Oceanography Research Needs and Priorities

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Ministry of Science, Technology and Innovation

Workshop on " Climate Change & Biodiversity: Mobilizing the Research Agenda"
13-14 December 2010, Senate Room, Chancellory Building, UKM, Bangi

PRESENTATION OUTLINE

- INTRODUCTION: NOD
- Limitations in knowledge on Climate Change, Biodiversity, Ocean around us , Stressors and Threats to Marine Ecosystem
- LARGE MARINE ECOSYSTEM APPROACH: Terrestrial species, communities and marine, estuarine, coastal and islands ecosystems
- RESEARCH COLLABORATION and Global, Regional and National Network: R & D, Capacity Building and Technology Transfer; Observations and Assessments: Invasive species, communication, climate variability and modeling
- SCIENCE AND MANAGEMENT-based questions; Data and information management, National Ocean Data Centre
- Fields in OCEANOGRAPHY, RESEARCH NEEDS AND PRIORITIES
- FUNDING , HUMAN RESOURCE AND INSTITUTIONAL SUPPORT
- POLICY AND GOVERNANCE: Linking National Policy on Climate Change, National Policy on Biodiversity, National Ocean Policy: Entry point for ETP

NOD'S VISION AND MISSION

VISION

Stewardship of oceanography and marine science through research and development, commercialization, competent human capital development towards sustainable marine resource management in accordance with the national aspiration.

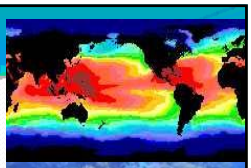
MISSION

To spearhead and harness the national excellence through innovations in oceanography and marine sciences



National Oceanography Directorate (NOD)

- NOD acts as the National focal point for strategic planning and setting direction and coordination for R & D, technology development, innovations and commercialization in the field of oceanography;
- Promotes sharing and exchange of ideas and knowledge;
- Enhance capacity building, leveraging on activities of R & D output from Centers of Excellence (COEs) at the Universities and Research Institutions via funding for research facilities and training of RSEs; and
- Enhance effort in networking, strategic partnerships for collaborative research at the national, regional and international level.




The Seas around us; Malaysia as Maritime Nation

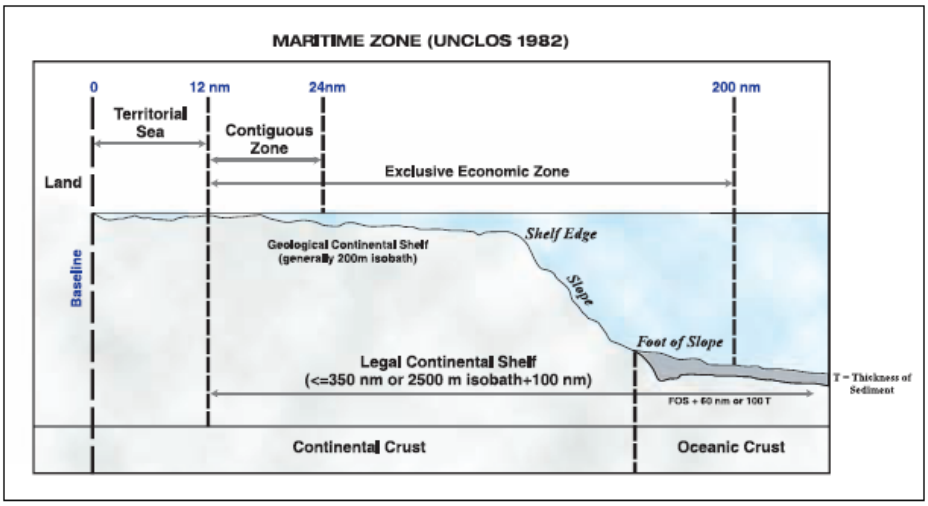


Figure 1.1: Maritime Zones According to the 1982 United Nations Convention on the Law of the Sea

Table 1.1: Malaysia's Sea Areas

Maritime Zone	Size (km^2)
Internal Waters	97,307
Territorial Sea	63,666
Exclusive Economic Zone	453,186
Total sea area	614,159
Continental Shelf	476,762

Source: Department of Survey and Mapping

IOC High Level Objectives

- Prevention and reduction of the impacts of ***Natural hazards***
- Mitigation of the impacts and adaptation to ***climate change and variability***
- Safeguarding the ***health of ocean ecosystems***
- ***Management procedures and policies*** leading to the sustainability of coastal and ocean environment and resources

NOD/MOSTI-Focal Point: Malaysia has been elected in the IOC Executive Council 2009-2011, Vice Chair for IOC/WESTPAC

IOC Areas of Activities

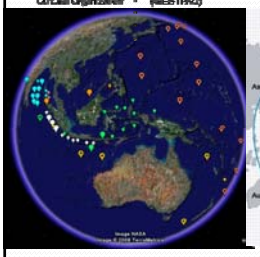
Ocean Observations and Service

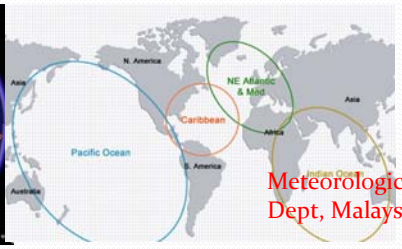
Ocean Science

Disaster Warning and Mitigation

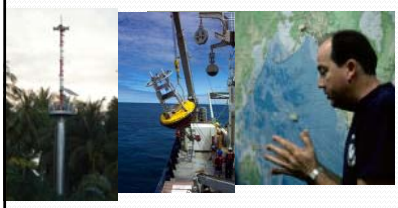
Capacity Development

Disaster Warning and Mitigation





Meteorological Dept, Malaysia



Four Intergovernmental coordination groups

- the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)
- the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS)
- the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS)
- the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE)

Climate Change: Biodiversity and Conservation of marine ecosystem

Maintaining the integrity of ocean ecosystems and managing their use in the face of rapid and inevitable global change is one of the greatest challenges of this century.

Changes in temperature, sea level, and ocean chemistry will have enormous implications for marine biodiversity and ecosystem function, and for human exploitation of marine resources, human migration, and national security.

- Global warming –Rising Sea-Surface Temperature (SST)
- Sea Level Rise (SLR)
- Marine ecosystem health
- Ocean Acidification
- Harmful algal bloom (HAB)/Invasive species

The state of marine environment and ecosystem health

Strategies

UNEP's 5-module strategy for measuring the changing states of the ecosystem and for taking remedial actions towards recovery and sustainability of degraded resources and environments :

1. Productivity
2. Fish and fisheries
3. Pollution and ecosystem health
4. Socio-economy
5. Governance.

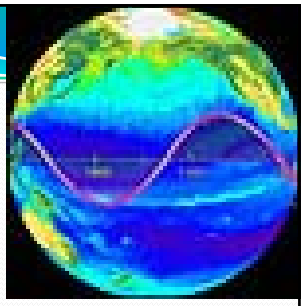
Three common elements:

1. Conserving biodiversity
2. Biodiversity conservation should not impede livelihoods
3. Equitable distribution of value from trade in marine commodities

Understanding Climate Change – Ocean component

- Measure
- Manage
- Monitor

- Physical Oceanography-Operational oceanography infrastructure to monitor and predict the evolution of marine ecosystem
- Chemical, Biological ,Geological
- Bio-geographic, Geo-political, Policy and Governance
- Marine industry

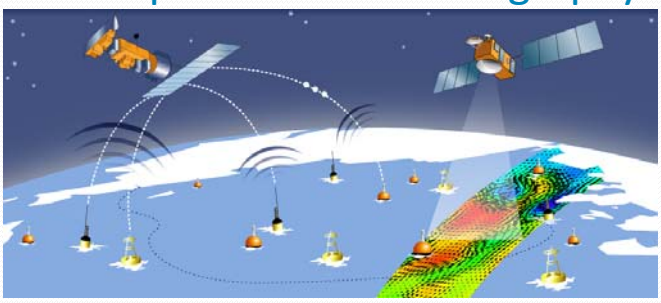


Ocean Cycles and Climate Change

Large scale physical and biological cycle

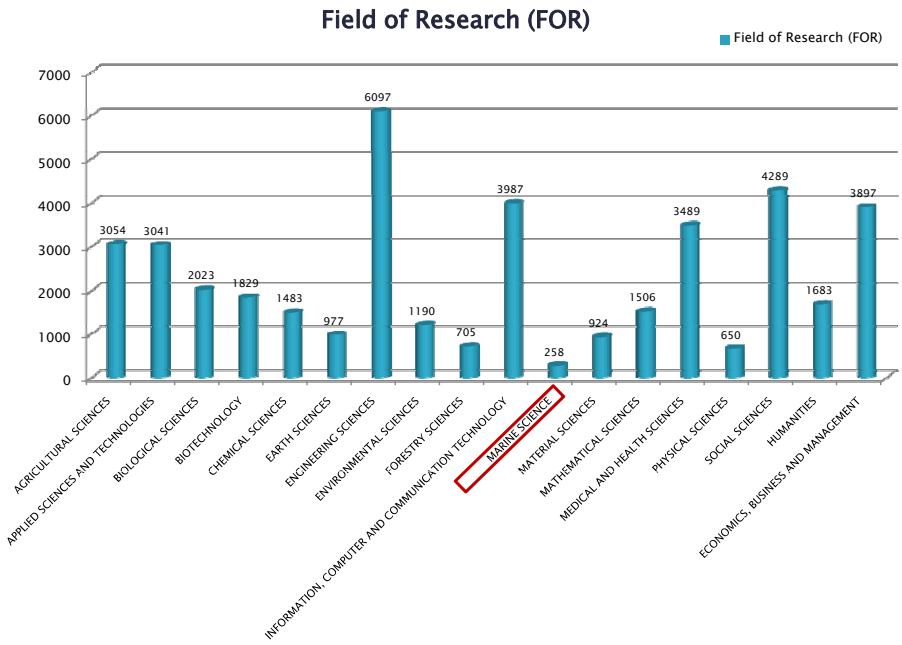
3 Ms: Measure, Monitor and Manage

Operational Oceanography

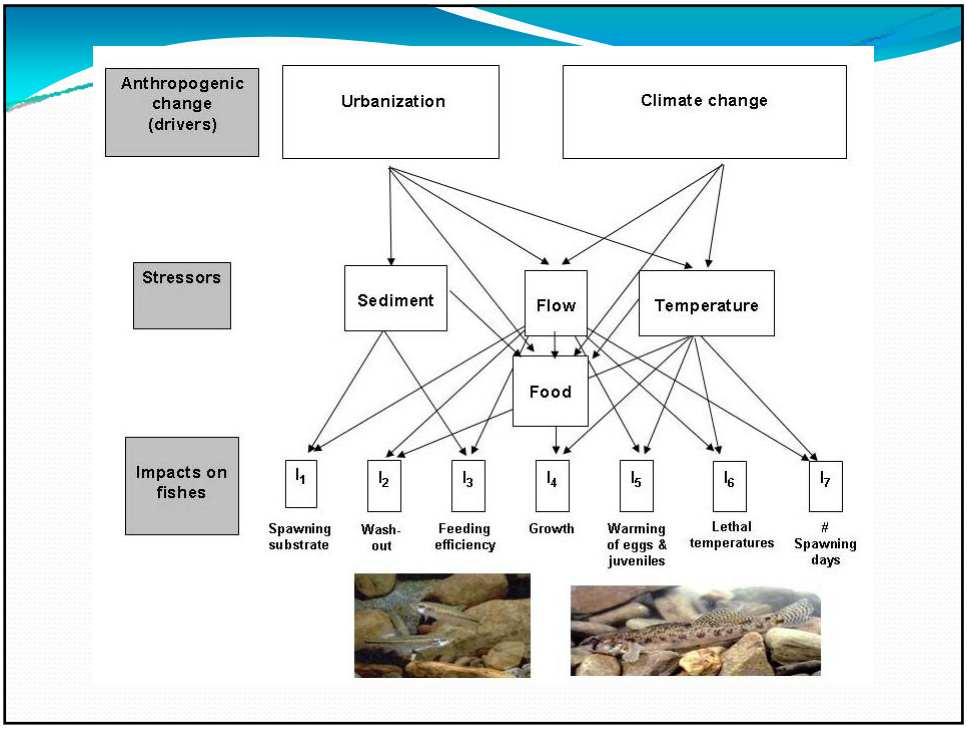


The main goal of operational oceanography is to establish infrastructures and services ready to support at institutional level for;

- The development of sustainable fisheries
- The protection of marine biodiversity
- The guarantee of food security for the region's inhabitants
- The monitoring of the climate change



How do we sustain marine biodiversity and Economic Benefits from the Oceans?



