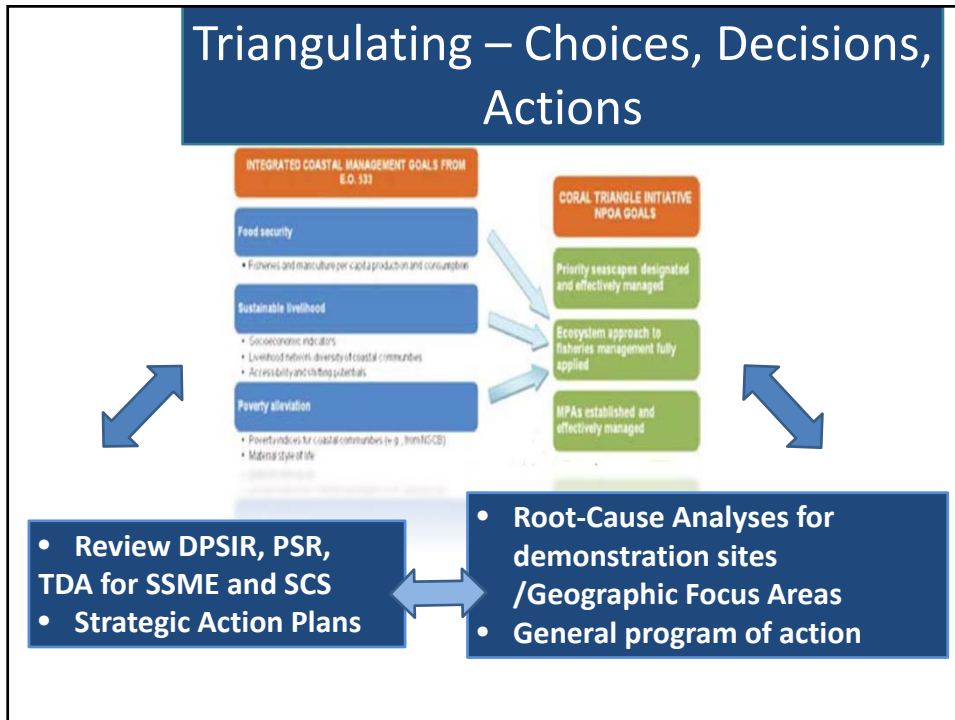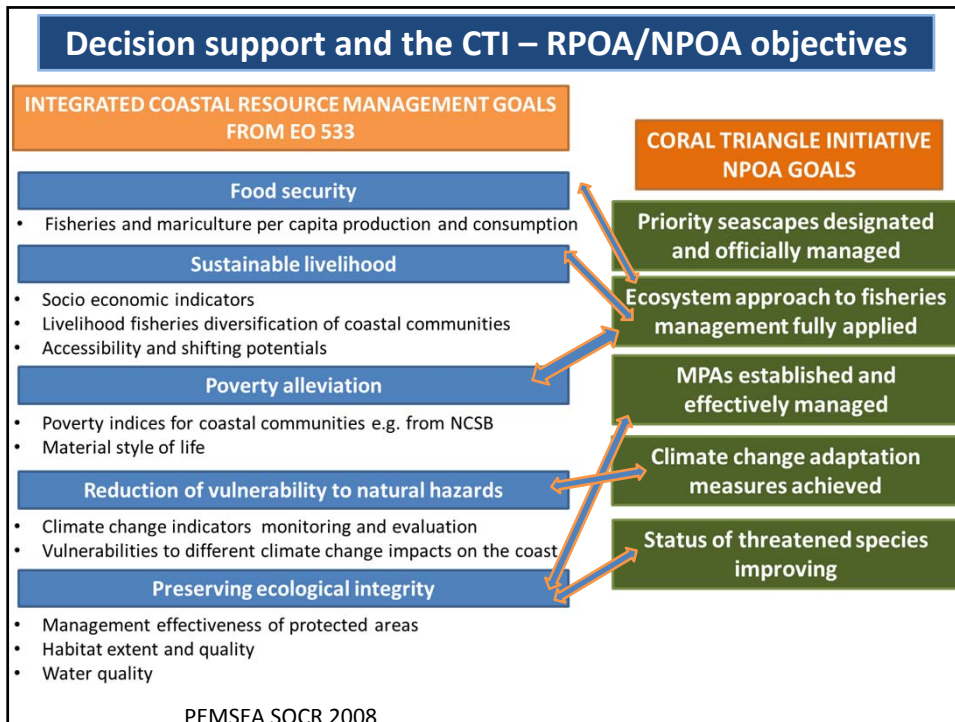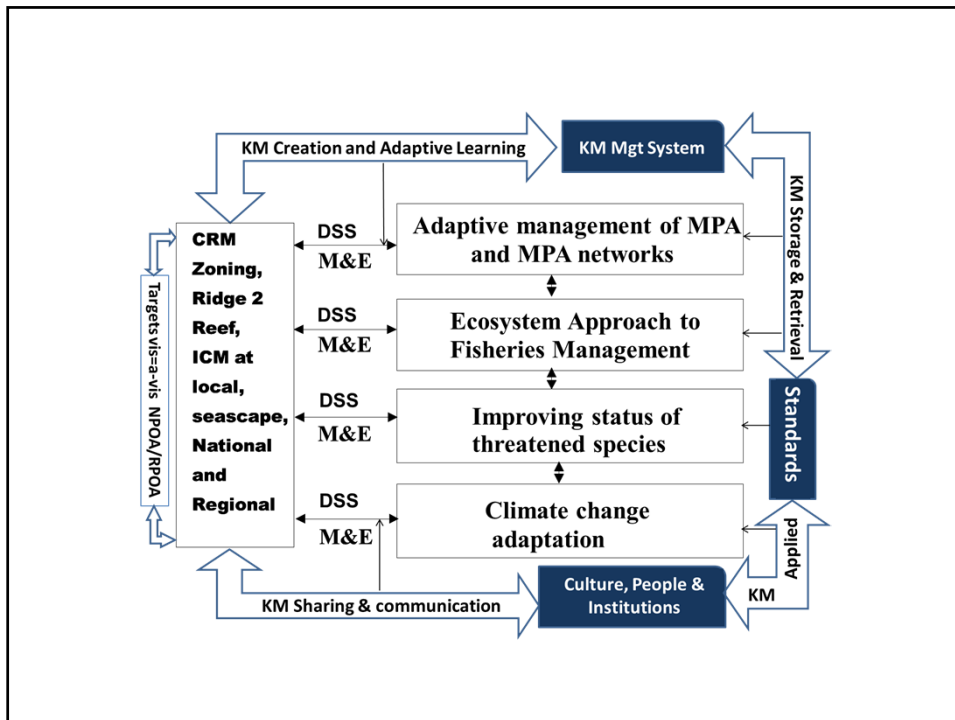# Integrating Marine Biodiversity Conservation to an Ecosystem Approach to Fisheries Management

Porfirio M. Aliño

Marine Science Institute

U.P. Diliman, Q.C.

