

# 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

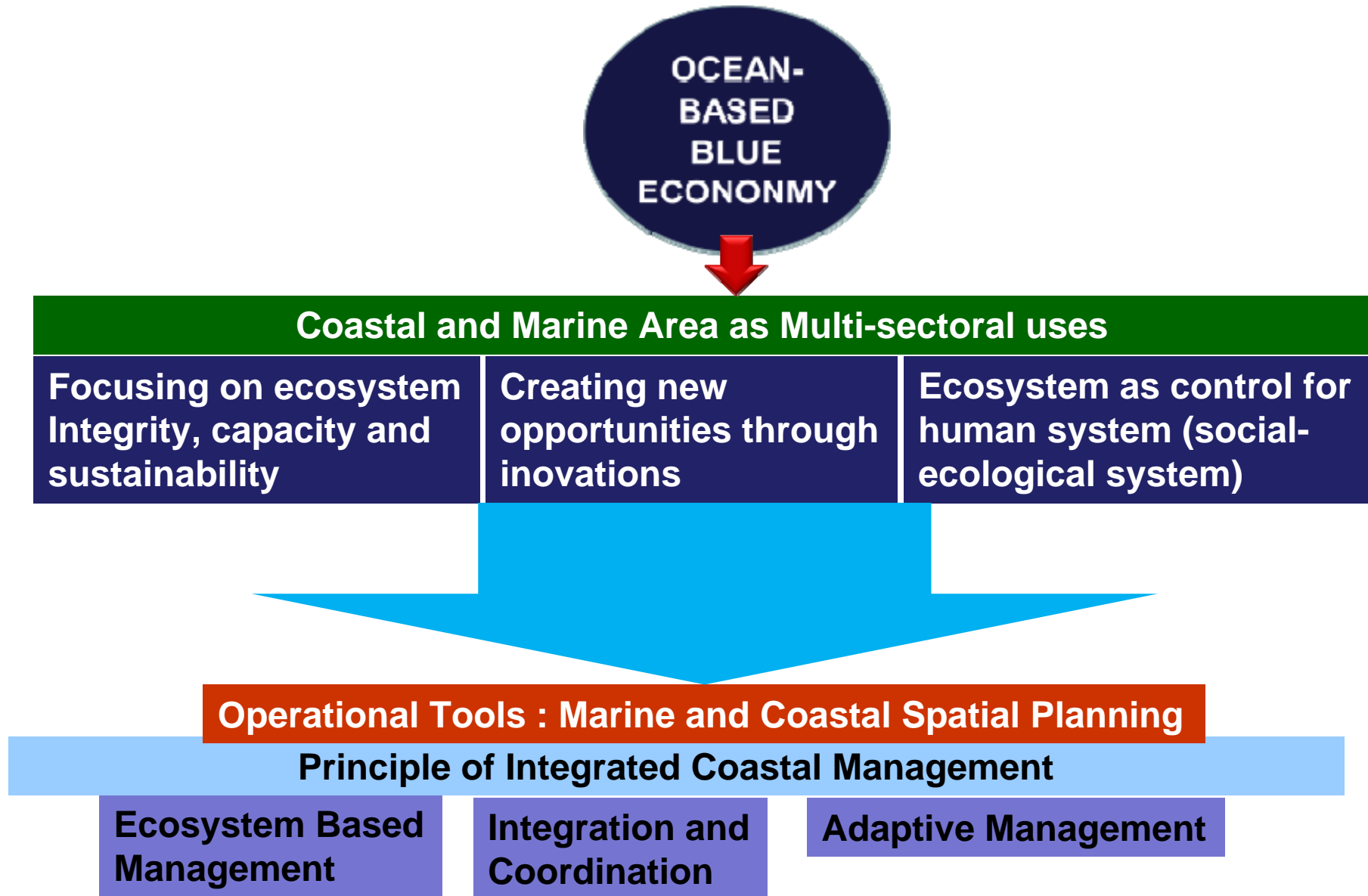
1. Background – Blue Economy, National Policy and Ecosystem Services
2. Framework of Ecosystems Services – Measuring, Mapping and Valuing
3. Lesser Sunda Ecoregion Ecosystem Services – Pelagic Fisheries at Glance
4. Mapping and Valuing the Manta Rays Fisheries for Tourims
5. Policy Recommendations –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

# An Insight of Blue Economy – A Paradigm

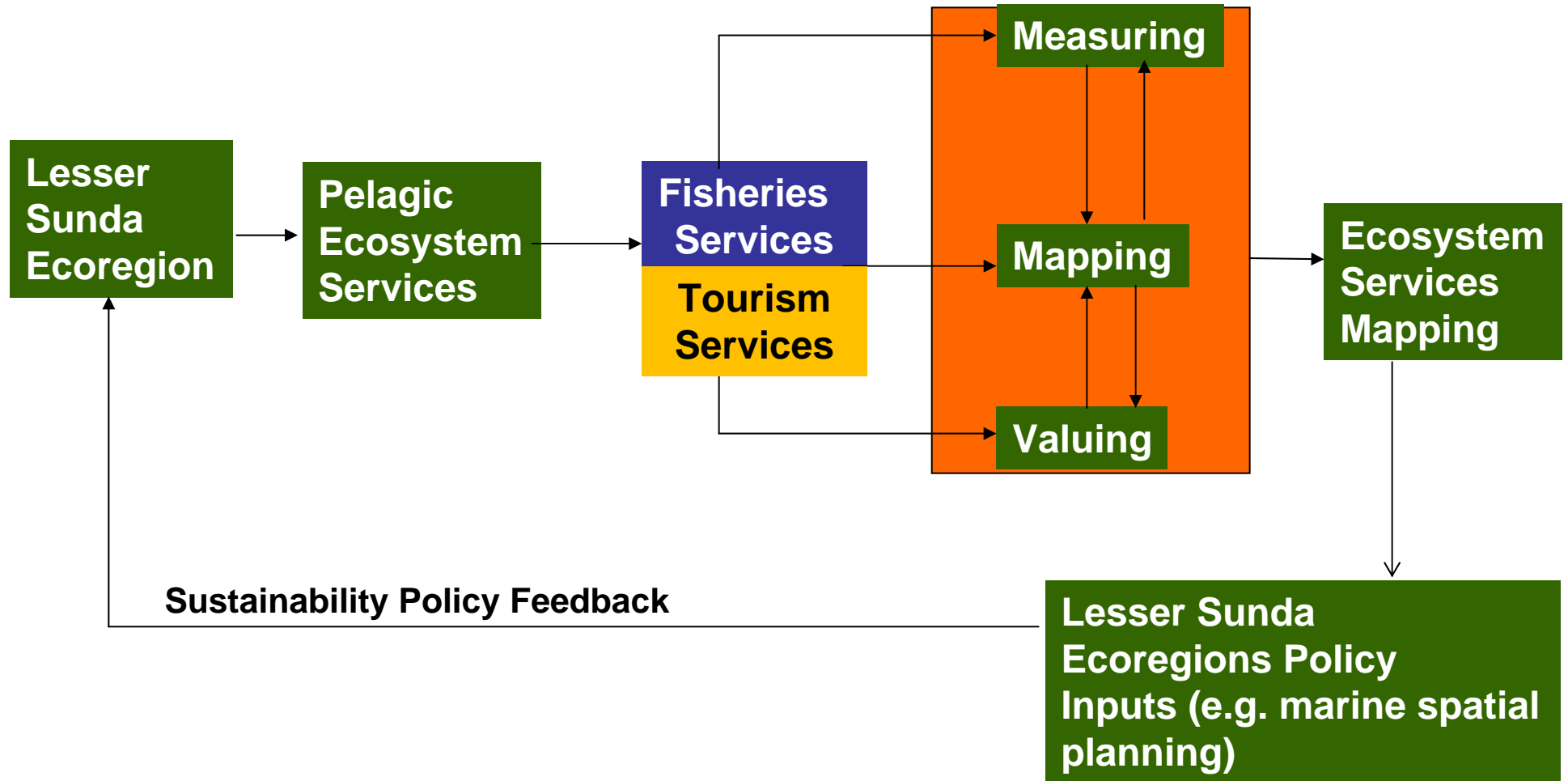
- Exploring and utilizing ecosystem services through the ecosystems functions and structures
- Creating new opportunities through innovation
- Creating cheaper inputs and outputs
- Working with nature and strong sustainability paradigm
- Ecosystem as control for human activities (*social-ecological system*)

Modified from Pauly (2010)

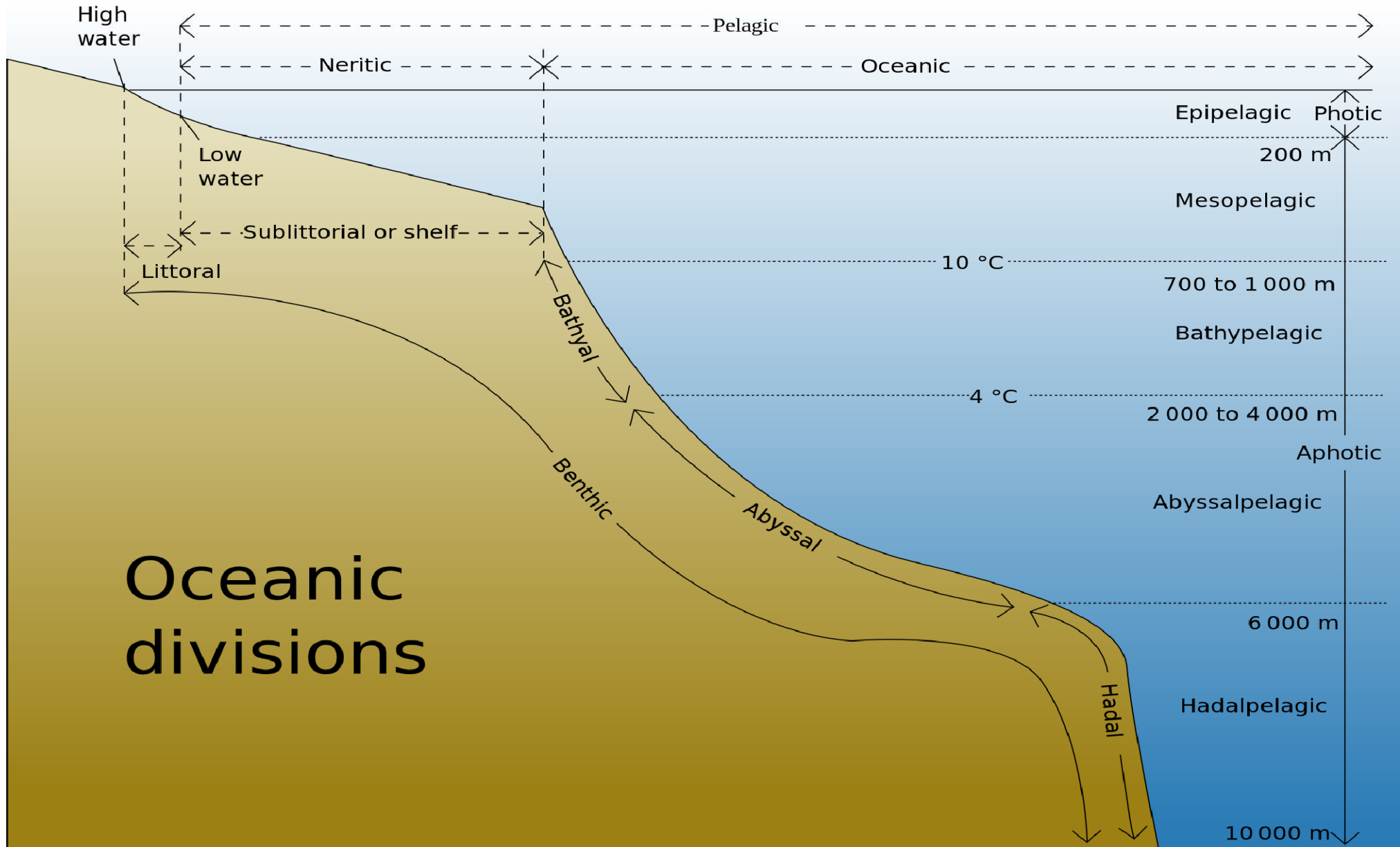
# ICM as tools for Ocean Based Blue Economy