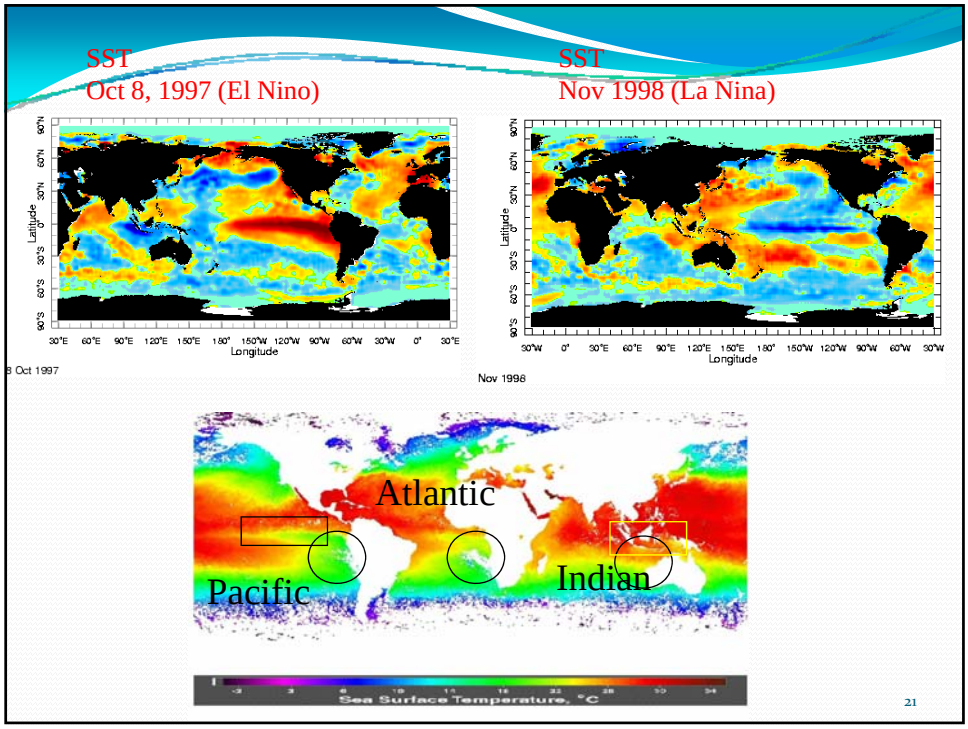
ECOSYSTEM MANAGEMENT: A PARADIGM SHIFT

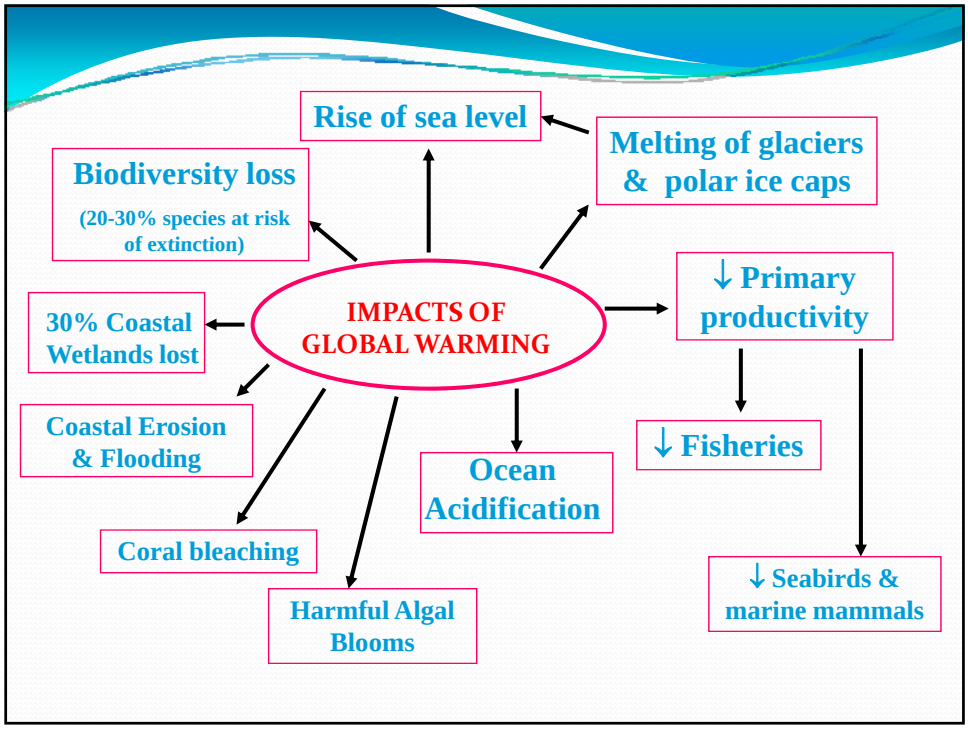
FROM	TO
Individual species	Ecosystems
Small spatial scale	Multiple scales
Short-term perspective	Long-term perspective
Humans: independent of ecosystems	Humans: integral part of ecosystems
Management divorced from research	Adaptive management
Managing commodities	Sustaining production potential for goods and services

NOTE: Some of the substantive changes between traditional resource management and ecosystem management.

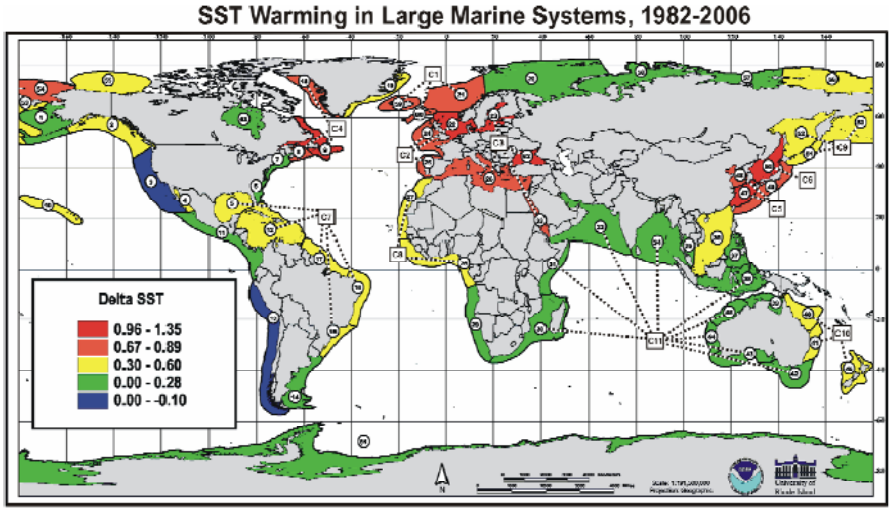
Global drivers

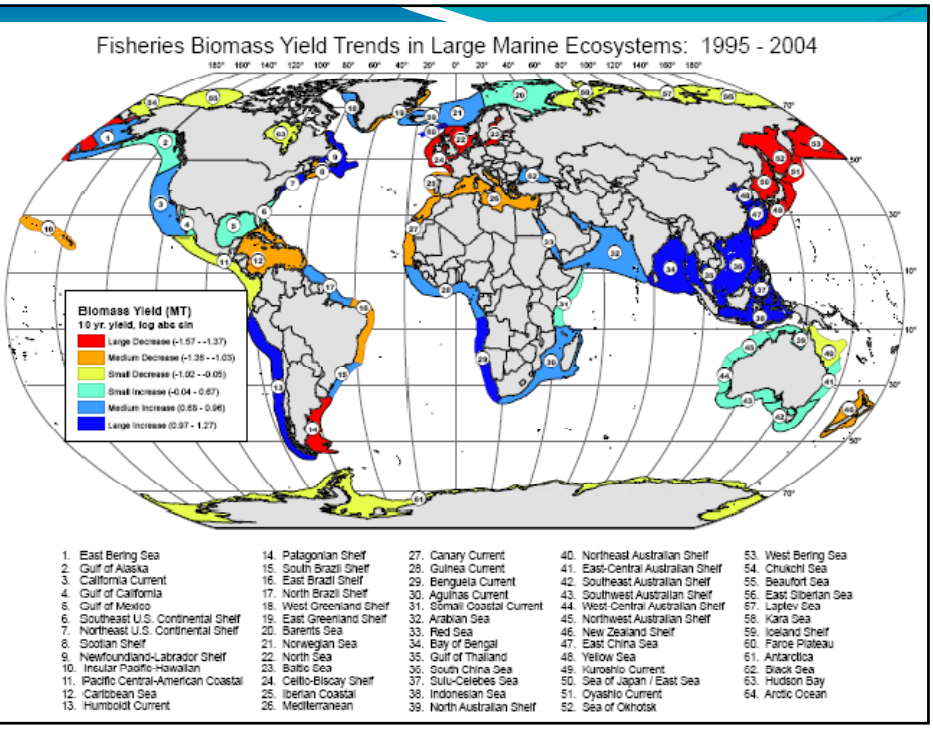
- - Understand the interdependence between climatic phenomena such as the ENSO and global warming and their individual as well as combined impacts on marine ecosystems.
- - Quantify the effects of ocean acidification in relation to future scenarios of anthropogenic CO_2 emissions and ocean warming
- - Develop models to map the results of small-scale studies to larger spatial and temporal scales (especially needed to predict the outcomes of management decisions such as the designs of MPAs)
- - Widen spatial and temporal scales of monitoring programmes to better link known biodiversity dynamics with global-scale studies of atmospheric and oceanic processes
- - Develop reliable global climate models stemming from various social and economic scenarios as well as numerical models of ecosystems that could be coupled to these climate models

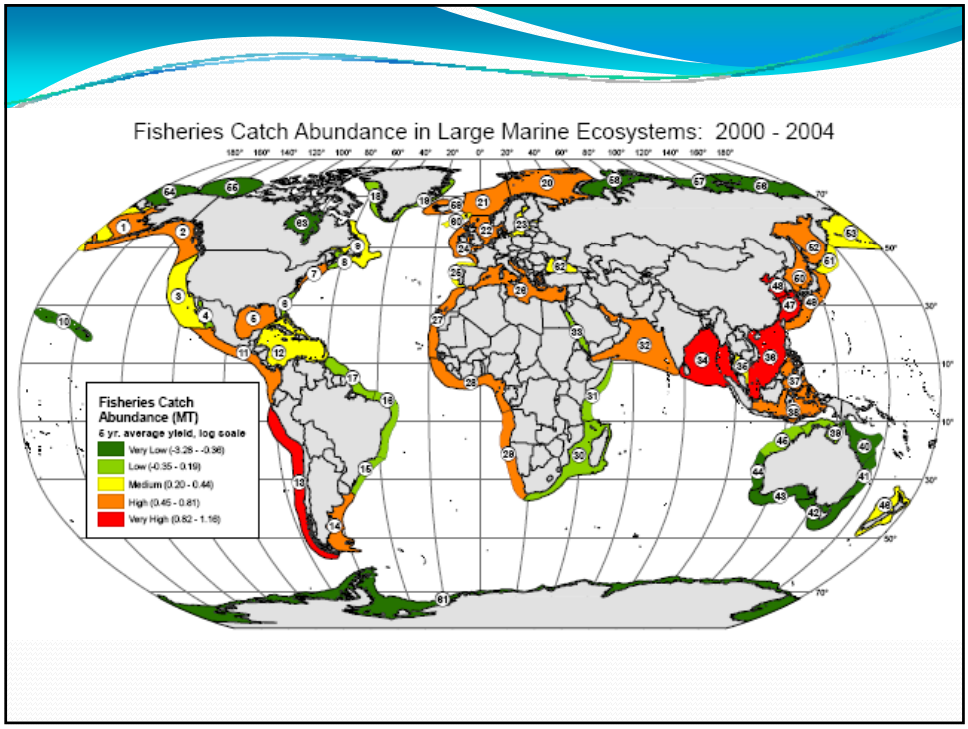

SST
Oct 8, 1997 (El Nino)
SST
Nov 1998 (La Nina)
Latitude
Longitude
8 Oct 1997
Nov 1998
Atlantic
Pacific
Indian
Sea Surface Temperature, °C
21