Outline

- The State of Marine Ecosystems & their Resources
- Decision support and the CTI – NPOA objectives
- Some DSS tools available in the CTI
- DSS and knowledge based CTI communities
- Integrating marine biodiversity conversation with fisheries managment

Decision support and the CTI – RPOA/NPOA objectives

INTEGRATED COASTAL RESOURCE MANAGEMENT GOALS FROM EO 533

CORAL TRIANGLE INITIATIVE NPOA GOALS

Food security
- Fisheries and mariculture per capita production and consumption

Priority seascapes designated and officially managed

Sustainable livelihood
- Socio economic indicators
- Livelihood fisheries diversification of coastal communities
- Accessibility and shifting potentials

Ecosystem approach to fisheries management fully applied

Poverty alleviation
- Poverty indices for coastal communities e.g. from NCSB
- Material style of life

MPAs established and effectively managed

Reduction of vulnerability to natural hazards
- Climate change indicators monitoring and evaluation
- Vulnerabilities to different climate change impacts on the coast

Climate change adaptation measures achieved

Preserving ecological integrity
- Management effectiveness of protected areas
- Habitat extent and quality
- Water quality

Status of threatened species improving

PEMSEA SOCR 2008

Triangulating – Choices, Decisions, Actions

- **Review DPSIR, PSR, TDA for SSME and SCS**
- **Strategic Action Plans**

- **Root-Cause Analyses for demonstration sites /Geographic Focus Areas**
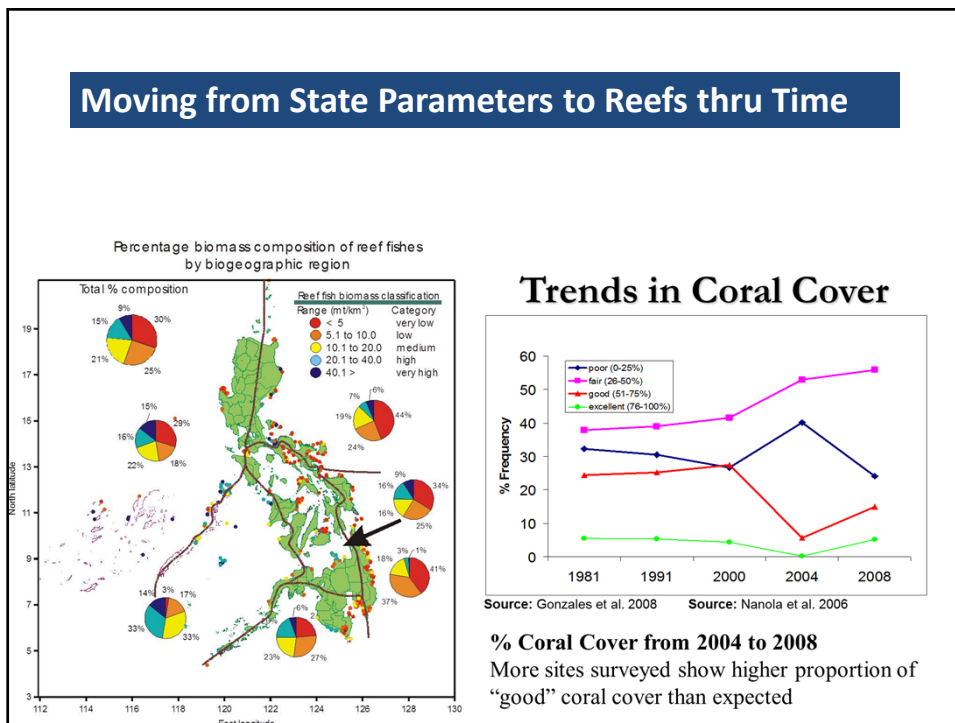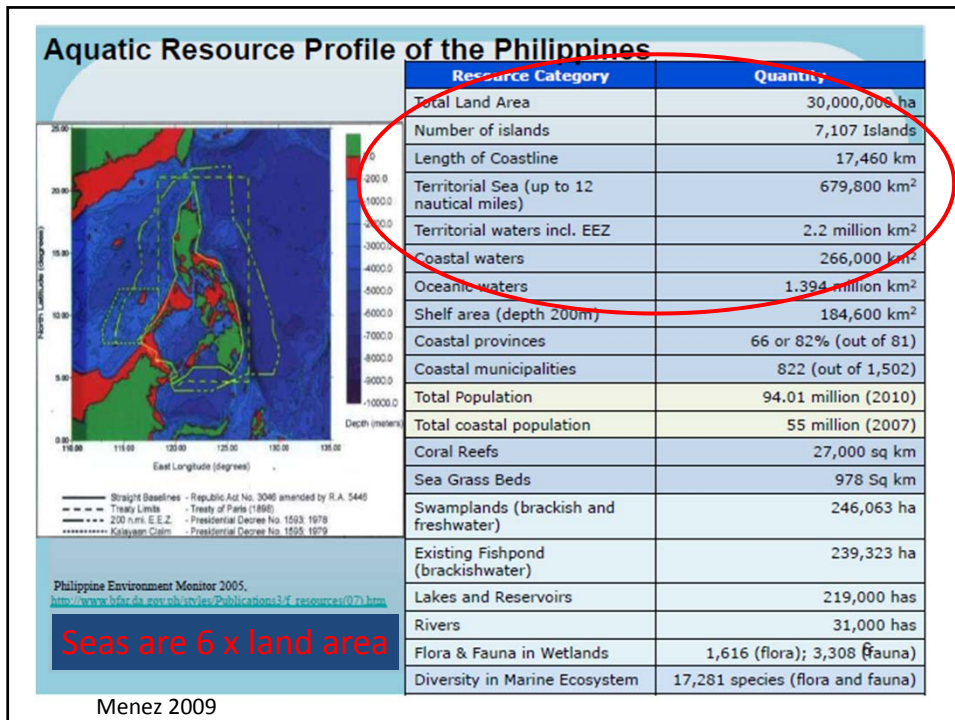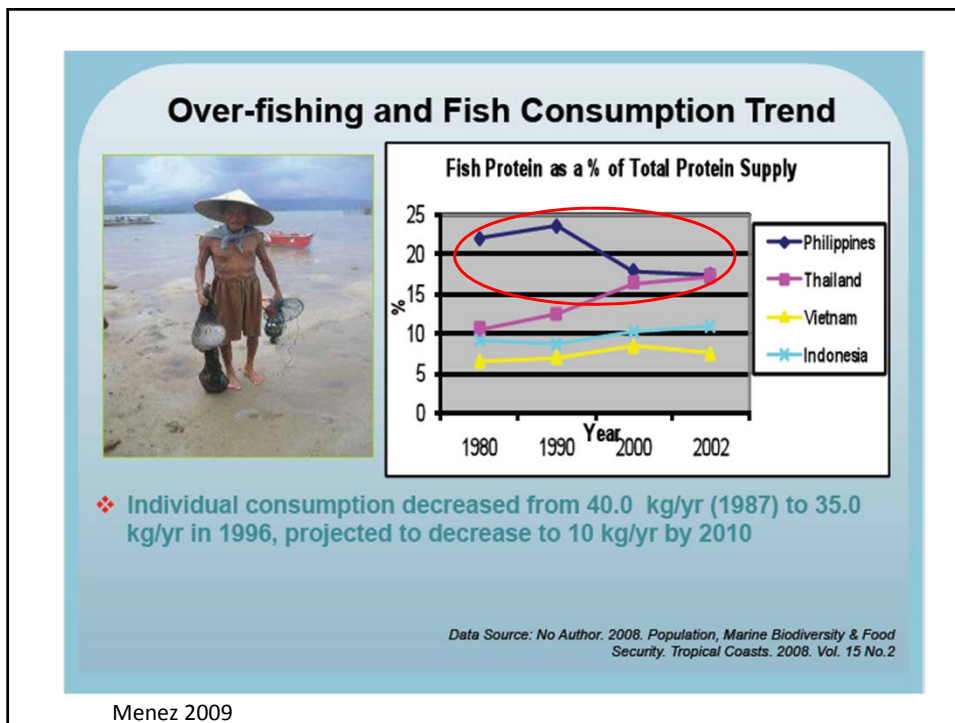- **General program of action**

