EVOLVING MPA MONITORING INTO MARINE SPATIAL PLANNING

Aligning science and policy to conserve dugongs and their habitat

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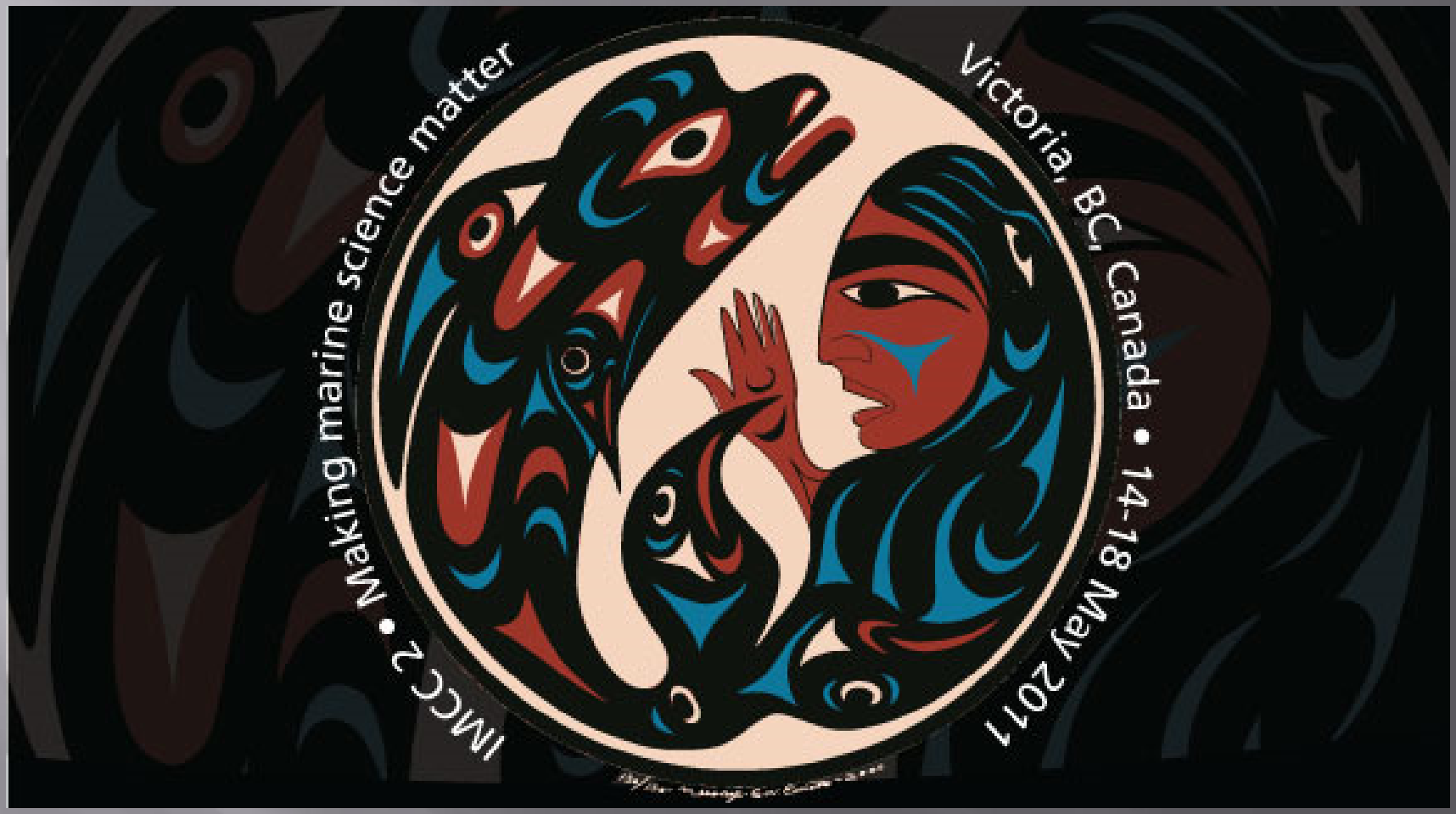


http://www.conbio.org/IMCC2011/

Topics

- MPA's for dugongs: summary of scientific workshop
- Marine Spatial Planning
- Climate Change
  - Effects of sea level rise on the Andaman Coast
  - Possible effects on seagrass

Take-home

- A declining dugong population is an indicator of habitat change or destructive human behavior
- Understand and value ecosystem services in communities
- Tools are available…need to be locally/regionally relevant
- Have to consider climate change on a precautionary basis

IMPROVING THE CONTRIBUTION OF MARINE PROTECTED AREAS TO THE CONSERVATION OF SIRENIANS (MANATEES AND DUGONGS):

