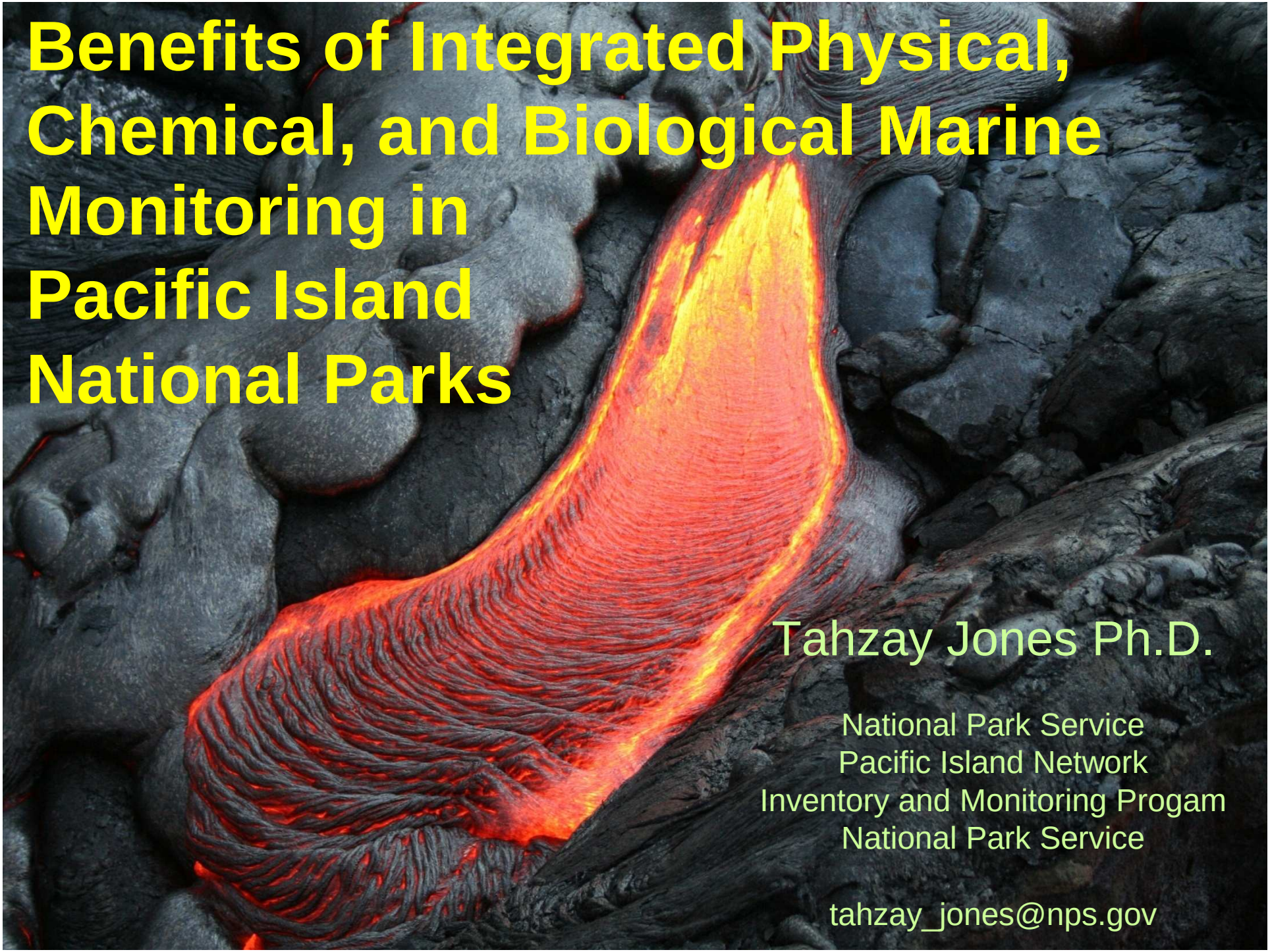
Benefits of Integrated Physical, Chemical, and Biological Marine Monitoring in Pacific Island National Parks



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Talk Objectives

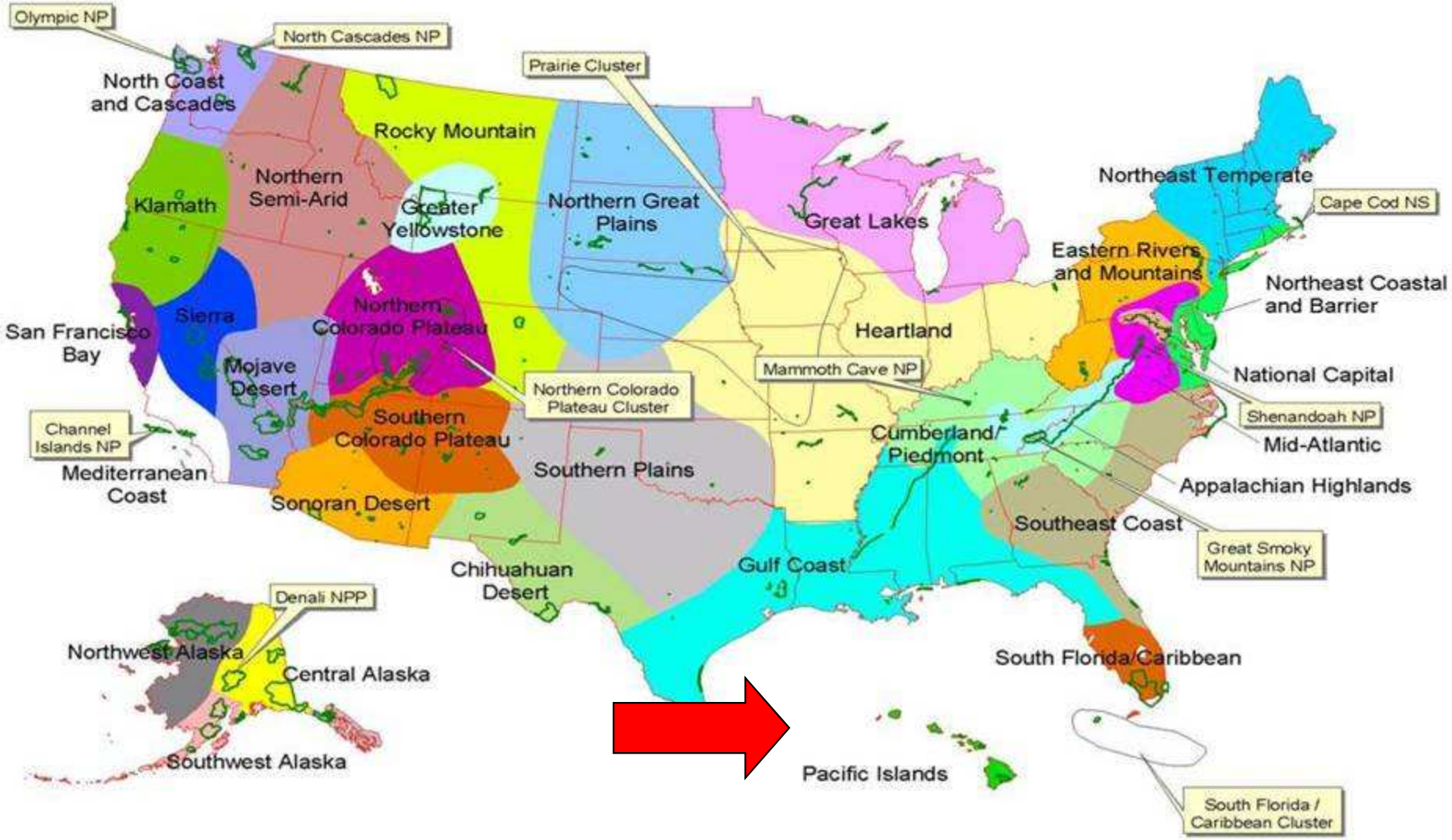
- Brief Introduction to the National Park Service's Inventory and Monitoring Program
- Describe the Pacific Island Network Approach to Integrated Monitoring
- Discuss the benefits associated with the Pacific Island Network approach