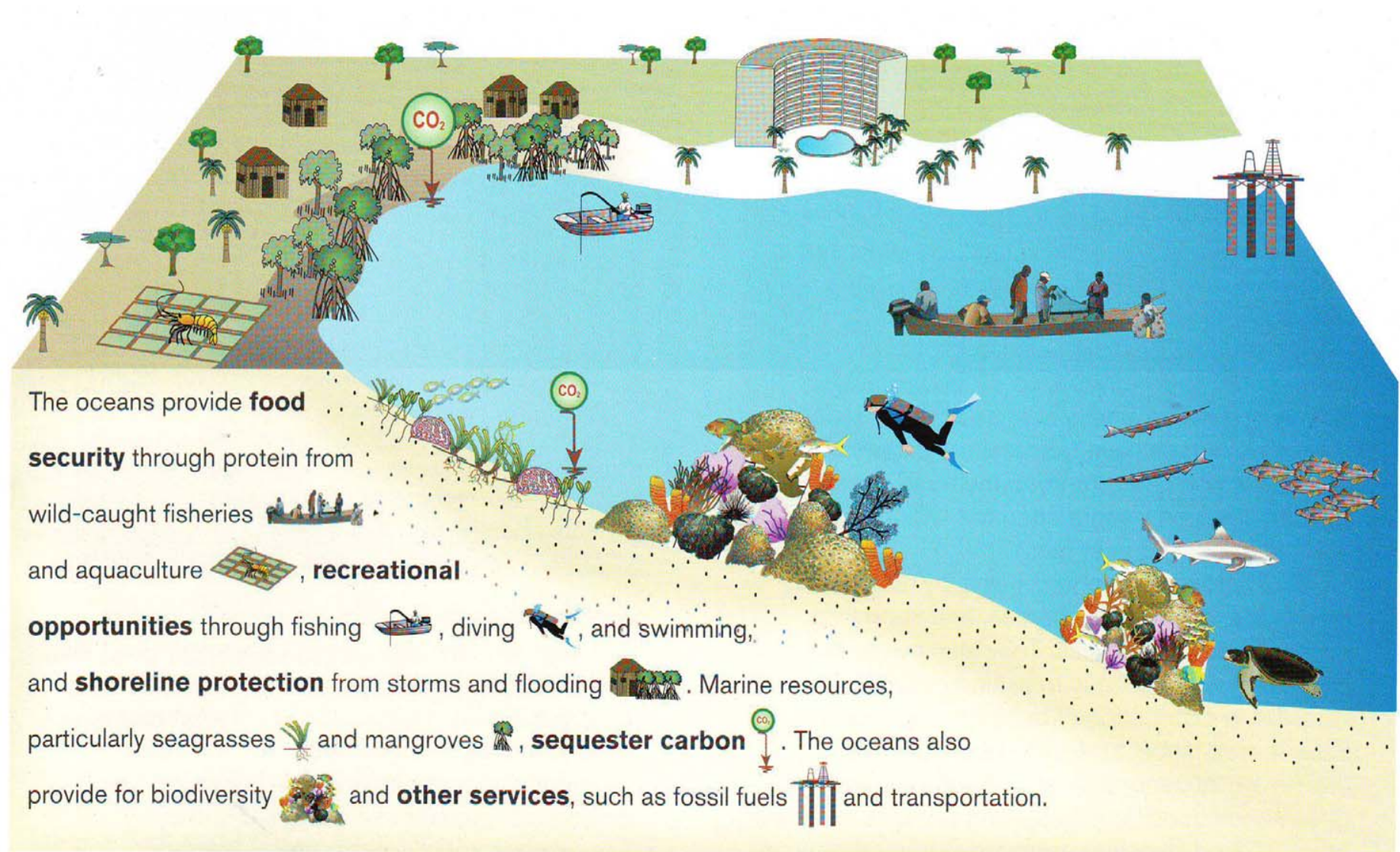
# Mapping Ocean Wealth



# Coastal and Ocean System



# Coastal and Ocean Ecosystem Services



*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.

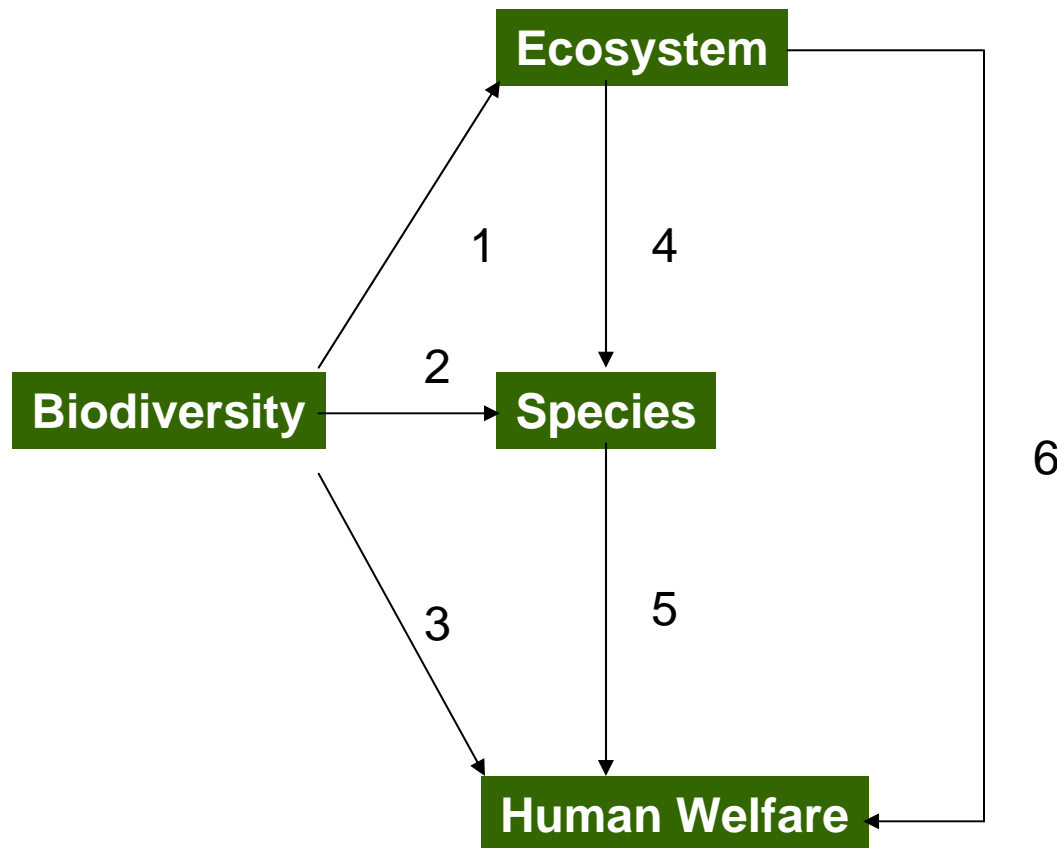
Source: Based on WRI materials.



# Mapping of the Ocean Wealth – the Objectives

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



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

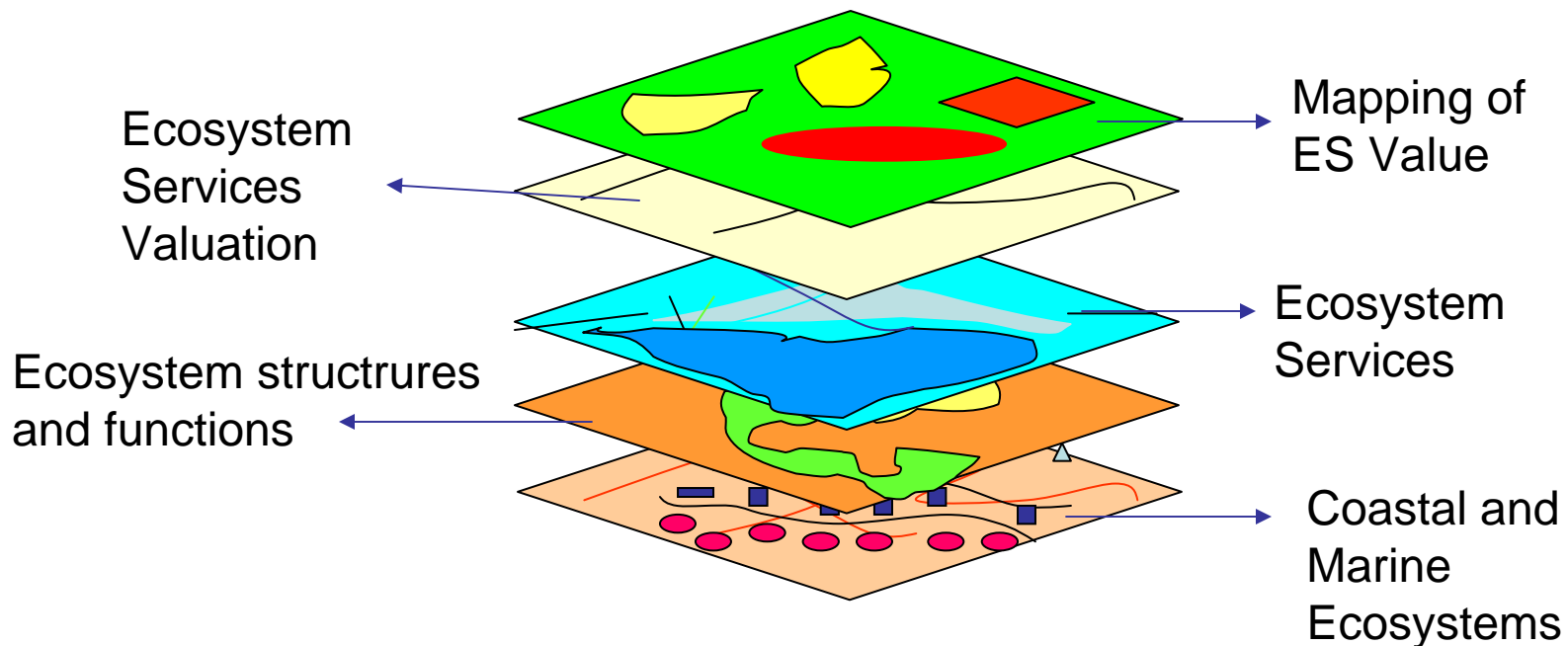
Link 2-5 : benefits of biodiversity in the context as input for ecosystem goods and services

