

*The MRC Regional Stakeholder Forum*

*14<sup>th</sup> – 15<sup>th</sup> December 2017*

*Vientiane, Lao PDR*



# **MRC Council Study – Assessing Impacts on the Environment: Ecosystems and Bioresources**



# Outlines of Presentation

## 1. Review of subjects from last Stakeholder Forum

- How water-resource developments affect rivers
- BioRA process:
  - focus areas/zones
  - indicators

## 2. BioRA results

- Main development scenarios
- Sub-scenarios

## 3. Key messages and recommendations



## Water-resource developments can affect river ecosystems by changing

- flow regimes
- sediment regimes
- water chemistry and temperature regimes
- erosion rates and habitats
- migration paths (dams act as barriers)
- abundance and diversity of plants and animals
- ecosystem services (fisheries and OAAAs)

# Task of BioRA

## **CAUSE**

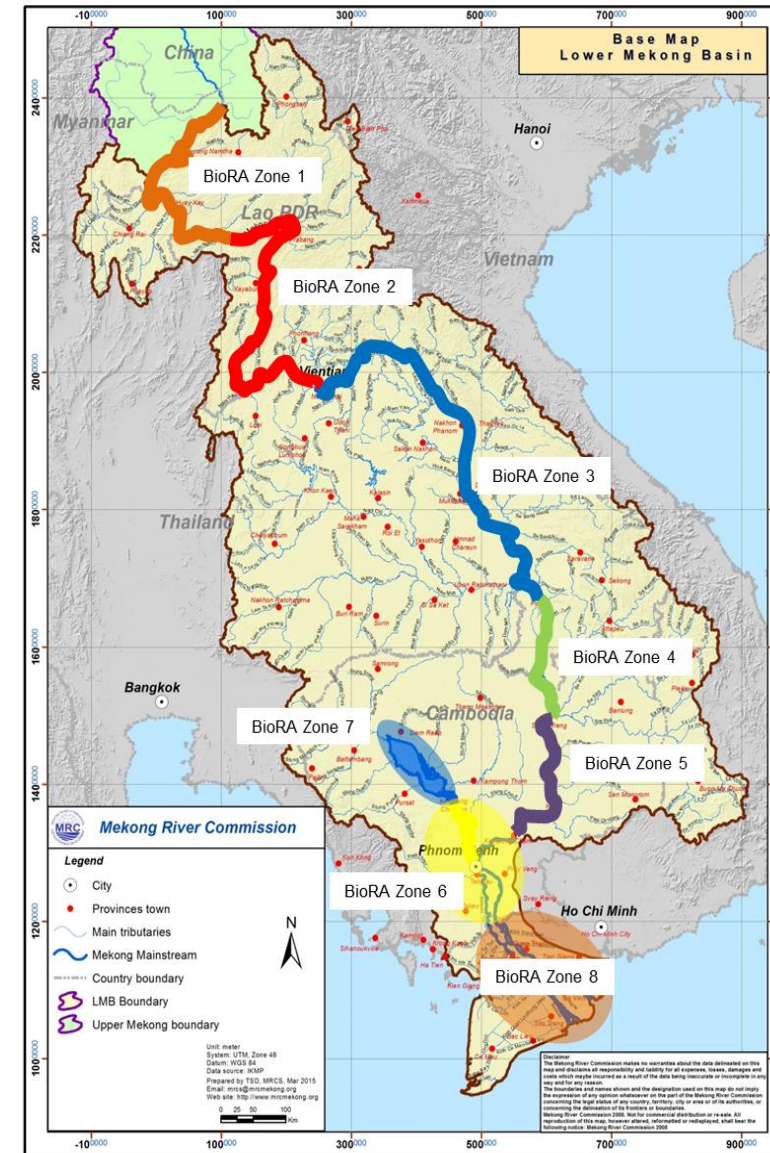
- flow regimes
- sediment regimes
- water chemistry and temperature regimes
- barriers

## **EFFECT**

- habitats
- fauna and flora (biodiversity)
- ecosystem services on which people depend.