What is a Decision Support Framework?

- It is a tool used **to identify and clarify problems**, help organize **available data and evaluate possible scenario** in order to arrive at the best strategy or decision
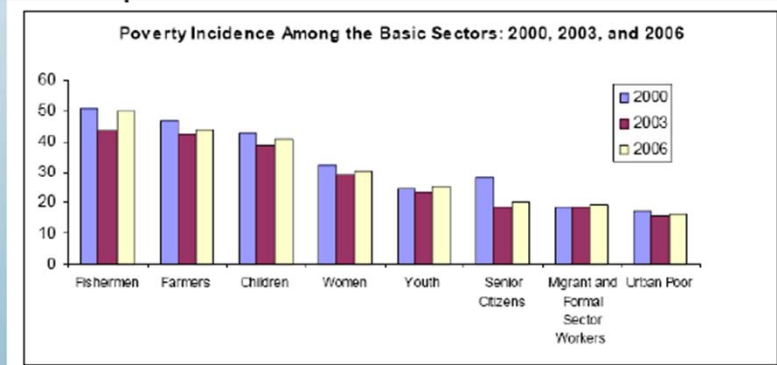
Reynolds et al, 1999

Aquatic Resource Profile of the Philippines

Resource Category	Quantity
Total Land Area	30,000,000 ha
Number of islands	7,107 Islands
Length of Coastline	17,460 km
Territorial Sea (up to 12 nautical miles)	679,800 km²
Territorial waters incl. EEZ	2.2 million km²
Coastal waters	266,000 km²
Oceanic waters	1.394 million km²
Shelf area (depth 200m)	184,600 km²
Coastal provinces	66 or 82% (out of 81)
Coastal municipalities	822 (out of 1,502)
Total Population	94.01 million (2010)
Total coastal population	55 million (2007)
Coral Reefs	27,000 sq km
Sea Grass Beds	978 Sq km
Swamplands (brackish and freshwater)	246,063 ha
Existing Fishpond (brackishwater)	239,323 ha
Lakes and Reservoirs	219,000 has
Rivers	31,000 has
Flora & Fauna in Wetlands	1,616 (flora); 3,308 (fauna)
Diversity in Marine Ecosystem	17,281 species (flora and fauna)

Straight Baselines - Republic Act No. 3046 amended by R.A. 5446
Treaty Limits - Treaty of Paris (1898)
200 n.mi. E.E.Z. - Presidential Decree No. 1593; 1978
Kalayaan Claim - Presidential Decree No. 1595; 1979

Philippine Environment Monitor 2005.
http://www.bfar.da.gov.ph/styles/Publications3/f_resources/07).htm

Seas are 6 x land area

Menez 2009

Moving from State Parameters to Reefs thru Time

Percentage biomass composition of reef fishes by biogeographic region

Reef fish biomass classification
Range (mt/km²)	Category
< 5	very low
5.1 to 10.0	low
10.1 to 20.0	medium
20.1 to 40.0	high
40.1 >	very high

Trends in Coral Cover

poor (0-25%)
fair (26-50%)
good (51-75%)
excellent (76-100%)

Source: Gonzales et al. 2008   **Source:** Nanola et al. 2006

% Coral Cover from 2004 to 2008
More sites surveyed show higher proportion of "good" coral cover than expected

Overexploitation of resources

Balancing Predators and Prey

Photo by JW McManus

Photo by PM Aliño

Over-fishing and Fish Consumption Trend

Fish Protein as a % of Total Protein Supply

- Philippines
- Thailand
- Vietnam
- Indonesia

❖ Individual consumption decreased from 40.0 kg/yr (1987) to 35.0 kg/yr in 1996, projected to decrease to 10 kg/yr by 2010

Data Source: No Author. 2008. Population, Marine Biodiversity & Food Security. Tropical Coasts. 2008. Vol. 15 No.2

Menez 2009

Menez 2009

Menez 2009

The Philippines as an Archipelagic state

ICE CREAM
COASTAL CLIMATE
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2000

LEGEND:
Municipal waters
Lightly exploited
(0.2 - 2 fishers/km)
Heavily exploited
(2 - 70 fishers/km)
Very heavily exploited
(>70 fishers/km)
Terrestrial area

Philippine Fisheries Decline: How do we address climate change concerns amidst reducing fishing effort, addressing poverty and food security concerns?

