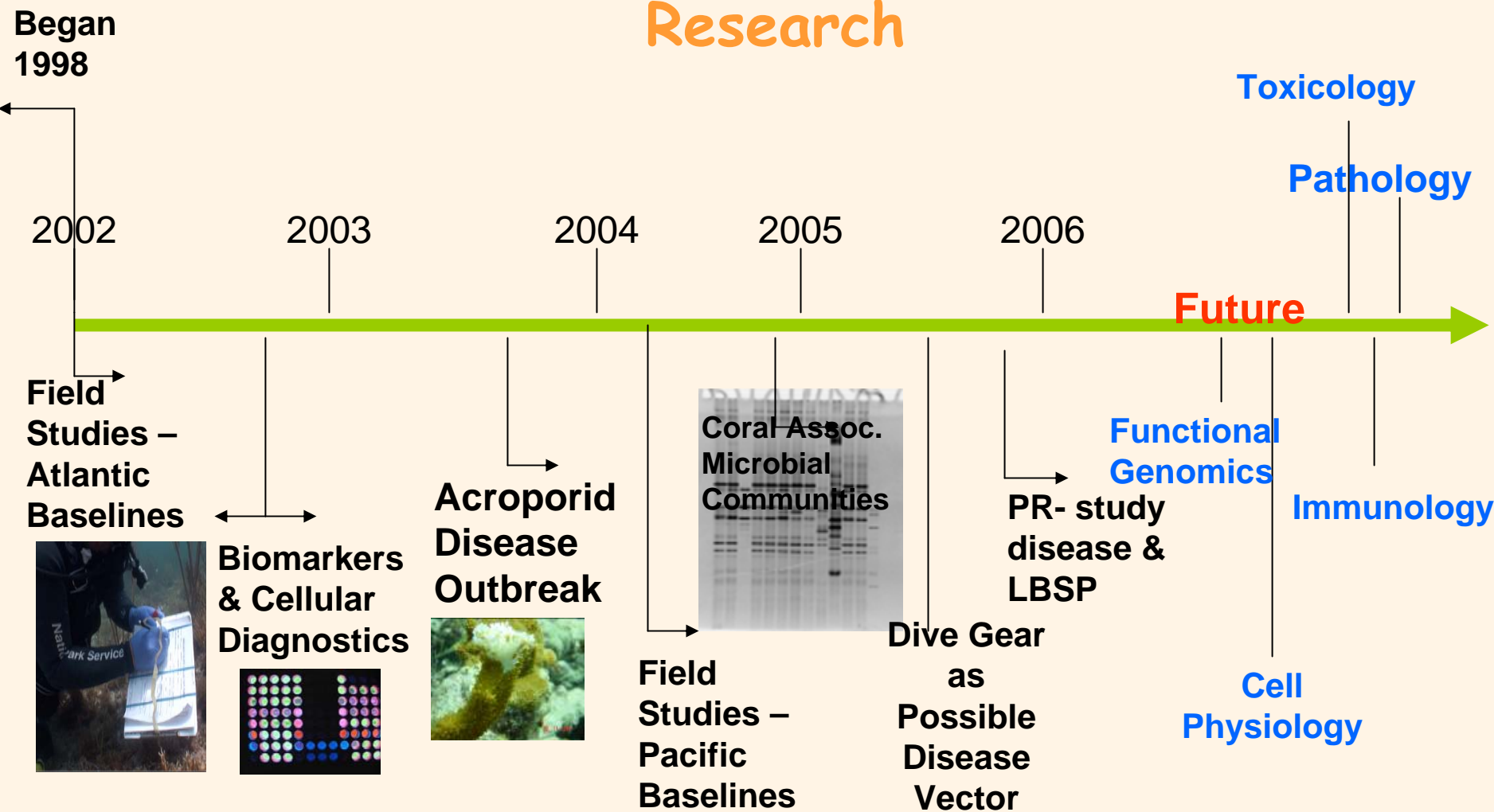


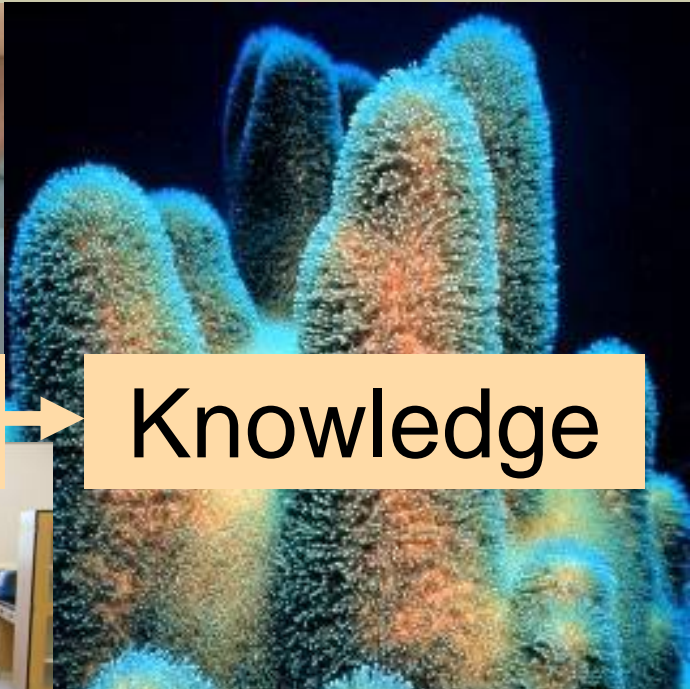
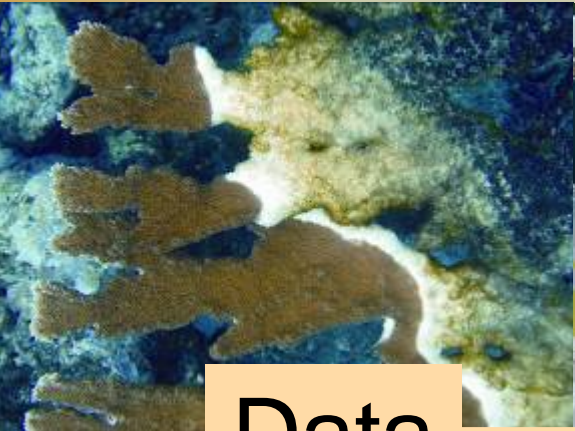


