

### Marine Biodiversity in Indonesia

DR. DIRHAMSYAH RESEARCH CENTRE FOR OCEANOGRAPHY

**INDONESIAN INSTITUTE OF SCIENCES** 





### Short information of RCO-LIPI



### **GENERAL INFORMATION**

### TERRITORIAL, GEOLOGICAL SETTING AND BIOLOGICAL CHARACTERISTIC OF INDONESIA





### **INDONESIA**

- China
- National Jurisdiction
- Total land area
- Total Sea area
- Archipelagic water
- Teritorial sea (12 miles)
- Economic Exclusive Zone
- Number of Island
- Total shoreline
- Length: west east north - south

- : 7.73 million km<sup>2</sup>
- : 1.93 million km<sup>2</sup>
- : 5.80 million km<sup>2</sup>
- : 2.80 million km<sup>2</sup>
- : 0.30 million km<sup>2</sup>
- : 2.70 million km<sup>2</sup>
- : 18,110 Islands
- : 108,920 km
- : 5,200 km : 1,760 km



### Indonesian archipelago - complex geological setting.

Extensive shelves, deep-sea basins, trenches, and submarine volcanoes

### Tectonically – highly unstable:

❖ Lies on the Pacific Ring of Fire: the Indo-Australian Plate and the Pacific Plate → pushed under the Eurasian Plate → melt at about 100 km deep → responsible to Tsunamis and Earthquakes

### Indonesia leads the world in many volcano statistics.

✤ 400 volcanoes → approximately 150 are active

### Climate in Indonesia is almost entirely tropical.

- Average temperature in coastal plains of 28°C
- ✤ Humidity: 62–81%.

Eurasian

plate

Pacific plate

m

*Philippines plate* 

Australian plate



- Tidal phenomena in the Indonesian seas are among the most complex in the world.
- Surface current: → more strongly influenced by circulation from the Pacific Ocean rather than the Indian Ocean.
- The Indonesian archipelago plays an important role in global water mass transport from the Pacific to the Indian Ocean: → the Indonesian Through Flow (ITF) or Arlindo.
- The Indonesian region is considered a "maritime continent" along with equatorial Africa and South America.



The Indonesian Through-Flow pathways and estimates of total volume transport (in Sv = 106 m3/sec). (Gordon, 2005)























- Marine and coastal area provide economic significances for 25% of Indonesian
- Indonesian waters have strategic position in global trade and shipping → more than 40% global shipping through 4 big straits in Indonesia (Malacca Strait, Sunda Strait, Lombok Strait and Makassar Strait)
- However, marine and coastal resources management facing with several problems, such as
  - Degradation of some marine ecosystems (coral reefs, mangroves and seagrasses)
  - Overfishing, IUU Fishing
  - Marine Pollution from shipping and domestic waste
  - Climate Change

### **Global Trade of Oil, Gas and Mineral)**



### Waste and Pollution Threats from shipping and Global Trade



Pacific Oce

6





# How to address the problems ??

### Inconesia Global Ocean Fulcrum A national development program in maritime sector

### Indonesian Global Ocean Fulcrum





### 1. Exploration and conservation research on marine and coastal resources



### (Flagship Program)

- Conducting the Widya Nusantara Expedition (EWIN) in border and frontier areas → annually
  - Inter-disciplinary studies (oceanography, geology, biology, & social)
  - Inventarisation of marine and coastal biodiversity
    - Marine and coastal biodiversity
    - Dynamic population of marine & coastal resources
    - Identification the potential fishing ground
    - Development of DNA's Bank of Indonesian marine biodiversity
    - Research and monitoring of coastal ecosystem and health
    - Small island and border areas management

Food security

### ARCHIPELAGIC MARINE EXPEDITION 2015-2019







Activities before 2014 2015 (Enggano, Sabang & Tomini) 2016 (Sumba Island)



2017 (Sulawesi Sea) 2018 (Miangas Island) 2019 (Natuna Island)



### New species and new record



Myzosłoma debiae a. sp.







Notonyx guinotae Rahayu & Ng, 2010



Indopinnixa kasijani Rahayu & Ng, 2010



Indopinnixa maasai Rahayu & Ng, 2010



Natanys castrol Rahayu & Ng, 2010



Notonyx falcatus Rahayu & Ng, 2010







Himontura tutul



Salmoneix yayo sp. nav,



Vanderhorstia lepidobucca

# Priority Program

Exploration, Management and Utilization of Marine Biodiversity: Sea cucumber in Indonesia