# BioRA Zones and Focus Areas

- Eight BioRA Zones, each with one or more Focus Areas
- MT provided scenario outputs at Focus Area
- BioRA Results reported by Zone



# BioRA: 47 Indicators

## **Geomorphology (6)**

- Erosion
- Bed sediment size
- Sandy habitat
- Rocky habitat
- Depth of bedrock pools
- Water clarity

## **Macroinvertebrates (8)**

- Burrowing mayflies
- Snail abundance
- *Neotricula aperta* abundance
- Bivalve abundance
- Polychaete worms
- Shrimps and crabs
- Diversity
- Emergence

## **Fish (11)**

- Rithron residents
- Main channel residents
- Main channel spawner
- Floodplain spawner
- Generalist species
- Floodplain resident (black)
- Estuarine species
- Anadromous species
- Catadromous species
- Marine visitor species
- Non-native species

## **Birds (9)**

- Medium/large ground-nesting channel species
- Tree-nesting large waterbirds
- Bank-/hole-nesting species
- Flocking non-aerial passerine of graminoid beds
- Large ground-nesting species of floodplains
- Large species using bank-side forest
- Rocky-crevice nester in channels
- Dense woody vegetation / water interface
- Small non-flocking using seasonally-flooded plants

## **Herpetofauna (4)**

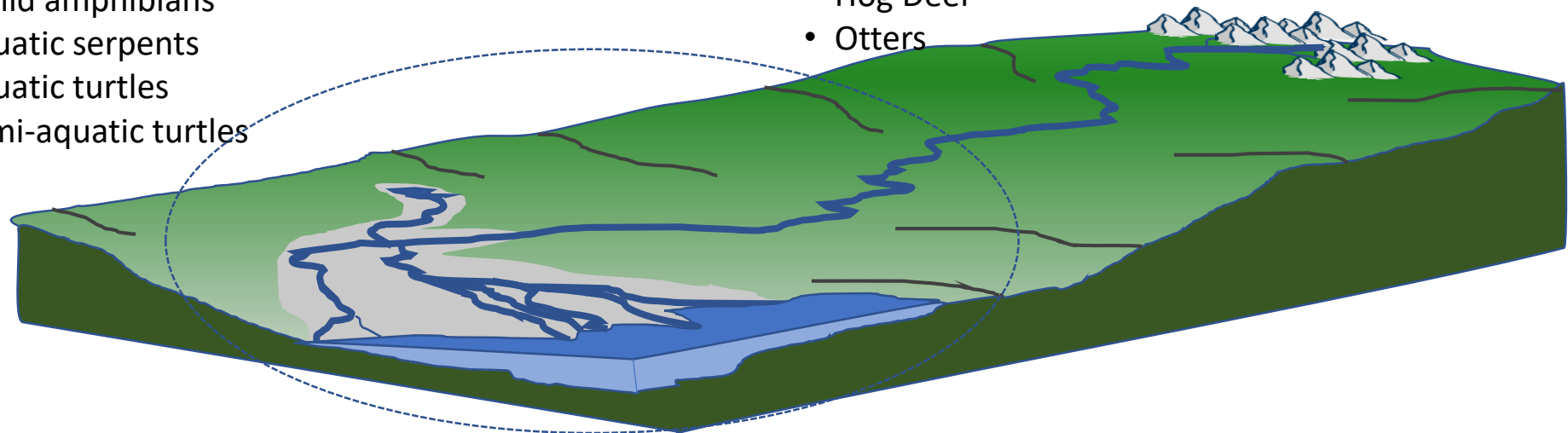
- Ranid amphibians
- Aquatic serpents
- Aquatic turtles
- Semi-aquatic turtles

## **Vegetation (6)**

- Riparian trees
- Bank vegetation cover
- Herbaceous marsh
- Weeds and grasses
- Flooded forest
- Grassland vegetation