Rise of sea level
Melting of glaciers & polar ice caps
Biodiversity loss
(20-30% species at risk of extinction)
IMPACTS OF GLOBAL WARMING
↓ Primary productivity
30% Coastal Wetlands lost
Coastal Erosion & Flooding
↓ Fisheries
Ocean Acidification
Coral bleaching
↓ Seabirds & marine mammals
Harmful Algal Blooms

Warming Clusters of LMEs in Relation to SSTs, 1982-2006






Fisheries Catch Abundance in Large Marine Ecosystems: 2000 - 2004
Fisheries Catch Abundance (MT)
6 yr. average yield, log scale
Very Low (-3.28 - -0.36)
Low (-0.35 - 0.19)
Medium (0.20 - 0.44)
High (0.45 - 0.81)
Very High (0.82 - 1.16)


Fish…
• Temperature increases → shift many species polewards where the climate is cooler & hence metabolic rates could be kept low.
• Warm water species may increase in abundance with more favourable conditions at lower altitudes
→ significant impact on commercial species
Photo by Affendi Yang Amri

The dugong…..

a marine species that is a key indicator of coastal health, is vanishing in 37 countries & territories (Cartegena, Columbia in Feb. 2002)

-climate change → storms & flash floods → destroys seagrass beds

(Environment News Service, Feb. 13, 2002)

Threats

- Overfishing creates growth of certain fish and organisms that can be damaging to the reef if they appear in great numbers

Threats

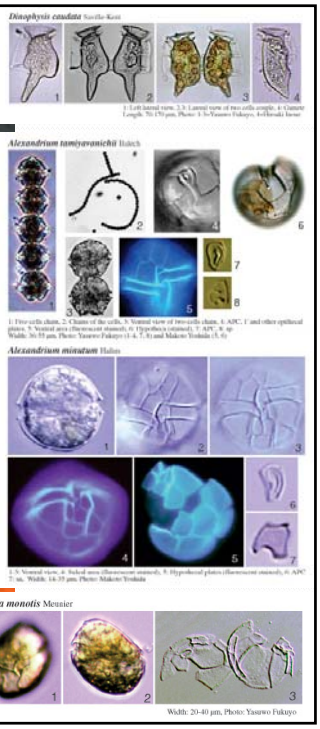
- Fish bombing and Cyanide Fishing

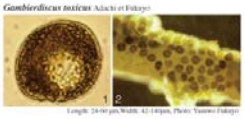

- Mass Tourism




Threats

Red tide, Harmful Algae Bloom

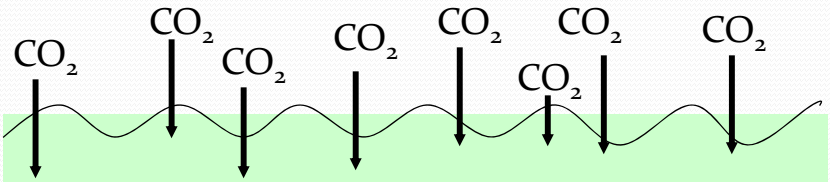





source: http://globallast.imo.org

OCEAN ACIDIFICATION

- The oceans are absorbing CO_2 from the atmosphere and this is causing chemical changes by making them more acidic



$CO_2 + H_2O \rightarrow H_2CO_3$

carbonic acid

$H_2CO_3 \rightarrow H^+ + HCO_3^-$ a bicarbonate ion

H^+ → pH decreases

Source: 'Ocean Acidification due to increasing atmospheric carbon dioxide' The Royal Society Policy Doc 12/05, p. vi & Annex 1

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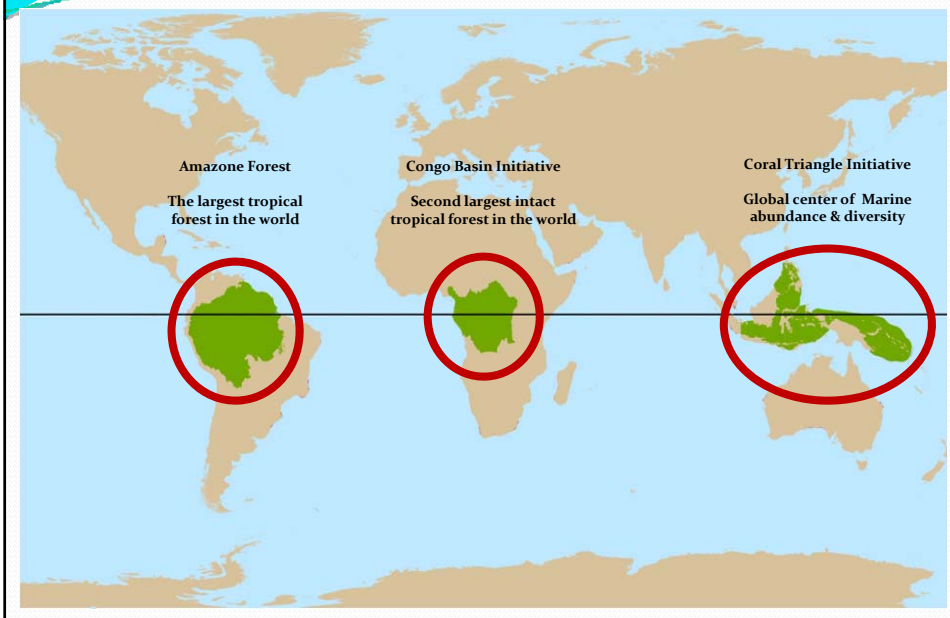
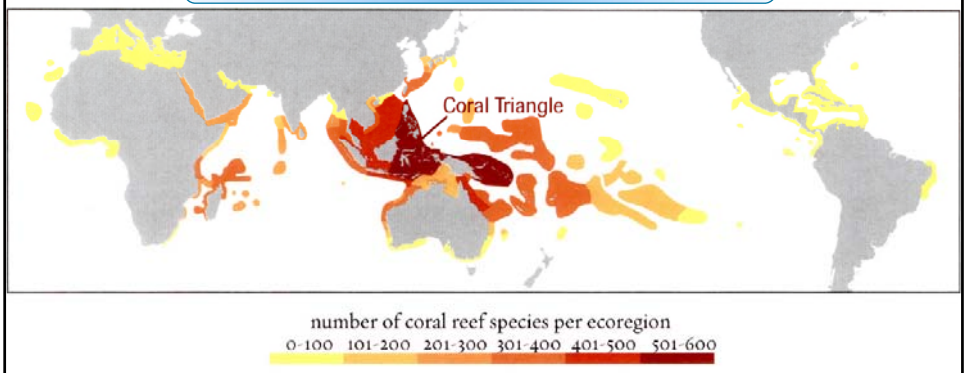
WORLD BIODIVERSITY CENTER



CORAL DIVERSITY OF THE WORLD

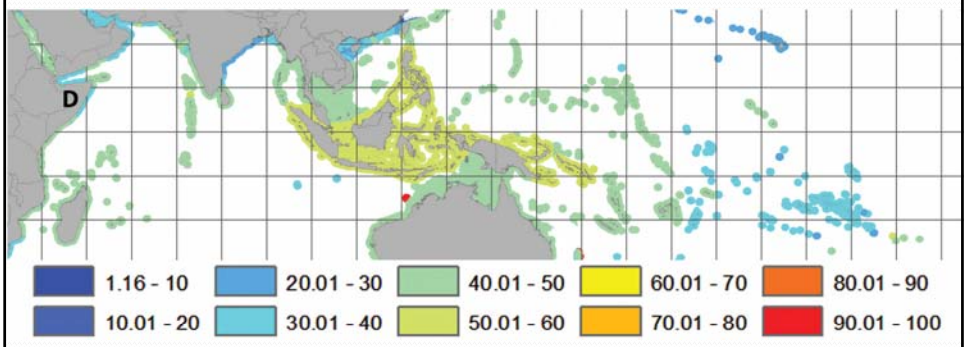


CTI Support Partners:

USAID, AUSAID, GEF, ADB, WWF, The Nature Conservancy, Conservation International, TNC

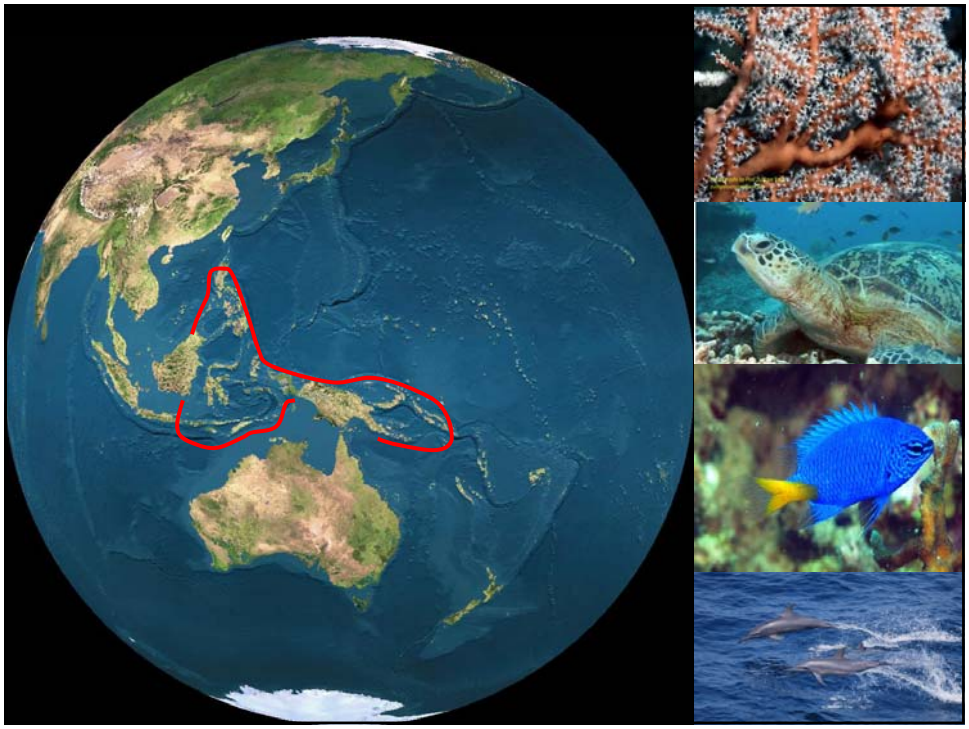
CTI: home to more than 75% of the world's known species of corals, exceeding 600 species, 35% of all known coral reef fish species-3,000 species of fish, largest tuna fishery spawning and juveniles growth area, large presence of six of the world's seven species of sea turtles, migrating sharks and manta rays, whales dolphins and coelacanths.

Status of reefs



Species in Threatened and Near Threatened categories as percent of total species in area

Carpenter et al 2008.



Why save the Coral Triangle?