### **Priorities Program**



### **Development of Sea Cucumber Aquaculture Technology**





### Development of Holothuria atra as pharmaceutical





**Drug production on the basis of marine biota materials** 

### **Thematic Program**



Marine Biodiversity studies	<ul> <li>Dynamic population of marine endangered species</li> <li>Ecology of spawning &amp; migration areas of such marine biota , such as eel &amp; tuna</li> </ul>	
Conservation and Restoration of Ecosystem Health	<ul> <li>Development Index of coastal ecosystem health</li> <li>Development of biota indicator for marine and estuary pollution</li> <li>Bioremediation technology of oil spill in coastal ecosystems</li> </ul>	
Climate Change	<ul> <li>Study of climate change impact on coastal environment</li> <li>Blue carbon in coastal ecosystems (carbon storage)</li> </ul>	
Utilization of Marine Biodiversity	<ul> <li>Mariculture for abalone, pearl oyster, sea horse and lobster</li> <li>Development of food supplement and medicine from marine resources</li> </ul>	
Renewable Energy	<ul> <li>Micro algae, wave, current and tide</li> </ul>	

### Special Assessment Program Coremap-CTI sites (2014-2019) LIPI





### Development of ecosystem database

**Spatial** 

Non-spatial

P ☆ 白 キ ☆ □

Database

CRITC



#### **National Repository Data**

- Coral reefs
- Seagrasses
- Mangroves

#### **Contribute to Onemap Policy**

- Coral reefs
- Seagrasses

#### **Climate Change**

- Carbon stock
- Potency of Co2 emission reducing in coastal ecosystems

#### **National Spatial Planning**

- Distribution of habitat
- Marine ecosystem status
- Marine environment



### Marine Biodiversity in Malacca Strait (*Batam and Bintan waters*)





### Marine biodiversity in Bintan and Batam waters

- All coastal ecosystems, such as mangroves, seagrasses, coral reefs exist in those areas
- According to the current survey by RCO-LIPI in 2014:
  - Mangroves

LIPI

- There exist 26 species of 16 families of mangrove which dominated by *Rhizophora apiculata* and *Rhizophora mucronata*
- The mangrove was categorized as moderate and good condition
- Mangrove percentage cover about 63.96 + 21.27 % sampai 89.57 + 3.71%. (Mannuputty, 2014)
- Seagrass beds:
  - Nine species of seagrass, i.e Enhalus acoroides, Thalassia hemprichi, Cymodocearotundata, Cymodocea serrulata, H Halodule univervis, Halophila pinifolia, Syringodium isoetifolium, Thalassodendron ciliatum and Halophila ovalis. With dominated by Enhalus acoroides and Thalassia hemprichi

### Marine biodiversity in Bintan and Batam waters

Coral Reefs

LIPI

- Coral cover in Bintan waters varies from 1.20% to 54.80% (from 'bad' to 'good' condition)
- There are 118 species of 14 families of coral reef
- Generally, the coral type is dominated by stony coral (Galaxea fascicularis, Porites cylindrica, Porites lobata and Porites lutea)
- The fringing reefs is dominated by Caulastrea furcata, Acropora brueggemanni, and Montipora foliosa.
- Coral Fish
  - Species indicator: two species of one family
  - Target indicator: 49 species of 11 families
- Mega benthos fauna (commercial)
  - Echinoderm: one species of Acanthaster planci and two species of Diadema sp.
  - Mollusk: three species (*Tridacna gigas*, Drupella sp., Trochus sp.)

### 

### **Other Species**

In Bintan also found other marine fauna such as sea horse (Hippocampus sp. and *dugong dugon* (endangered species)







### Mangroves and coral fish in Bintan



#

LIPI







### Water Quality Condition

- According to the current survey carried out by RCO-LIPI in 2014:
  - The water quality of Bintan and Batam is relatively still in good condition. Most of the water quality parameters, such as acidity (pH), salinity, oxygen, temperature, NO<sub>3</sub>, PO<sub>4</sub>, and SiO<sub>3</sub> are included in a normal level (according to the Indonesian National Standard of Seawater quality)
  - As well as the water quality condition, the condition of microbiology (heterotrophic and coli form) still good condition (RCO-LIPI, 2012)
- However, in the north season there found 'tar ball' along the beach of Mapur Island, in northern part of Bintan Regency





### **Additional Information**

- The importance of marine environment for human being has occurred in Bintan
- Several initiatives for sustainable marine resources management have been done in this area for more a decade.
- Ultimately, in 2009 through the Decree of Bintan Major (No. 58/II/2009), the local government established a District Marine Conservation Area (DMCA) with the width area of 472.905 ha.
- The designated area is based on the richness of biodiversity and the threat of anthropogenic impact.