## **Mammals (3)**

- Mekong dolphin
- Hog Deer
- Otters



## Scenarios assessed

- Four main development scenarios:
  - 2007, 2020, 2040, 2040CC
- Thirteen sub-scenarios
  - Variations in climate change, agriculture and land use, irrigation, flood protection, navigation and hydropower
- For each Focus Area
- Change reported relative to 2007 Baseline

# Summary of main results

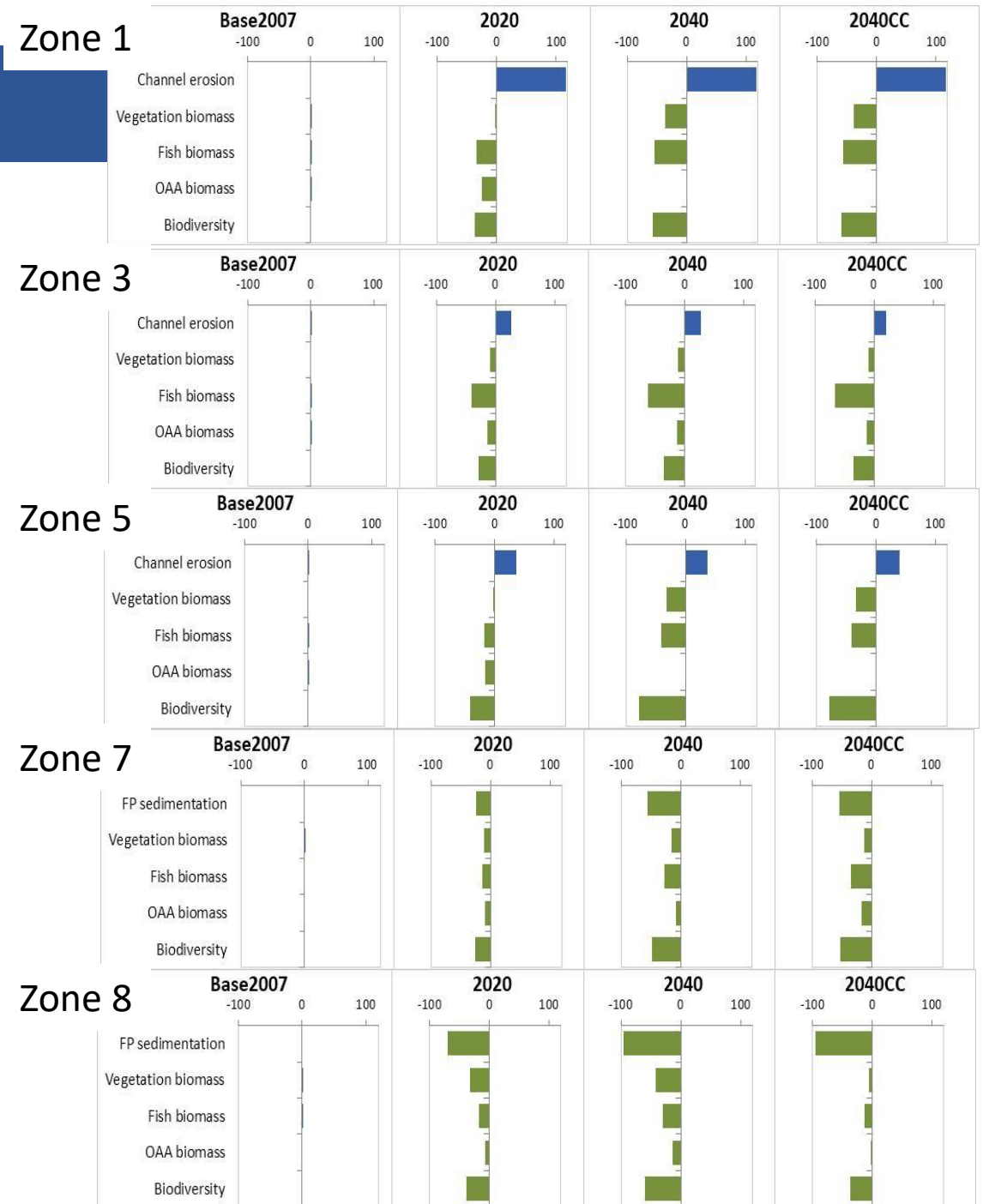
- Impacts driven by:
  - Reduced floodplains
  - Very reduced sediments
  - Barriers to fish and prawn migration
  - Inundation of mainstream river
- Predictions for every indicator:
  - Only summaries shown here





