

# State of Mekong Fishes: their Potential for Biodiversity Indicator of the Basin



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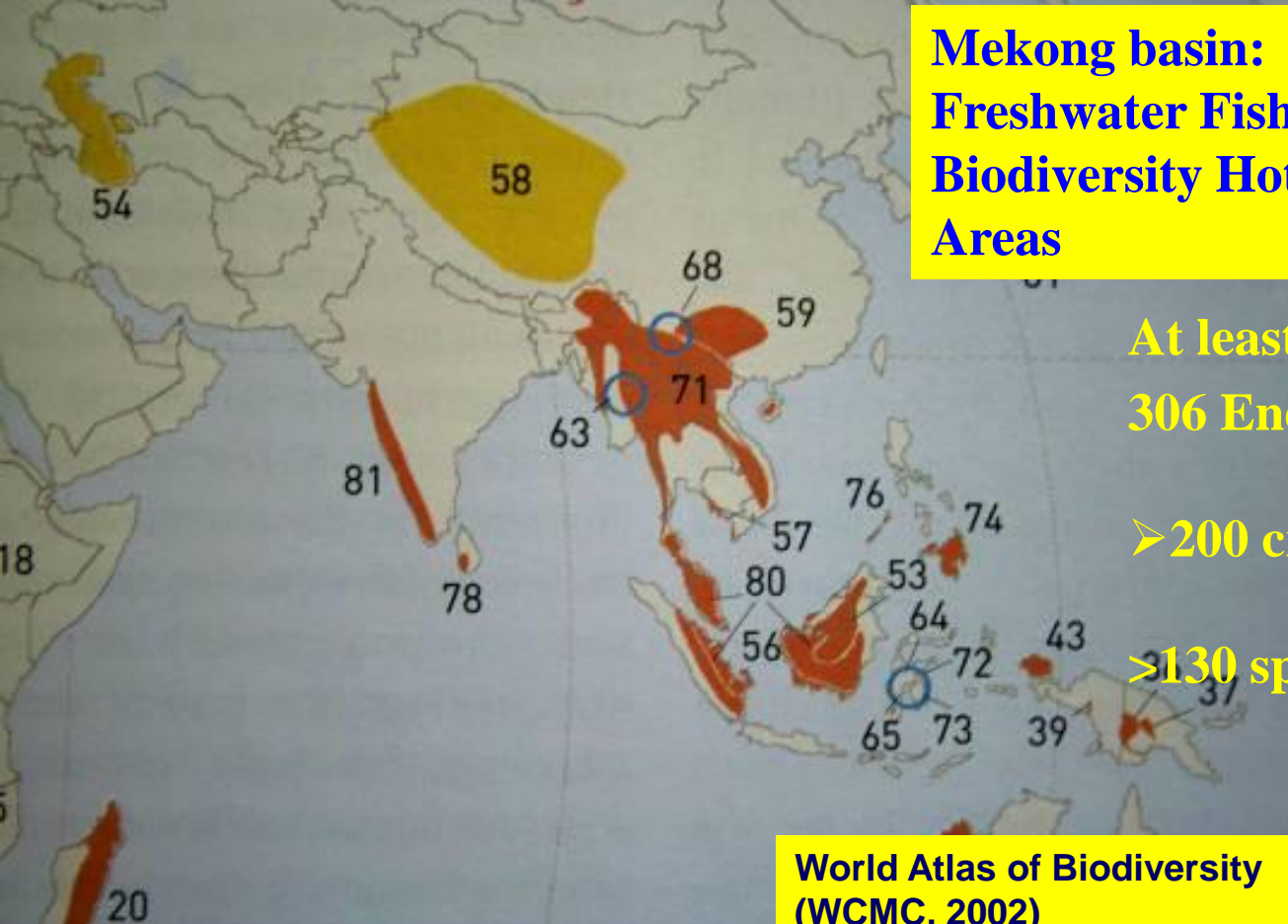
# Mekong basin: one of the Global Freshwater Fish and Shellfish Biodiversity Hotspots and Endemism Areas

At least 900 fish species with 306 Endemic

>200 crabs and shrimps

>130 species snails, clams

World Atlas of Biodiversity (WCMC, 2002)