### MARINE ENVIRONMENTAL BASELINE SURVEY

### PROPOSAL

- **H** LIPI
  - □ Study Parameters:

### Biological Oceanographic Parameters:

- Plankton and Primary Productivity
- Macrobenthos (Polychaet, Mollusk. Crustacean, Echinoderm, Minor Phylla)
- Microbiology
- Physical Oceanographic Parameters:
  - Current Flow, Tide, Temperature, Dissolved Oxygen (DO), Salinity, Turbidity, Total Suspendid Solids (TSS)
- Chemical Oceanographic Parameters:
  - Total Organic Carbon (TOC), Nutrient (Nitrogen and Phosphorus), Heavy Metals in sediment (Cu, Pb, mercury)

### **Equipment:**

### Biological Oceanographic Parameters:

- Plankton net (Kitahara), MacIntyre Grab, Sieve
- Physical Oceanographic Parameters:
  - Current meter, Turbidity meter, Secchi disc,
- Chemical Oceanographic Parameters:
  - Niskin bottle

### PROPOSAL



### **Study Location:**

- 4 major ports in Indonesia: Tanjung Priok (Jakarta), Tanjung Perak (East Java), Belawan (North Sumatera) and Soekarno Hatta (Makassar)
- 8 international ports: (based on suggestion from the Ministry of Transportation)

### Personnel:

- Dr. Yetty Darmayati, Team Leader (Microbiology)
- Dr. Dwi Hindarti, Chemist
- Lestari, M.Sc., Chemist
- Hikmah Thoha, Plankton
- Yunia Sari, M.Sc., Geology
- Inayat al Hakim, M.Sc., Macrobenthos
- Edy Kusmanto, Physical Oceanography
- Hanif, M.Sc., Chemist (Nutrient)
- □ Time: 2016 2017
- Budget: ??

### Study location in 4 Main Ports





### Short information about Research Centre for Oceanography Indonesian Institute of Sciences (RCO-LIPI)





### The RCO's history

- 1905: Direktur s'Lands Platentuin established Visscherijj Station
- **1922:** Laboratorium voor het onderzoek der zee
- **1949: Marine Research Institute**
- 1962: Marine Resource Institute changed to Marine Research Institute (LPL)
- 1970: Oceanology National Institute (LON-LIPI)
- 1986: Research & Development Centre for Oceanology (P3O LIPI)
- 2001: Research Centre for Oceanography (RCO LIPI)







Marine Biodiversity Resources and conservation

Protection and restoration of marine ecosystem health

LIPI

Research

Groups

Oceanography and Global Climate Change

**Pollution and Bioremediation** 

Aquaculture and Marine bioprospecting

### Human Resources

#### **Employee based function**

LIPI



#### Employee based on age



### Total employee per 31 August 2016 347 persons

### Total employee based on education



# OUR EXPERTISE

### 149 scientists have expertise on:

<ul> <li>Biological Oceanography:</li> <li>Coral reef</li> <li>Mangroves</li> <li>Seagrass and Algae</li> <li>Macrobenthos <ul> <li>Mollusk,</li> <li>Crustacean,</li> <li>Polychaeta,</li> <li>Echinoderm,</li> <li>Minor phylla</li> </ul> </li> <li>Nekton (Fish)</li> <li>Plankton</li> <li>Microbiology</li> </ul>	<ul> <li>Chemistry Oceanography:         <ul> <li>Nutrient</li> <li>Organic Pollutant (heavy metals)</li> <li>Un-organic Pollutant</li> <li>Toxicity</li> </ul> </li> </ul>	<ul> <li>Physical Oceanography :         <ul> <li>Physical</li> <li>Current, Tide, Wave</li> <li>Water mass characteristic:</li> <li>Salinity,</li> <li>Temperature</li> </ul> </li> <li>Mariculture and Marine Biotechnology :         <ul> <li>Mariculture of invertebrate</li> <li>Marine Biotechnology</li> <li>Biological molecular</li> <li>Marine Bioprospection</li> </ul> </li> </ul>
	<ul> <li>Marine Geology :         <ul> <li>Paleo-oceanography</li> <li>Foraminifera</li> <li>Geology:                 <ul> <li>Sedimentology</li> <li>Mining</li> </ul> </li> <li>Environmental Science :                      <ul> <li>Coastal Management</li> <li>GIS</li></ul></li></ul></li></ul>	

# **OUR EXPERIENCE DE LA LE LA LA**







Seagrass field study



Coral reefs field study



### Mangroves field study



Fish identification in lab





Sediment and Water Sampler

### SPECIFIC EXPERIENCED ON BALLAST WATER MANAGEMENT



□ Research Centre for Oceanography is:

- Indonesian Focal Point for the "Project of Extent of Transfer of Nuisance Organisms between South and Southeast Asia by Shipping" collaboration project between ASEAN – India supported by IMO
- The project deals with water quality and invasive species generated from water ballast
- The project started from 2013 still on going project
- In July 2016, there is a workshop in Goa to discuss the extension of this project

## THANK YOU