RESEARCH



Research





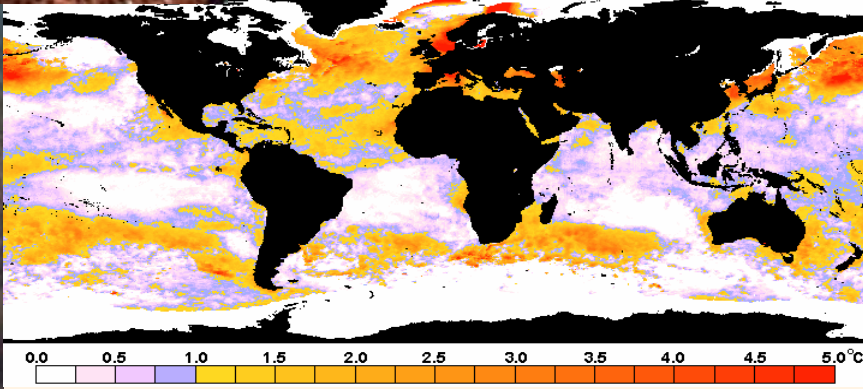
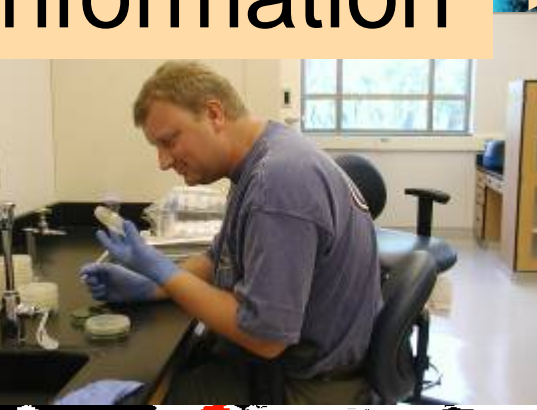
Data