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

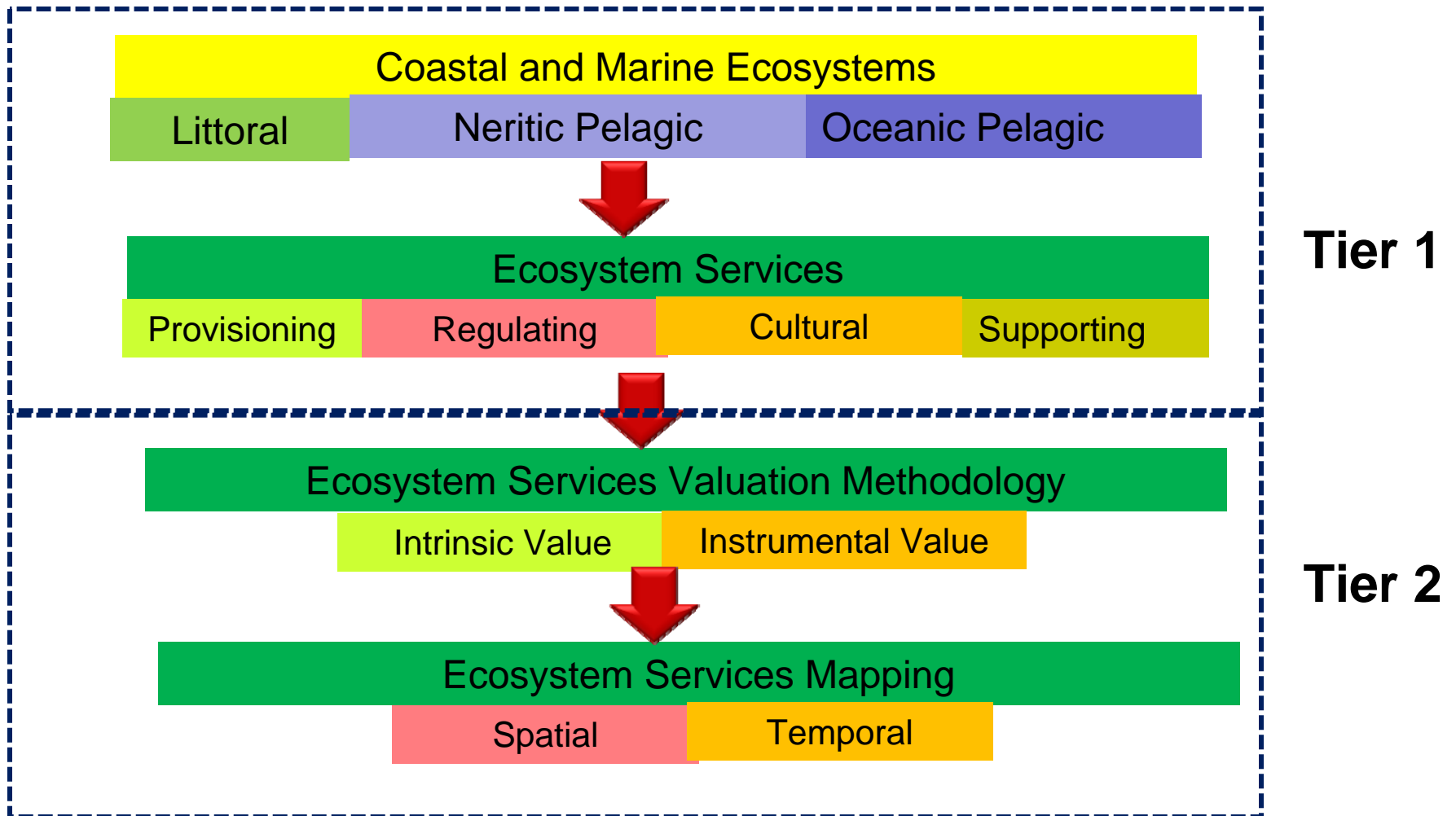
Algorithm of Valuation

# Approach to Mapping Ocean Wealth – Lesser Sunda

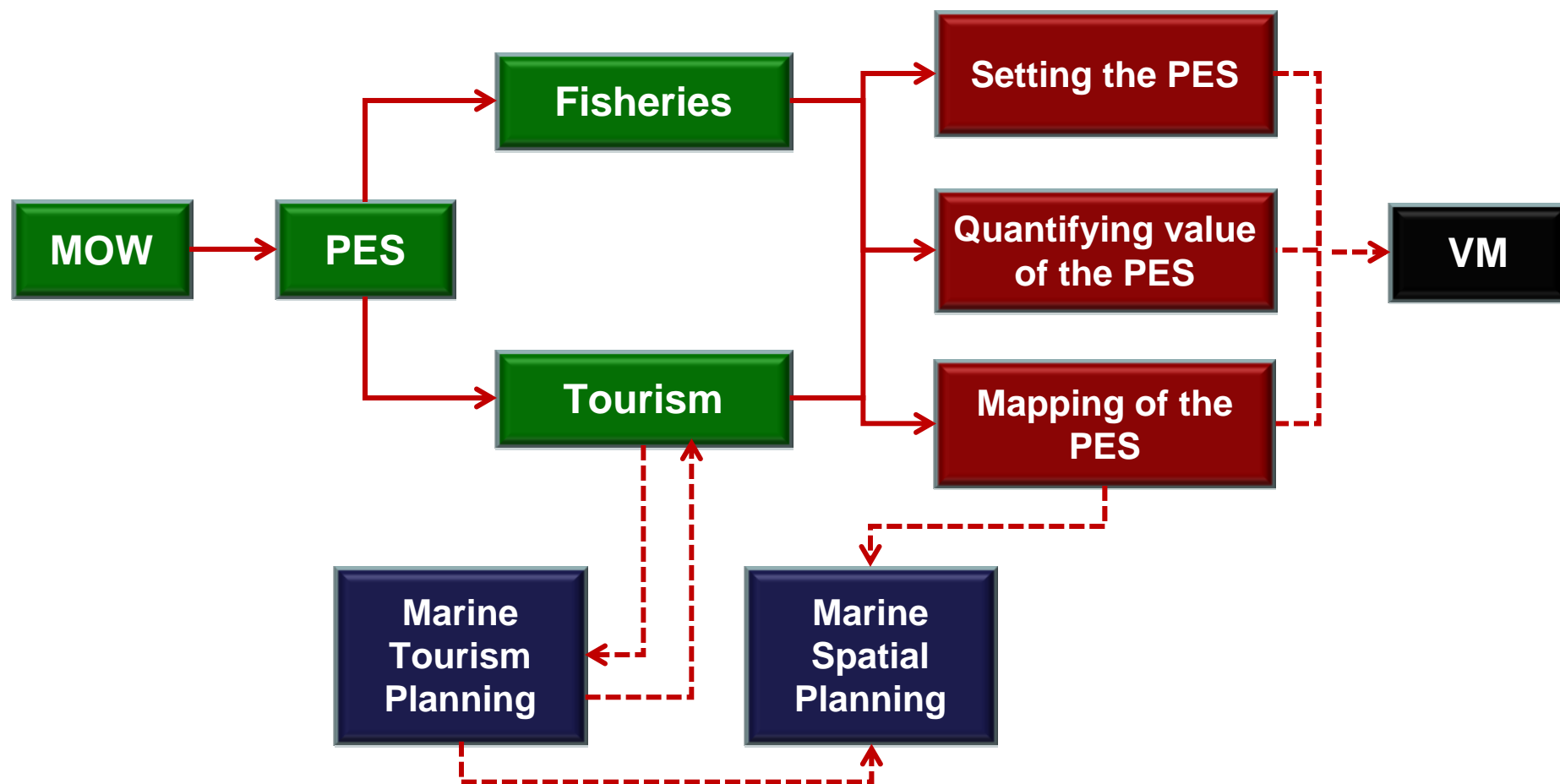
## Algorithm of Mapping



# General Approach to Mapping Ocean Wealth



# MOW, VM and MSP



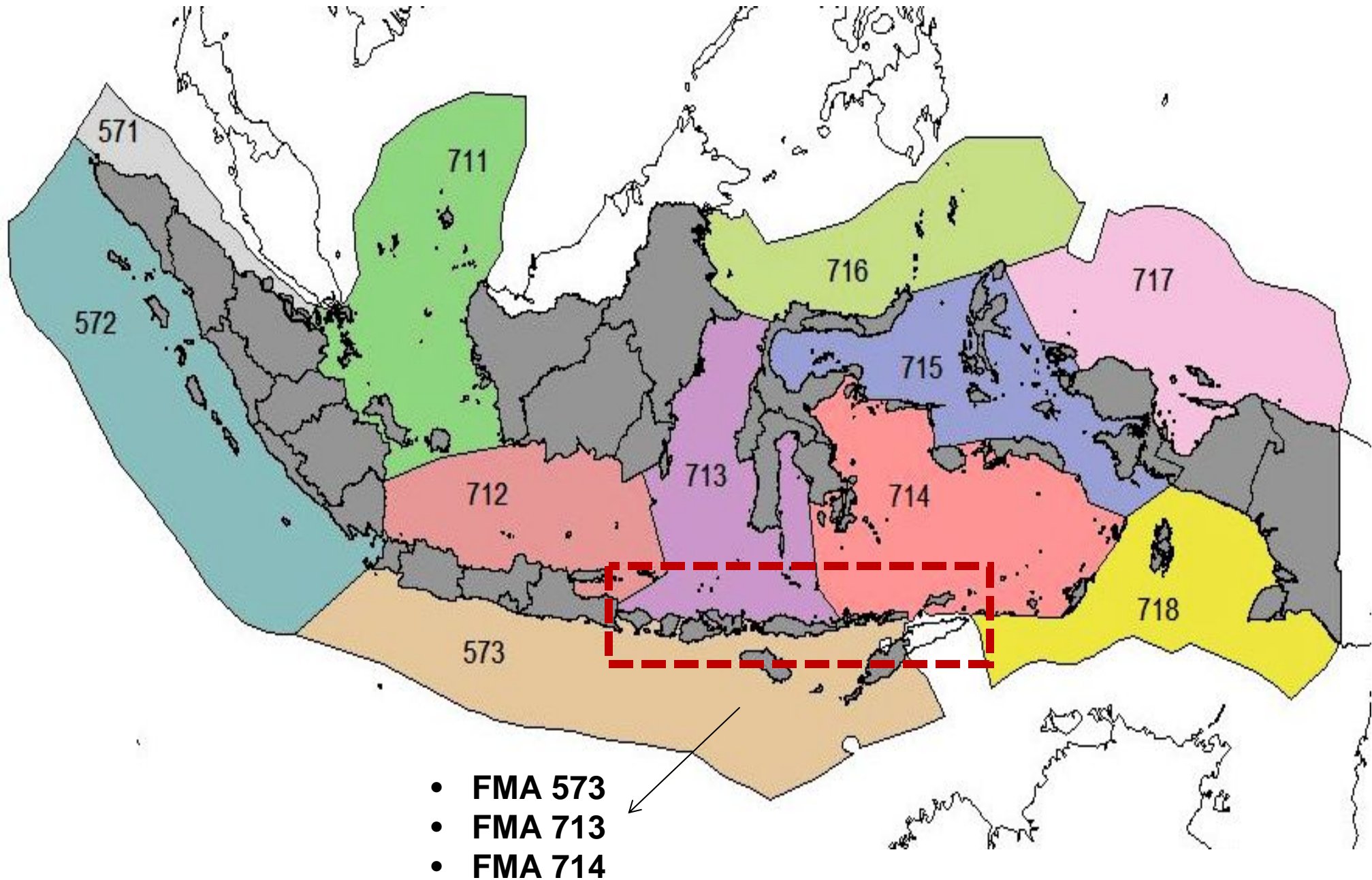
PES = Pelagic Ecosystem Services  
MOW = Mapping of Ocean Wealth  
VMs = Value Mapping