Alino 2004
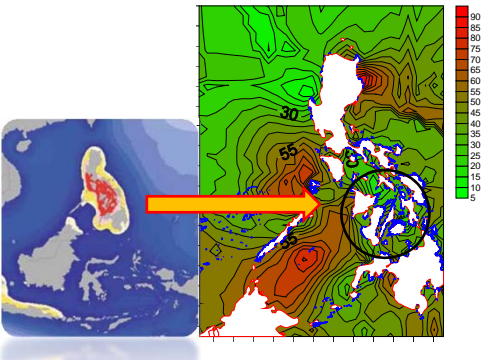
Dealing with the dilemma of increasing demand for food and declining fish yields

Figure 5. Map of heavily exploited areas in the Philippines.[78]
Source: Green et al. 2003

Our heritage under threat!

Fish biodiversity declines in the center of the center, the Philippines → the Visayan Seas

Pattern of species richness based on sampling in early to mid 1900s(Carpenter and Springer 2005)

Interpolated species diversity map of fish species in the Philippines from fish visual census data (1990s to 2008) (* Nañola et al, 2010)

The Philippines as a rich area of ecosystem goods and services needs to be understood and managed wisely

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The Ocean, coasts and climate change
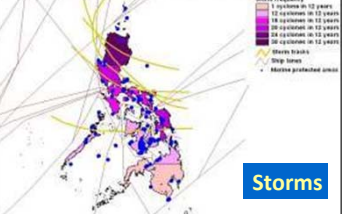
- **Coral reefs and MPA networks can serve as "sentinels"**
- **Enhance effectiveness of science-management synergies**
- **Help build resilience Seas**

Bleaching

Source: Pollunin and Roberts 1996

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Storms

THE ICE CREAM PROGRAM IS ONE OF THE REGIONAL MODELS FOR CLIMATE CHANGE ADAPTATION IN THE CORAL TRIANGLE REGION

The Coral Triangle
with marine ecoregions

The Philippines is the Global Center of Marine Biodiversity is found at the apex of the coral triangle.

Triangulating – Choices, Decisions, Actions

- **Food security**
- **Livelihood**
- **Poverty alleviation**

Ecosystem Approach to Fisheries Management

See also Licuanan et al. 2006

The Philippine Environmental Governance 2 Project

Triangulating – Choices, Decisions, Actions

See also Licuanan et al. 2006

DSS and knowledge based CTI communities

Relief Map · ReefGAME · CoastPlan · Cabral et al. 2010 · CORSET: Coral Reef Scenarios Evaluation Tools · Melbourne-Thomas et al. 2010

Adaptive Management through (MEMES) Motivating Ecosystem Management Enhancement Strategy

Scenarios for the Philippines: Coral bleaching and pollution · CORSET: Coral Reef Scenarios Evaluation Tools · Melbourne-Thomas et al. 2010

MARXAN

- It is an optimization program that is designed for marine protected area site selection
- Defines an objective function which can **give a relative value on the quality of different potential marine protected areas** in terms of their **size and cost** and **ability to meet biodiversity representation requirements**
- Optimization methods to generate systems of protected areas

Ball and Possingham 2000

The world of MARXAN

Scientific design of a resilient network of marine protected areas for Kimbe Bay, Papua New Guinea
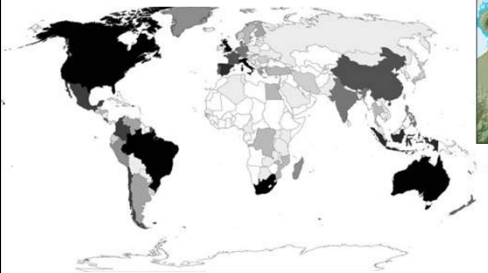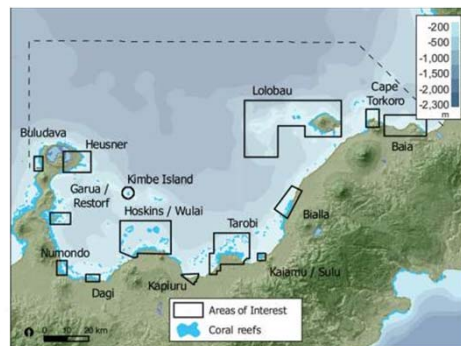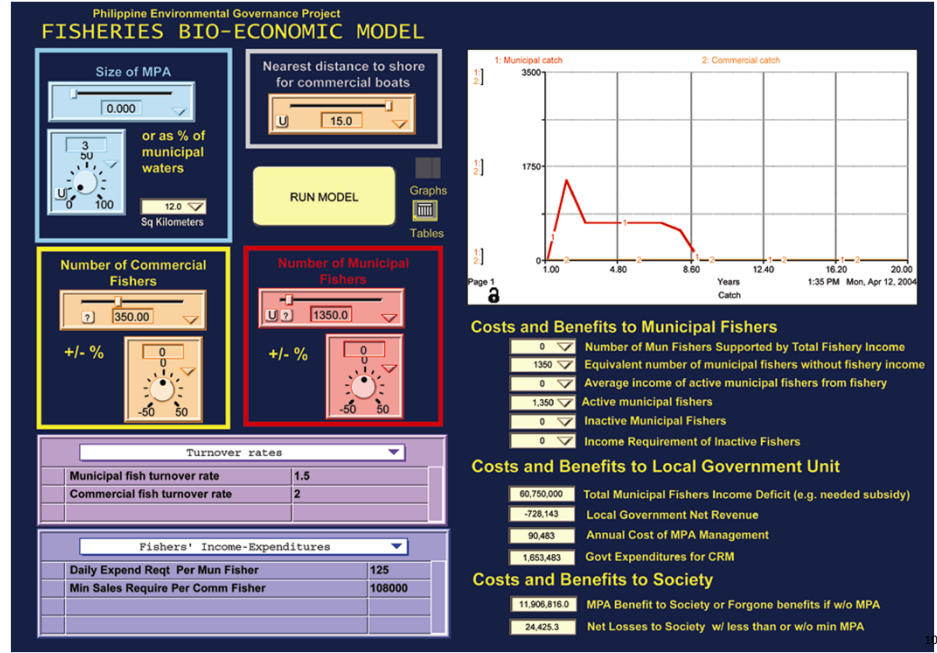
Green et al. 2009

Ball et al. 2009

Licuanan, W.Y., P.M. Aliño, W.L. Campos , G.B. Castillo and M.A. Juinio-Meñez. 2006. A Decision Support Model for Determining Sizes of Marine Protected Areas: Biophysical Considerations. **The Philippine Agricultural Scientist** 89(1): 34-47.