A REPORT ON THE WORKSHOP

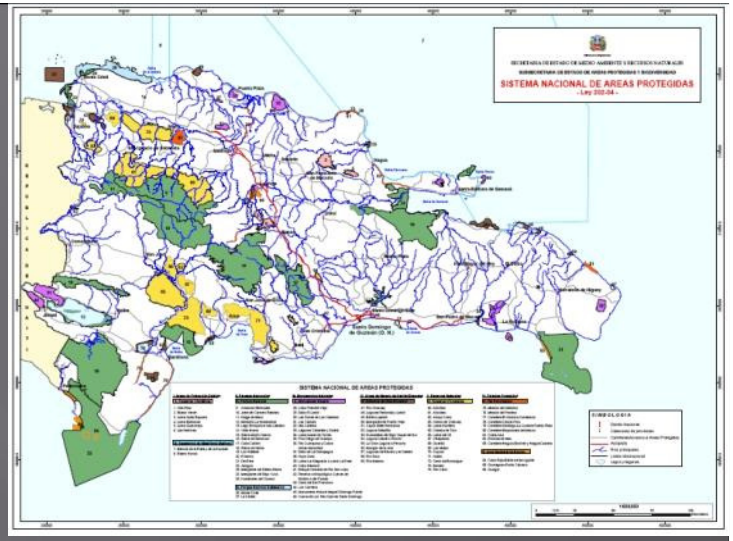
ORGANIZED BY HELENE MARSH, ELLEN HINES, CYNDI TAYLOR & CARYN SELF SULLIVAN

At the First International Marine Conservation Congress, May 2009, Washington DC

Rationale

- Our goal: enhance the theoretical framework for MPA planning for sirenians in developing countries by comparing regional examples of comparable issues, complemented by case studies that serve as practical illustrations.
- Sirenians have featured prominently in the rationale for developing MPAs throughout their range; but few evaluations of the effectiveness of this approach have been conducted from the perspectives of conservation or stakeholder satisfaction.

Attendees



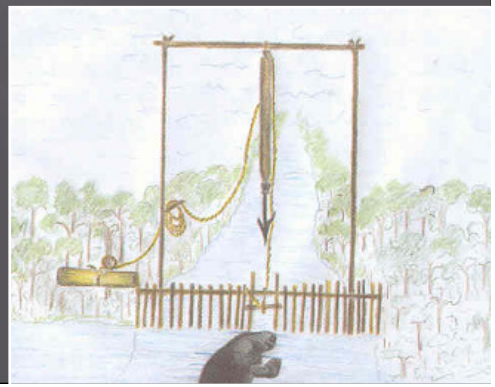
- 25-35 on each of 4 days from 16 countries:
  - Australia, Belize, Brazil, Colombia, Cote d'Ivoire, Guatemala, India, Japan, Malaysia, Mexico, Senegal, South Africa, United Arab Emirates, USA, UK

S.W.O.T. (Strengths, Weaknesses, Opportunities and Threats)

- An interactive group exercise on designing effective protected areas for sirenians in developing countries

Strengths of Protected Areas:

- Identifies areas for protection.
- Legal framework of the Protected Area.
- Access to funding.
- Inclusion of sirenians as flagship species within the area to protect.
- Official presence within the areas.
- Attracts civil support (NGO, community, university)



Weaknesses of Protected Areas:

- Mostly too small
- Low representation of the range of sirenians
- Not usually implemented.
- No rules; creation of a paper park.
- Enforcement is lax.
- Many are multiple use.
- Massive tourism.
- Lack of continuous funding.
- Based on inadequate knowledge of sirenians
- Capacity deficit of park staff
- Often dependent on the enthusiasm and energy of short term champions.
- Lack of succession planning for managers and scientists
- Ephemeral funding
- Lack of alternative livelihoods
- May not resolve hunting problems
- Top-down imposition of rules and regulations.
- Mismatch between geopolitical and ecological scales

Threats to Sirenians in Protected Areas

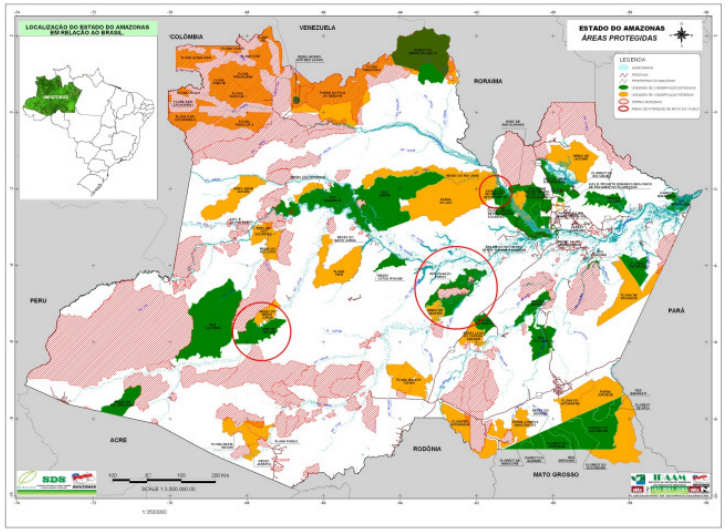
- Unsustainable tourism.
- Illegal hunting
- Continued use of fishing gear that causes sirenian mortality and destroys habitat
- Lack of continuous funding
- Lack of connectivity between protected areas.
- ***Illusion of protection.***
- Deleterious activities can influence the creation of protected areas.
- Failure to manage impacts outside the protected area
- Political conflict between nation states.
- Lack of political will to manage the protected areas.

Summary: Features of Protected Areas that reduce risks to sirenians in developing countries:

1. **Community involvement** that incorporates **local knowledge**
2. Management plan that reflects **legal framework and includes goals specific to sirenians**
3. Legal framework with political will
4. Strong **education and outreach** program
5. Protected Area network large enough to **protect ecological processes** and include a high proportion of the sirenian population throughout the year
6. **Co-management** involving government, NGOs, local communities and researchers
7. **Effective enforcement** of management plan
8. **Capacity building** including succession planning for all partners in the co-management arrangement: government, NGOS, community, researchers
9. Management **informed by active research** program
10. **Alternative livelihoods** for those community members affected by the implementation of the management plan