“The vital signs monitoring networks are designing systems for scientific data collection, analysis, and reporting that is unprecedented in the history of the National Park Service”
The NPS Inventory and Monitoring program provides baseline resource information, monitors long-term trends in resource condition, and facilitates collaboration, information sharing, and economies of scale in natural resource management.

Selected NPS Monitoring Goals

- **Determine status and trends of selected indicators**
- **Provide early warning of abnormal conditions**
- **Provide data: (a) park ecosystems, & (b) baseline for management and restoration**
- **Provide data to protect and manage resources sharing cultural & natural value**

NPS Inventory and Monitoring Program: 32 National Networks with 266 National Parks



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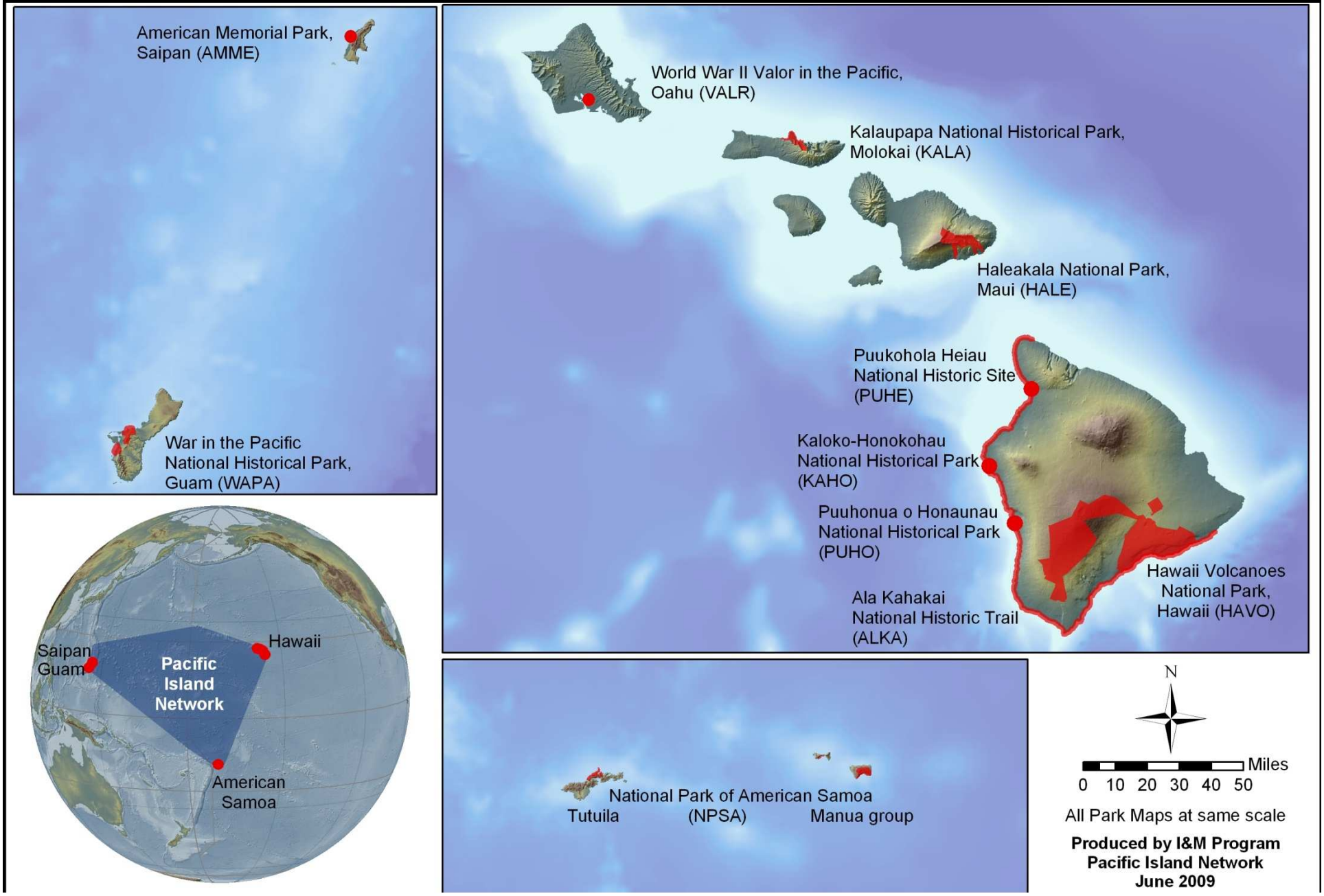