- Ecosystem Resiliency
- Pharmaceuticals Potential?
- Livelihoods : 120 million people
- Habitats: $2.3 Billion /yr
- Tourism: $12 Billion / yr
- Live Reef Fish: $1 Bill / yr
- 50% of World Tuna stocks
- 60% of their protein from the sea

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Reef Biodiversity

- 450 species of scleractinian corals
- 2,500 species of mollusks
- 1,512 species of crustaceans
- 850 species of sponges
- 745 species of echinoderms
- 2,334 species of fish
- 30 species of marine mammals
- 38 species of reptiles

Source: Moosa (1999); Nontji (2003)

National Oceanography Directorate, MOSTI

Common Vision

Towards

- increasing observations for baseline information,

- ecosystem health checks and integrated management,

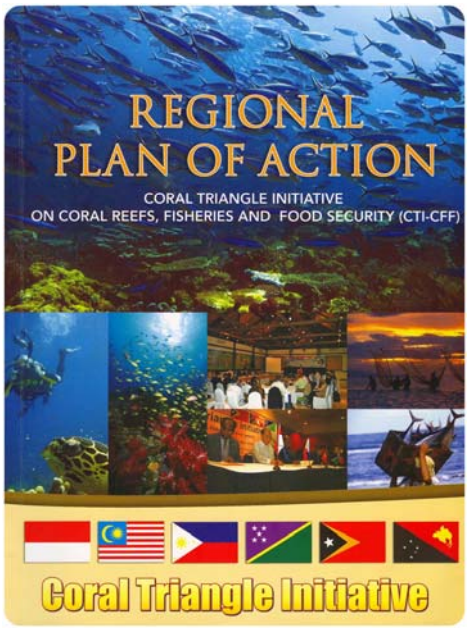
- based on ecosystem approaches of priorities and concerns related to the coastal and marine environment in the form of action plans,

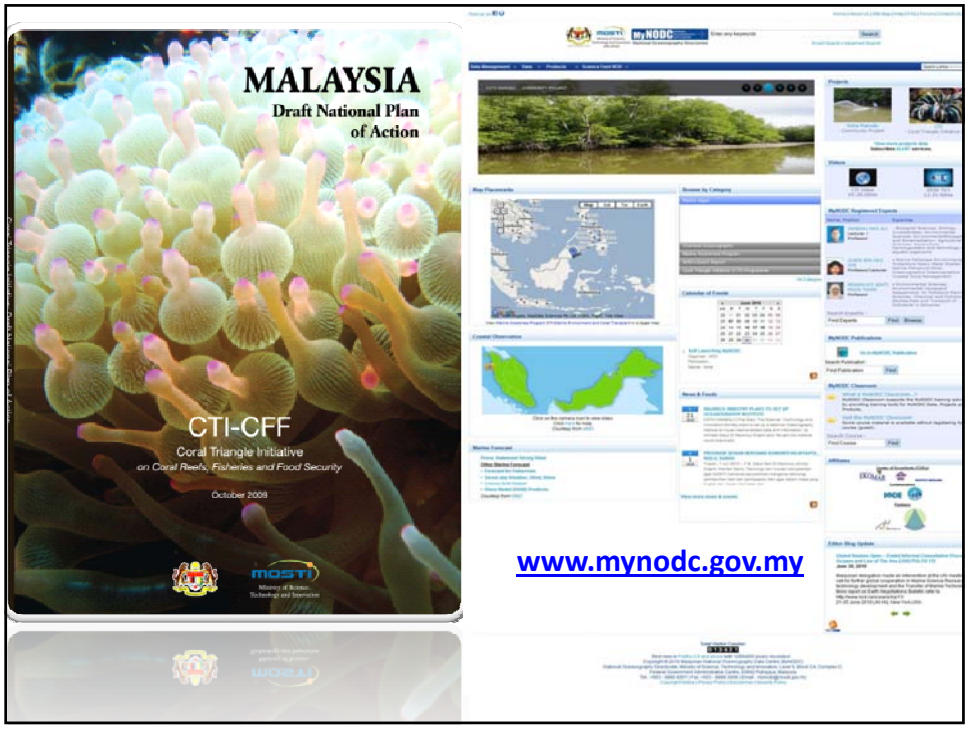
- introducing amongst others; proactive, creative and innovative partnerships or co-management for sustainable financing such as Payments for Ecosystem Services (PES),

- knowledge management and learning networks on models, tools and best practices via effective communication strategies.

"We, the leaders who are entrusted with the management of the world's most pristine coral reefs pledge to conserve the sustainability and productivity of biodiversity for generations to come".
This was the declaration made by the leaders of the six Coral Triangle Initiative (CTI) countries namely Indonesia, Malaysia, Philippines, Papua New Guinea, Timor Leste and Solomon Islands as they penned down their signatures to promise for the regional collaborative action in protecting the 6 million km² of Coral Triangle region;

- **Goal 1** – Priority Seascapes Designated and Effectively Managed
- **Goal 2** – Ecosystem Approach to Management of Fisheries (EAFM) and Other Marine Resources Fully Applied
- **Goal 3** – Marine Protected Areas (MPAs) Established and Effectively Managed
- **Goal 4** – Climate Change Adaptation Measures Achieved
- **Goal 5** – Threatened Species Status Improving

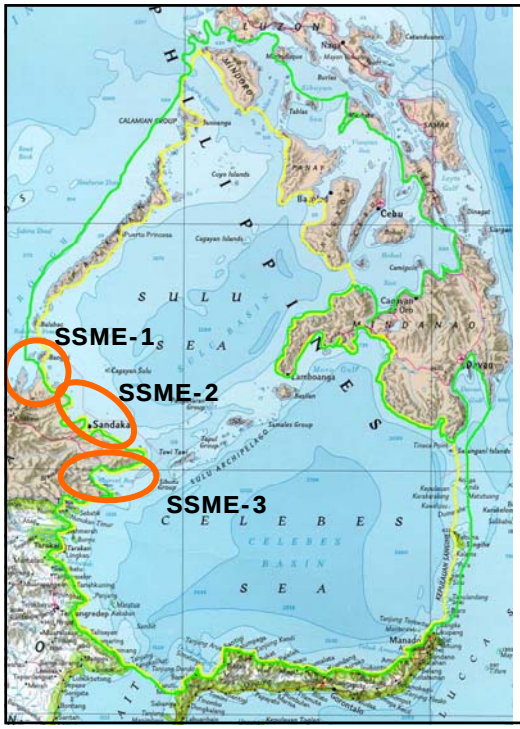




COUNTRY REPORT: MALAYSIA

NPOA Prioritisation List

Goals and Targets	List of Prioritised Actions
G1 T1	Jointly develop investment plans with seascape partners for all identified Priority Seascapes (including the existing SSME seascape)
G1 T2	Strengthen coordination amongst the Sabah Environment Education Network (SEEN) (comprising policy- makers, practitioners, planners, and trainers from government agencies, NGOs, and private sector) to undertake Environmental Education efforts in Sabah.
G2 T1	Establish a national policy on EAFM.
G2 T2	Undertake education and public awareness programs to foster better understanding among the general public of the multiple values of mangrove forests.
G2 T3	As a SSME initiative, share information on existing legislation and policies for the management of tuna and small pelagic.
G2 T4	Implement seasonal closure of spawning aggregation areas.
G3 T1	Establish and enforce additional marine sanctuaries (no-take zones).
G4 T1	Strengthen coordination amongst the Sabah Environment Education Network (SEEN) (comprising policy- makers, practitioners, planners, and trainers from government agencies, NGOs, and private sector) to undertake Environmental Education efforts in Sabah.
G5 T1	Identify cultural and economic uses of endangered species (both consumptive and non-consumptive), and assess the level and impact of traditional harvest, with particular attention to shark fins and turtle eggs.



MALAYSIAN PORTION OF THE SSME AREA

MALAYSIAN SSME
- Area: 29,000 km^2 – 5% SSME area (600,000 km^2)
- 3 sub zones

SSME-1: 7,500 km2 (26% SSME)
SC Balabac Straits,
South China Sea & Sulu Sea

SSME-2: 9,600 km2 (33% SSME)
TIPHA – Selingan Group of Islands, Sulu Sea

SSME-3: 11,800 km2 (41% SSME)
SC Sibutu Channel,
Sulawesi Sea

MALAYSIAN SSME – small in area but with significant fisheries role

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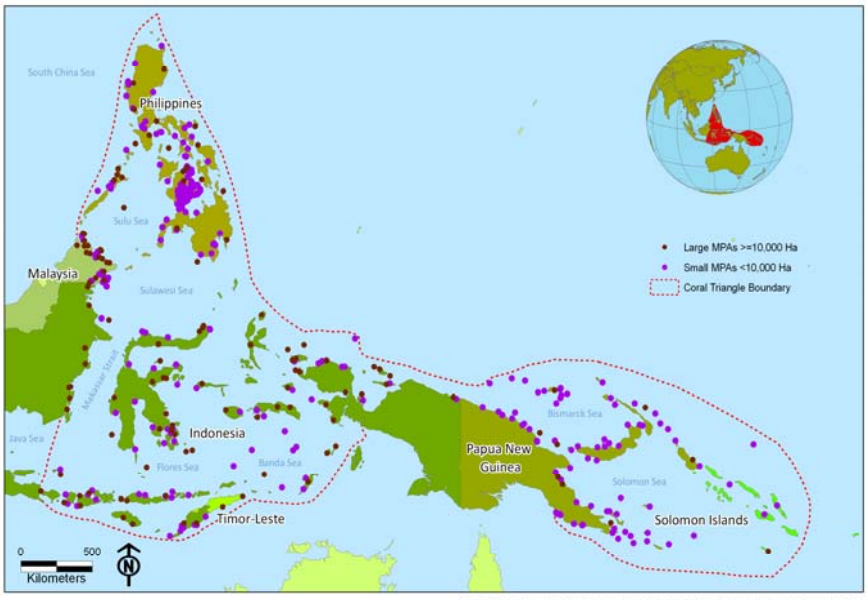
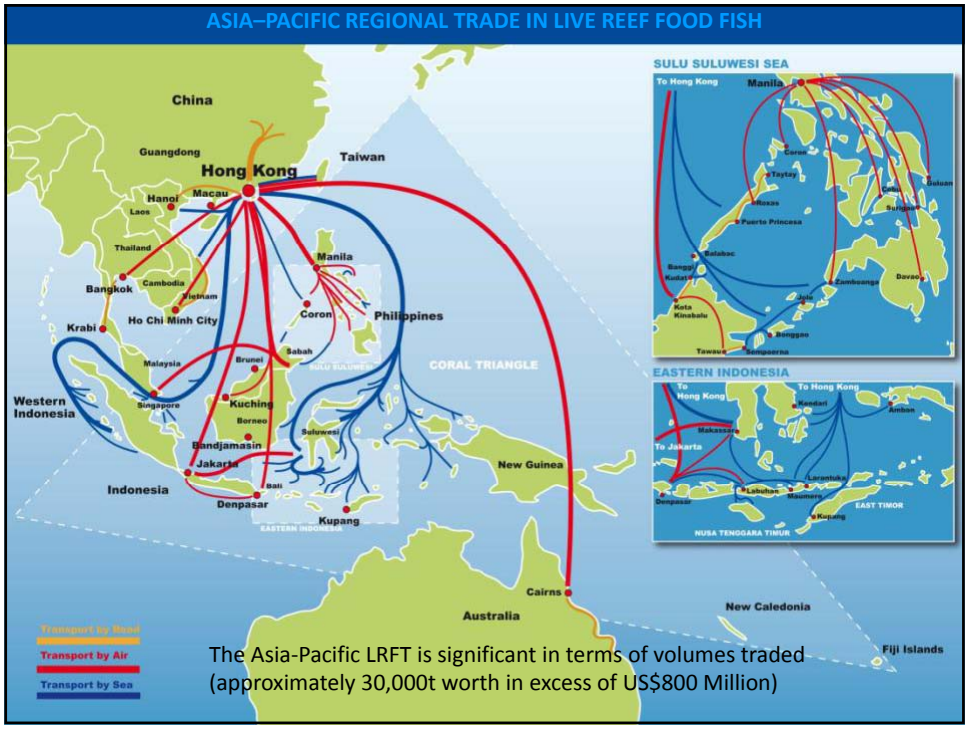
MPAs in the Coral Triangle (>1500)

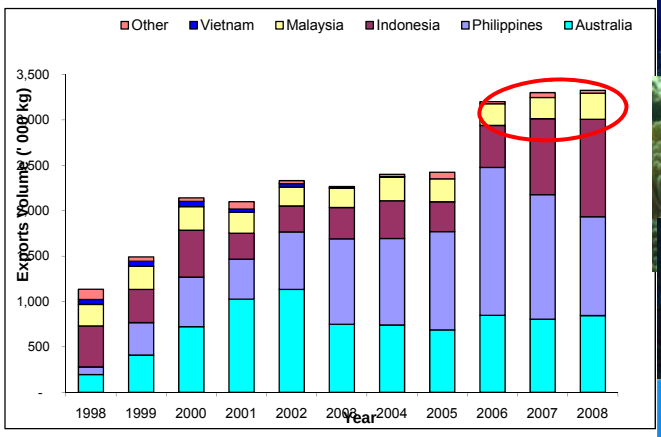


Coral Triangle boundary source: Coral Geographic (Veron et al unpublished data)
MPA source: WDPA v.2007



The Asia-Pacific LRFT is significant in terms of volumes traded (approximately 30,000t worth in excess of US$800 Million)

Coral Trout Exports 1998-2008



- Total exports from Malaysia rose 39% from 2002 – 2008

Business as Usual or Action?