Licuanan W.Y., S Mamauag, R Gonzales, and PM Aliño. 2008. The Minimum Sizes of Fish Sanctuaries and Fishing Effort Reductions Needed to Achieve Sustainable Coastal Fisheries in Calauag and Tayabas Bays. **The Philippine Agricultural Scientist** 91(1):51-60.

The model interface

Fishery Capacity Chart from FISHBE
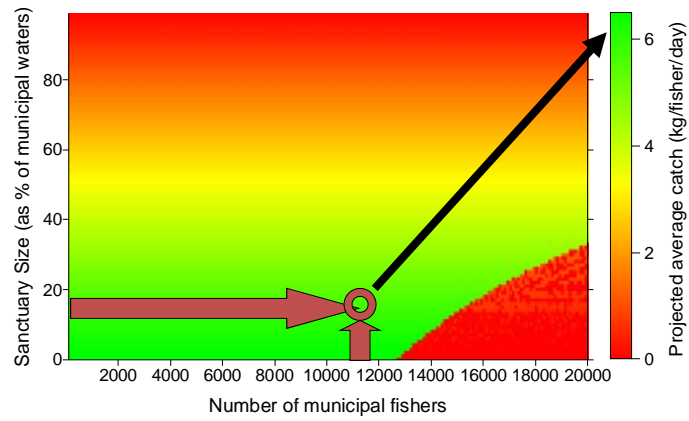
Embayments studied
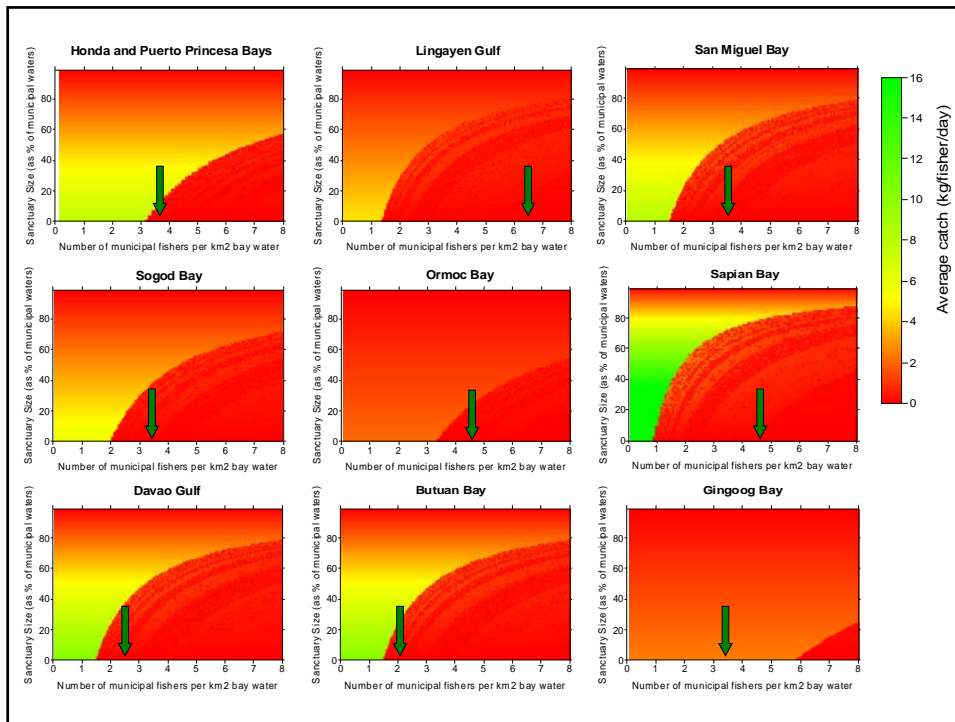
Minimum MPA sizes for other areas

Site	Area of waters (km²)	Municipal catch per unit area	Number of municipal fishers	Fixed comp minimum MPA size	Variable comp minimum MPA size
Lingayen Gulf	2,100	1 kg/day for 200 days, 45 km2	16,035	94%	99%
Tabina	400	5.8 kg/day for 200 days, 240 km2	1,350	4%	51%
Dinalungan	190	8.7 kg/day for 200 days, 500 km2	486	0%	10%

	Total area (reef)	MPA (km²)
Highly overfished	13,750	12,925
Moderately overfished	6,250	250
Underfished	5,000	
Total	25,000	13,175
	MPA size needed:	52.7%

Approximate management costs:	
For 6 years	PHP 19,762,500,000
Per year	PHP 3,293,750,000

An MPA must be embedded in a network
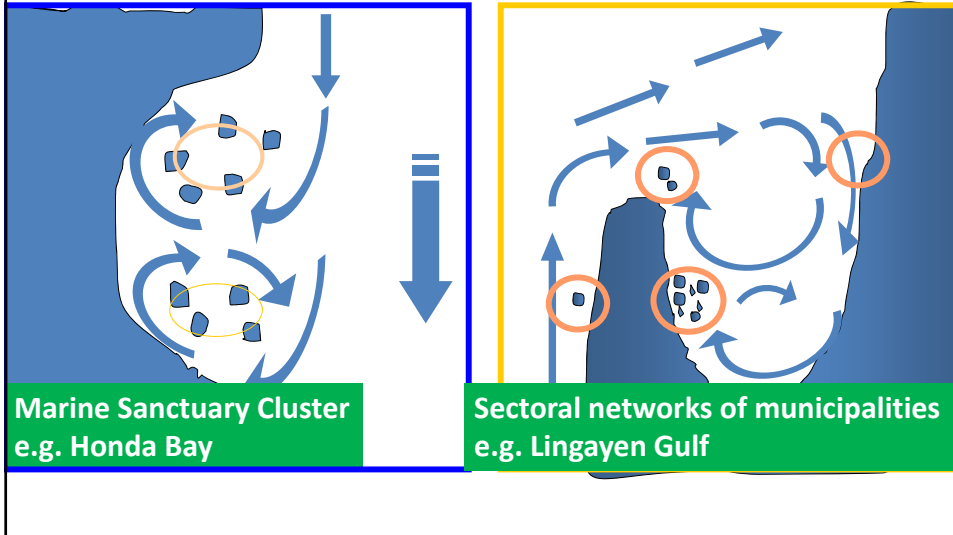
Marine Sanctuary Cluster e.g. Honda Bay
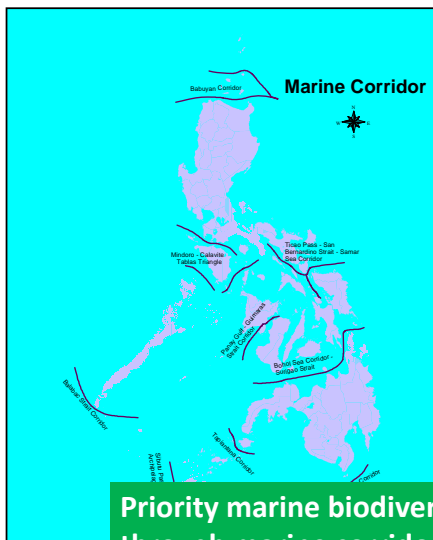
Sectoral networks of municipalities e.g. Lingayen Gulf