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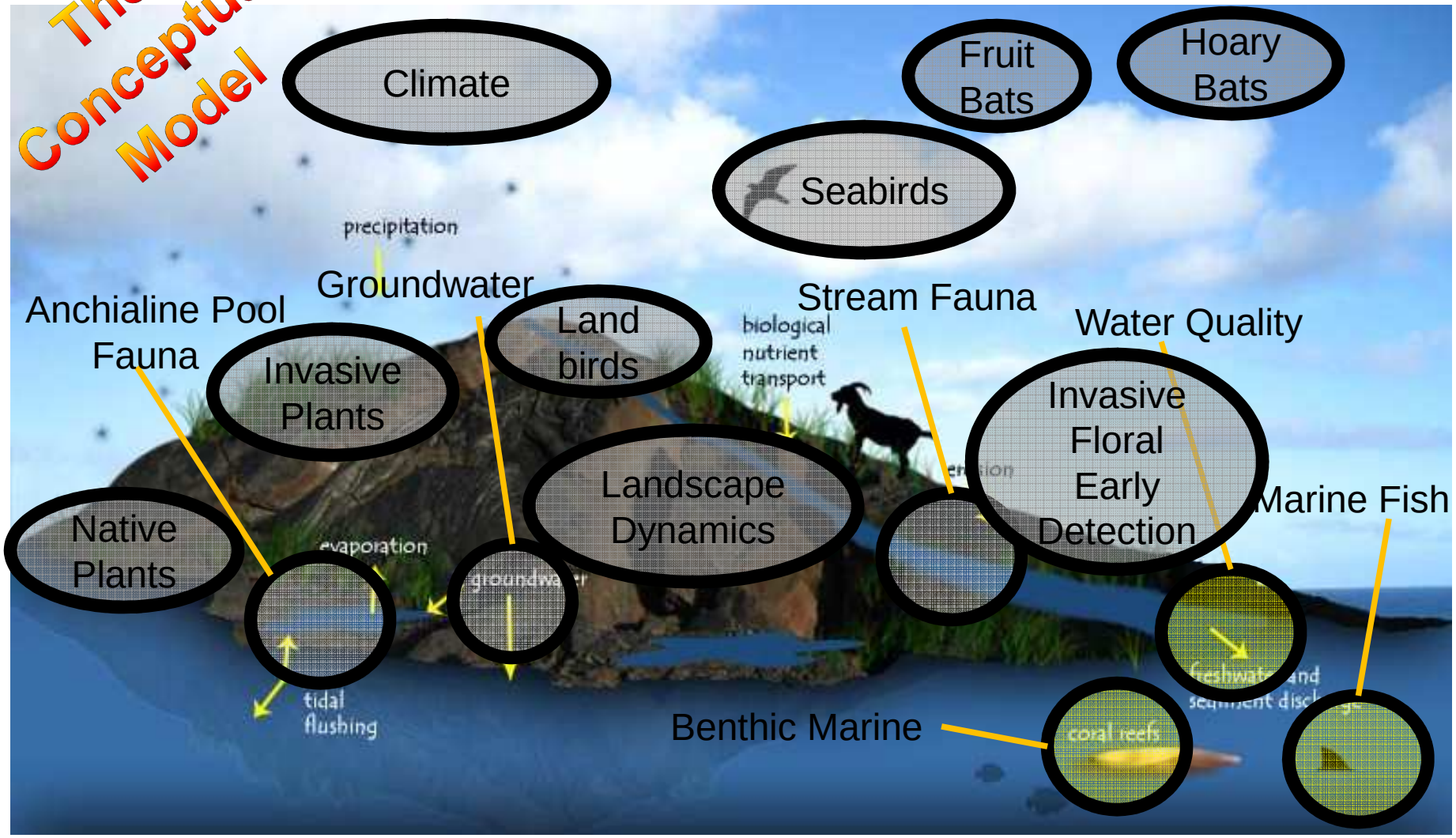
June 2009

Designing Marine Monitoring for the Island Environment in Each Park



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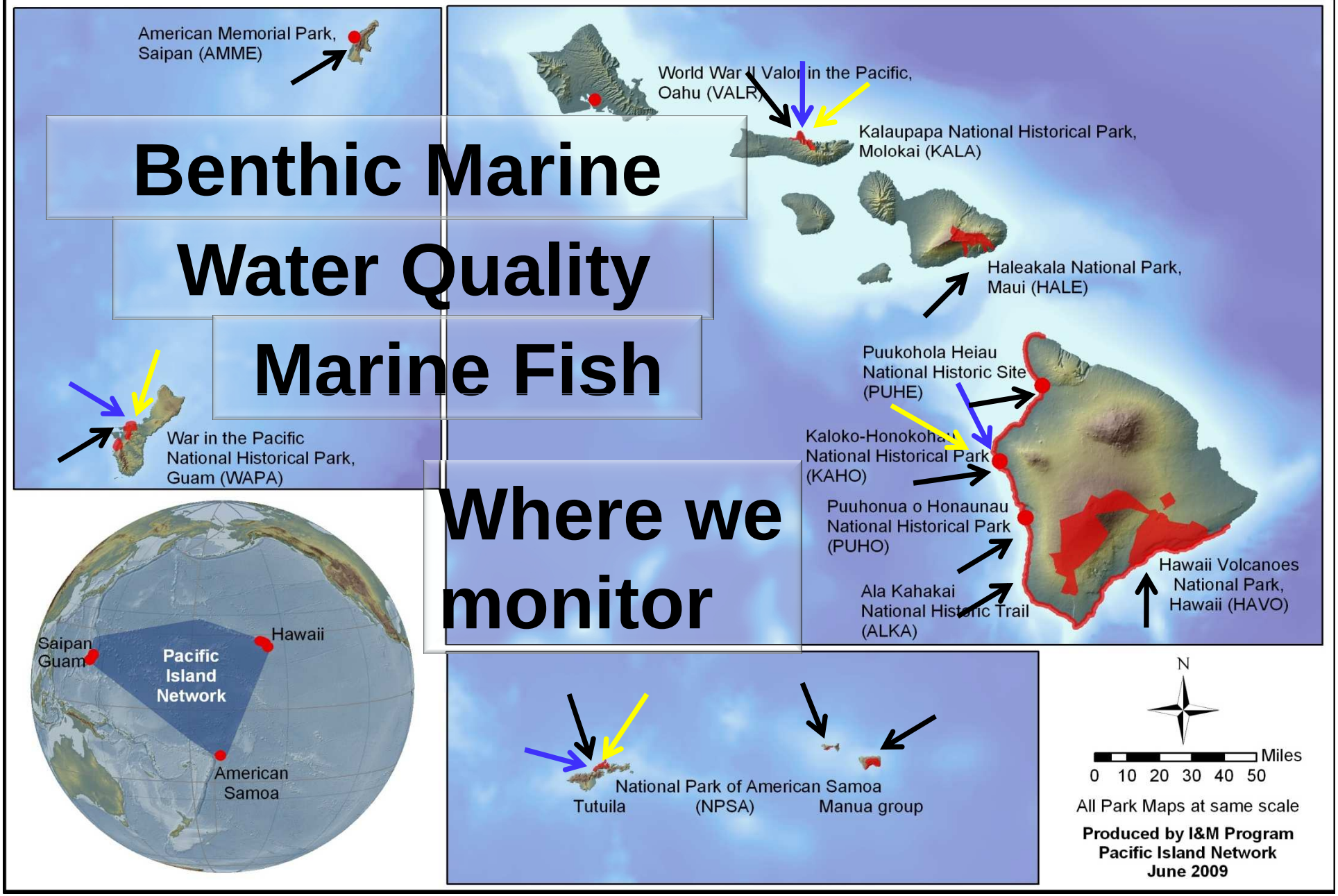
Benthic Marine
Water Quality
Marine Fish
Where we monitor