- Illegal, Unreported and Unregulated (IUU)- Business as usual will bring
  - more fishery collapses
  - loss of livelihoods
  - devastated habitats
  - impoverished coastal communities

Priority Issues to Take Forward

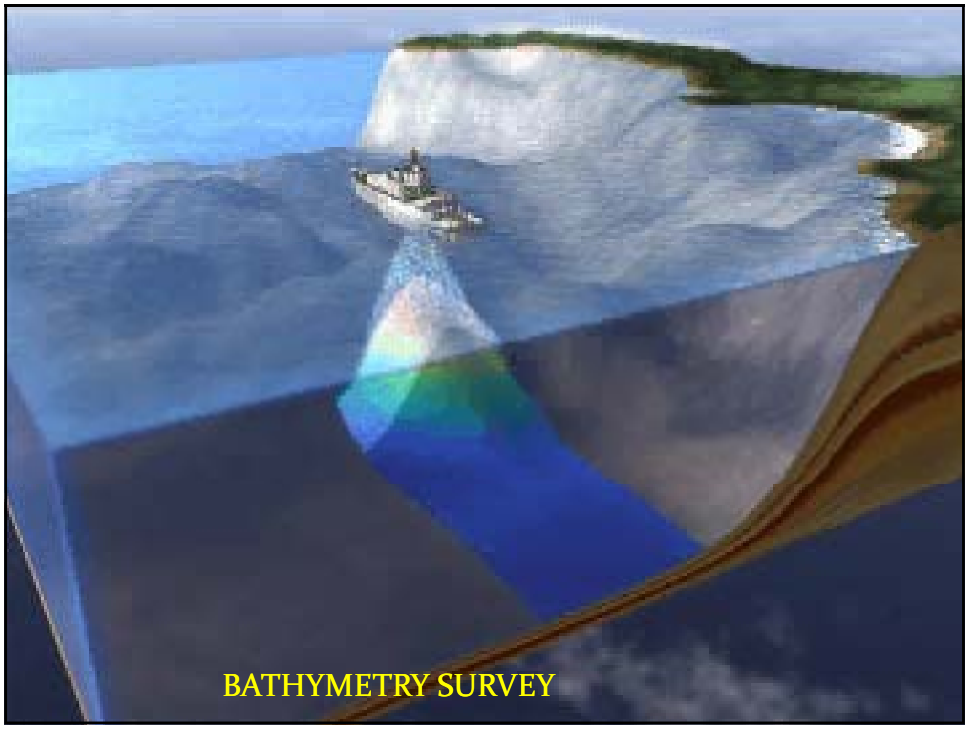
- Government to government collaboration including on:
  - Technology exchange
  - Regulatory enforcement
  - Information sharing
- Government facilitation with NGOs, private sector and research institutions
  - Education, training and extension and research
- Objective oriented data collection on ecology, production and marketing, socio-economic (e.g. reef productivity to inform quota)
  - Database and information storage platforms
- Enforcement against IUU activities
  - Management and enforcement policies are weak, VMS, permits

Priority Issues to Take Forward

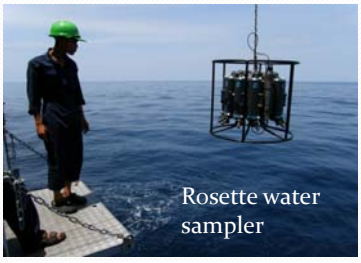
- Mitigate consequences of "displacement"
  - New related jobs, better value for lower volume of production
- Multi stakeholder alliance/round table/dialogue
  - Branding and furthering of good practices
  - Building membership constituencies

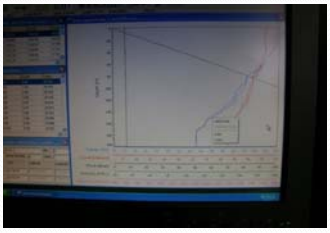
MOSTI

Ekspedisi Pelayaran Saintifik Perdana 2009 (EPSP '09)



Physical Oceanographic Studies





CTD data

Biological Oceanography Studies

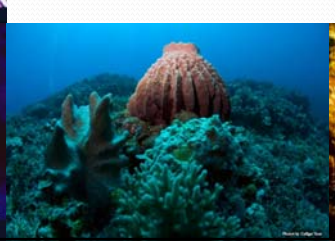

Bongo net


Nanoplankton sequential sieve


Macrobenthos sieving


Flourescent mushroom coral

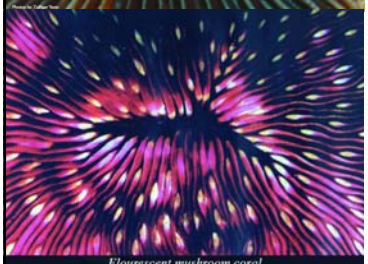

Flourescent sea anemone, Mabul



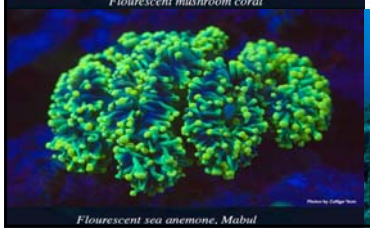
Biodiversity of corals, coral reef organisms, marine mammals

Researchers:

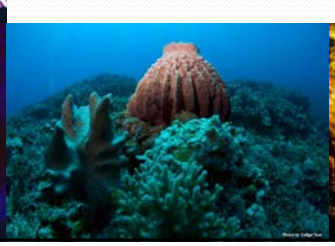
- Lead scientist: Prof. Zulfigar Yassin (USM)
- Assoc. Prof. Dr. Azhar Hussin (UM)
- Researchers: Dr. Louisa (UM)
- Assoc. Prof. Dr. Aileen Tan (USM)



Flourescent mushroom coral



Flourescent sea anemone, Mabul



Biodiversity of corals, coral reef organisms, marine mammals

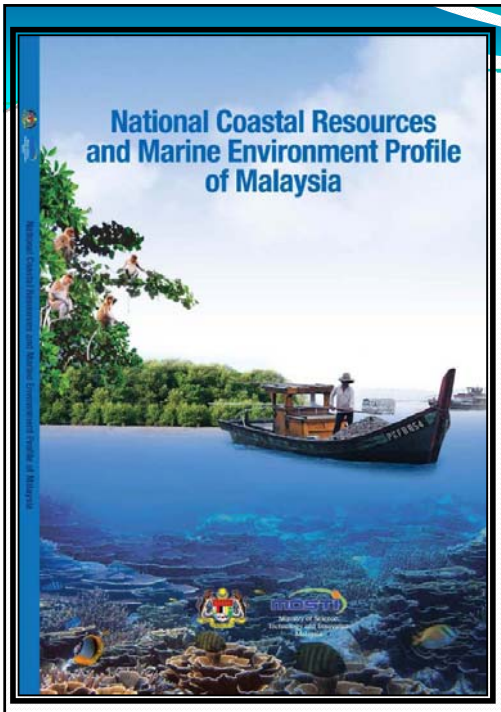
Researchers:

- Lead scientist: Prof. Zulfigar Yassin (USM)
- Assoc. Prof. Dr. Azhar Hussin (UM)
- Researchers: Dr. Louisa (UM)
- Assoc. Prof. Dr. Aileen Tan (USM)

RESEARCH FINDINGS

SOCIO-ECONOMIC STUDY

1. Resources are important for the communities economics but less important for the purpose of social activities (ritual, weather prediction, medicinal etc.)
2. Importance of coastal resources to the locals' livelihood known but they are less conscious of its importance to conservation
3. The degradation of resources is not a critical issue of concern to the community



The need for current and quality data:

1. Secondary data
2. Primary data colle cted during field observations and expeditions

MyNODC Architecture

MOSTI

Hybrid Data Centre Model:

- ✓ Autonomous management
- ✓ Heterogeneous business process
- ✓ Computing infrastructure capacity

Data Centre

PHN, ARSM, J MM,CoEs etc.

Data Custodian or Provider

Web services / XML

interface

NODC-ODT

MyNODC NATIONAL OCEANOGRAPHY DATA CENTRE

Data Sharing via MyNODC portal (http://www.mynodc.gov.my/)

NODC-DB

1. Physical Oceanography
2. Chemical Oceanography
3. Marine Contaminants/Pollution
4. Marine Biological/Fisheries
5. Marine Geology/Geophysics
6. Marine Meteorology

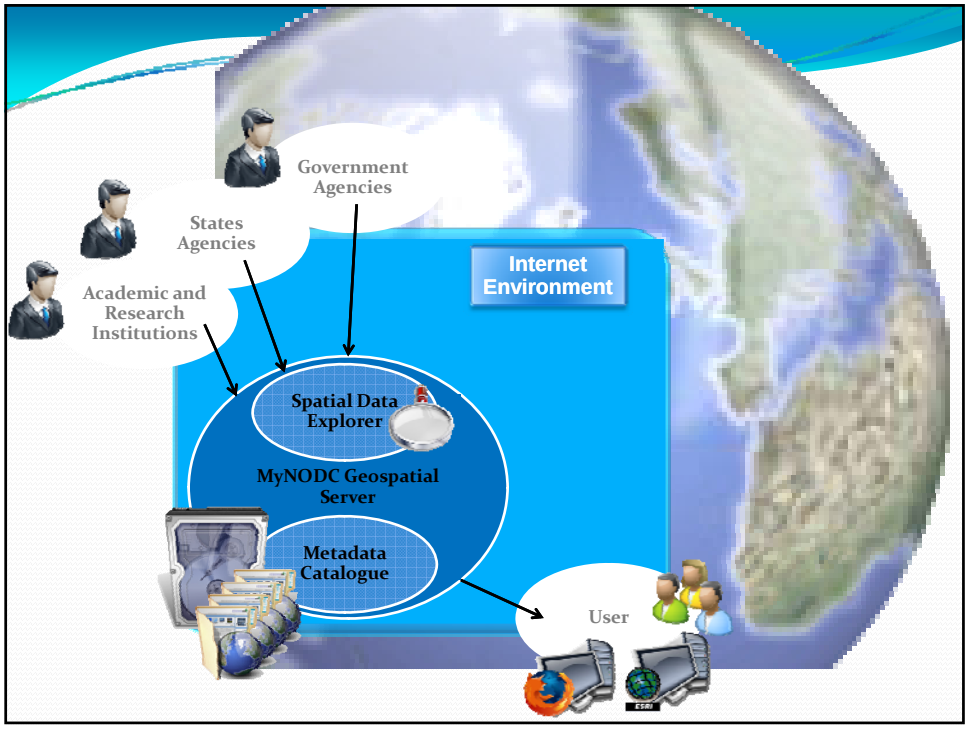
Government Agencies

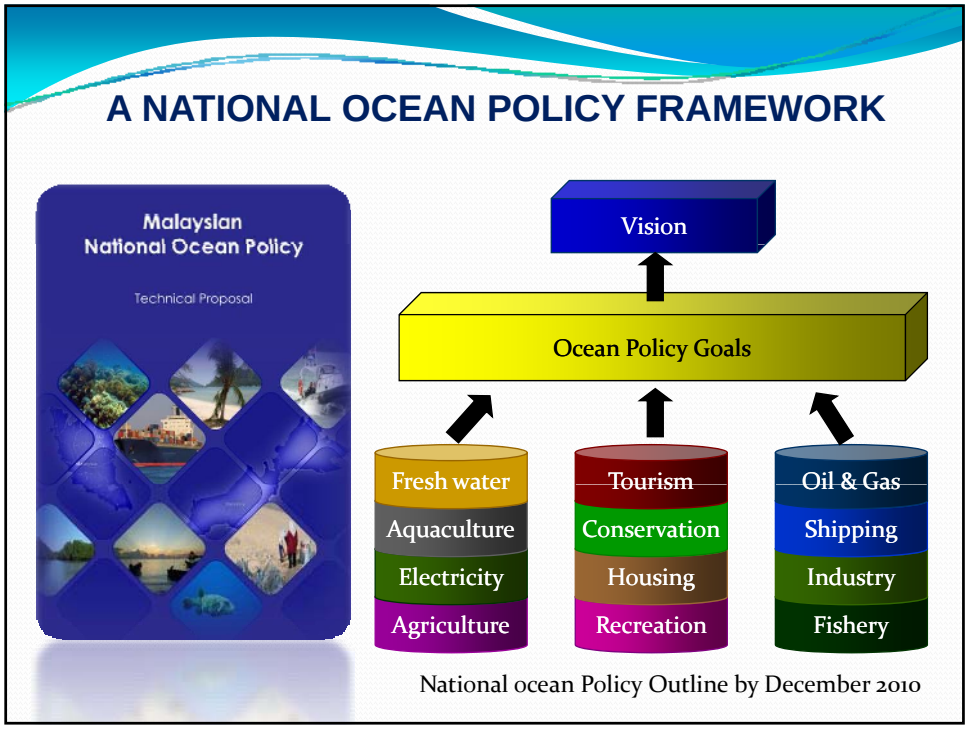
Academic & Research Institutions

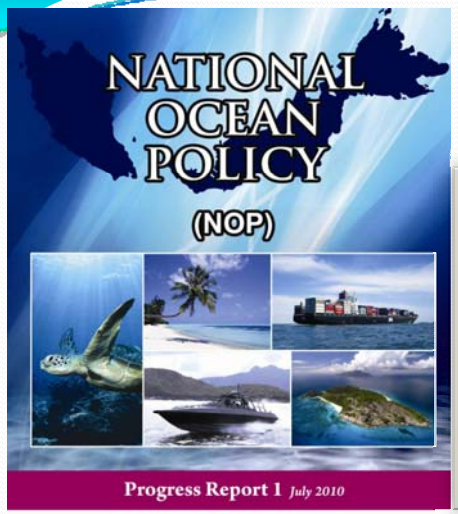
Private Sector

Public

MyNODC NATIONAL OCEANOGRAPHY DATA CENTRE


Government Agencies
States Agencies
Academic and Research Institutions
Internet Environment
Spatial Data Explorer
MyNODC Geospatial Server
Metadata Catalogue
User