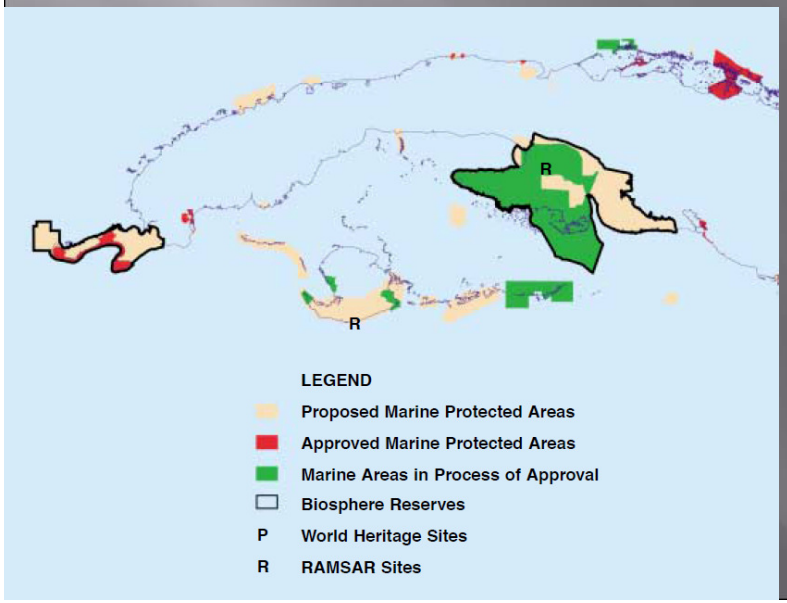
Additional recommendations

- Reduction of human-induced mortality to sirenians should be the highest priority for sirenian conservation
- Regional workshops and community level exchanges would provide valuable opportunities to exchange ideas



- A series of workshops where we continue to discuss the recommendations and guidelines and create communication and training standards,
- a series of workshops at the international level that create national/binational/regional conservation/research/training strategies and standards for marine protected areas that actually protect sirenians.

Next?



Marine Spatial Planning

- A planning framework for protected area management
  - Multi-sector
  - Public process
  - Considers ecosystem health and services
- Economics
- Ecology
- Governance
- Social/Cultural Parameters

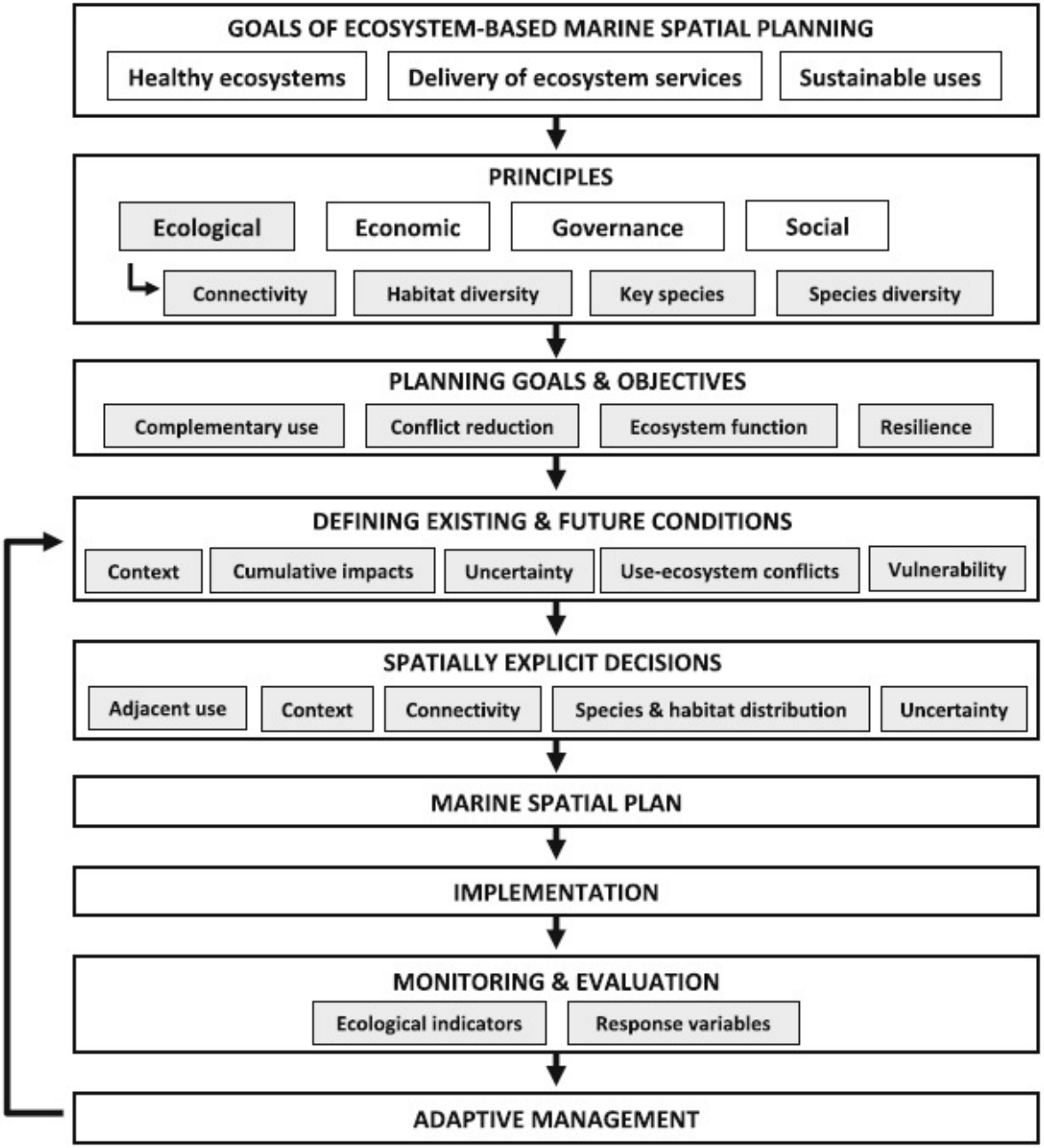


Fig. 1. Flow diagram outlining the key aspects of any marine spatial planning process with an emphasis on how ecological principles can be used throughout the planning and implementation process. Boxes that specifically pertain to components of an ecosystem-based approach are shaded in gray. This diagram would be used in conjunction with similar diagrams outlining the components of economic, governance, and social principles to develop and implement a comprehensive marine spatial plan.