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Benthic Marine Communities monitoring

- **Benthic marine monitoring utilizes photographic datasets**
- **Photographs are taken in the field - 1 photo per meter on 25 meter transects (25 photos per transect with 30 transects per park)**
- **The photos are brought back to the office and uploaded**
- **The originals are duplicated and archived.**
- **The duplicates are used for data analyses.**
- **Photographs are imported into Photogrid and 50 points are analyzed for species located at each point (30 transects x 25 photos = 750 images).**

Marine Fish monitoring

- Marine fish monitoring uses belt transects
- The belt transects are 25 meters long and 5 meters wide.
- A single data collector swims along the transect at ~ 1.5 meters per minute (total time to finish the transect is ~15 minutes)
- Data on fish species, size, and abundance are collected
- Data is then transcribed and entered into a local database and analyzed

Water Quality Protocol

Random and fixed sampling stations (evenly divided half and half among all stations in each park)

- Random points are used to evaluate the current status of the resource while
- Fixed points are used to determine trends in the quality of that resource.

Each of the parks are sampled quarterly but co-located and co-visited with marine sites annually

Sampling during the marine sampling occurs as follows:

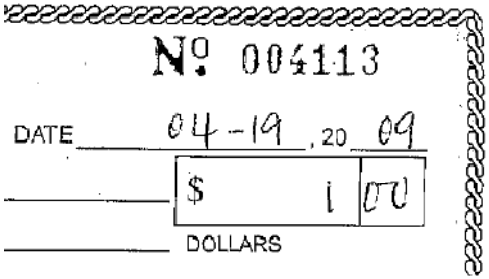
Parks	Strata	Sampling Interval	Sites	Staff	Fieldwork (per year)
WAPA	Marine	quarterly	30	2	10 days
NPSA	Marine	quarterly	30	2	10 days
KALA	Marine	quarterly	30	2	10 days
KAHO	Marine	quarterly	30	2	10 days

Benthic marine and marine fish monitoring are co-located with field sampling sites for this protocol.

What does it take to do this monitoring?

People

Money



Equipment

Logistics

Time

Agreements

Safety

Health

A Sense of Humor

What does it look like in the marine environment?

First we do water quality

Next the fish diver goes down

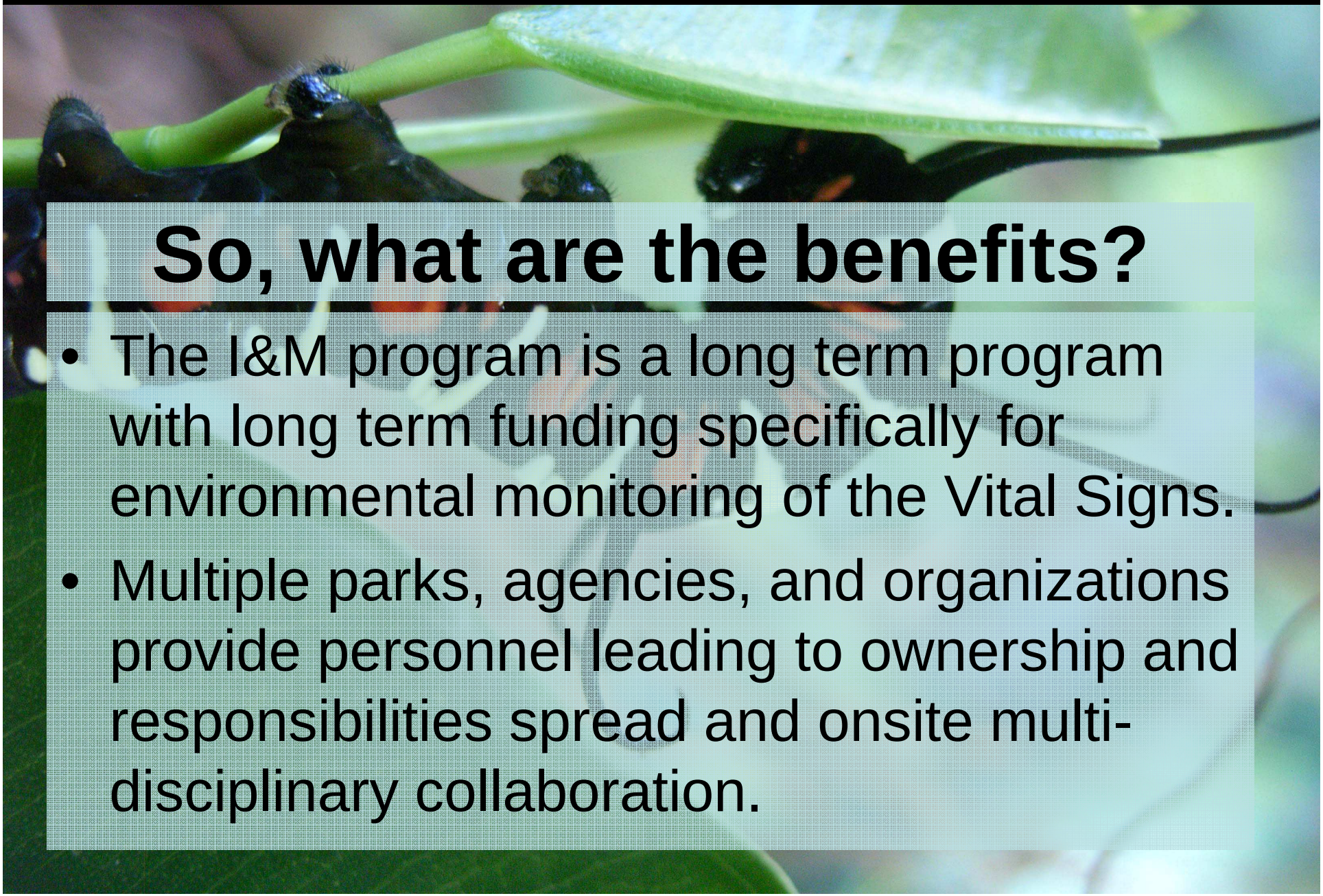
Then all return with equipment safely to the boat