A NATIONAL OCEAN POLICY FRAMEWORK
Malaysian National Ocean Policy
Technical Proposal
Vision
Ocean Policy Goals
Fresh water
Aquaculture
Electricity
Agriculture
Tourism
Conservation
Housing
Recreation
Oil & Gas
Shipping
Industry
Fishery
National ocean Policy Outline by December 2010

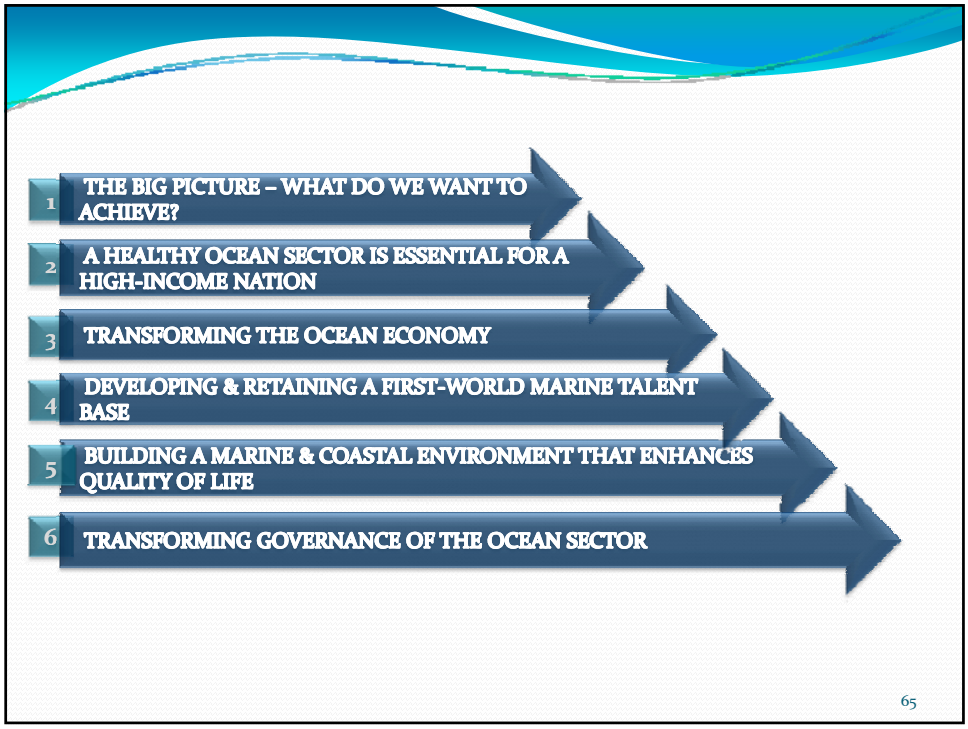


Development of National Ocean Policy

Government-National Governance
Co-Management Governance
Community Governance

VISION

A healthy and productive ocean, rich in biodiversity and heritage, wisely managed, safe and secure, and economically developed for the equitable benefit of all, now and in the future.



PROPOSED
NATIONAL GRAND CHALLENGES IN RMK10

- Synthesizing drivers and thematic issues for integrated research under Climate Change and Biodiversity Conservation involving Atmospheric, Land and Ocean Interactions, addressing impacts on both terrestrial and marine ecosystems

- **Establishing mechanisms for implementation of SCIENCE TO DECISION MAKING AND MANAGEMENT – action based on national priorities (NKEAs)**

  Need systematic data on status of marine ecosystems, including key indicators of pressures on environment and socio-economic sustainability, linking human activities (fishing-non-fishing) to change in ecosystem indicators

Requirement 1
Systematics and taxonomy

- - Revise taxa
- - Compile comprehensive catalogues of faunas and floras
- - Analyse the genetic and morphological diversity in multiple marine communities and combine these with the analysis of long-term data to assess global change phenomena

REQUIREMENT 2
Baselines, monitoring and indicator species

-Explore understudied marine geographical regions

- Determine baselines in order to better understand the impacts of ongoing and future changes

- Long-term monitoring of intra-specific genetic biodiversity and genetic expression to improve the knowledge base of studies on the impacts of global change and human activity

- Carry out quantitative monitoring to record the effects of acute and chronic disturbances to intertidal ecosystems

-Increase funding to long-term monitoring networks
(to derive 'evidence-based' policies)

REQUIREMENT 3

Mechanisms by which species respond to climate change

-Determine the thermal and pH tolerances of marine organisms

-Better understand sensitivities and adaptation capabilities of key species in the marine environment

-Determine the effects of climate on recruitment pathways and phenology of coastal habitat biodiversity

-Understand the mechanisms by which a warming climate affects marine organisms

-Understand the mechanisms by which ocean acidification affects marine organisms

- Understand the ecological mechanisms by which climate change alters the marine environment

REQUIREMENT 4

Variability in climatic and biodiversity responses

- - Better understand the interactions between natural climate variability and anthropogenically driven change

- **Invasive species**
- - Research on the impact of marine species invasion on native biodiversity
- Better understand the role of climate change in invasion success

- **Ecosystems consequences**
- - Understand the effects of climate change on ecosystem functioning in
- benthic communities
- - Understand and assess pelagic diversity and heterogeneity (e.g. by
- using top predators as potential indicators of pelagic biodiversity and
- oceanographic processes)
- - Determine the effects of "low-dissolved-oxygen" events such as hypoxia and anoxia on function and status of the marine environments

REQUIREMENT 5
Validation and prediction

- Develop systems that can track, forecast and control uncertainties regarding biodiversity loss

- Develop tools to validate predictions

REQUIREMENT 6
Historical ecology, data acquisition and data access

-**Expand on the current status of data access and dissemination**

- Retrieve environmental data from historical sources, reports and other grey literature and to make this data available and compatible with future scientific analyses

- Create more detailed fisheries data sets

Restoration and mitigation
-Assess the responses of different biodiversity indicators to restoration measures

- Determine the impact of global change on planktonic communities and the sequestering of carbon in ocean sediments.

REQUIREMENT 7

- - Promote the development of multidisciplinary studies in the field of marine resource management
- - Create representative Marine Protected Areas which factor climate change into their design

STEP 1

In order to better understand the **effectiveness of mitigation and adaptation measures** with respect to the impacts of climate change on marine biodiversity, and the role of marine and coastal ecosystems in the mitigation of climate change effects

- There is need to carry out research to:
- - Determine the consequences of coastal defences on ecosystem function and services
- - Conduct sound monitoring before and after construction of coastal defences in order to assess their effectiveness at meeting management goals.
- - Determine the effects of coastal defences on non-target systems and species, including promotion of range extensions on non-natural habitat
- - Establish the environmental benefits and costs of wind farms, especially the long-term effects on ecosystem processes and function
- - Determine the impacts of tidal and wave projects on marine biodiversity
- - Determine the effectiveness of iron fertilization and the long-term impacts of such fertilisation on the marine food web.
- - Carry out molecular and biochemical research to enhance the physiological properties of algal strains, as well as optimisation of algal production and harvesting systems.

STEP 2

Update current status and trends:

- - Map, list and rank coastal habitats types in terms of vulnerability
- to human impact, species richness, relevance for ecosystem functioning and uniqueness
- - Understand the cause-effect relationships between impacts and biotic response in estuarine habitats
- - Develop knowledge of deep-sea specific diversity and distribution of main macro-habitats
- - Develop current knowledge on the ecology and functioning of biodiversity in the high seas

STEP 3

Drivers of biodiversity change in marine environments:

- Assess the main drivers of change by addressing impact and environmental quality at the relevant scale
- Develop consistent methods for monitoring environmental parameters (e.g. water and sediment nutrient concentrations, light attenuation) to better interpret community variability
- Determine the impact of new chemicals and synthetic materials and compounds on the structure and functioning of marine ecosystems
- Understand the links between increased marine traffic and the spread of alien species
- Determine the impacts of industry, commercial fishing, and pollution on deep-sea environments
- Develop new functional indicators (rather than species) as a more predictive approach to detecting ecosystem changes

STEP 4

Biodiversity management:

- Develop a framework that allows MPAs to be treated as designed experiments at the appropriate spatial and temporal scales, allowing for the re-design of MPAs following proper assessment and critique.
- Analyse fine scale spatio-temporal data and information (e.g. on fisheries) in the creation of MPAs
- Determine current and predicted future state of benthic communities and how fishing activities could impact on these communities
- Determine the actual effects of marine reserves on the genetic structure of populations, the spatial scales involved, and the suitability of islands as reserves in terms of connectivity
- Promote the creation of large deep-sea and high sea MPAs to protect habitats such as deep corals and other natural reefs, seamounts, coldseep and hydrothermal vent communities.
- Promote the development of a sustainable fishery certification mechanism

STEP 5

Policy relevant priorities

- - Develop guidelines to summarize and effectively disseminate scientific results to end-users
- - Develop mechanisms by which science could inform policy and practice more rapidly
- - Promote the training of intermediaries between scientists and policy makers, who could interpret the scientific data, and put an “economical” value on or, at least, clearly identify the “risk” factors involved.
- - Develop better communication systems between scientists, policy and stakeholders

STEP 6
Linking research with policy:

- Develop a balanced dialogue between scientists and policy makers to ensure that research priorities are correctly identified and supported
- Develop mechanisms to better incorporate key actors and publics in the discussions about marine biodiversity conservation to gain their active support for conservation measures
- Develop mechanisms to integrate effective, detailed and long-term knowledge with precautionary policy-making flexible enough to be able to incorporate new knowledge
- Carry out research on the adaptation of existing legislative instruments
- Carry out research on integration within nature conservation instruments and integration with other sectors

Top Priority
Bridging the gaps in Policies

- National policy on Biodiversity
- National Policy on Climate Change
- Newly formulated National Ocean Policy
- Other related Policies and legal instruments

OPPORTUNITIES

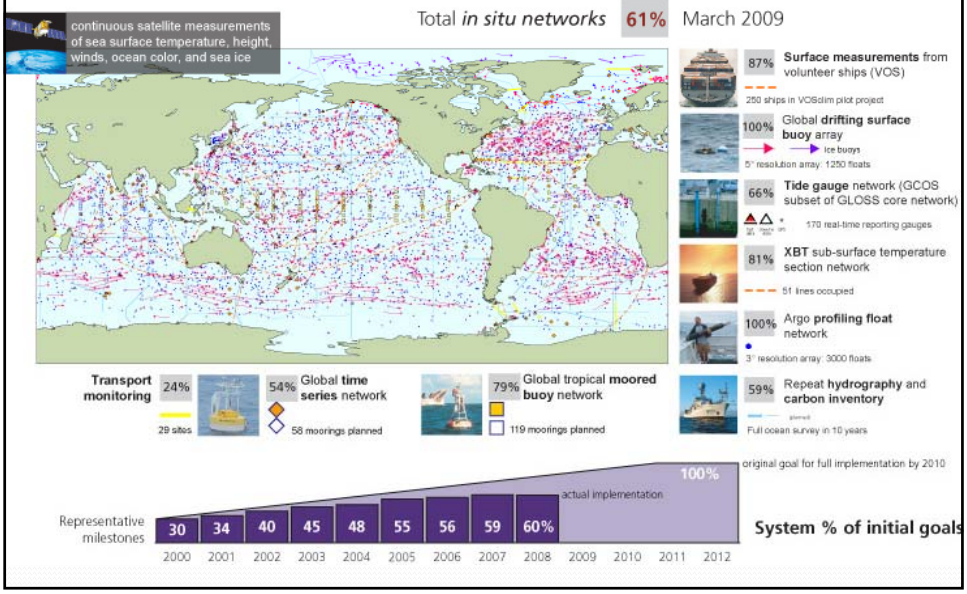
❖International, Regional Collaborative Research
❑INTERGOVERNMENTAL OCEANOGRAPHIC COMMISION (IOC-UNESCO)
❑ IOC-WESTPAC
▪IODE & ODIN-WESTPAC