Highland streams



Nam

Gulf of Tonkin

# 12 habitat types from highland to coastal sea

Chiangsaen-Bo Kaew

Kut ting-Bung Khong Long

Lower Songkram basin



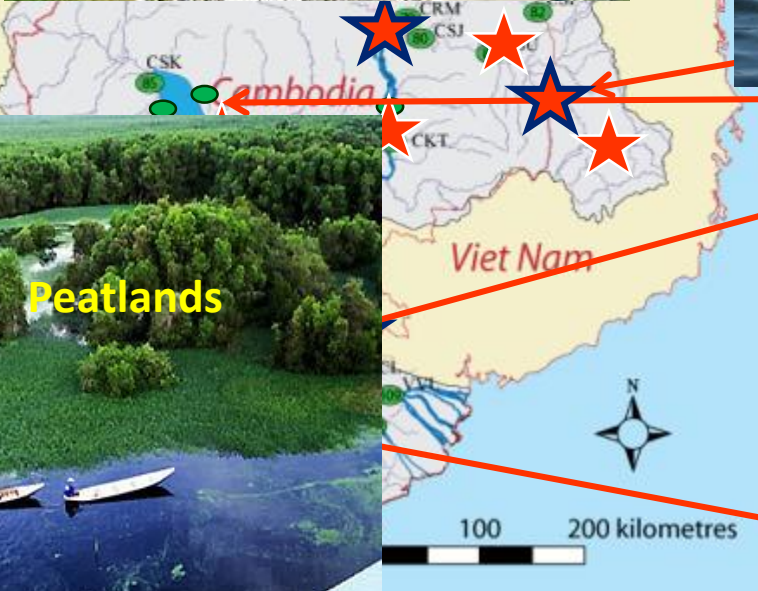
Thailand



Subterranean waters



Great lake



Cambodia

Viet Nam

100 200 kilometres

Tonle Sap/ Great Lake system

Southern

Mekong-



Peatlands

Delta

U Minh-Tra

Chim-Lang S



# Fish species diversity in the 6 main zones of the Mekong River

From: Ian Cowx et al. 2017, Fish and Fisheries in MRC BioRA  
Preparation Meeting 10-12 May 2017, Vientiane



## HIGH MOUNTAINS



151 species  
(12% endemics)

## PLATEAU

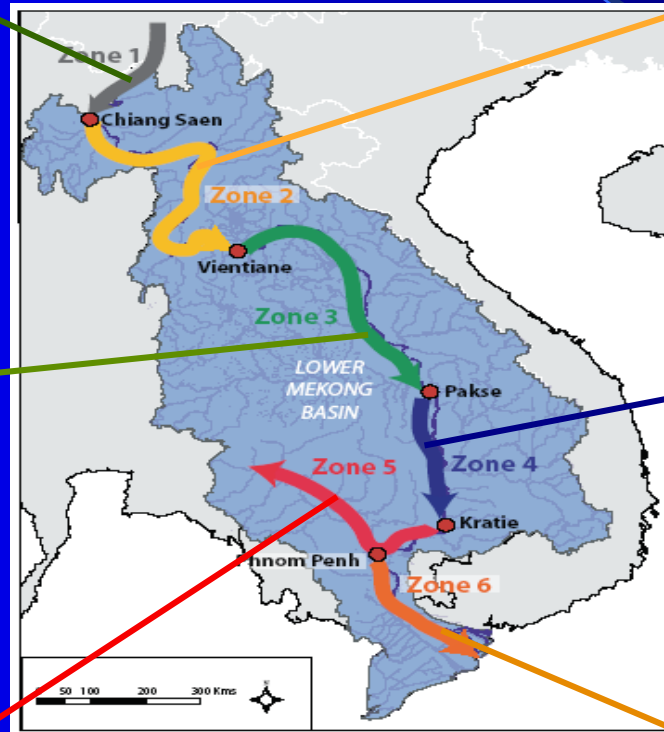


191 species  
(14% endemics)

## FLOODPLAINS



328 species  
(11% endemics)



## LOW MOUNTAINS



140 species  
(18% endemics)

## ISLANDS, WETLANDS



267 species  
(16% endemics)