And the rugosity diver sinks with the sonde

work

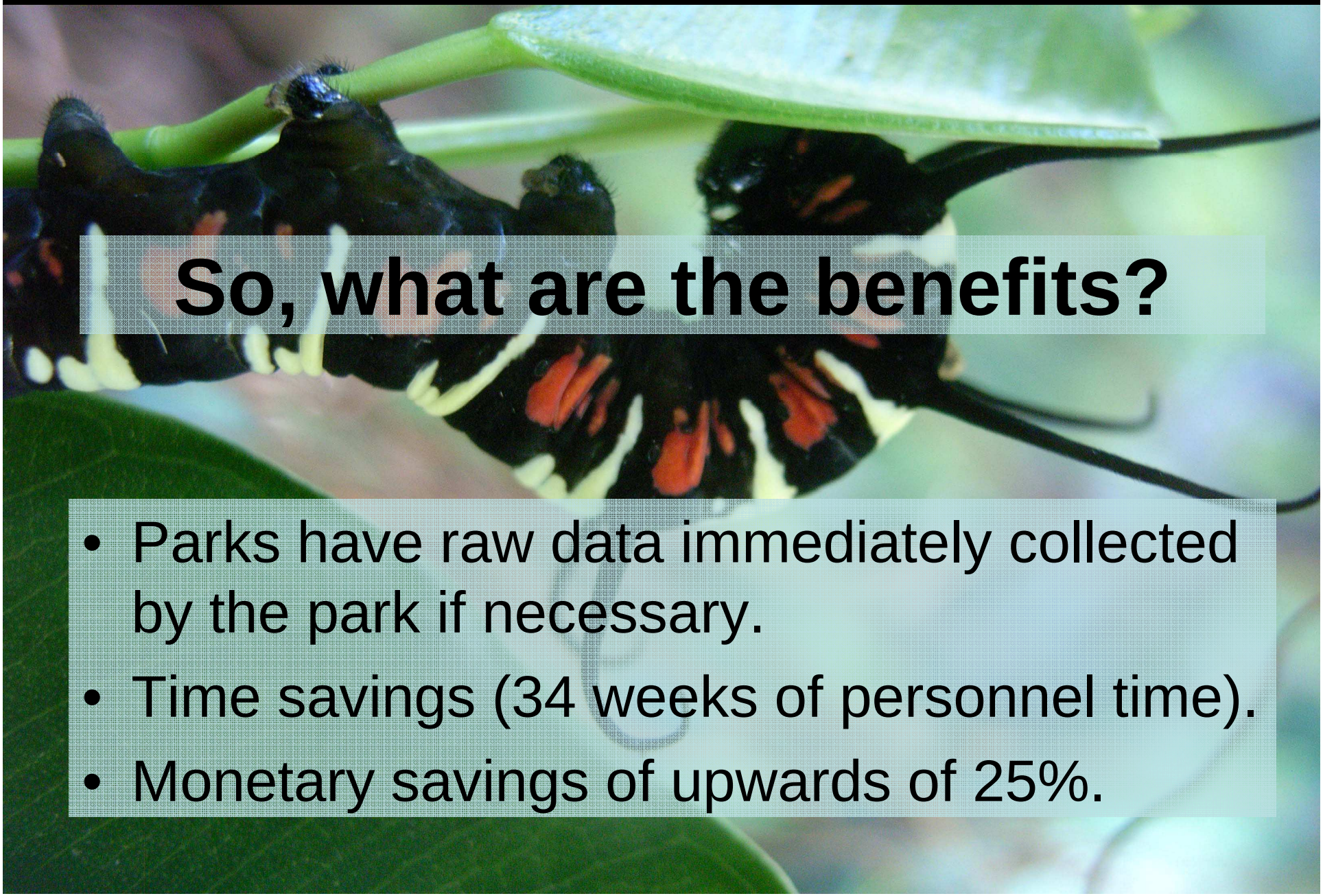
Problems we face…

- People power
- Access limitations
  - Physical and Logistical
    - Cost
    - Distances
- Cost per sample
- Time constraints
  - Seasonal
  - Personnel



So, what are the benefits?

- The I&M program is a long term program with long term funding specifically for environmental monitoring of the Vital Signs.
- Multiple parks, agencies, and organizations provide personnel leading to ownership and responsibilities spread and onsite multi-disciplinary collaboration.



So, what are the benefits?

- Parks have raw data immediately collected by the park if necessary.
- Time savings (34 weeks of personnel time).
- Monetary savings of upwards of 25%.