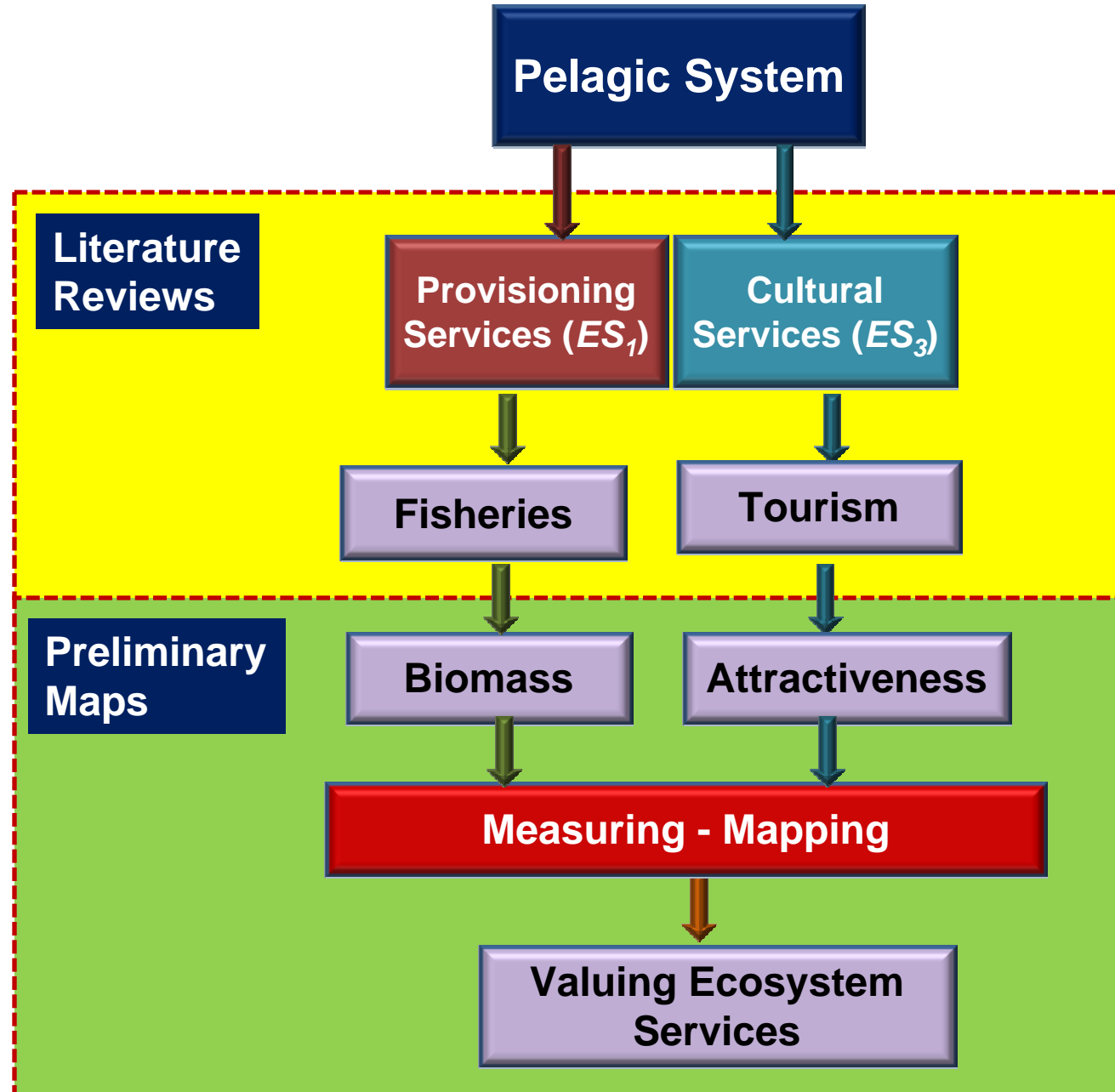
# Lesser Sunda Ecoregion



## Lesser Sunda Ecoregion - FMAs

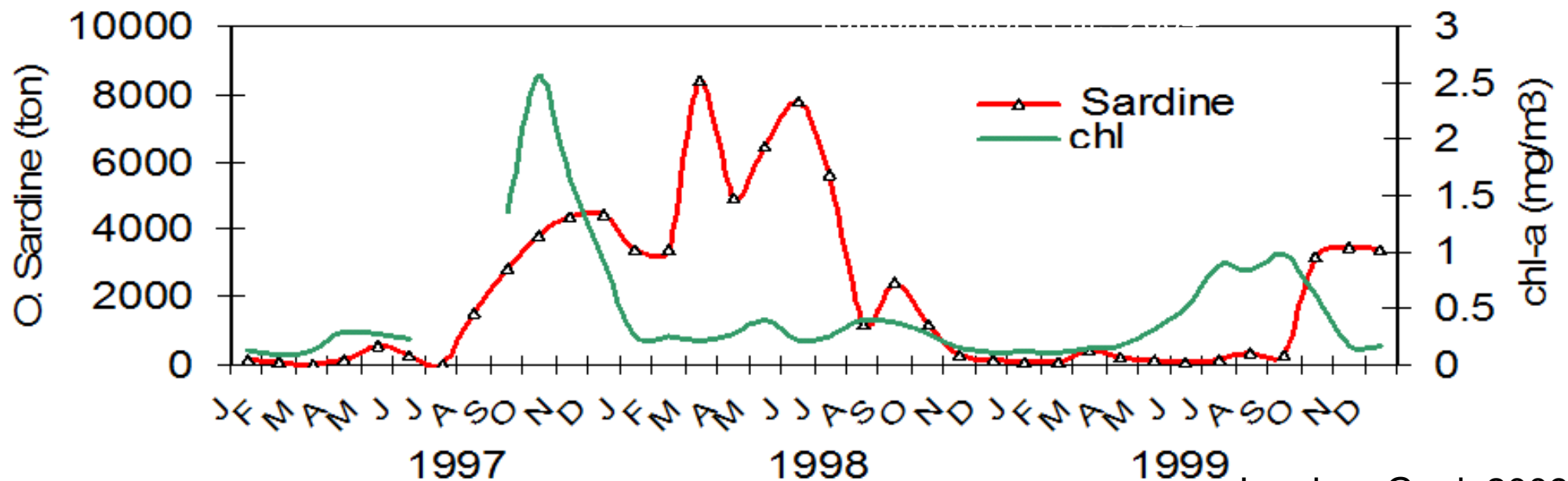
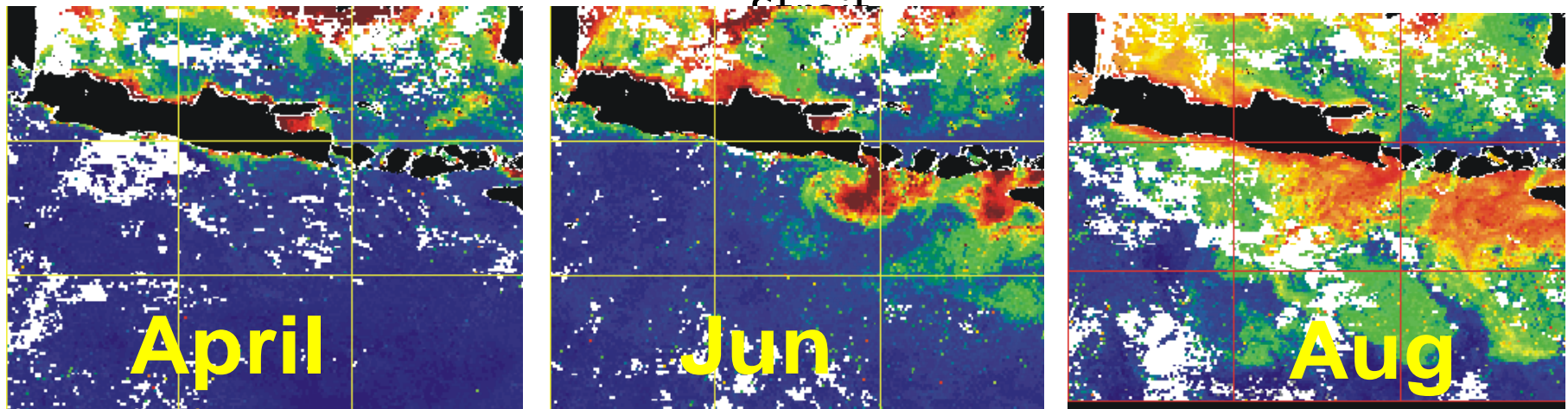


# Research Methodology



# Oceanographic Backgrounds

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

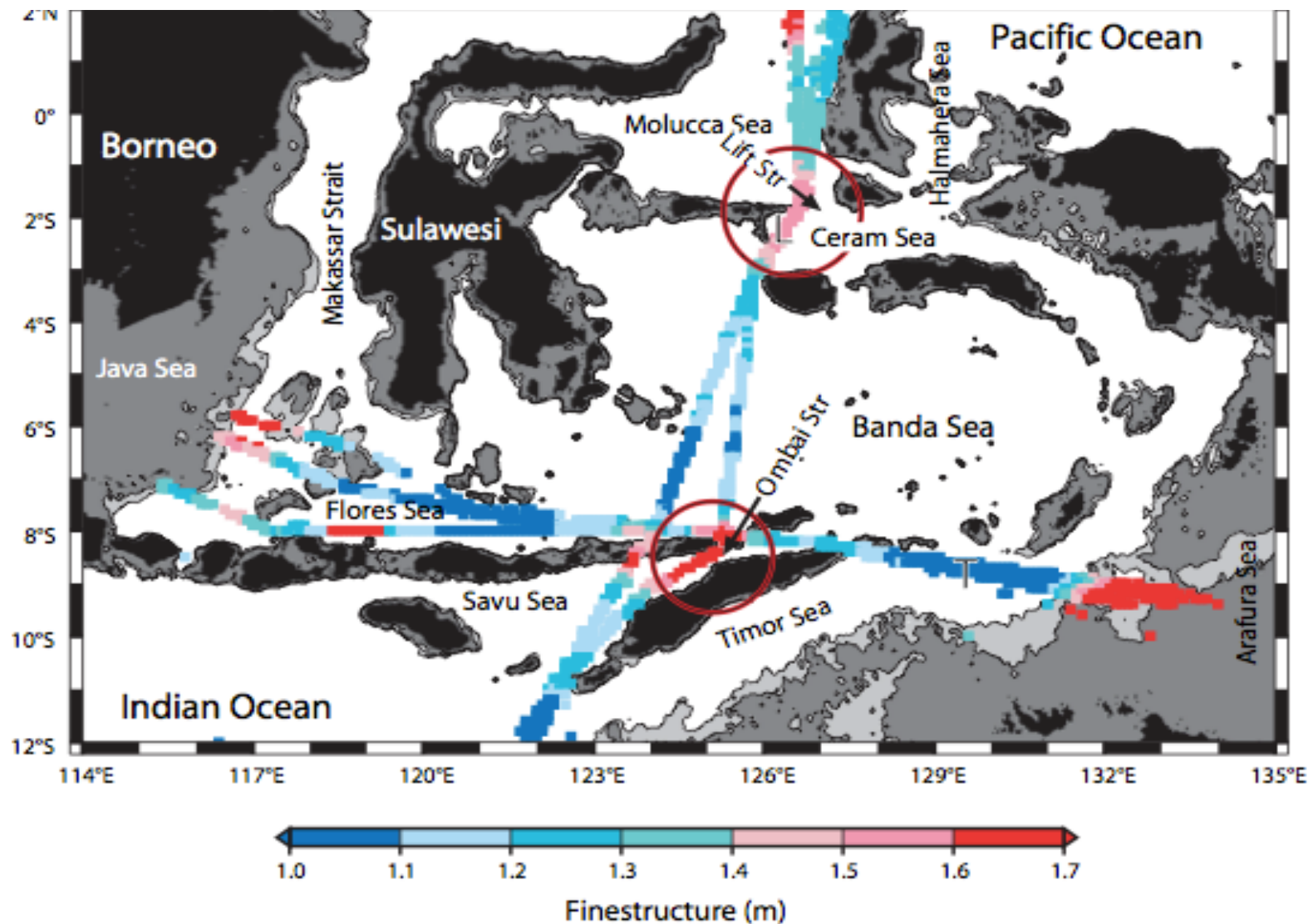


Lumban Gaol, 2009



# Oceanographic Backgrounds

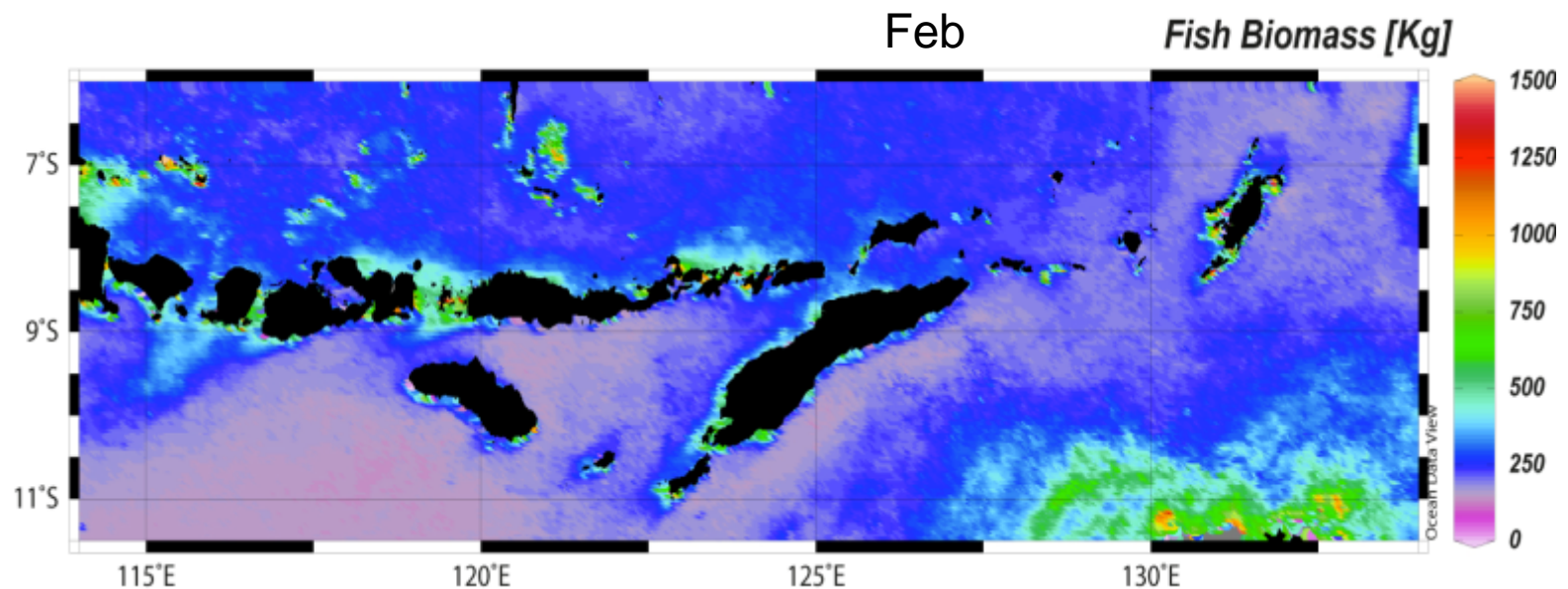
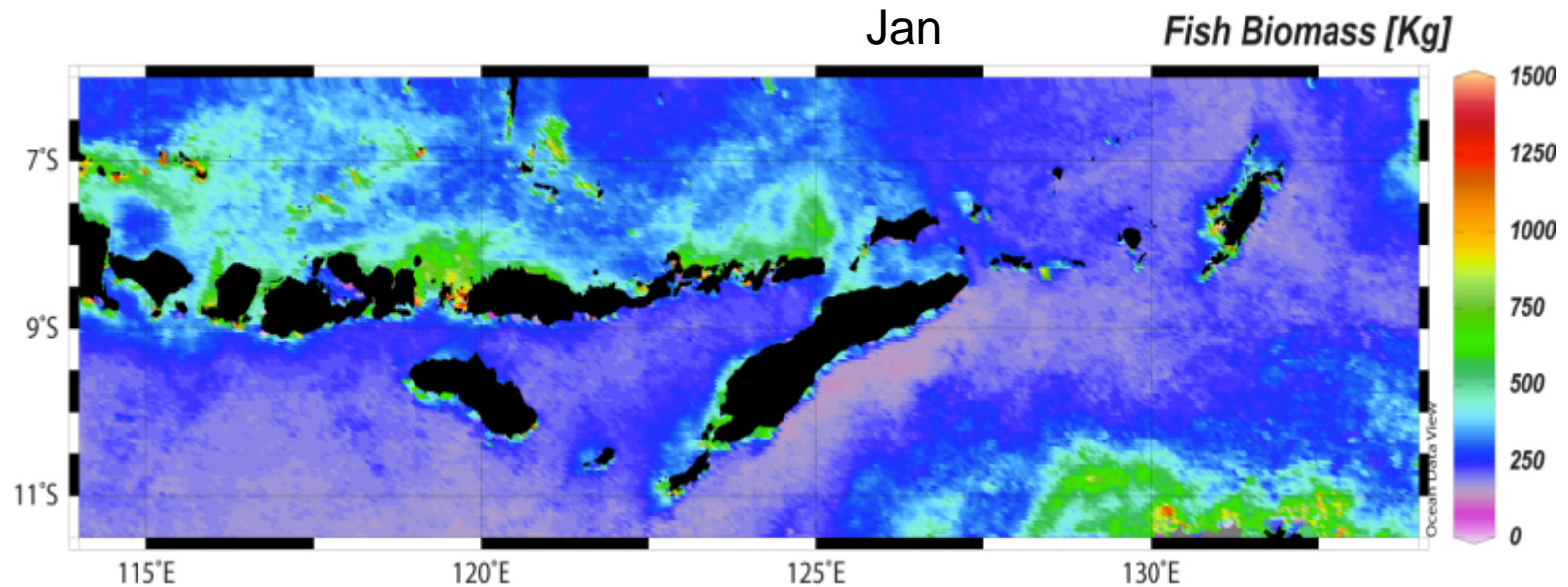
## Internal mixing induced nutrients pumping