FISH-BE model
MPA network version
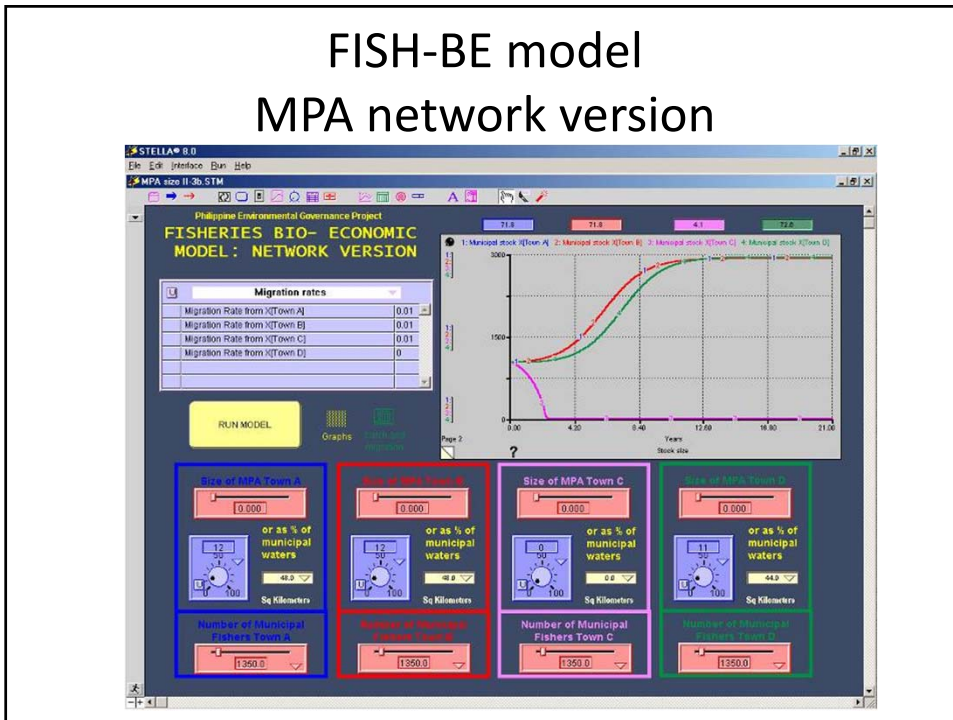
Catch increases in MPA networks

	Panmictic migration rate					
MPA Size	0%	1%	5%	10%	20%	40%
0%	-	-	-	-	-	-
1%	0%	0%	0%	7%	13%	33%
5%	0%	1%	3%	5%	12%	35%
10%	0%	1%	3%	5%	12%	34%
20%	0%	0%	0%	0%	0%	0%
40%	0%	0%	0%	0%	0%	0%

The conservation role of MPA mean their context must be considered

Marine Corridor

Marine Integrated

Priority marine biodiversity conservation areas through marine corridors and a network of MPAs

PM Alino

Feedback and partnerships forums

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The Philippine Environmental Governance 2 Project

- SoCTR and Provincial and /or Inter-LGU Summits
- Reviewing goals and objectives
  - Governance, ecological and social-economic concerns
- Utilize focus areas and/or management concerns
- Forging partnerships
  - Thru unifying goals and objectives
  - Common and joint actions
  - Highlighting convergence and synergies
- Continuing learning and practice and knowledge based communities

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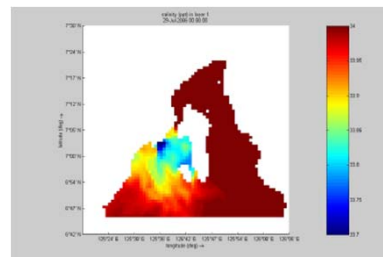
STATE OF THE CORAL TRIANGLE REPORT OUTLINE

Coral reef watch

- **BIOPHYSICAL CHARACTERISTICS**
- **CURRENT STATUS OF MARINE RESOURCE ECONOMIES**
- **THREATS AND VULNERABILITIES**
- **Current issues for Marine Resources Use**
- **POA INITIATIVES AND FUTURE PLANS**
- **Management issues – M&E Baseline with indicators**
- **Other Management Issues**
- **KNOWLEDGE MANAGEMENT SYSTEMS**

STATE OF COASTS 2010

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Integrated Coastal Enhancement:
Coastal Research, Evaluation and Adaptive Management for Climate Change Program
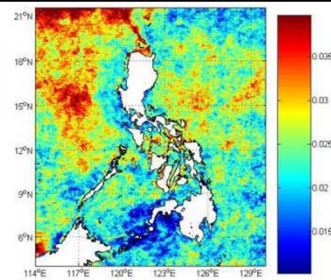
Sample Benefits Derived from Inter-LGU Collaboration
(Cost for CLE operations per square kilometer of municipal waters)

Fish Biomass

LGU 1	LGU 2	LGU 3	LGU 4	LGU 5
PhP 528.60	PhP 2,217.68	PhP 879.18	PhP 12,780.53	PhP

Individual LGUs enforcing their respective municipal w...
(effective enforcement up to 5 kilometers)
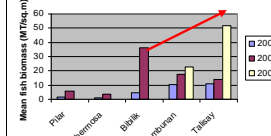
LGU 1	LGU 2	LGU 3	LGU 4	LGU 5
PhP 467.64	PhP 1,095.14	PhP 418.84	PhP 6,744.44	PhP 242.21