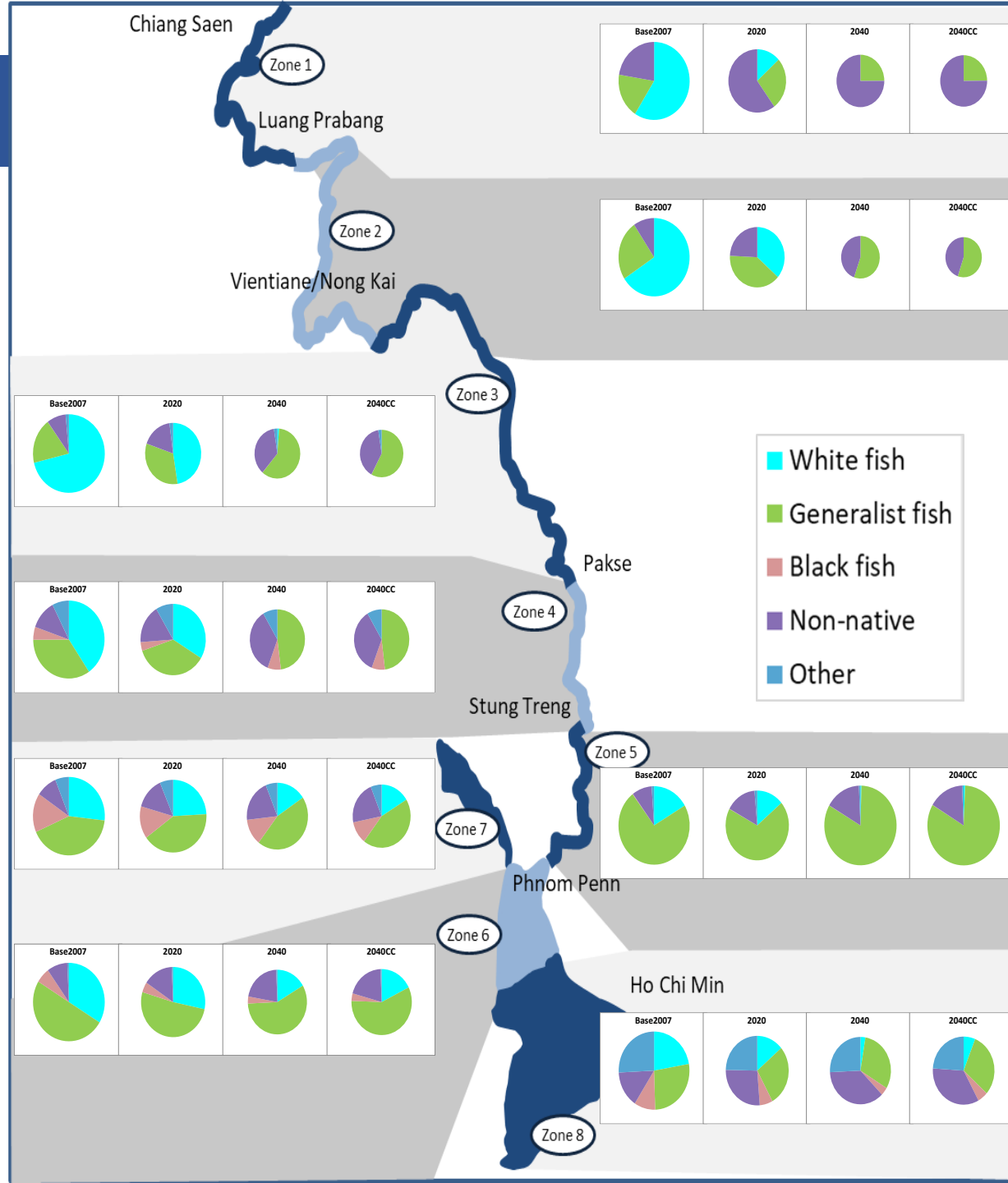
# Change in key indicators

- Increased:
  - Channel erosion
  - OAAs
- Decreased:
  - FP sedimentation
  - Vegetation biomass
  - Fish biomass
  - Biodiversity