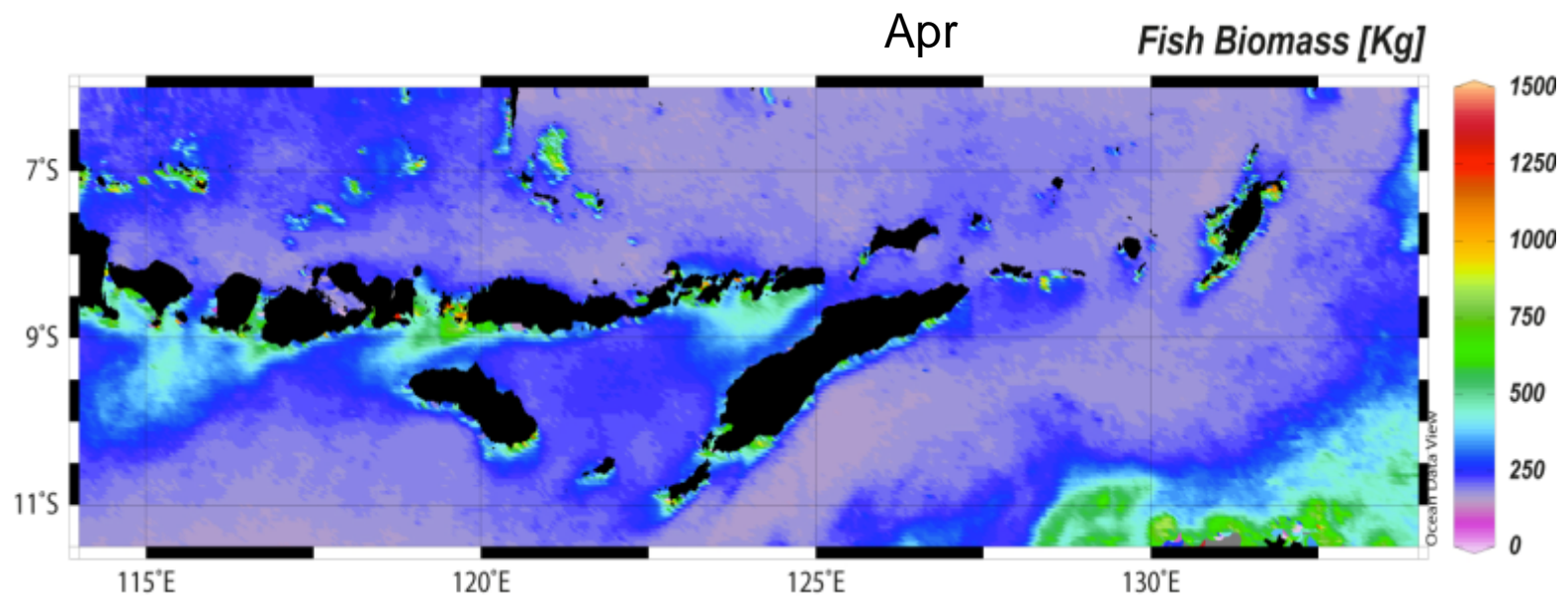
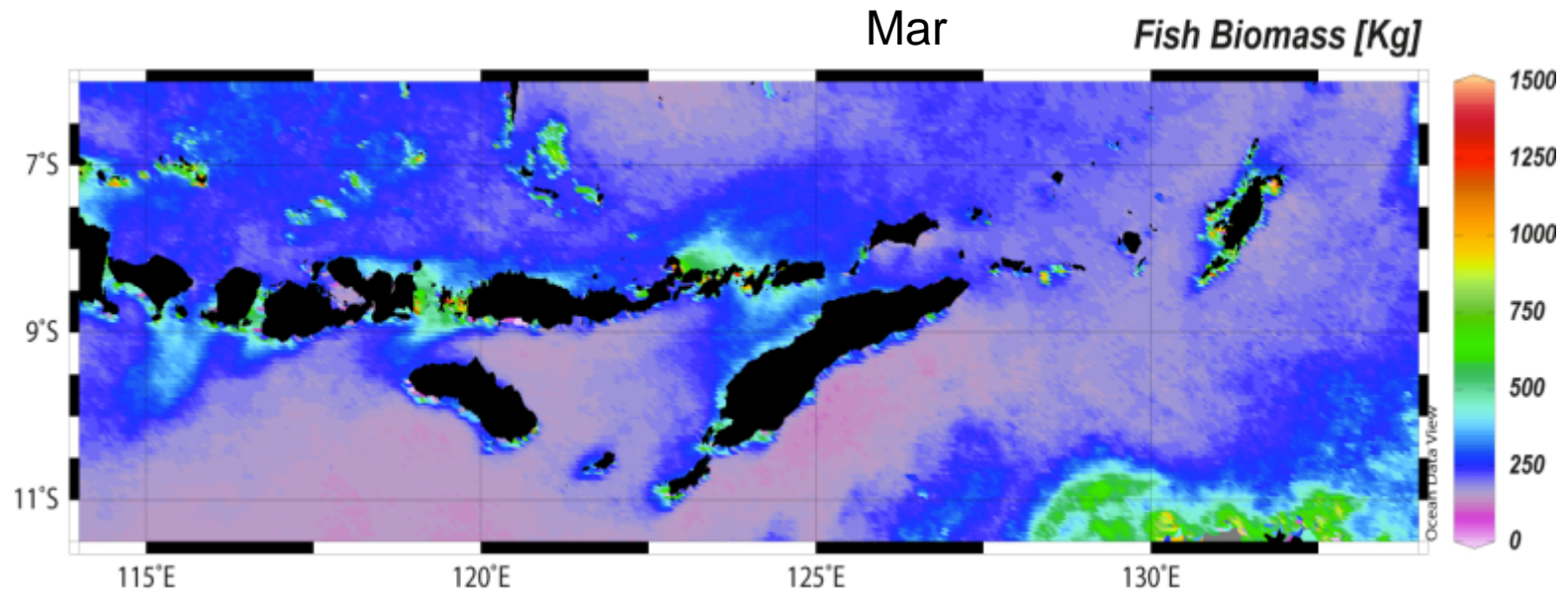
The finestructure in the Indonesian seas region averaged over 18 years between 100 and 300 m depths and plotted along the XBT transects (5359 profiles) (Field and Robertson, 2005)



# Monthly mean of Fish Biomass Distribution during 2004-2014

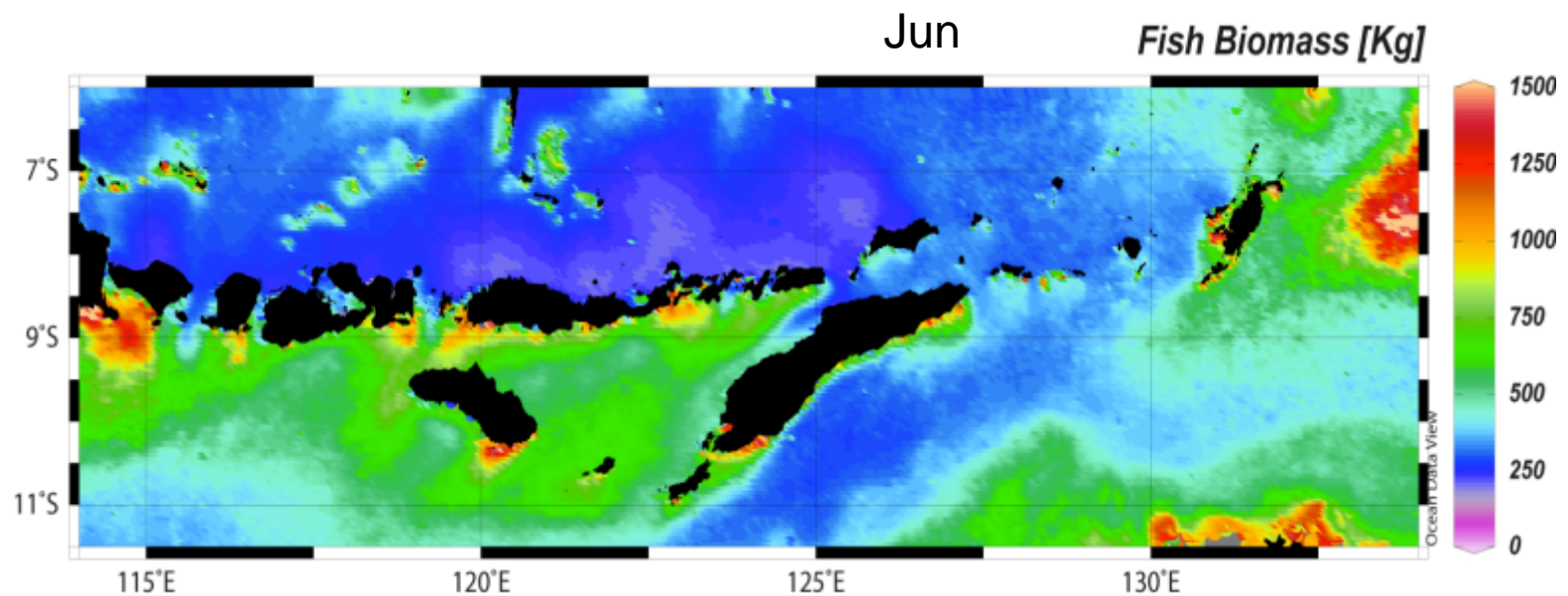
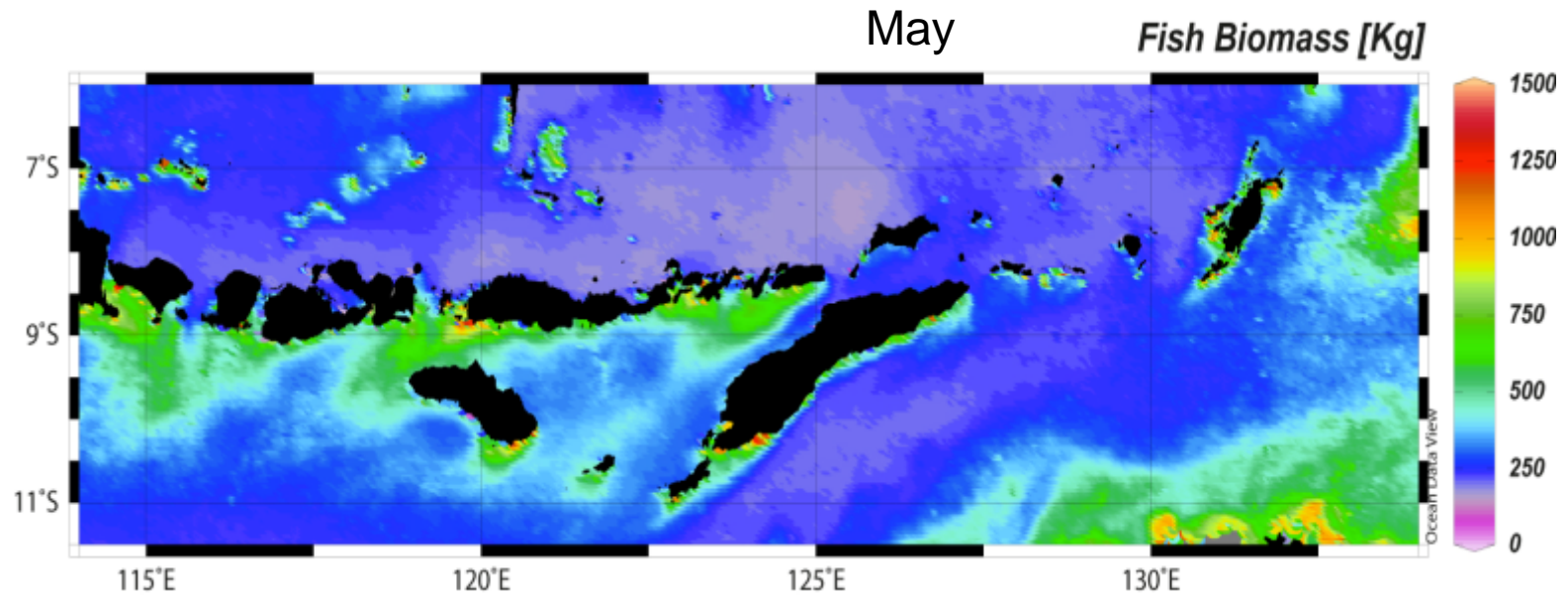