Inter-LGU Coastal Resource Management with joint enforcement
(effective enforcement up to 10 kilometers)
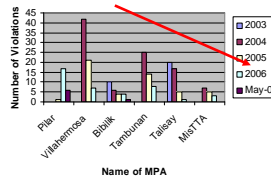
USAID FROM THE AMERICAN PEOPLE   **The Philippine Environmental Governance 2 Project**   35

The ICRI, MSN and CTI

Partnerships in Adopting Adaptation Strategies
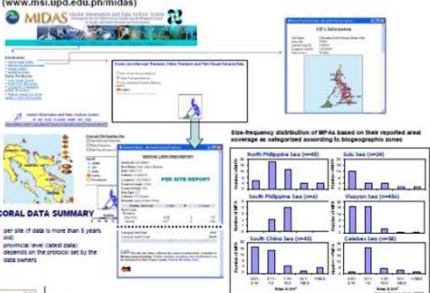
- •Expanding partnerships by adopting adaptive communities
- • MPA networks establishing climate resiliency
- • State of the Coasts Reports (SoCR) feedback and learning to be prepared
- • Responding with a climate sea change prepared mind
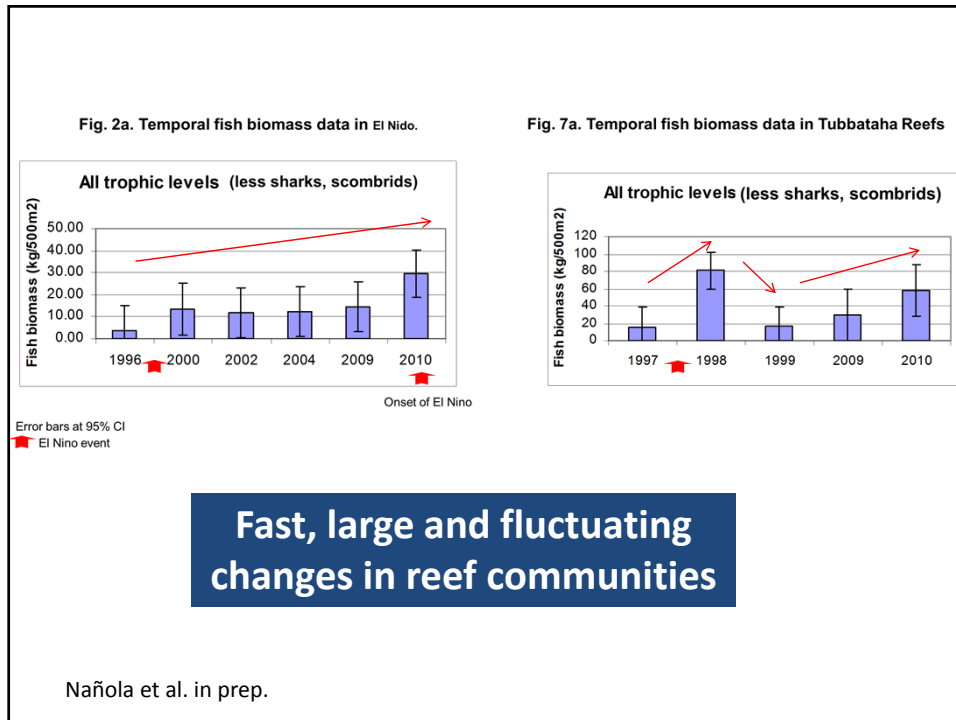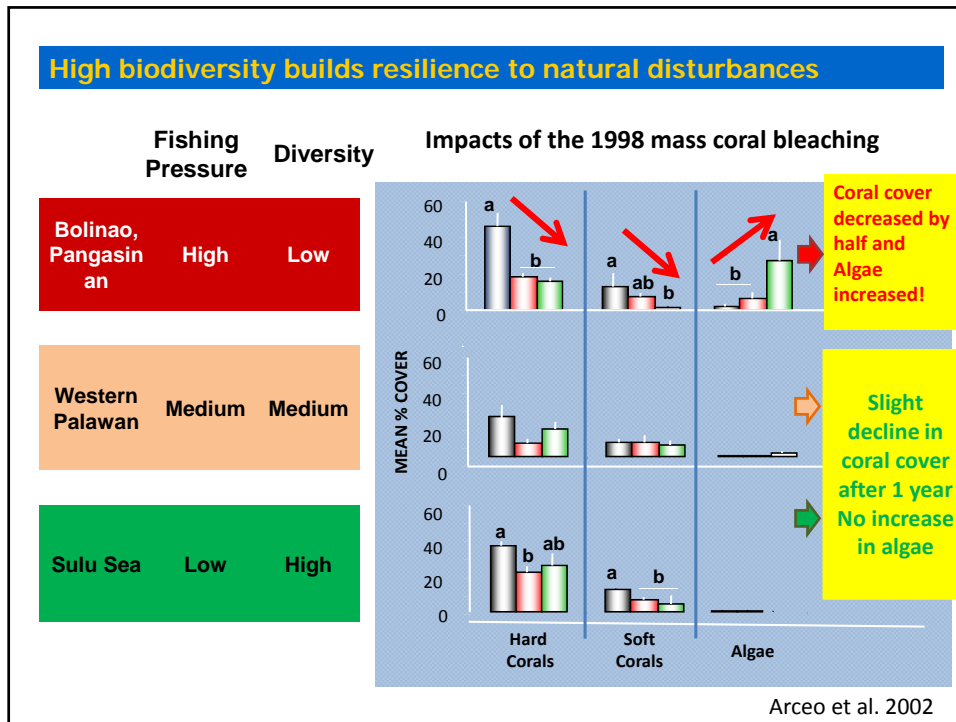
TLC night : The Linking of Champions

Global fish production and climate change

K. M. Brander*

International Council for the Exploration of the Sea, 44–46 Hans Christian Andersens Boulevard, DK-1553 Copenhagen V, Denmark

Edited by William Easterling, Pennsylvania State University, University Park, PA, and accepted by the Editorial Board September 26, 2007 (received for review March 6, 2007)