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A reduction in over 25% of personnel cost for marine monitoring

Orginal

Vital Sign	Staff	Field Time (weeks)	Total Cost ($750/personwk)
Freshwater	3	11	$24,750
Water Quality	2	36	$54,000
Groundwater	1	3	$2,250
Marine Fish	3	8	$18,000
Benthic Marine	3	12	$27,000
Fish Harvest	3	48	$108,000

Integrated

Vital Sign	Staff	Field Time (weeks)	Total Cost ($750/personwk)
Freshwater	2	8	$12,000
Water Quality	2	25	$37,500
Groundwater	1	2	$1,500
Marine Fish	3	8	$18,000
Benthic Marine	3	8	$18,000
Fish Harvest	3	12	$27,000

Total Original Cost $99,000

Implementation Budget

	Original	Integrated
Aquatic Group	$234,000	$114,000

Total Integrated Cost $74,500

A reduction in over 38% of personnel time for marine monitoring

Orginal

Vital Sign	Staff	Field Time (weeks)	Total Cost ($750/personwk)
Freshwater	3	11	$24,750
Water Quality	2	36	$54,000
Groundwater	1	3	$2,250
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Marine Fish	3	8	$18,000
Benthic Marine	3	8	$18,000
Fish Harvest	3	12	$27,000

Total Original Time: 54 weeks

Implementation Budget

	Original	Integrated
Aquatic Group	**$234,000**	**$114,000**

Total Integrated Time: 34 weeks

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And of course

Ecological relevance

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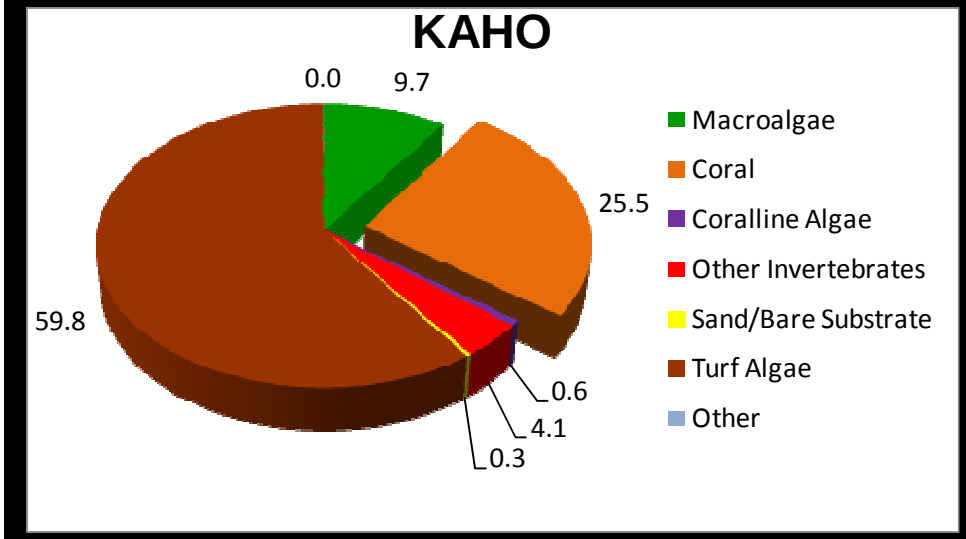
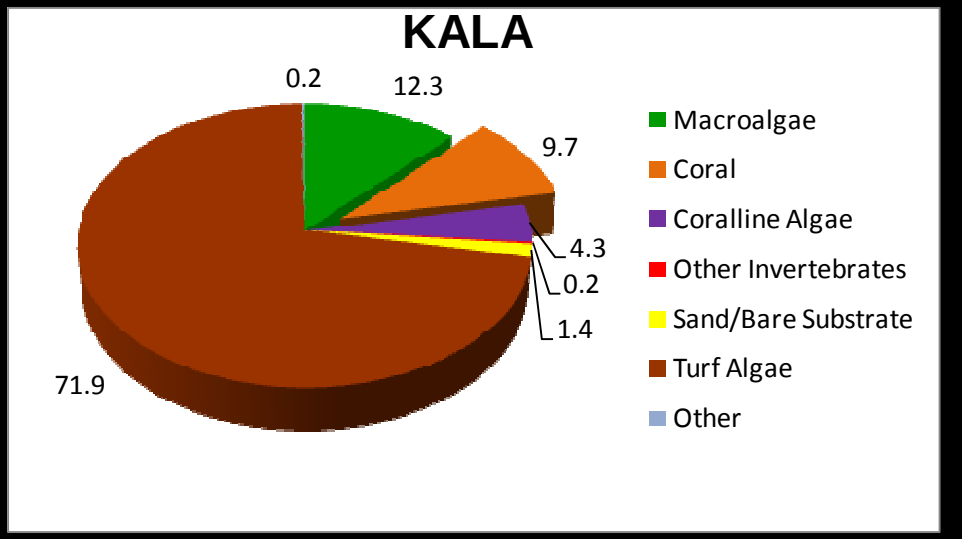
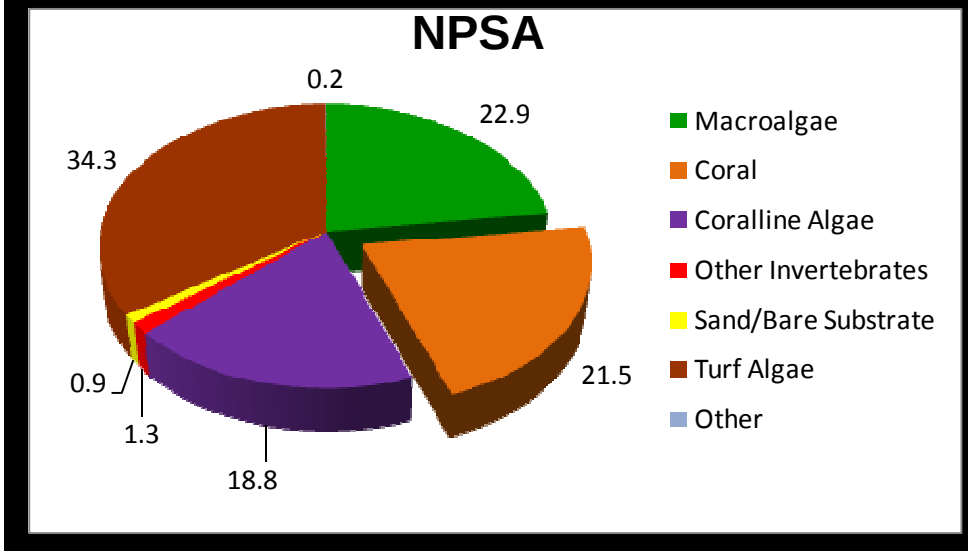
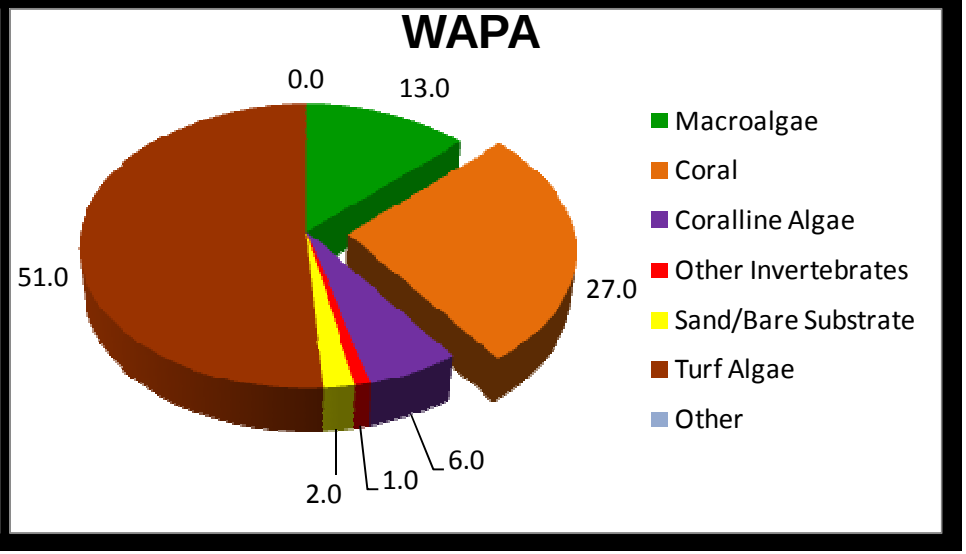
Composition of Benthic Communities