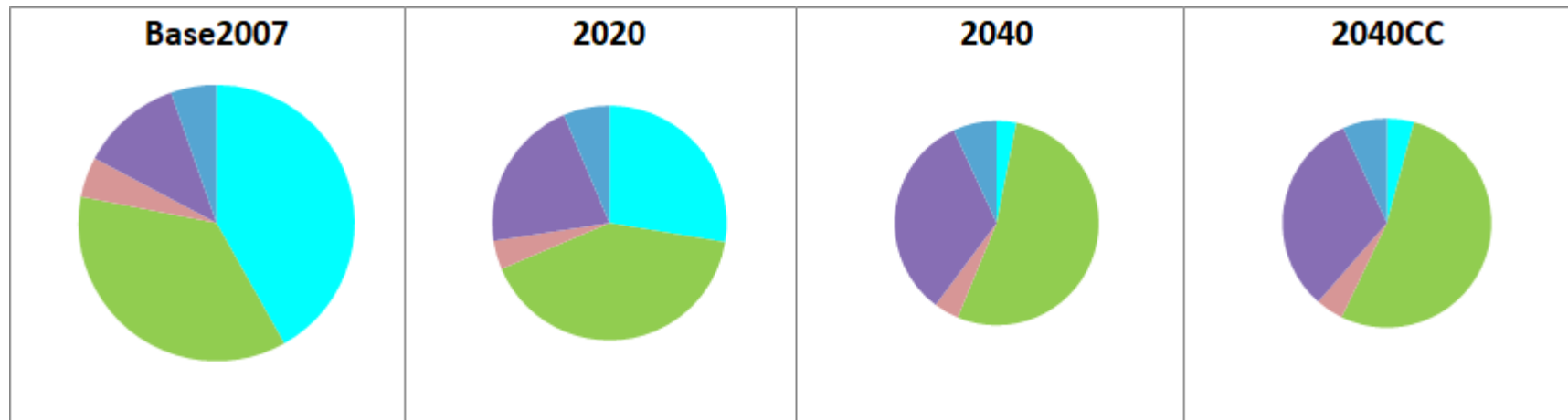


# FISHERIES

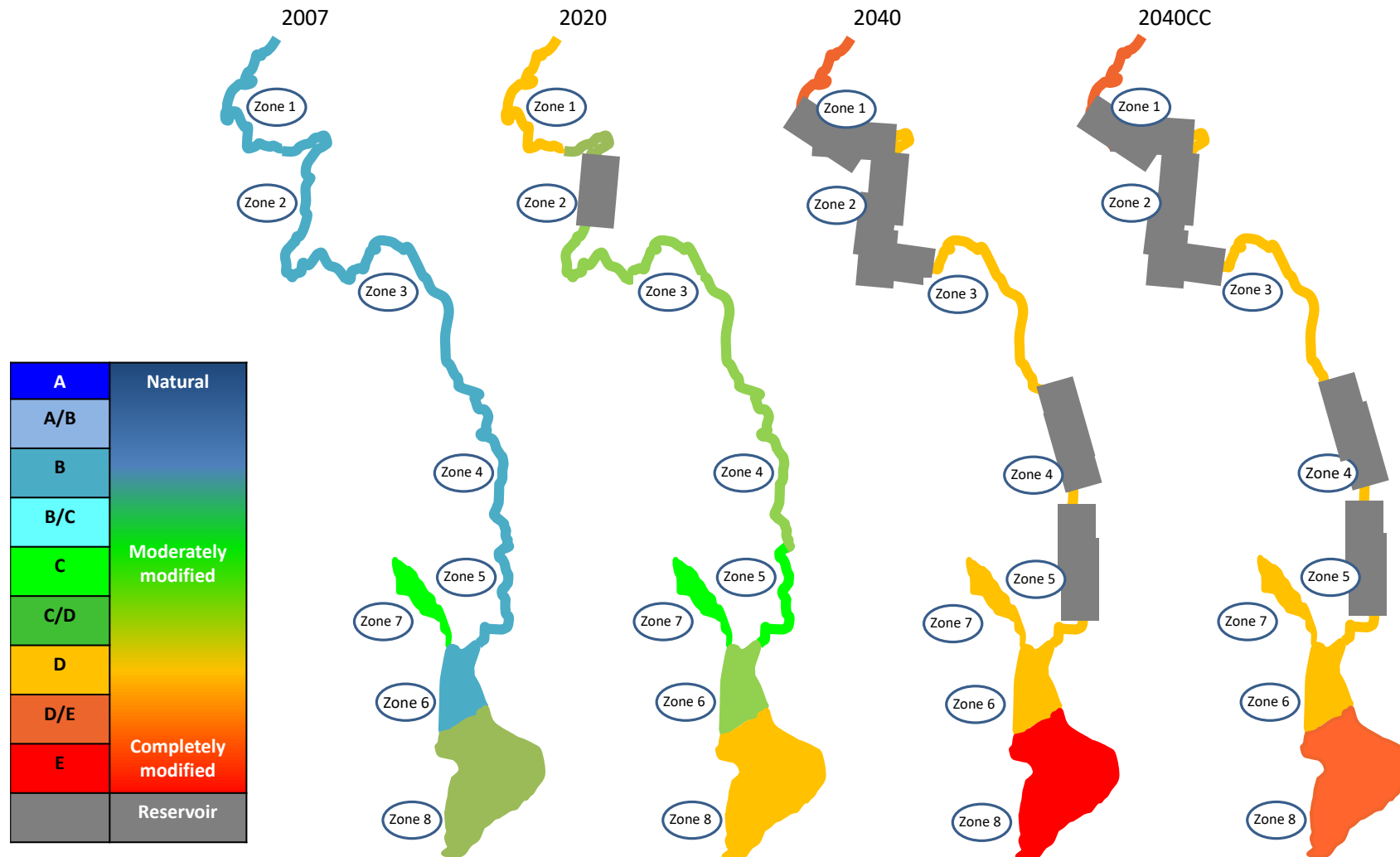
**FISHERIES**  
**Fish biomass drops**  
**White fish lost**  
**Alien fish dominate**