# Monthly mean of Fish Biomass Distribution during 2004-2014

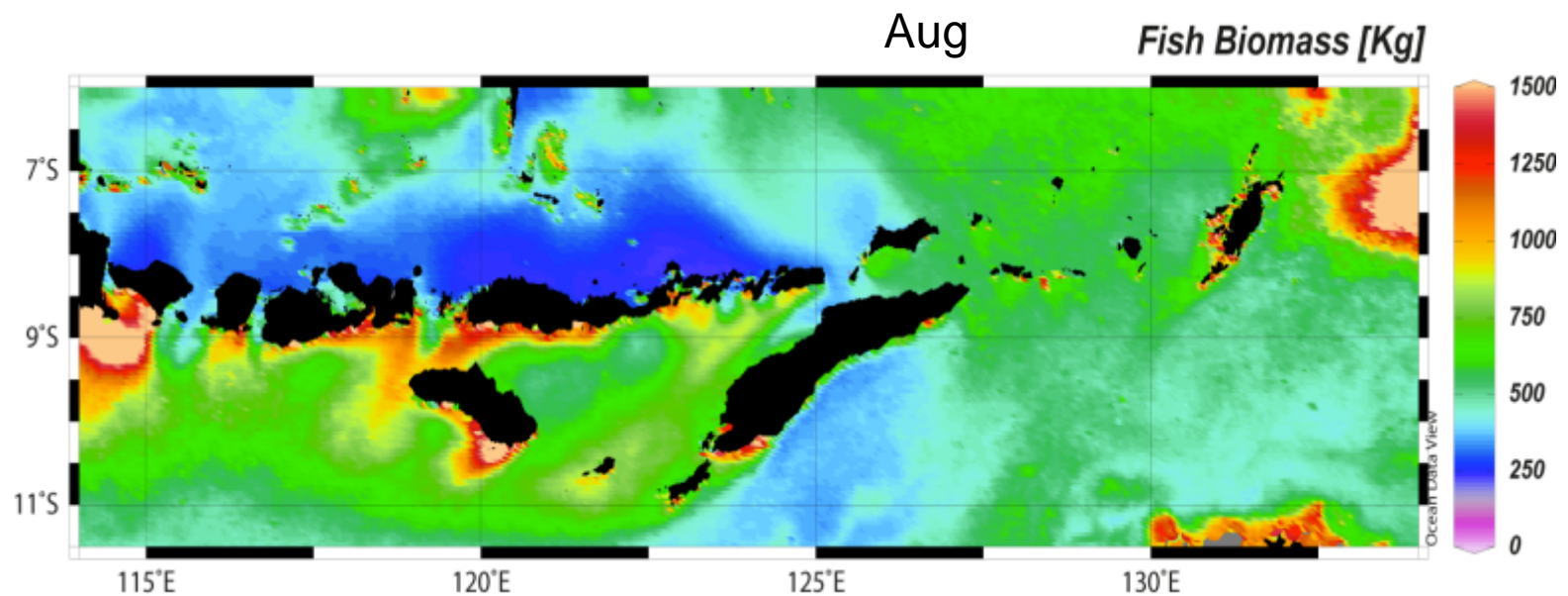
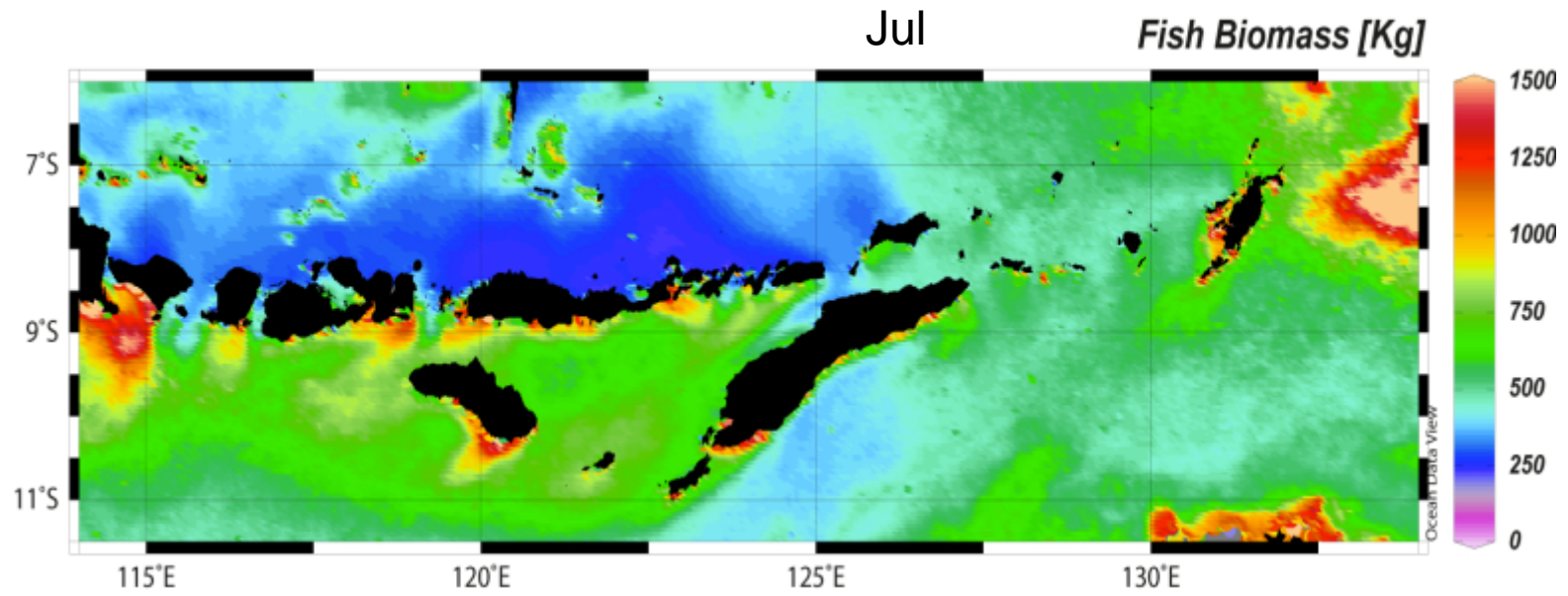




# Monthly mean of Fish Biomass Distribution during 2004-2014

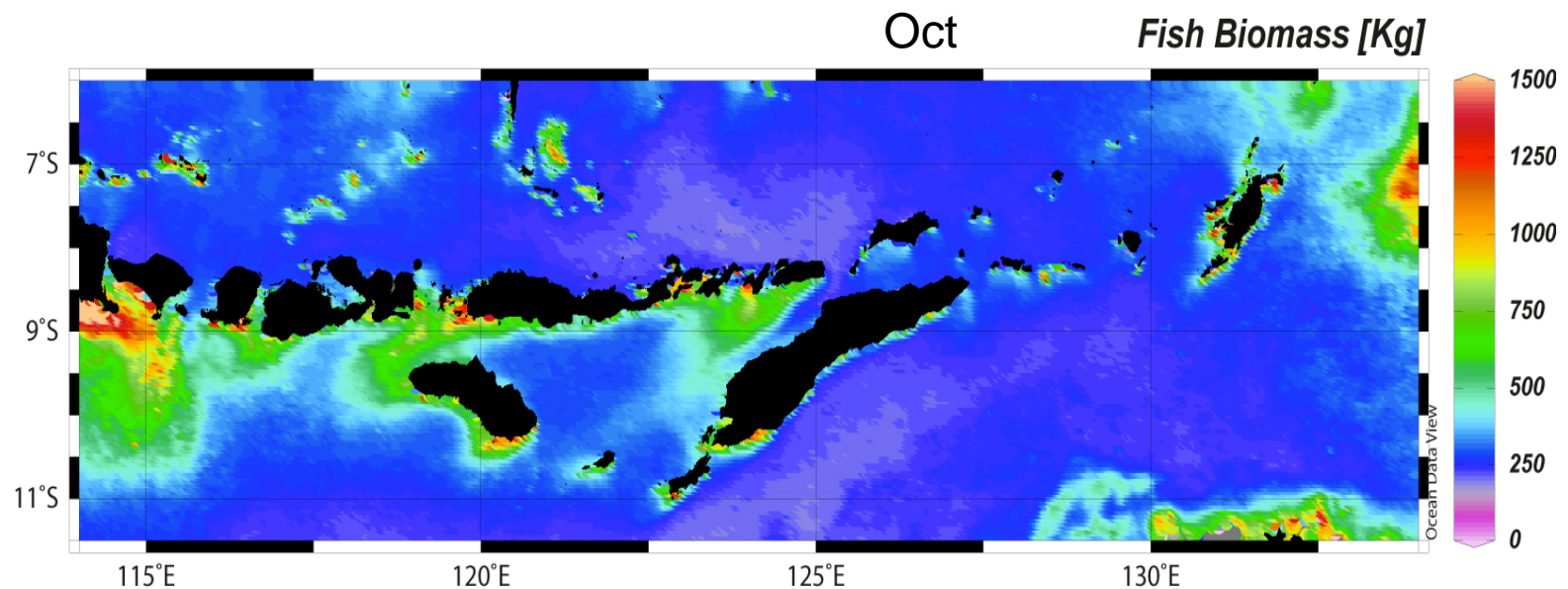
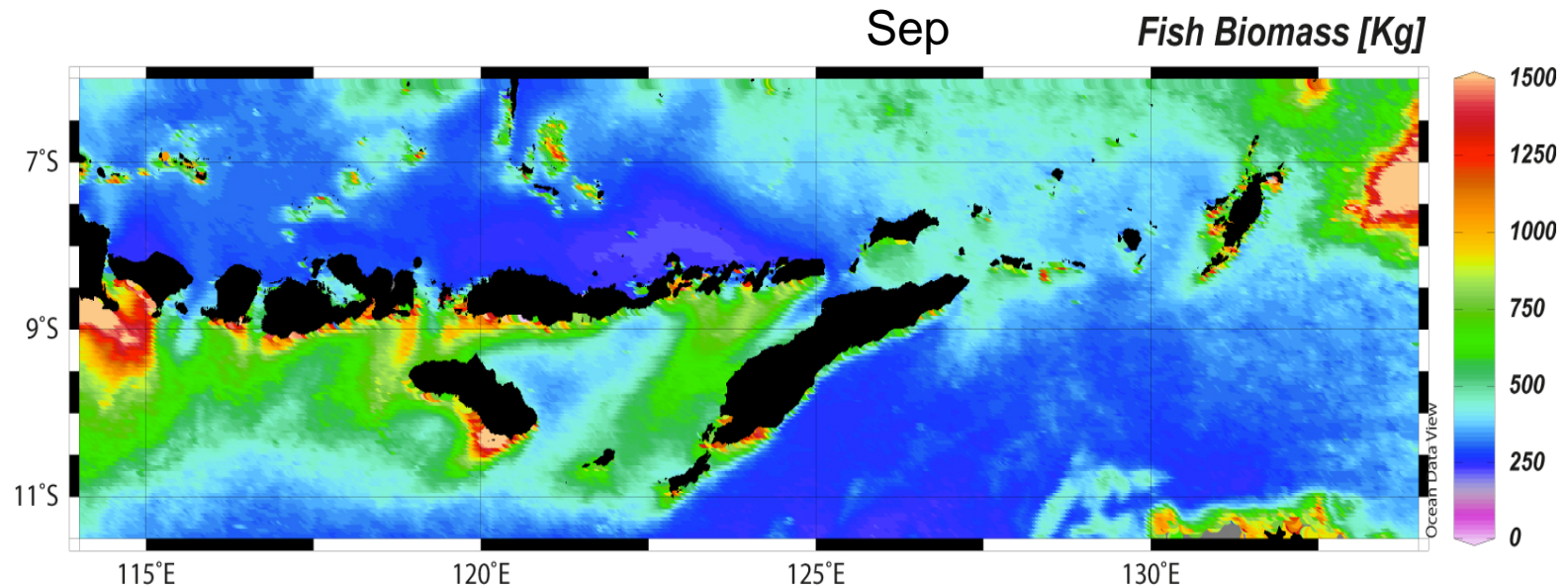