The **frequency and intensity of extreme climate events** is likely to have a major impact on future fisheries production in both inland and marine systems. **Reducing fishing mortality** in the majority of fisheries, which are currently fully exploited or overexploited, is the principal feasible means of reducing the impacts of climate change.
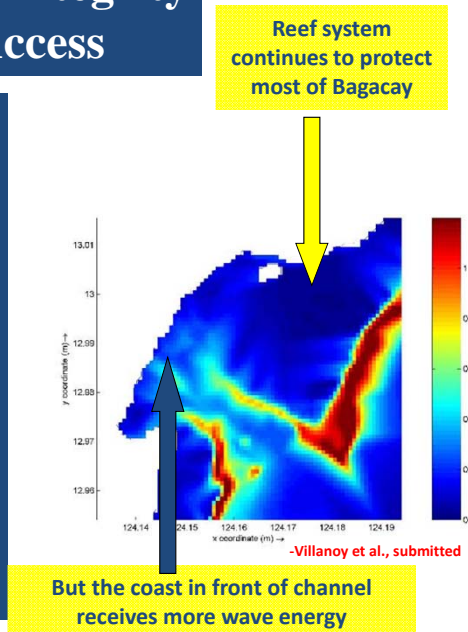
From Anchovies to Sardines and Back: Multidecadal Change in the Pacific Ocean

Francisco P. Chavez,* John Ryan,* Salvador E. Lluch-Cota,* Miguel Ñiquen C.*

SCIENCE VOL 299 10 JANUARY 2003

A Sardine Regime
B Anchovy Regime

213 - 221

High biodiversity builds resilience to natural disturbances

Impacts of the 1998 mass coral bleaching

Arceo et al. 2002

Fig. 2a. Temporal fish biomass data in El Nido.

Fig. 7a. Temporal fish biomass data in Tubbataha Reefs

Fast, large and fluctuating changes in reef communities

Nañola et al. in prep.

Maintaining Coastal Integrity And Equitable Access

- **R**estoring coastal protection
- **E**ffective erosion buffers
- **S**ustaining coastal integrity
- **T**hresholds maintained within acceptable limits vis-a-vis coastal erosion, sedimentation and thermal anomalies
- **O**rganizing coastwatch
- **R**educing threats and sharing costs
- **E**nhancing equitable access
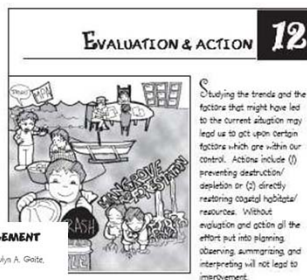- **D**isaster risk reduction

Reef system continues to protect most of Bagacay

-Villanoy et al., submitted

But the coast in front of channel receives more wave energy

Restoring Resiliency thru Learning Communities

ICE CREAM
COASTAL CLIMATE RESEARCH AND ADAPTATION PARTNERSHIP

- **R**epresentative, replicated, resilient reserves
- **E**nhancing management effectiveness
- **S**ustaining healthy ecosystems
- **T**hreat reduction in coastal ecosystems
- **O**rganizing knowledge based communities
- **R**eplenishing MPA networks
- **E**nhancing connectedness
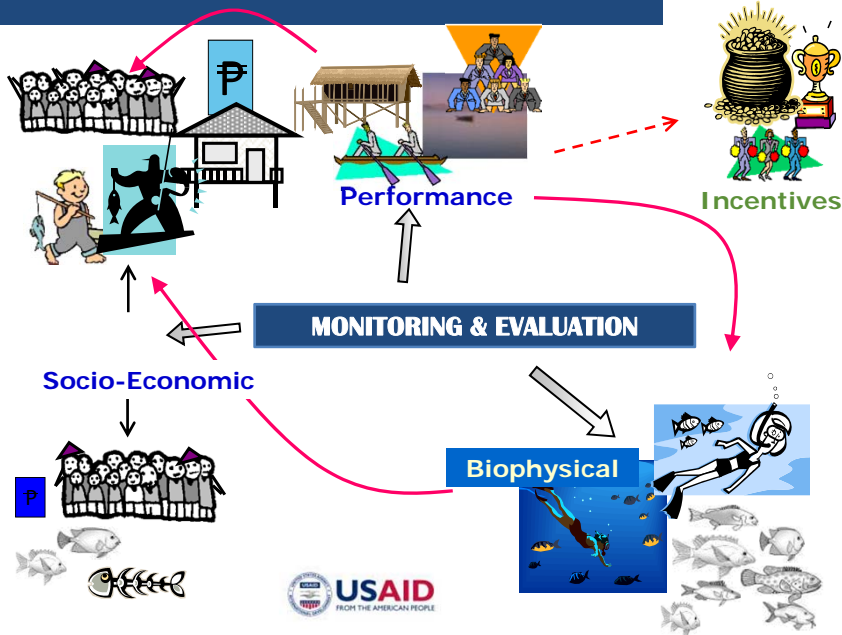- **D**oing good governance

21

Implementing actions

- Investing on ICM governance
- Enforcement and IEC
- Monitoring and Evaluation
- Sharing forums and updates
- Governance adjustments (Policy and institutional mechanisms)
- Capacity development and resilience building

Monitoring & Evaluating Objectives

Performance

Incentives

MONITORING & EVALUATION

Socio-Economic

Biophysical

Knowledge management convergence persons

Table 26. Some example inputs for the Municipal Coastal Database.

Governance and equitability of costs and benefits for adaptation

- **Inter-hierarchical synergy and transformability**
- **Development trajectories should consider the equity and sustainable use of stakeholders**
- **Clarifying access and property rights**
- **Diversifying opportunities through capacity building**

Nature does not dictate that poor people, or women, should be the first to die. Cyclones do not hand-pick their victims. Yet, history consistently shows that vulnerable groups end up suffering from such events disproportionately …. In the 1991 Bangladesh cyclone, for example, four times more women died than men …. Disasters are therefore an issue of unsustainable and unequal development at all levels ….

Insight
Resilience Thinking: Integrating Resilience, Adaptability and Transformability

Social – Ecological – Systems (SES)
Folke et al. 2010

Next Steps and Suggestions

- **ICM as opportunity to integrating good environmental governance**
- **MPA and MPA networks are good entries towards an EAFM**
- **DSS tools and knowledge based communities are helpful in paving the way towards synergy and environmental governance and sustainable development**

Thank You
TO ALL OUR PARTNERS

- DOST-PCAMRD &ICE CREAM Program Partners
- DOST-PAGASA, Manila Observatory & NAMRIA
- MPA Support Network, CRTR
- Dave & Lucille Packard Foundation
- GTZ, USAID
- Coral Triangle Initiative – Partners & NCC DENR, DA-BFAR