Foley et al
2010
Marine Policy

Ecological goals for MSP

- Maintain native species diversity
- Maintain habitat diversity/heterogeneity
- Maintain populations of key species
- Maintain connectivity between and within populations
- Go beyond designation of hotspots to system drivers: oceanographic, temporal, spatial

Why???

- Beyond counting…
- Beyond individual mpa's
- More defensible to agencies
- Minimizes cost:information ratios
- Informs and creates a framework for long term planning (example GBRMPA)

Ecosystem vulnerability

- Habitats and species
  - Do not react equally to stimuli
- Culmulative impacts
  - Multiple and synergistic
    - IMPACT = a+b+c OR (a+b)+c OR a+(b+c) OR……
- Climate change
  - Sea level rise, temperature rise, acidification
- Resilience
  - Thresholds
    - Points at which a system can either resist change or recover from it

How?

- Integrated baseline assessment
  - Ecology, socio-cultural, economic
  - Inside & outside protected areas
  - Create monitoring that addresses & tracks trajectories

- Ecosystem characterization
  - Sampling methods well established
  - Requires multi-disciplinary research
  - *Indicators:* substrate change, water clarity, seagrass cover % & extent,
  - *Proxies:* magnitude of larval delivery, sightings/area
  - *Spatial correlation:* identify high density of sites with similar community structure, select a subset

Ecosystem based management; methods

- Ecosystem based management approach
  - How do you tell an Ecosystem story?
  - What are the pulse points, the vital signs?
- Design management actions as experiments
- Select informative metrics…such as:
  - Seagrass extent and health
  - Focal species information
- Set up easily interpretable goals/criteria by which to determine decline
  - Goals: be able to identify those elements that contribute to resilience, find cost-effective solutions for ongoing monitoring, identify key socio-economic & ecological integrations
- Evaluate metric performance against goals

Quick reference for recommended ecological principles for ecosystem-based MSP.

Principle	Important features	Ecosystem function(s) supported	Considerations for operationalizing
Maintain native species diversity	Species diversity and composition	Productivity	Diversity measures—species, genetic and functional
	Genetic diversity	Resilience (resistance and recovery)	Historic baselines
	Functional redundancy	Food web stability	
Maintain habitat diversity and heterogeneity	Habitat representation	Maintenance of species diversity	Habitats in a range of environmental conditions
	Habitat arrangement	Connectivity	Size of habitats
	Dynamic habitats	Shelter/refuge	Proximity of habitats
		Productivity	Spatial arrangement of habitats
			Historic baselines
Maintain populations of key species	Keystone	Species diversity	Age structure, dispersal, and population demographics
	Foundation	Food web stability	Breeding and aggregation locations
	Basal prey	Resilience	Migration routes
	Top predators	Ecosystem engineering	Historic baselines
Maintain connectivity	Population and species persistence	Species diversity	Scale of ecosystem
	Flow of subsidies	Metapopulation and metacommunity dynamics	Dispersal distance (larval and adult)
			Oceanographic currents/features

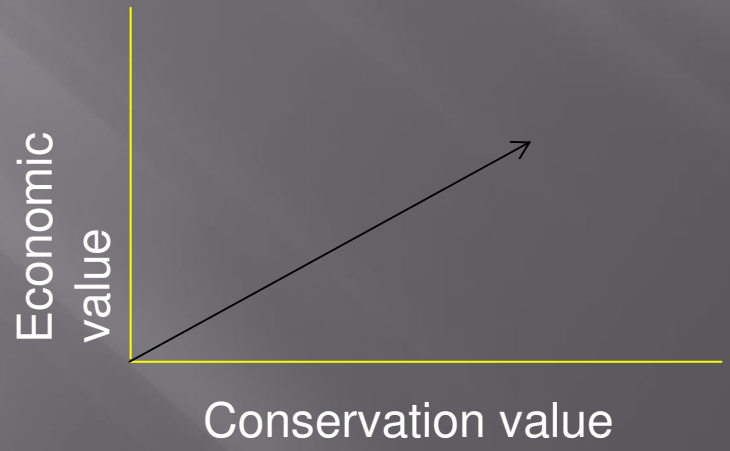
Foley et al
2010
Marine Policy

Adaptive management

- "Adaptive management," management policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing **program actions as tools for learning.**
- Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and **monitoring and evaluation shall be emphasized so that the interaction of different elements** within marine systems may be better understood."