▪ INTERNATIONAL CONSORTIUMS

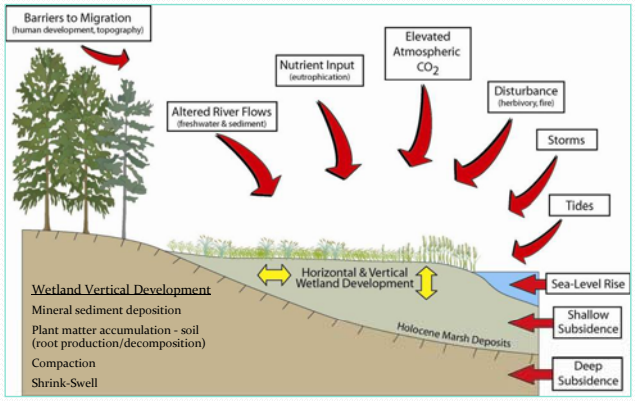
❑ASEAN-COST
▪Sub-Committee on Marine Science and Technology (SCMSAT)
❑CORAL TRIANGLE INITIATIVE (CTI) & CT-Support partners (USAID, AUAID), Conservation International, WWF, TNC, ADB
▪Bilateral Malaysia-China, EU, India, USA, Rep. of Korea, Japan
▪BIMP-EAGA, BOB-LME, SSME, etc

▪Establishment of MyNODC nodes and learning network.
▪Strategic frameworks for research areas under RMK-10 through competitive biddings.
▪Roadmap for Ocean Data and Information Management

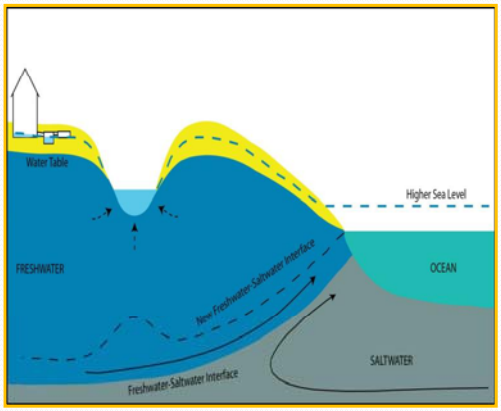
Degree of completion of the initial design targets for the ocean component of the Global Climate Observing System to be reported to the UN Framework Convention on Climate Change SBSTA (Bonn, June 2009).

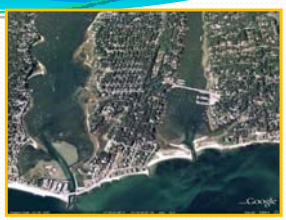


Coastal Wetlands Respond Dynamically to Environmental Change

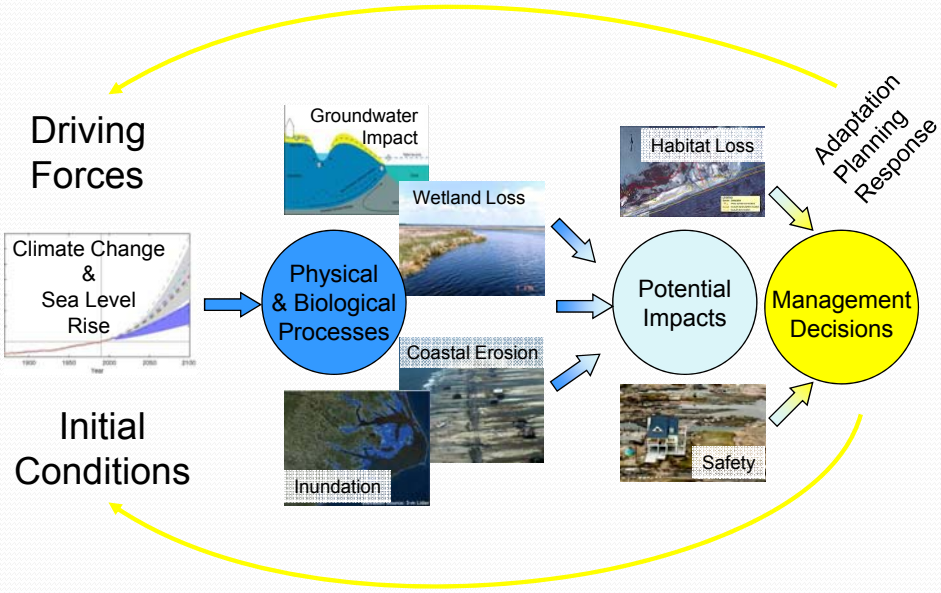


Sea-Level Rise Impacts on Groundwater Systems

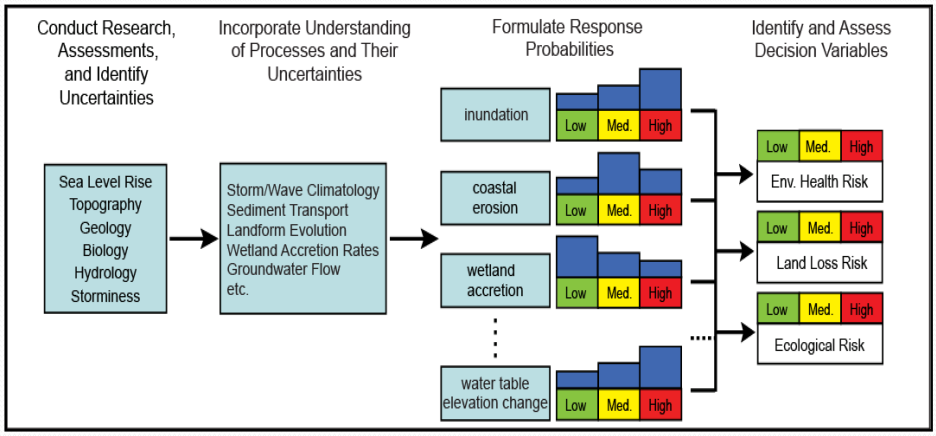




Sea-level rise impacts: A multivariate problem with uncertainties everywhere

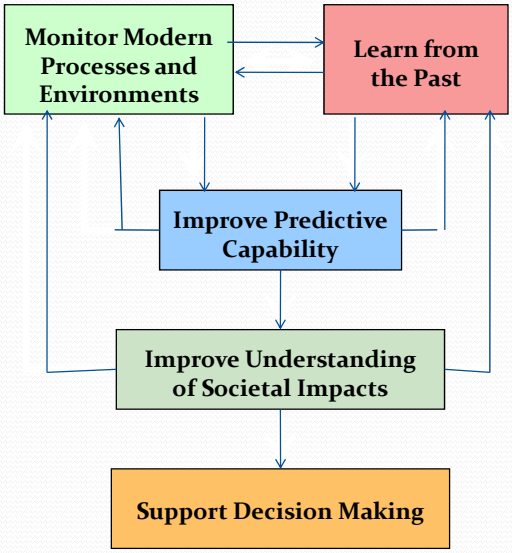


A conceptual approach to the multivariate, uncertainty problem



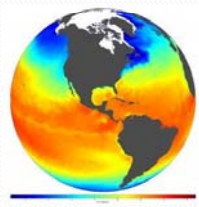
Explicitly include uncertainties, as well as management application

Science strategy to address the challenge of climate change and sea-level rise



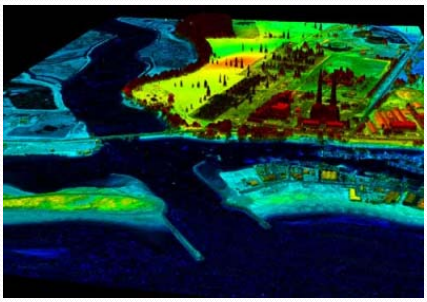
(Thieler et al., 2009)

Importance of Spatial Scale



Advance Understanding

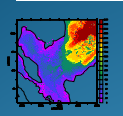
- Improve Research
- Improve Data Access
- Assess Vulnerability

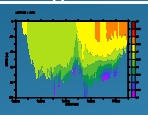


Sub-Commission for the Western Pacific

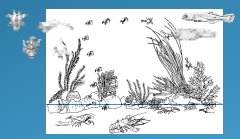
New IOC/WESTPAC Projects

- **Ocean Forecasting Demonstration**





- **DNA Taxonomy and Recruitment Monitoring of the Coral Reef Marine Organisms**



In situ analysis & monitoring

Marine Biological Information DB

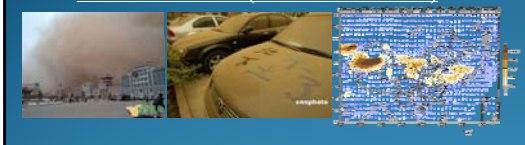
Species identification & information Service

- **Ensuring Seafood Safety from Toxic Marine Organisms**

Sub-Commission for the Western Pacific

Newly proposed WESTPAC Working Groups

Asian Dust and its Impact on Ocean Ecosystem in the Western Pacific (WESTPAC-ADOES)



*as a new mechanism for attracting the leading scientists to deliberate on focused scientific topics, marine-related societal concerns and other international **emerging** issues,*

Regular Process for Global Reporting and Assessment of the State of the Marine Environment (WESTPAC- GRAME)

Objectives

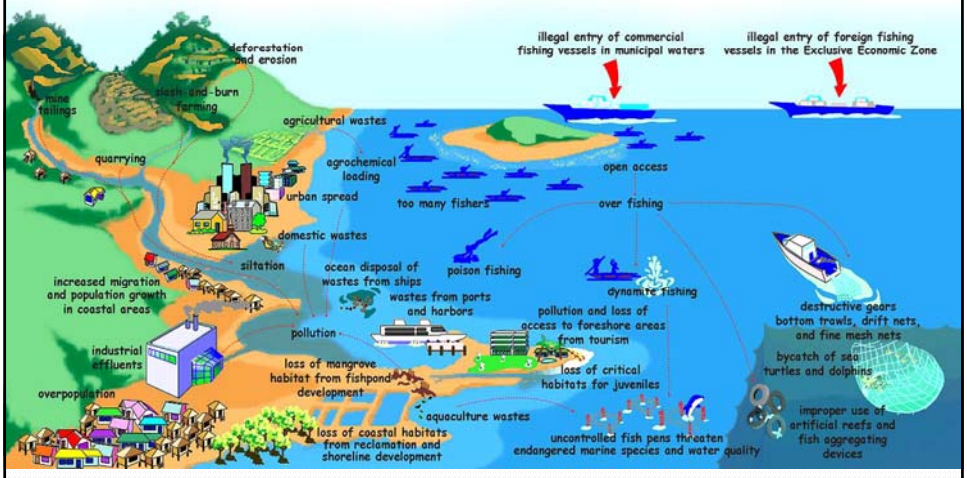
- *improve the understanding of the deposition flux and bioavailability of Asian dust, and its impact on biogeochemical processes and productivity of marine ecosystem in the western Pacific*

Objectives

- *function in its advisory capacity to the Sub-Commission to facilitate and advise on the development of GRAME in WESTPAC region.*

Resource utilisation and sustainability:

Our complex coastal environment - must be managed in integrated manner using EBM systems with interventions tailored to local needs



(IUCN-WCPA 2008)

Proposed Research Initiatives under RMK10 to MOSTI/EPU

- Facilitate to provide funding and research management support to intensify R&D and innovations in prioritised areas