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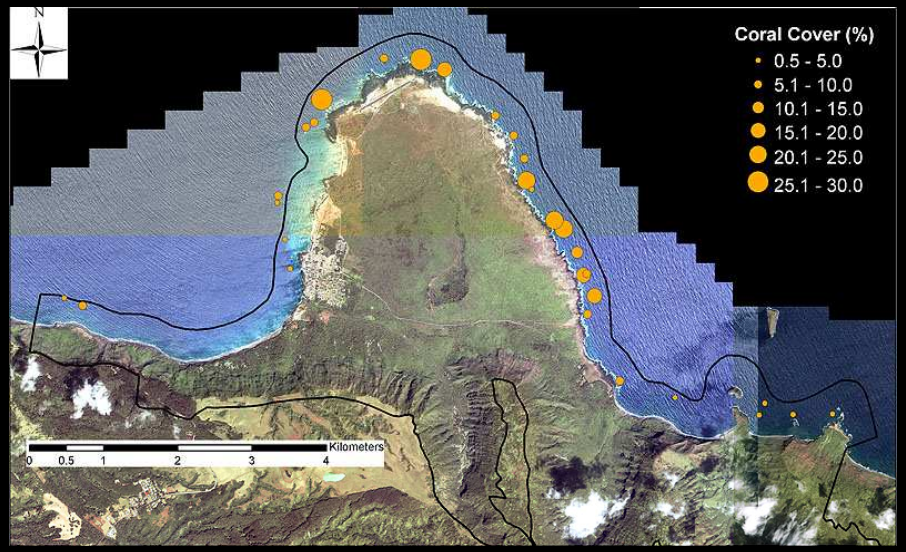
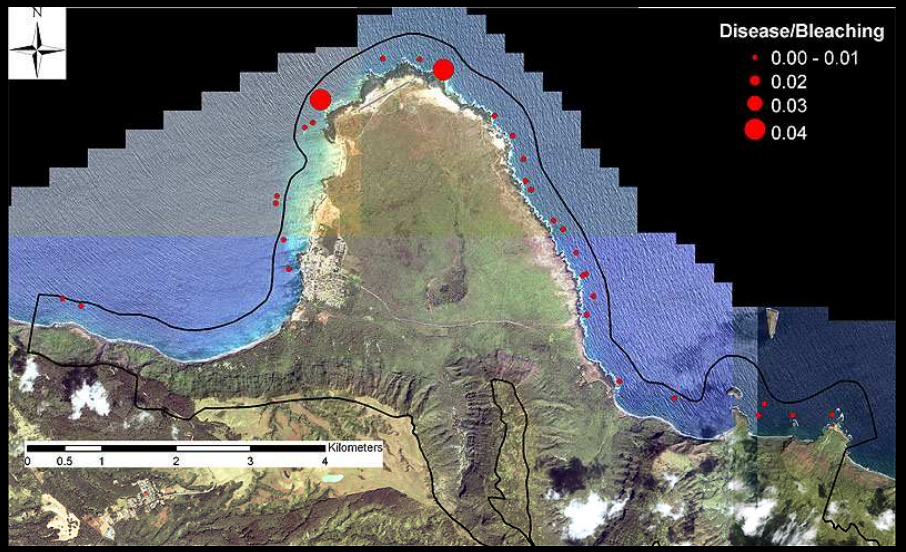
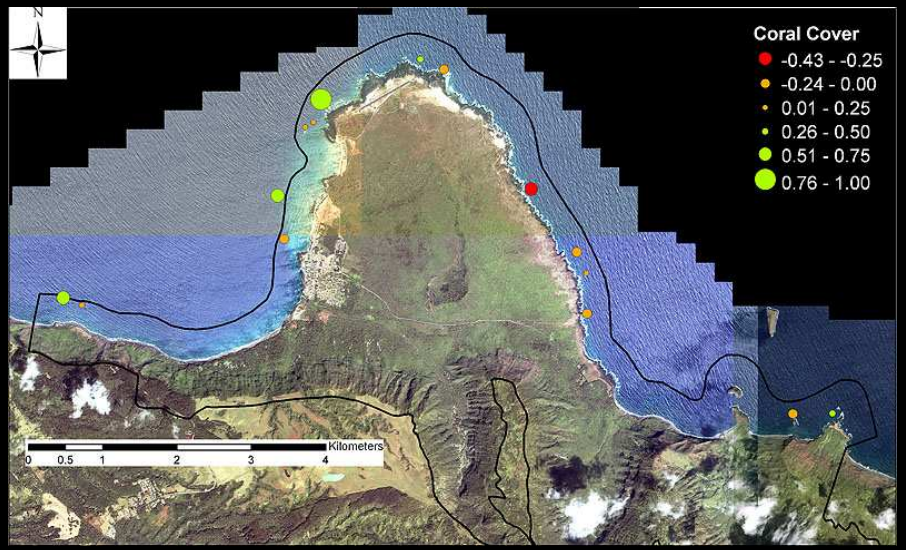
Spatial Distribution