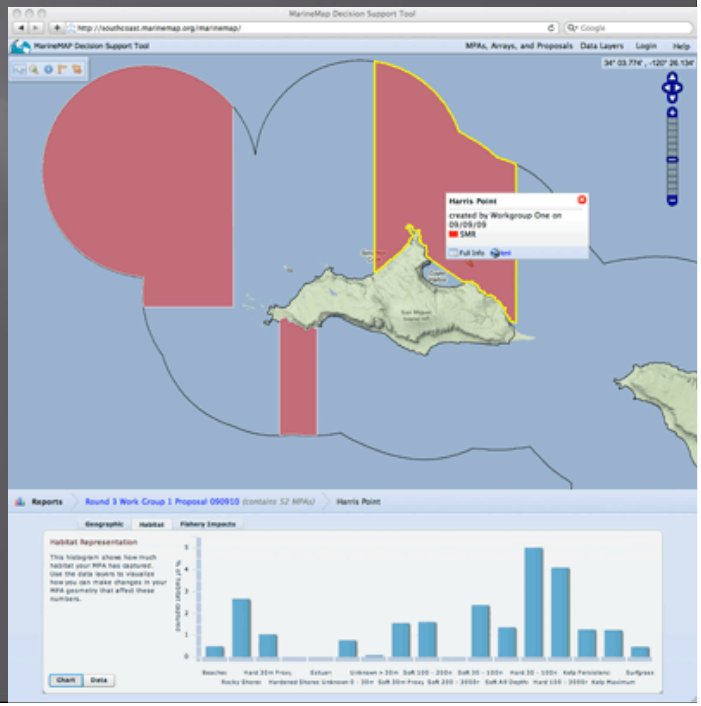
Methods continued

- Track the spatial distribution of human use
  - Measure the direct economic impact
  - Operational costs
  - Effort vs landing (CPUE)
  - Consumptive and non-consumptive users
  - Tie to demographic and economic characteristics of coastal users
- Using interviews, track the values of local communities



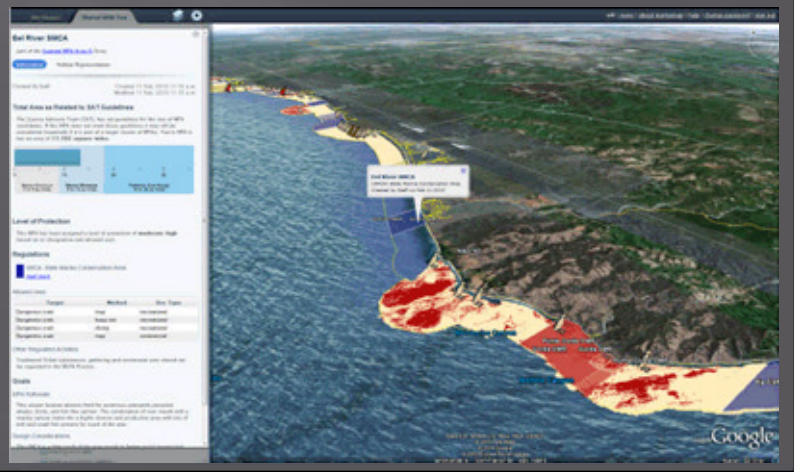
Spatial planning

- Zones
  - A SIMPLIFIED classification system
  - http://www.dfg.ca.gov/mlpa/defs.asp#system
- Corridors
- Networks
- …..follow the monitoring criteria and adapt…



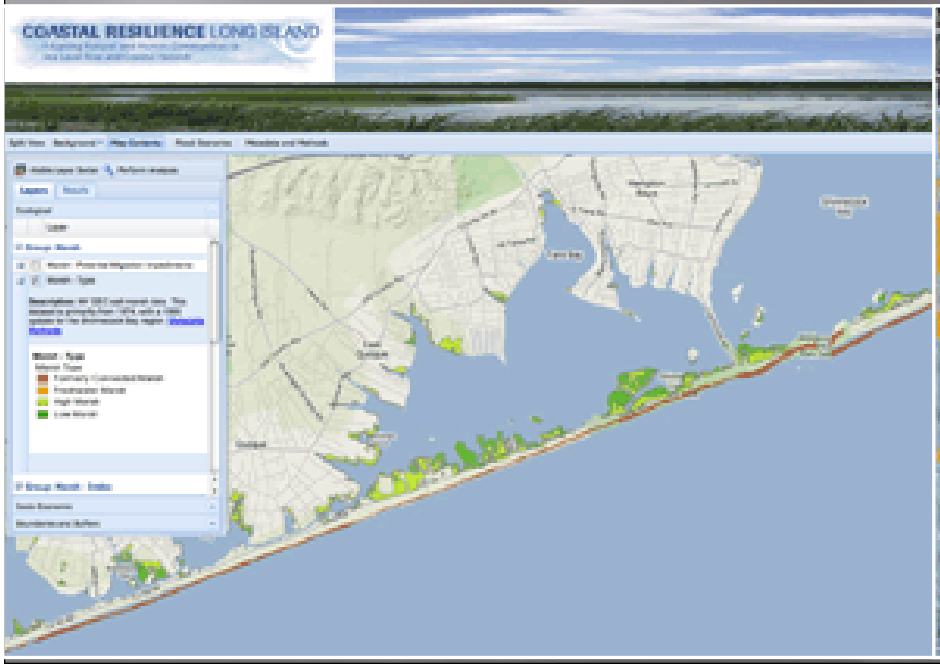
MSP tools

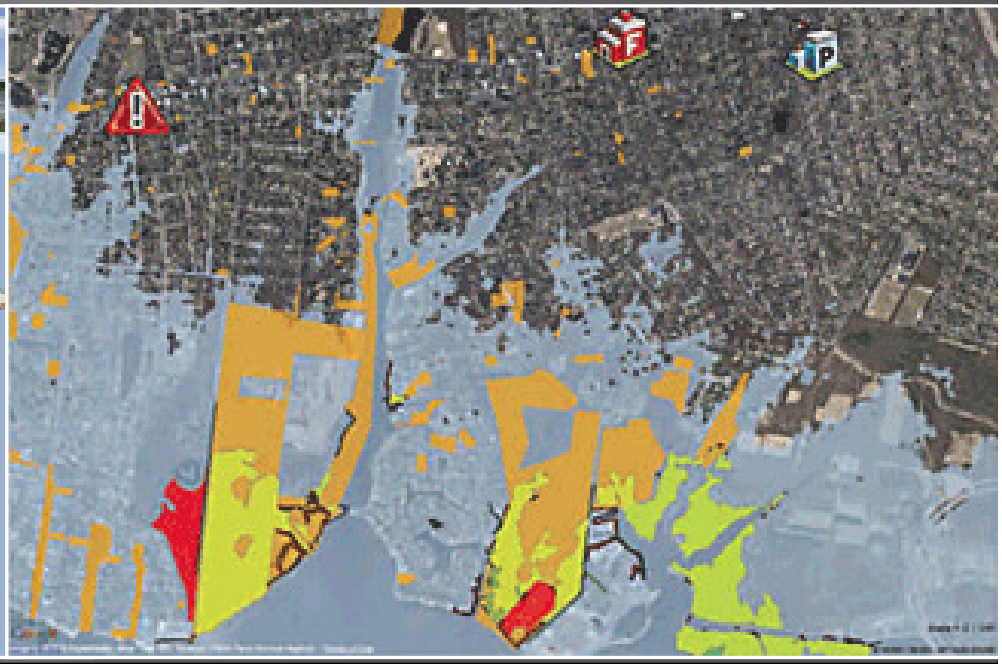
- http://marinemap.org/demos/mmintro/mmintro.htm
- http://marinemap.org/decision-support-tool
- http://southcoast.marinemap.org/marinemap/#
- http://www.marineplanning.org/30.htm
- Marxan
  - http://www.uq.edu.au/marxan/