1)Prime/Mini Marine Scientific Expeditions to Special Scientific Areas (SSA)
2) Marine Biodiversity/Biotechnology For Food Security, Aquaculture, Pharmaceutical And Biofuel
3) Renewal Energy Sources From The Sea (Wave, Current, Tides)
4) Modelling of Ocean And Coastal Dynamics, Ocean-Atmosphere Interaction, Climate change, Marine Pollution and Invasion of Alien Species (including Ballast Water Management)
5) Underwater Instrumentations And Marine Innovations Development for Maritime Industry
6) Continental Shelf And Deep Sea Research For New Sources of Economic Growth

Polar Research- Antartic Expedition

Short-Live halocarbons--_ SHIVA - EU Project-Atmospheric-Ocean interaction

PROGRAM/PROJECT CONTINUATION IN RMK10

- Oceanographic Data Management and Information Exchange (NODC Applications, Spatial Data Info-Structure, Knowledge Management)
- Implementation of CTI National and Regional Plan of Actions ; Regional Exchange & Learning Network,
- State of Coral Triangle Report
- Baseline data-Coastal Environmental Profiles

Sub-Commission for the Western Pacific

New Challenges and regional development: Coral Triangle Initiative implementation of NPOA and RPOA

Priority Actions Recommended

The workshop identified nine priority actions from the Regional Plan of Action that required collective action(s), or that generated economies of scale that warranted collective or parallel actions. These included:

- Goal 1 (*Seascapes*), Target 2 (*Marine and coastal resources within all "Priority Seascapes" are being sustainably managed),* Action 1: **Adopt a general "model" for sustainable management of seascapes.**
- Goal 2 (*EAFM*), Target 1 (*Strong legislative, policy and regulatory frameworks in place for achieving an ecosystem approach to fisheries management (EAFM)*), Action 1: **Collaborate to develop a "common regional framework for legislation and policy" that would support EAFM; drawing on this, strengthen regional and national legislation, policies and regulations.**
- Goal 2 (*EAFM*), Target 1, Action 2: **Improve enforcement of IUU fishing through greater collaboration**

Priority Actions Recommended

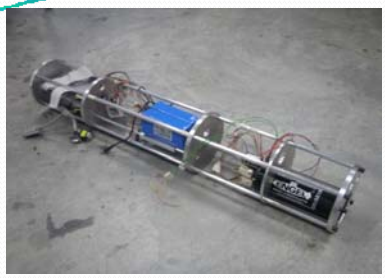
- Goal 3 (*MPA*), Target 1: (*Region-wide Coral Triangle MPA System (CTMPAS) in place and fully functional),* Action 1: **Jointly establish overall goals, objectives, principles, and operational design elements for a CTMPAS centered around priority MPA networks.**
- Goal 3 (*MPA*), Target 1: (*Region-wide Coral Triangle MPA System (CTMPAS) in place and fully functional),* Action 3: **Build capacity for effective management of the CTMPAS.**
- Goal 4 (*CCA*), Target 1 (*Region-wide Early Action Plan for Climate Change Adaptation for the near-shore marine and coastal environment and small island ecosystems developed and implemented*), Action 1: **Identify the most important and immediate adaptation measures that should be taken across all Coral Triangle countries, based primarily on analyses using existing models.**

Priority Actions Recommended

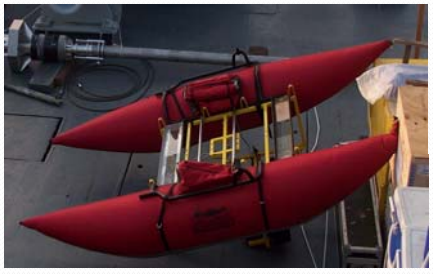
- Goal 4 (*CCA),* Target 1, Action 3 and 4: (blended) **Complete and implement a Region-wide Early Action Plan for Climate Change Adaptation** and **Conduct capacity needs assessments and develop capacity programs on climate change adaptation measures**
- Goal 5 (*Threatened Species*), Target 1 (*Improved status of sharks, sea turtles, seabirds, marine mammals, coral, seagrass, mangroves and other identified threatened species*), Action 3: **Complete and implement region-wide Sea Turtles Conservation Action Plan.**
- Goal 5 (*Threatened Species*), Target 1, Action 5: **Complete and implement region-wide Marine Mammals Conservation Action Plan.**

DrosoBot

AUG



ASV



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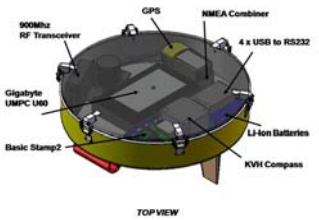
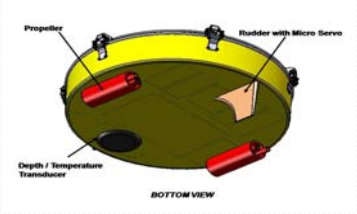
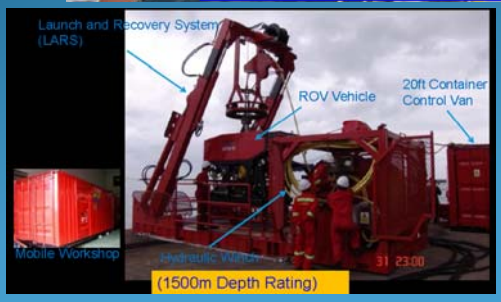




Kaspia, Iran



Satria 101 yang sedang beroperasi ke Laut Kaspia, Iran

ROV Satria 102

Model Satria 102 semperna pameran SME di Kuala Lumpur Convention Centre

Perdana Menteri YAB Datuk Seri Najib Tun Razak mendengar taklimat oleh En. Zainal Abidin, pengarah projek Satria 102

Anugerah yang diterima "Innovation Certification for Enterprise Rating & Transformation (1 InnoCert Rating)

RENEWABLE ENERGY-
Reducing Emissions and Carbon Footprint

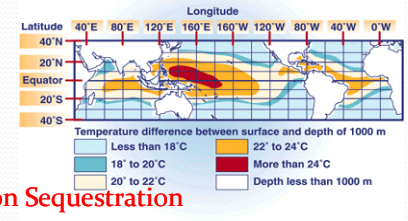
- Renewable Energy harnessed from Ocean
  Wind, Current, Wave, Tide, Salinity and Ocean Thermal Conversion
- Biofuel from Marine Algae
- Mangrove Carbon Sequestration –Carbon Trading

Alternative Energy Sources From The Sea

Wind Energy

Solar Energy

Wave, Tide, current, Ocean Thermal Energy

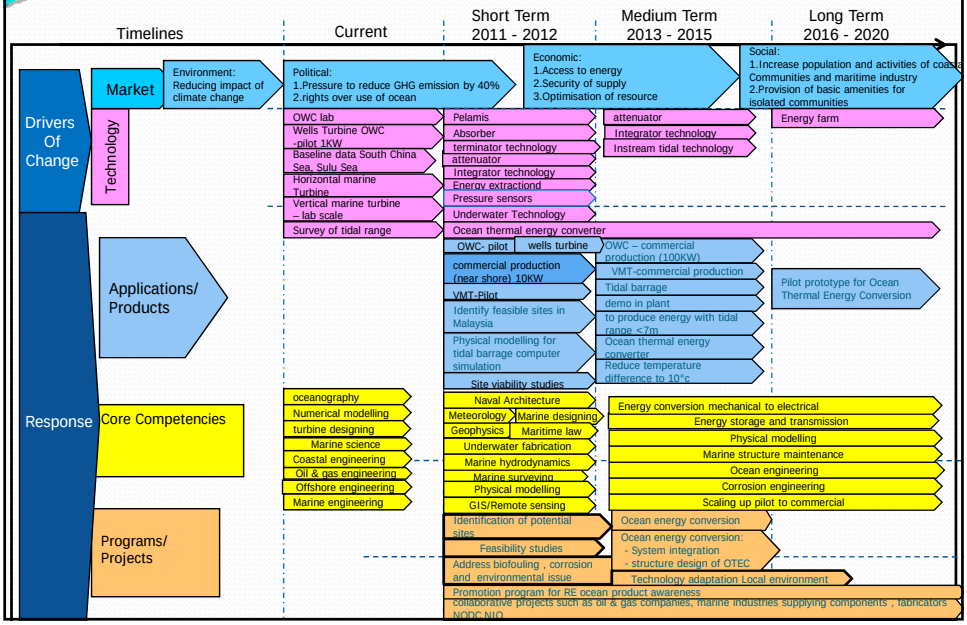


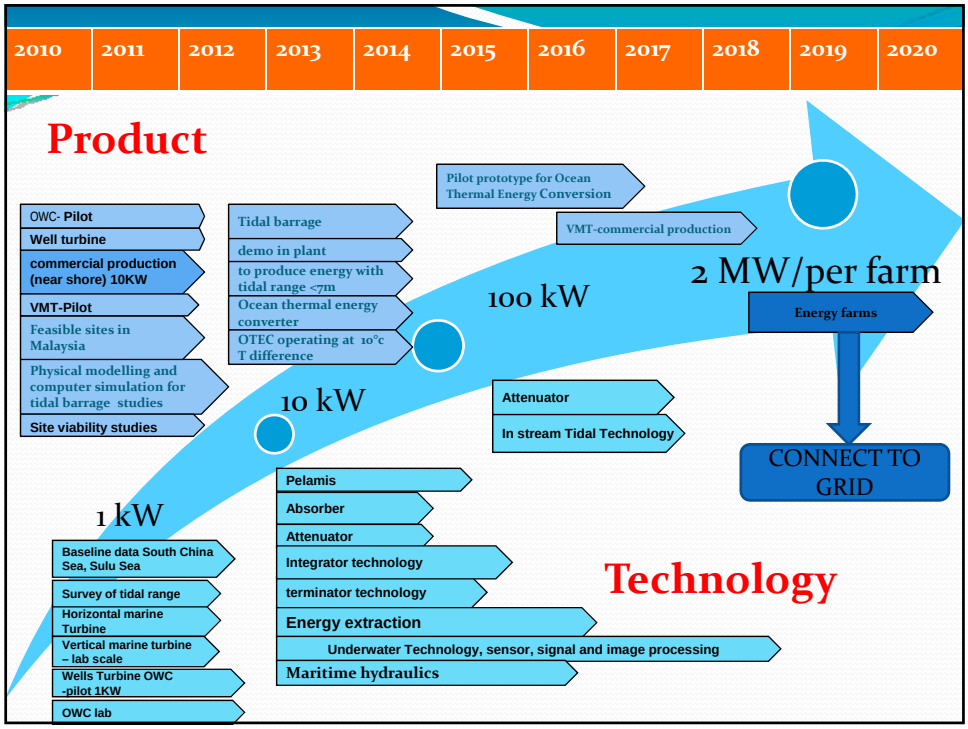
Green Energy: Bio Fuel (Ethanol)

from Marine Algae? Mangrove for Carbon Sequestration

National Oceanography Directorate, MOSTI

RE Strategic Landscape for Ocean





Marine Centres of Excellence (CoEs) Established

No.	CoEs	Research Station
1.	UMT – Institute of Oceanography (INOS)	• Setiu • P. Bidong • P. Redang (Cagar Hutang) Terengganu
2.	USM – Centre of Marine and Coastal Studies (CEMACS)	• Muka Head, Penang
3.	UKM – Marine Ecosystem Research Centre (EKOMAR)	• Tg. Resang, Mersing, Johor
4.	UM – Institute of Ocean & Earth Sciences (IOES)	•Pulau Tioman, Johor •Bachok, Kelantan
5.	UPM – Institute of Bioscience (IBS)	• Port Dickson, Negeri Sembilan
6.	UIAM – Institute of Oceanography and Maritime Studies (INOCEM)	• Langkawi, Kedah • Chenor, Pahang
7.	UMS – Borneo Marine Research Institute (BMRI)	• Pulau Sebatik, Sabah
8.	UTM – Coastal and Engineering Institute (COEI)	
9.	UNIMAS – Aquatic Science Department (ASD)	

N.I.O

The Establishment of National Institute of Oceanography

IN FULL SUPPORT OF THE **MYNIC** CONCEPT

Propose appropriate funding for

R & D in Oceanography:

Towards Economic Benefits
SUSTAINABLE GROWTH

•Political will
and commitment
•Champions

National Oceanography Directorate, MOSTI