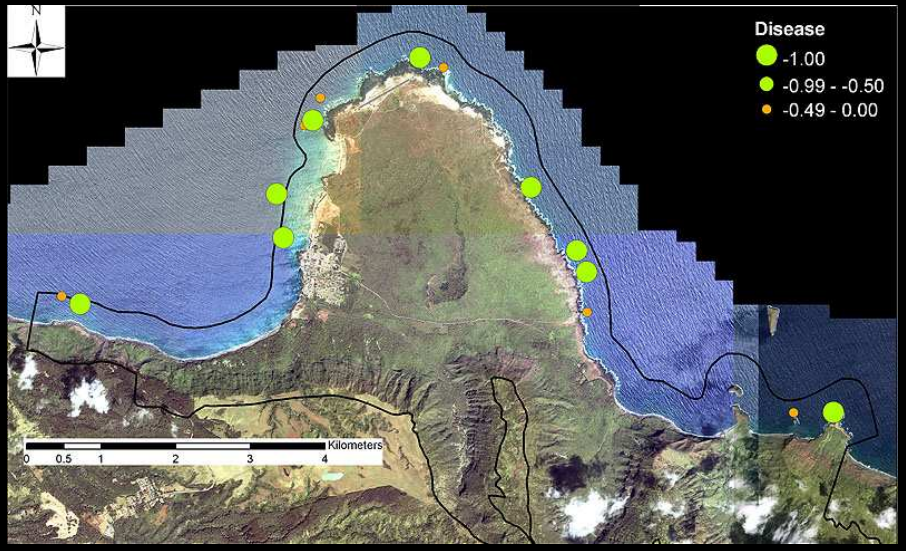




Mean Change = +16%



Mean Change = -60%



Relevance

- Multiple monitoring efforts give rise to increased inference capabilities with data collected simultaneously
  - While individual monitoring efforts give rise to high quality data with a high degree of ecological inference, by coordinating efforts with other large scale monitoring efforts, the degree of inference can be increased statistically and for management purposes through lines of multiple evidence

The statistical designs for each monitoring protocol were created before implementation to allow for addressing this issue specifically


Special thanks to the partners and supporters of the PACN Inventory and Monitoring Program
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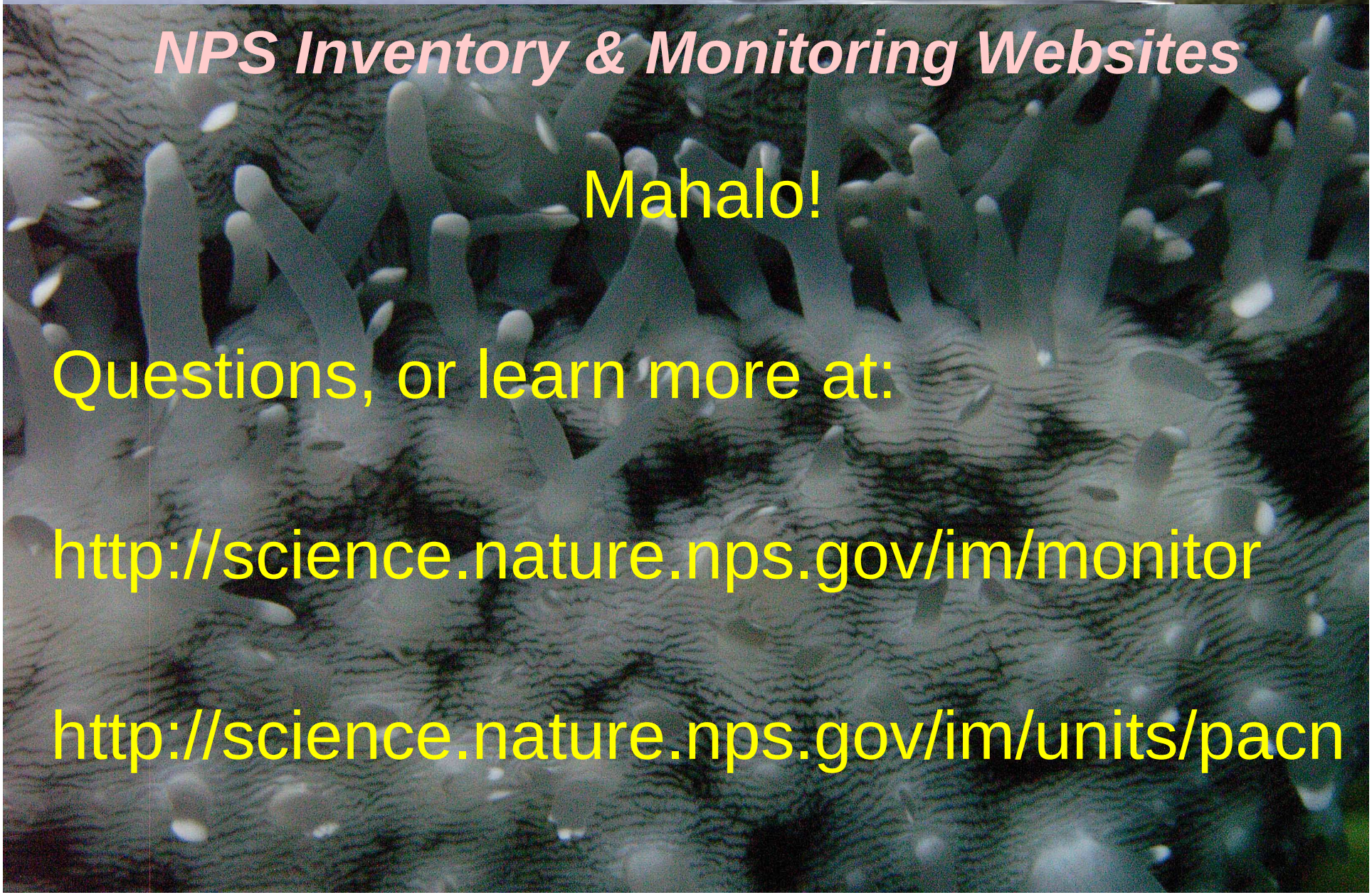

NPS Inventory & Monitoring Websites

Mahalo!

Questions, or learn more at:

http://science.nature.nps.gov/im/monitor

http://science.nature.nps.gov/im/units/pacn