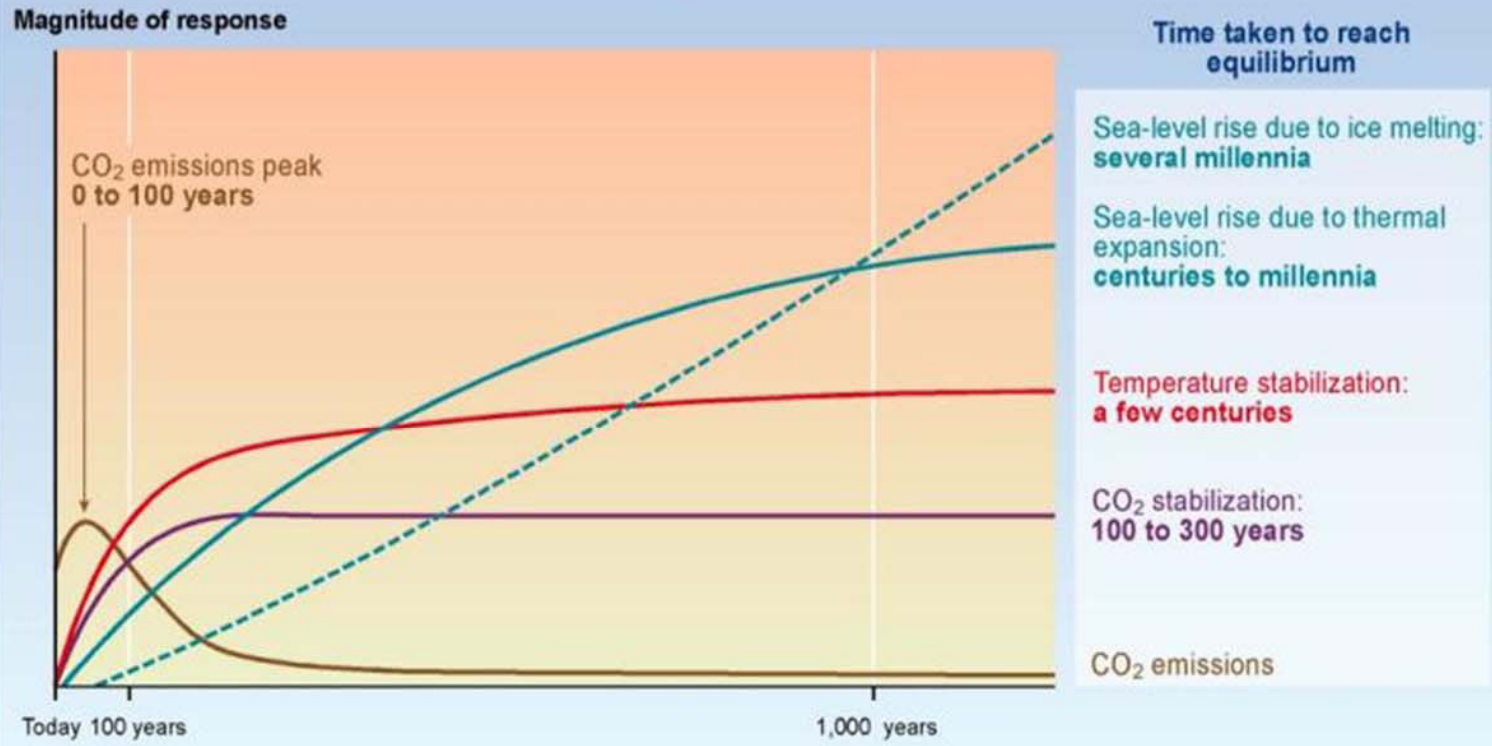
Global coastal resiliance

- http://globalcoastalresilience.org
- Scenario mapping tools for climate change/sea level rise





CO_2 concentration, temperature, and sea level continue to rise long after emissions are reduced