# Monthly mean of Fish Biomass Distribution during 2004-2014



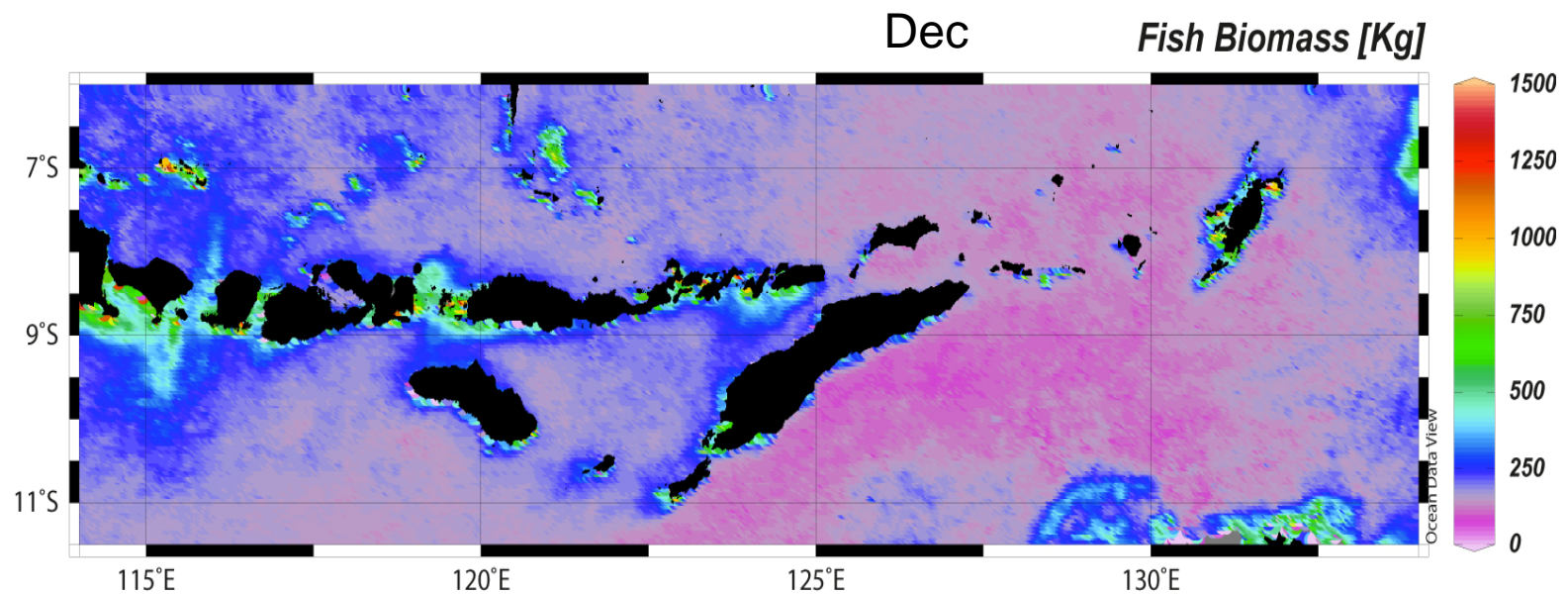
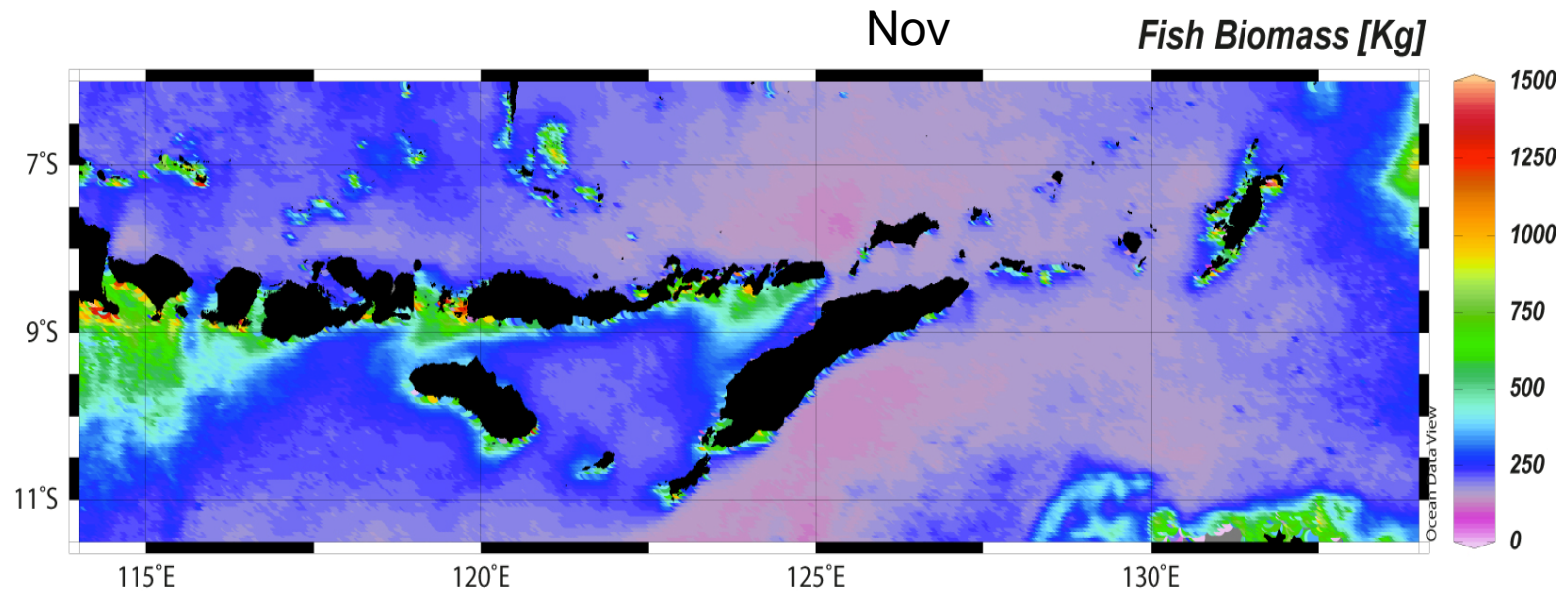


# Monthly mean of Fish Biomass Distribution during 2004-2014





# Monthly mean of Fish Biomass Distribution during 2004-2014



## The world distribution of *Manta birostris* (IUCN Redlist, 2014)



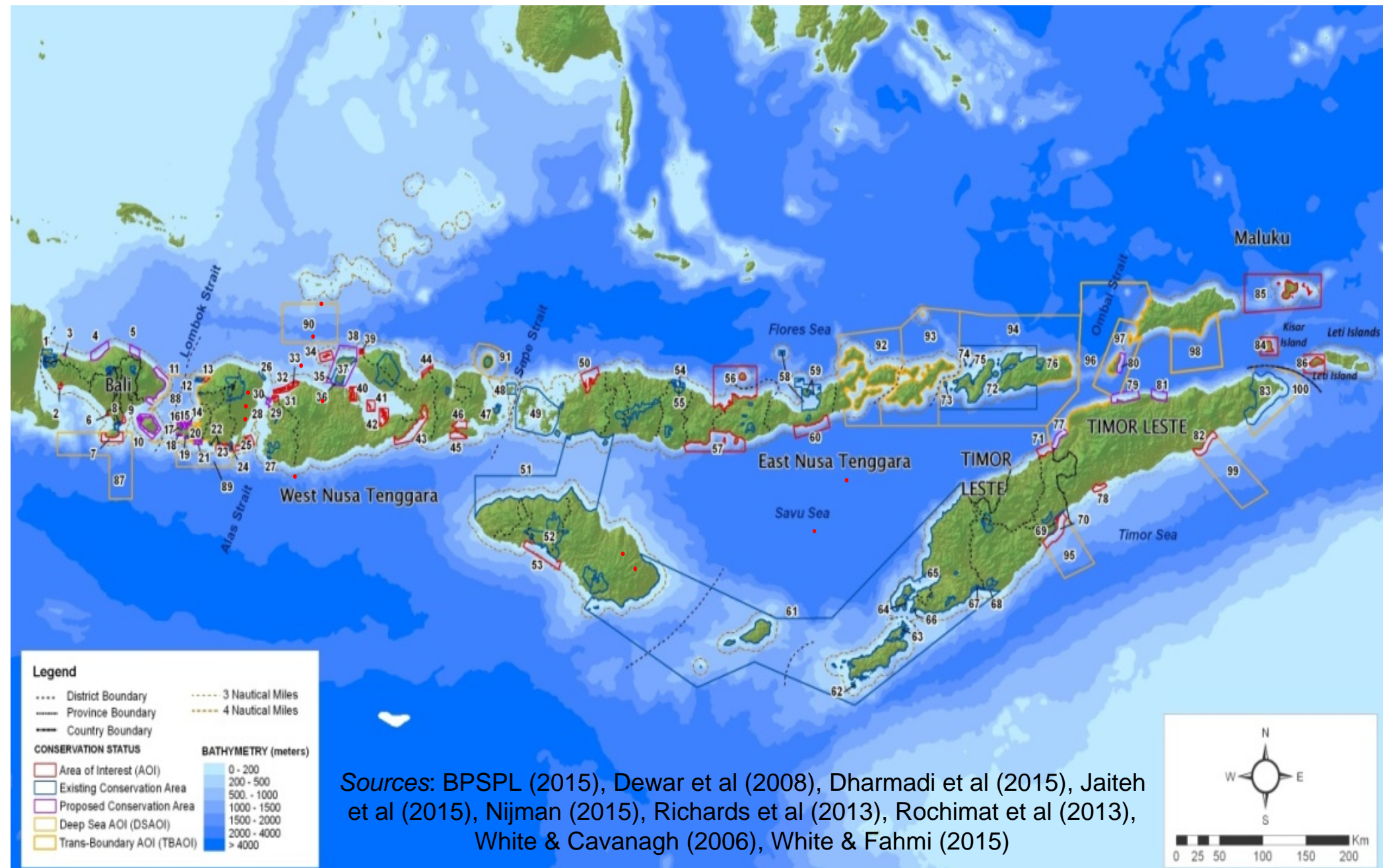
# Mapping of Manta Rays in Indonesia

✦ : *Manta alfredi*  
✦ : *Manta birostris*



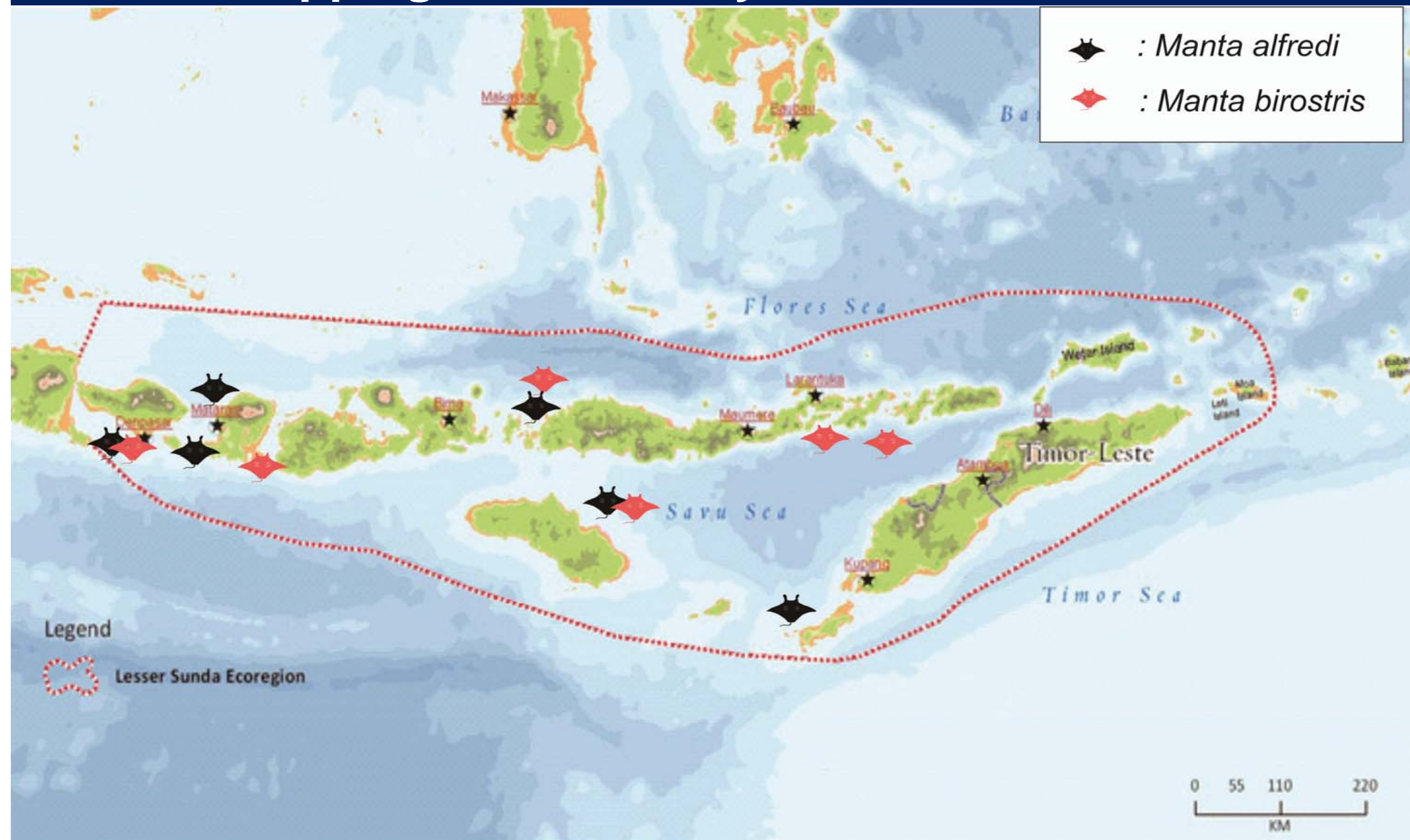


# Mapping of Manta Rays in Lesser Sunda



Sources: BPSPL (2015), Dewar et al (2008), Dharmadi et al (2015), Jaiteh et al (2015), Nijman (2015), Richards et al (2013), Rochimat et al (2013), White & Cavanagh (2006), White & Fahmi (2015)

# Mapping of Manta Rays in Lesser Sunda





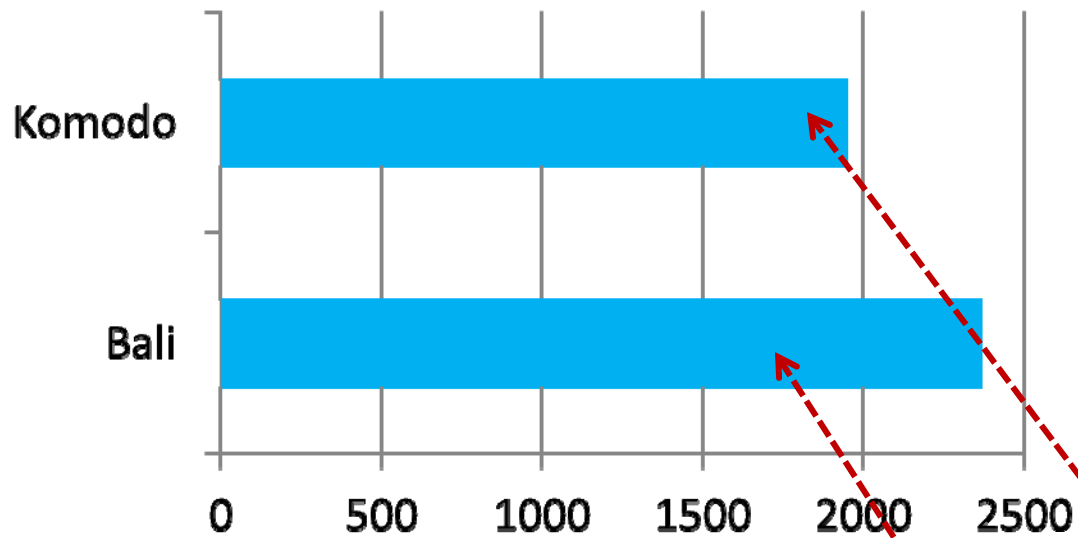
## A Case map result of PSAT Manta Rays in Nusa Penida (BPSPL Denpasar, 2015)



