Mapping and Valuing Pelagic Ecosystem Services in the Lesser Sunda Ecoregion

Preliminary Results on the Manta Rays Pelagic Fisheries for Tourism

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The Outline

1. Background – Blue Economy, National Policy and Ecosystem Services
2. Framework of Ecosystems Services – Measuring, Mapping and Valuing
3. Lesser Sunda Ecoregion Ecosystem Services – Pelagic Fisheries at Glance
4. Mapping and Valuing the Manta Rays Fisheries for Tourism
5. Policy Recommendations – EAFM and Integrating Fisheries into ICM
An Insight of Blue Economy – A Paradigm

- Exploring and utilizing ecosystem services through the ecosystems functions and structures
- Creating new opportunities through innovation
- Creating cheaper inputs and outputs
- Working with nature and strong sustainability paradigm
- Ecosystem as control for human activities (*social-ecological system*)

Modified from Pauly (2010)
ICM as tools for Ocean Based Blue Economy

Coastal and Marine Area as Multi-sectoral uses

- Focusing on ecosystem Integrity, capacity and sustainability
- Creating new opportunities through innovations
- Ecosystem as control for human system (social-ecological system)

Operational Tools: Marine and Coastal Spatial Planning

Principle of Integrated Coastal Management

- Ecosystem Based Management
- Integration and Coordination
- Adaptive Management

Adrianto (2013)
Mapping Ocean Wealth

Lesser Sunda Ecoregions Policy Inputs (e.g. marine spatial planning)

Lesser Sunda Ecoregions Policy Feedback

Sustainability Policy Feedback

Adrianto, et.al (2015)
Coastal and Ocean Ecosystem Services

The oceans provide **food**, **security** through protein from wild-caught fisheries and aquaculture, **recreational opportunities** through fishing, diving, and swimming, and **shoreline protection** from storms and flooding. Marine resources, particularly seagrasses and mangroves, **sequester carbon**. The oceans also provide for biodiversity and **other services**, such as fossil fuels and transportation.

Conceptual diagram illustrating the ecosystem services provided by oceans and the ways in which humans depend on oceans.

Source: CI (2010)
Coastal and Ocean Ecosystem Services

**Provisioning services**
Products or goods such as water, fish & timber.

**Regulating services**
Ecosystem functions such as flood control & climate regulation.

**Cultural services**
Non-material benefits such as recreational, aesthetic & spiritual benefits.

**Supporting services**
Fundamental processes such as nutrient cycling & photosynthesis that support the other three categories.

Source: Based on WRI materials.

PEMSEA (2013)
1. To measure the ecosystem services of the Lesser Sunda Ecoregion with particular focus on pelagic ecosystem services;

2. To map pelagic ecosystem services regarding to the fisheries system and tourism system of the Lesser Sunda Ecoregion;

3. To value the ecosystem services with emphasizing on fisheries and tourism pelagic system of the Lesser Sunda Ecoregion
Approach to Mapping Ocean Wealth – Lesser Sunda

Biodiversity

Ecosystem

Species

Human Welfare

Link 1-6 : benefits for human from ecosystem supporting functions

Link 1-4-5 : benefits of biodiversity for human in the context of habitat protection and conservation

Link 2-5 : benefits of biodiversity in the context as input for ecosystem goods and services

Link 3 : benefits of diversity in terms of bio-ethics framework of thinking

Algorithm of Valuation

Van den Berg (2010)
Approach to Mapping Ocean Wealth – Lesser Sunda

Algorithm of Mapping

- Ecosystem structures and functions
- Ecosystem Services
- Ecosystem Services Valuation
- Mapping of ES Value
- Coastal and Marine Ecosystems
General Approach to Mapping Ocean Wealth

Coastal and Marine Ecosystems
- Littoral
- Neritic Pelagic
- Oceanic Pelagic

Ecosystem Services
- Provisioning
- Regulating
- Cultural
- Supporting

Ecosystem Services Valuation Methodology
- Intrinsic Value
- Instrumental Value

Ecosystem Services Mapping
- Spatial
- Temporal

Tier 1

Tier 2
MOW, VM and MSP

PES = Pelagic Ecosystem Services
MOW = Mapping of Ocean Wealth
VMs = Value Mapping
Lesser Sunda Ecoregion
Lesser Sunda Ecoregion - FMAs

- FMA 573
- FMA 713
- FMA 714
Research Methodology

Pelagic System

Provisioning Services ($ES_1$)

Cultural Services ($ES_3$)

Fisheries

Tourism

Biomass

Attractiveness

Measuring - Mapping

Valuing Ecosystem Services

Literature Reviews

Preliminary Maps
Oceanographic Backgrounds

Upwelling (monsoon effect) and ENSO effect on Sardine Production in Bali Strait

Lumban Gaol et al., 2004

Lumban Gaol, 2009

O. Sardine (ton)
The finestructure in the Indonesian seas region averaged over 18 years between 100 and 300 m depths and plotted along the XBT transects (5359 profiles) (Field and Robertson, 2005)
Monthly mean of Fish Biomass Distribution during 2004-2014
Monthly mean of Fish Biomass Distribution during 2004-2014
Monthly mean of Fish Biomass Distribution during 2004-2014
Monthly mean of Fish Biomass Distribution during 2004-2014

July

August
Monthly mean of Fish Biomass Distribution during 2004-2014
Monthly mean of Fish Biomass Distribution during 2004-2014

Nov

Fish Biomass [Kg]

Dec

Fish Biomass [Kg]
The world distribution of *Manta birostris* (IUCN Redlist, 2014)
Mapping of Manta Rays in Lesser Sunda

Mapping of Manta Rays in Lesser Sunda

Legend:
- Manta alfredi
- Manta birostris

Lesser Sunda Ecoregion

Flores Sea

Savu Sea

Timor Leste

Timor Sea

Legend:
- Lesser Sunda Ecoregion

0  55  110  220

KM
A Case map result of PSAT Manta Rays in Nusa Penida (BPSPL Denpasar, 2015)
Manta rays migration route suggests mantas travels alongside southern Lesser Sunda (Bali-Lombok-Sumbawa-Flores) (BPSPL Denpasar, 2015)
Economic Value of Manta Rays

Estimated Value per cycle of Manta Rays in million IDR (LIPI, 2014)
Economic Value of Manta Rays

Estimated Value total revenues of Manta Rays in million IDR (LIPI, 2014)
ICM and Seagrass Ecosystems Management

Goods and services flow

Preservation and Rehabilitation

particular coastal ecosystem: seagrass

coastal and ocean ecosystem

costal, ocean ecosystem and human activities

costal, ocean Ecosystem, human activities and policies

Integrated Coastal Resources Management
EAFM as tools of ICM – Systematic Thinking

ICM Framework

policy and functional integration

Sector A

Integrated Coastal Management

Sector B

Ecosystem Approach to Fisheries Management

Sector C

Coastal and Marine Ecosystem

Sector D

Fisheries Management

Sustainable Fisheries

State of the Coast
Thank You