SYR - FIGURE 5-2

San Francisco Bay
Conservation and Development Commission

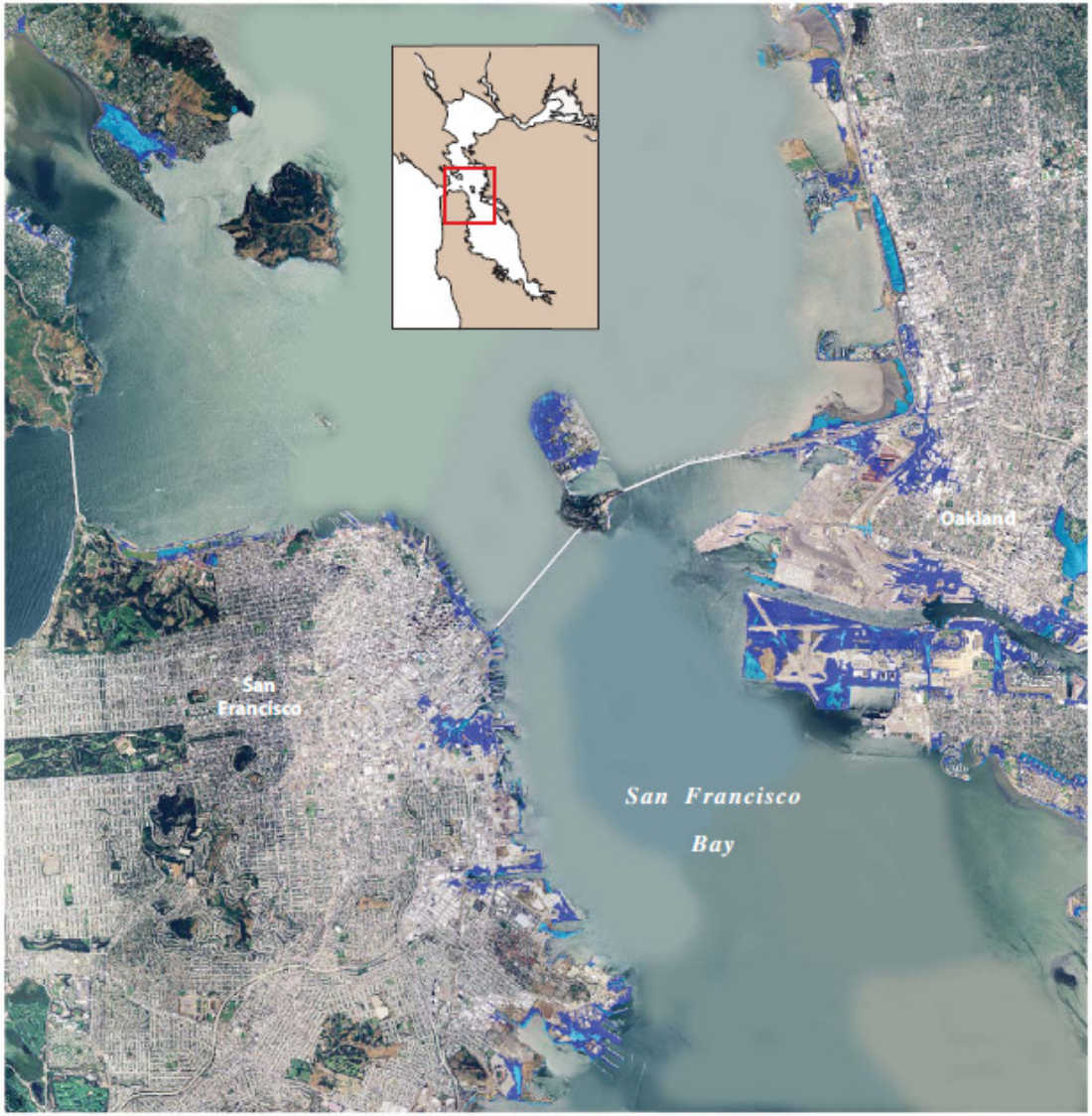
Shoreline Areas Vulnerable To Sea Level Rise: Central Bay