Information



Knowledge





Epidemiology

Descriptive

Analytical



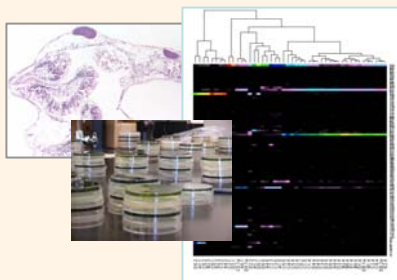
2002 2003 2004 2005 2006

Future

Began 1998

Atlantic Field Surveillance

Acroporid Disease



Diagnostic Tool Dev.
Cellular Biomarkers

Pacific Field Surveillance

Diagnostic Tool Dev.
e.g. PCR Pathogen Screen



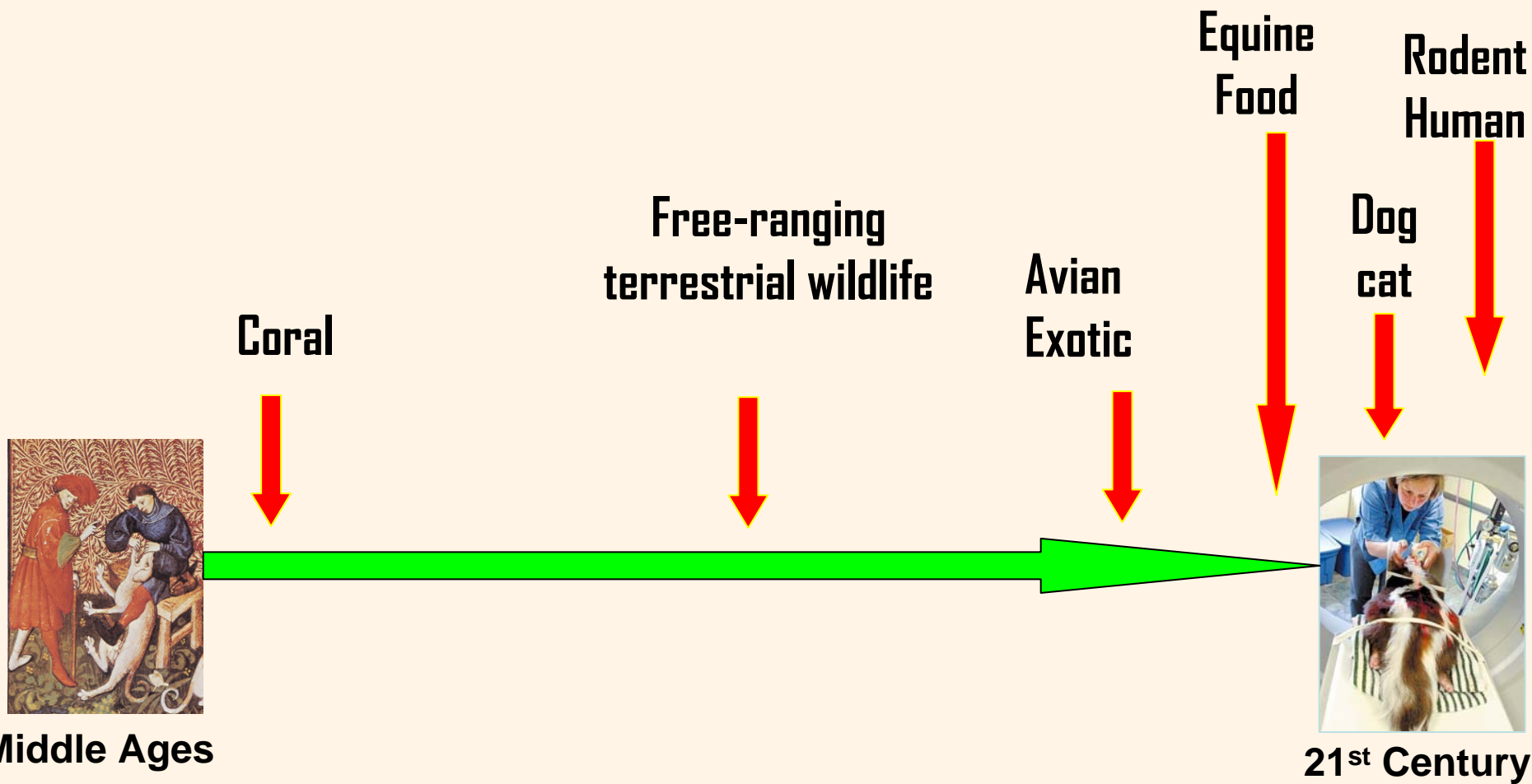
Outbreak Investigation Response Network

New Field & Lab Diag. Assays

Risk Characterization & Health Management

Regional Diagnostic Centers

Veterinary Medicine Perspective



Vision for the future

Move from a triage mentality for coral reef decline to a state of knowledge where causal links can be disentangled and factors driving system failures can be identified for corrective measures effectively employed.

Goal:

Managing for Coral Reef
Health: A Preventative
Health Care Model