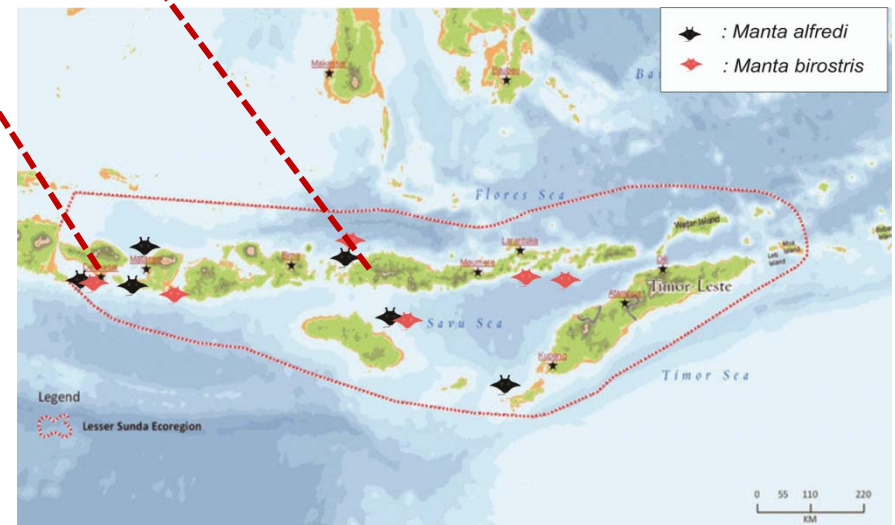
## Manta rays migration route suggests mantas travels alongside southern Lesser Sunda (Bali-Lombok-Sumbawa-Flores) (BPSPL Denpasar, 2015)



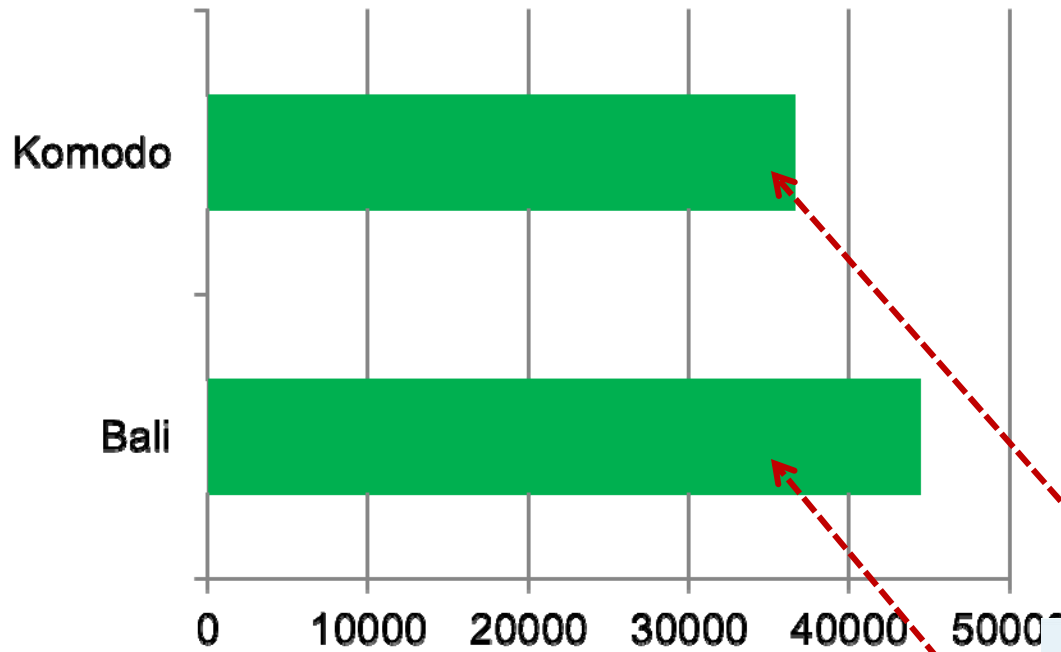
# Economic Value of Manta Rays



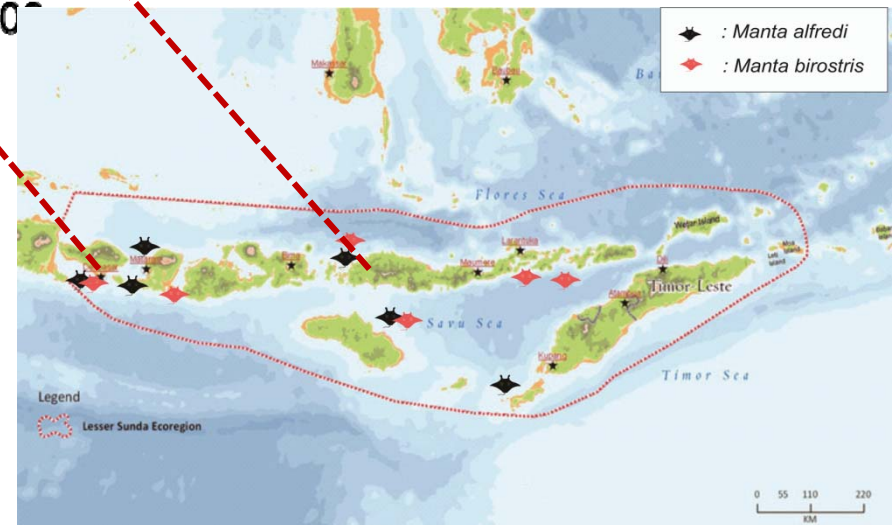
Estimated Value per cycle of Manta Rays  
in million IDR  
(LIPI, 2014)



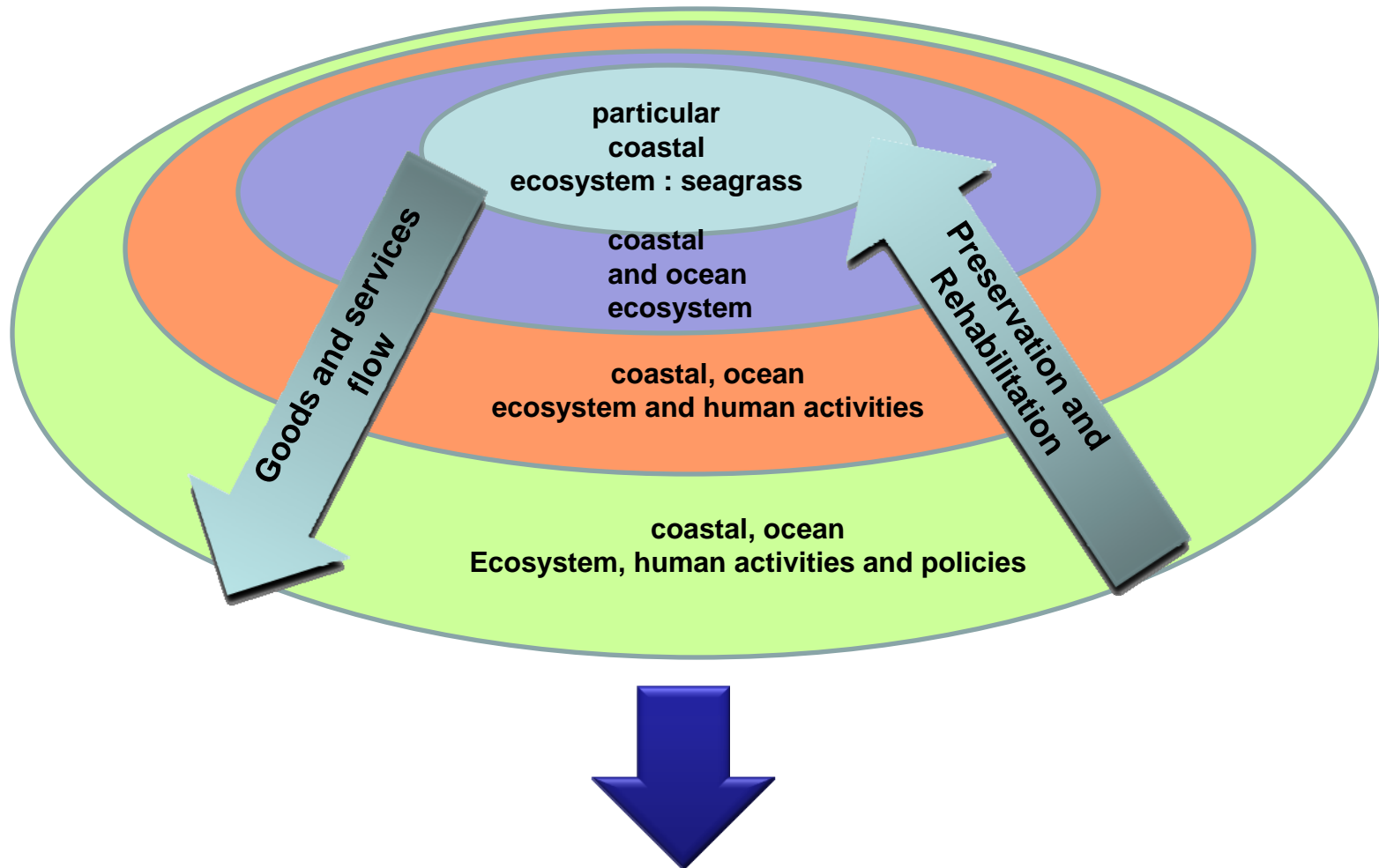
# Economic Value of Manta Rays



Estimated Value total revenues of Manta Rays in million IDR (LIPI, 2014)

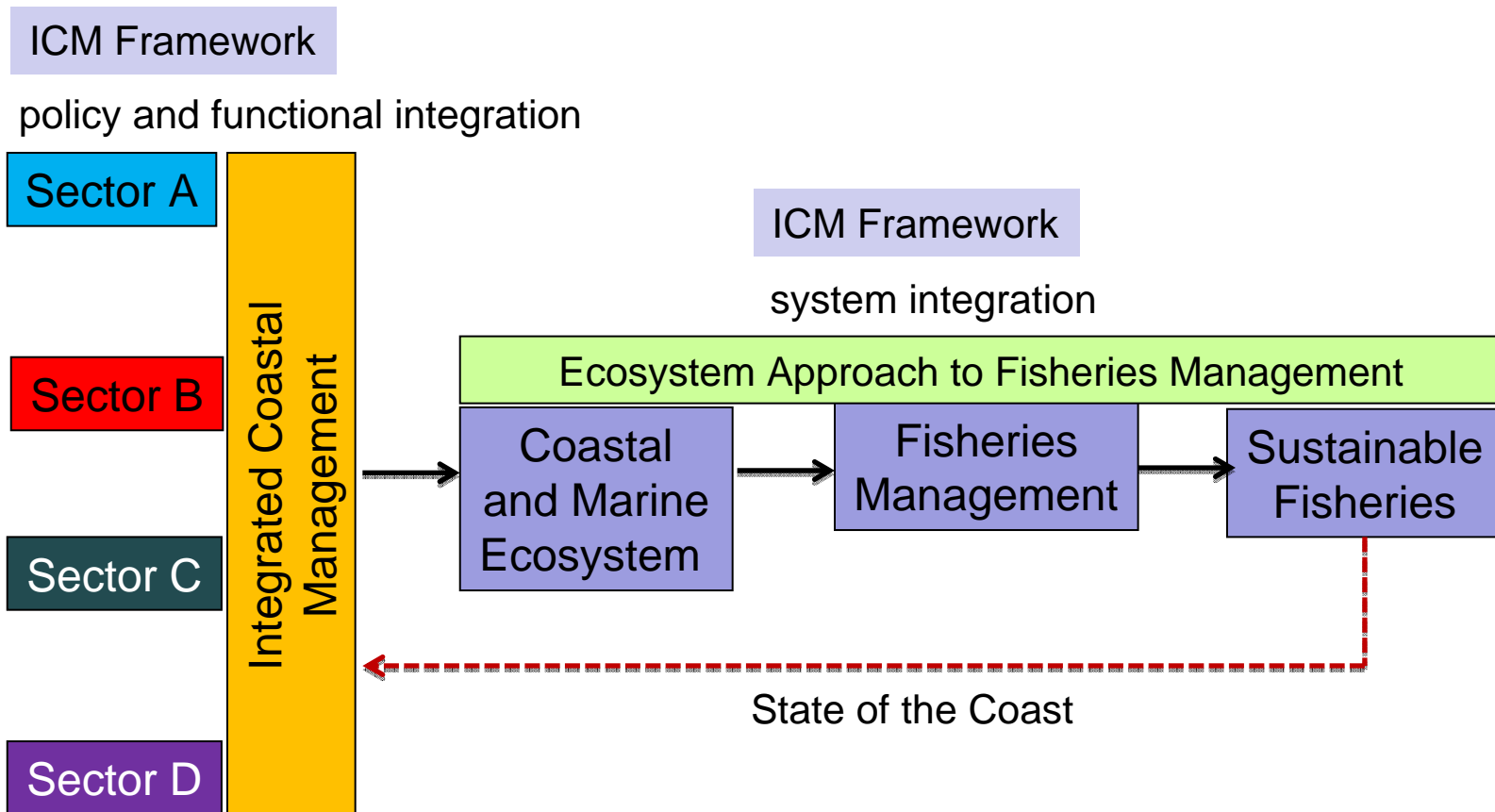


# ICM and Seagrass Ecosystems Management



**Integrated Coastal Resources Management**

# EAFM as tools of ICM – Systematic Thinking



**Thank You**