Area vulnerable to an approximate 16 inch sea level rise

Area vulnerable to an approximate 55 inch sea level rise

0 1.5 3 MILES

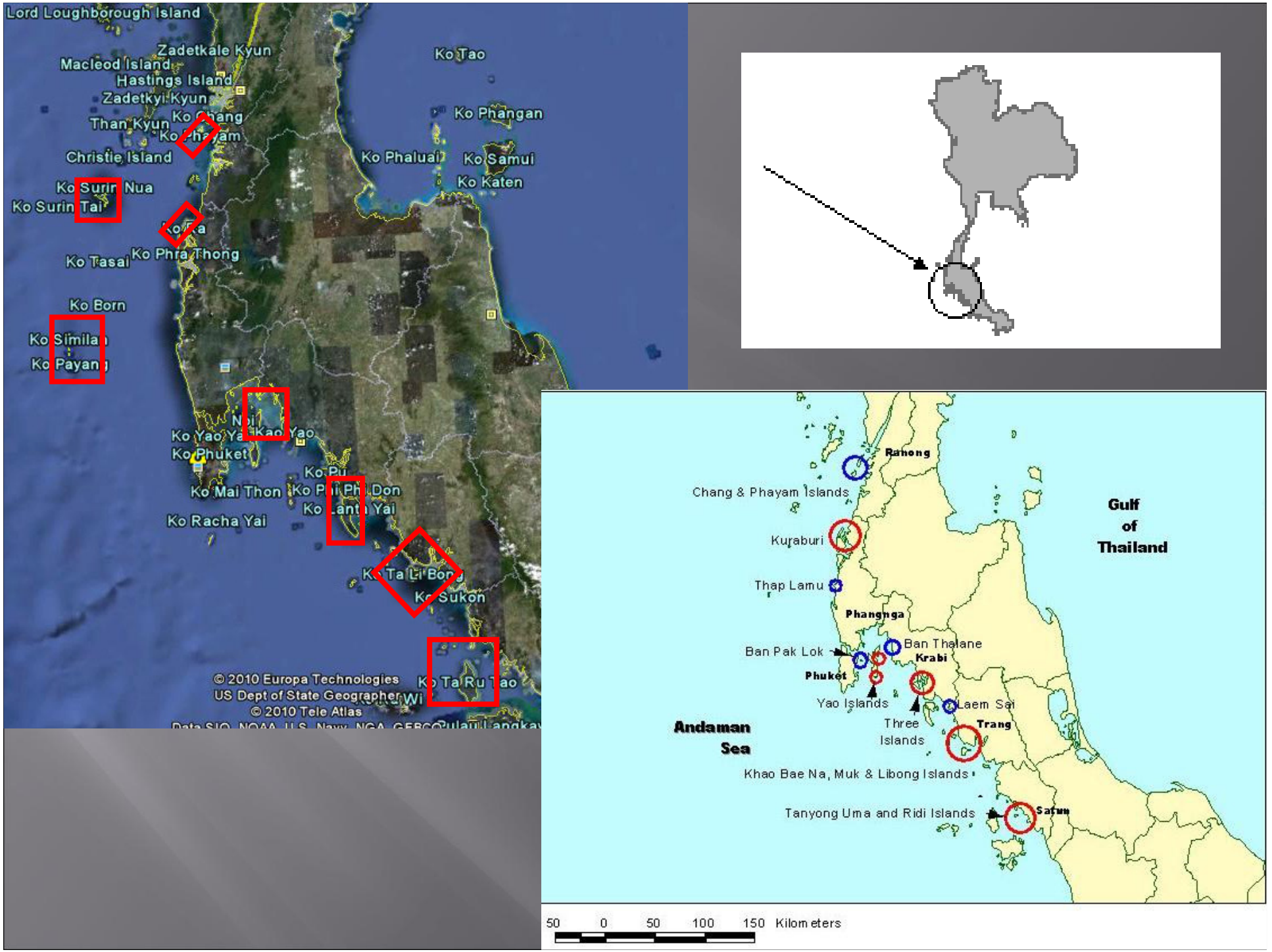
NORTH



SOURCE: Inundation data from Knowles, 2008. Additional salt pond elevation data by Siegel and Bachand, 2002. Aerial imagery is NAIP 2005 data.

The Andaman Coastal Bioregion

- 500km along coastal Thailand from the Myanmar border in the north to the Malaysian border in the south.
- 6 distinct ecoregions (primarily coral reef, mangrove, seagrass, coastal forest and limestone karst)
- several important biogeographic transition zones, with the core elements of 18 marine and coastal protected areas totaling 538,000 ha of national parks and reserves.


Lord Loughborough Island
Zadetkale Kyun
Macleod Island
Hastings Island
Zadetkyi Kyun
Than Kyun
Christie Island
Ko Surin Nua
Ko Surin Tai
Ko Phra Thong
Ko Tasai
Ko Born
Ko Similan
Ko Payan
Ko Yao Noi
Ko Yao Yai
Ko Phuket
Ko Mai Thon
Ko Racha Yai
Ko Phi Phi Don
Ko Lanta Yai
Ko Sukon
Ko Ta Ru Tao
Ko Tao
Ko Phangan
Ko Phaluai
Ko Samui
Ko Katen
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US Dept of State Geographer
© 2010 Tele Atlas
Rahong
Chang & Phayam Islands
Kuraburi
Thap Lamu
Phangnga
Ban Pak Lok
Ban Thalane
Krabi
Phuket
Yao Islands
Three Islands
Laem Sai
Trang
Khao Bae Na, Muk & Libong Islands
Tanyong Uma and Ridi Islands
Satun
Gulf of Thailand
Andaman Sea
50 0 50 100 150 Kilometers

Current process (Petch Manopawitr)

- network design will be conducted using GIS and decision support software (Marxan).
- management options for MPA networks to address the impact of climate change by enhancing ecological resiliency.
- a platform for long-term marine spatial planning and help develop regional conservation strategies across Andaman bioregion.
- will examine:
  - i) how current global climate change has affected marine ecosystems in this bioregion
  - ii) where are the most ecologically resilient areas within the Andaman coast based on ecological characteristics and resilience frameworks

Climate change along the Andaman Coast

- http://gu.com/p/2cpyc
- The coastal areas of Thailand are considered particularly vulnerable to climate change and its impacts.
- Temperature change: modest
  - Coastal temps <1°C next 10-25 years
- Rainfall change: very significant
  - Monsoon will shorten: 2 weeks 2018, 4 weeks 2033
  - 10% decrease by 2033
- Sea level rise: substantial
  - 1cm annually over next 25 years
  - Depending on location, current shorelines retreat 10-35 m
- Intense tropical storms: fewer
  - Because of warming, at or below current levels
  - As sea levels rise, storms will do more damage to coastal infrastructure

Implications

- Fresh water availability
- Coastal ecosystems, especially mangroves and seagrass
- Storm and storm surges
- Coastal villages
  - Coastal erosion
  - Longer fishing seasons, increased pressure on already depleted stocks
- Higher temperature, less water in upland areas

Seagrass and climate change

- Additions or removal of sediment
  - Storms, flooding, soil erosion, dredging
- Eutrophication
  - Excess nutrients
  - Algal growth
- Light reduction
  - Turbidity or increased water depth
- Temperature increase
- Increasing seawater CO_2 levels
- Decreasing pH (ocean acidification)
- Coastal development barriers

Dugong in seagrass: Halophila stipulacea bed, Red Sea, Egypt
Copyright: SeagrassNet

Björk M., Short F., Mcleod, E. and Beer, S. (2008). *Managing Seagrasses for Resilience to Climate Change.* IUCN, Gland, Switzerland. 56pp.

Take-home

- A declining dugong population is an indicator of habitat change or destructive human behavior
- Understand and value ecosystem services in communities
- Tools are available…need to be locally/regionally relevant
- Have to consider climate change on a precautionary basis

K. Adulyanukosol

Remember that in poverty all available resources will be used.

Benjamín Morales-Vela and Ester Quintana-Rizzo

Thank you!