# Fish biomass – whole LMB



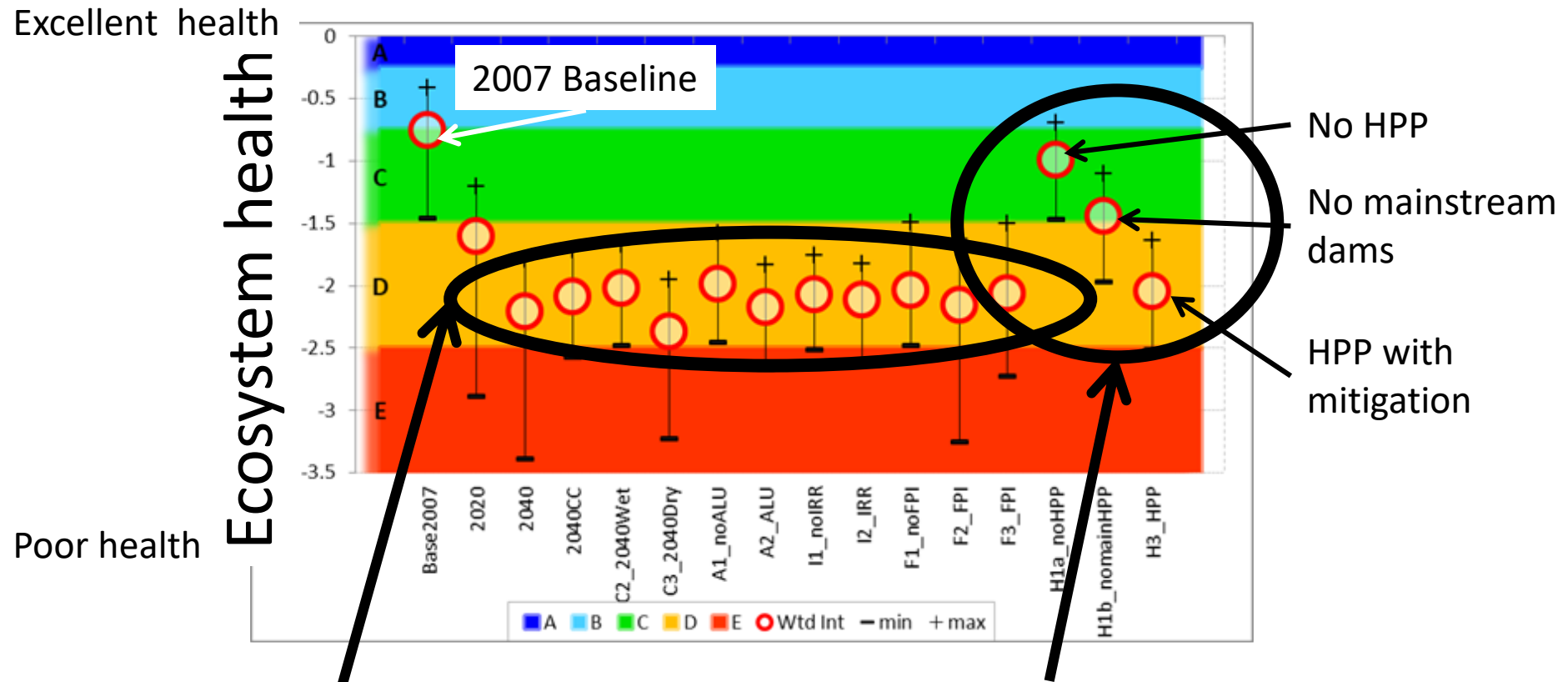
# Overall ecosystem condition



# Thematic sub-scenarios

Designation	Code	Description
Climate change	C2_2040Wet	2040CC with wetter climate
	C3_2040Dry	2040CC with drier climate
Agricultural landuse	A1_noALU	2040CC with agriculture development at 2007 levels
	A2_ALU	2040CC with more agriculture development
Irrigation	I1_noIRR	2040CC with irrigation development at 2007 levels
	I2_IRR	2040CC with more agriculture development
Flood protection infrastructure	F1_noFPI	2040CC with FPI at 2007
	F2_FPI	2040CC with FPI at 'Level 2'
	F3_FPI	2040CC with FPI at 2020 levels and joint operation among dams to reduce flooding
Hydropower	H1a_noHPP	2040CC with LMB hydropower development at 2007
	H1b_nomainHPP	2040CC with Lancang HPPs plus 2040 tributary HPPs
	H2_HPP	Same as 2040CC
	H3_HPP	2040CC but with consideration of mitigation

# Thematic sub-scenarios (2)



Changing hydropower developments significantly affects impacts

Impacts of most sub-scenarios similar to those for 2040

# Key messages

- Significant loss of biodiversity and biomass (fisheries and OAAs) with 2040 developments
- Hydropower impacts overshadow those of all other planned water-resource developments in the LMB.
- Wetter climate will mitigate some of the ecological impacts associated with the Scenario 2040, but only slightly
- Drier climate future will exacerbate the ecological impacts especially in the Tonle Sap System
- Resilience of the LMB aquatic ecosystems to climate change reduced by the developments in Scenario 2040.

## Key recommendations (2)

- Use the BioRA DSS to assist in guiding broad-scale planning and management of the aquatic ecosystems of the LMB, including:
  - the location of new infrastructure,
  - adaptation and mitigation measures;
  - design and evaluation of mitigation options
- Establish guidelines for transparent decision-making on developments based on outcomes of the Council Study.



# Thank you