## DELTA

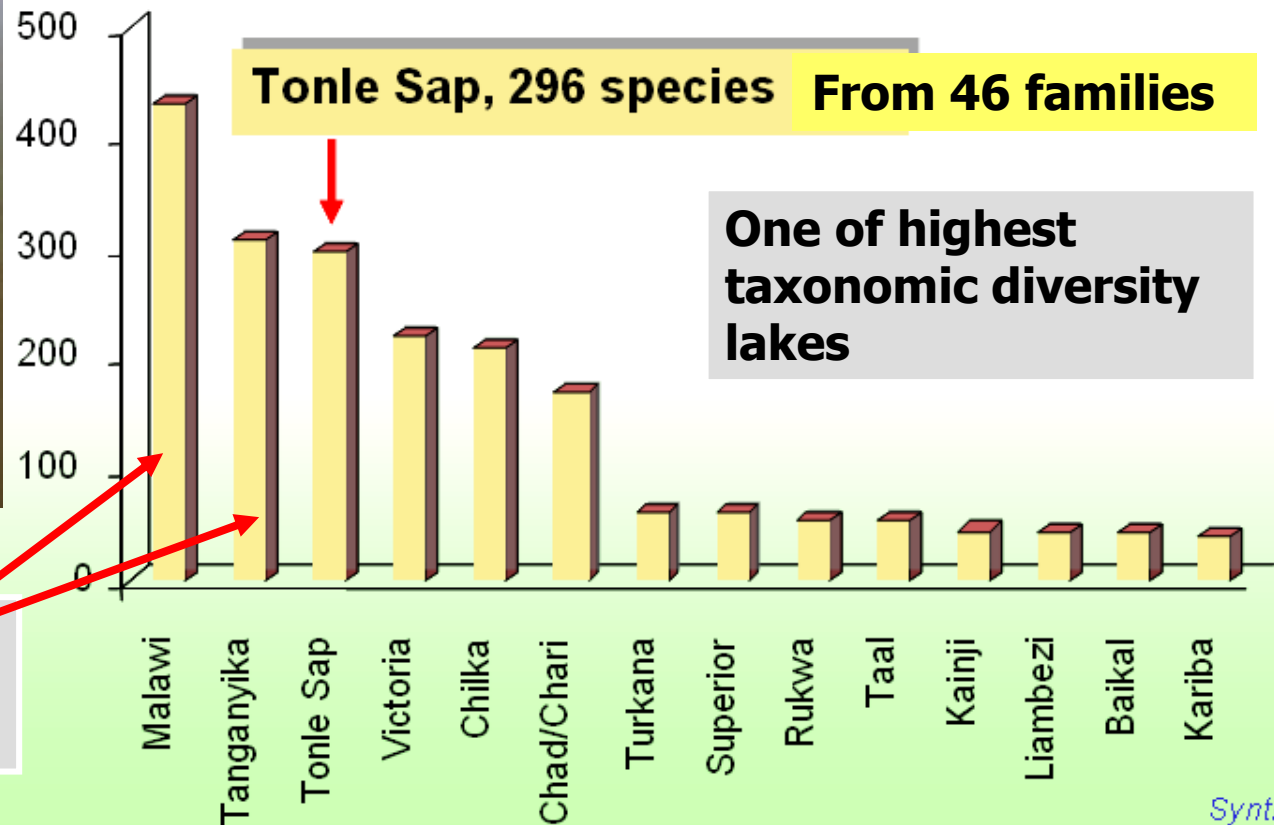


484 species  
(6% endemics)

**Mekong River mainstream is characterized by a gradient of increasing species richness from the headwaters to the sea**

# TONLE SAP LEVEL

The Tonle Sap Lake has almost 300 species, making it the third-richest lake in the world in terms of fish diversity.



Ca. 10 families,  
most species are  
Cichlids

# Mekong Fish Diversity



So far 900 species known  
with 700 primary and secondary FW and  
> 200 outer estuarine and regular marine visitors  
27.3% are Endemic taxa : 306 spp.

Represent ~ 2% of global Vertebrates  
Or ~ 3.3 % of global fish species  
(from 33,100 valid spp.; *FishBase*, 2017)

**One of Highest species density per area; 1000 km<sup>2</sup>**

**Mekong 1,120 spp. / 805,627 km<sup>2</sup> = 1.365 spp./10<sup>3</sup> km<sup>2</sup>**

The Amazon (3,000 species/6,144,727 km<sup>2</sup> = 0.488 spp./10<sup>3</sup> km<sup>2</sup>)

# Mekong Fishes ~ 1,118 species (based on Rainboth *et al.* 2012)



Over 30 undescribed spp  
*In press*

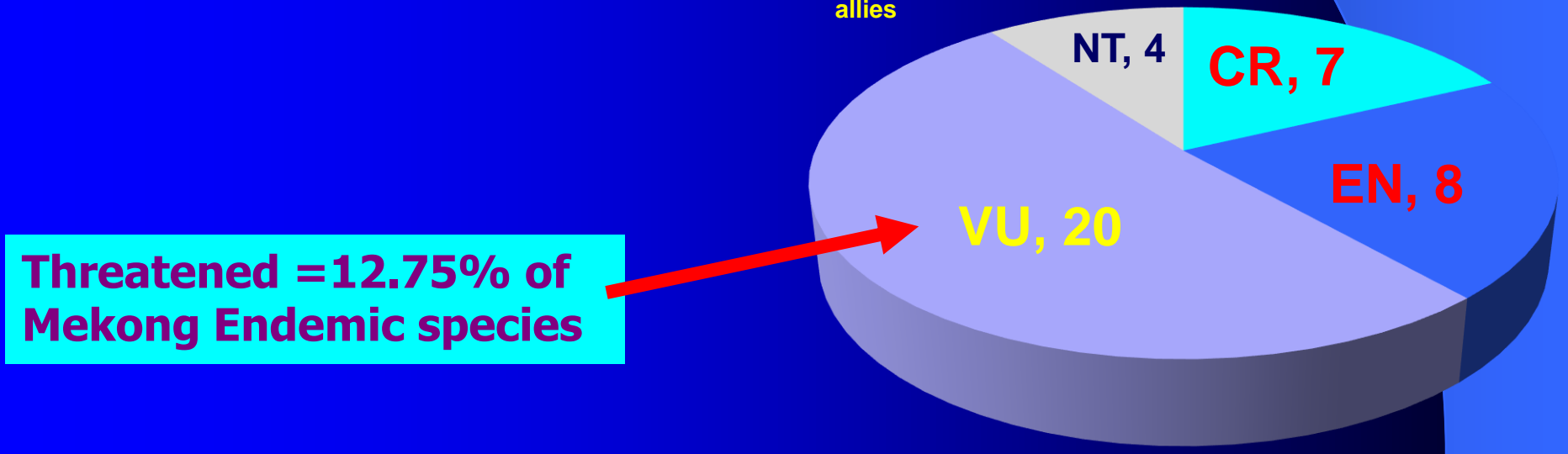
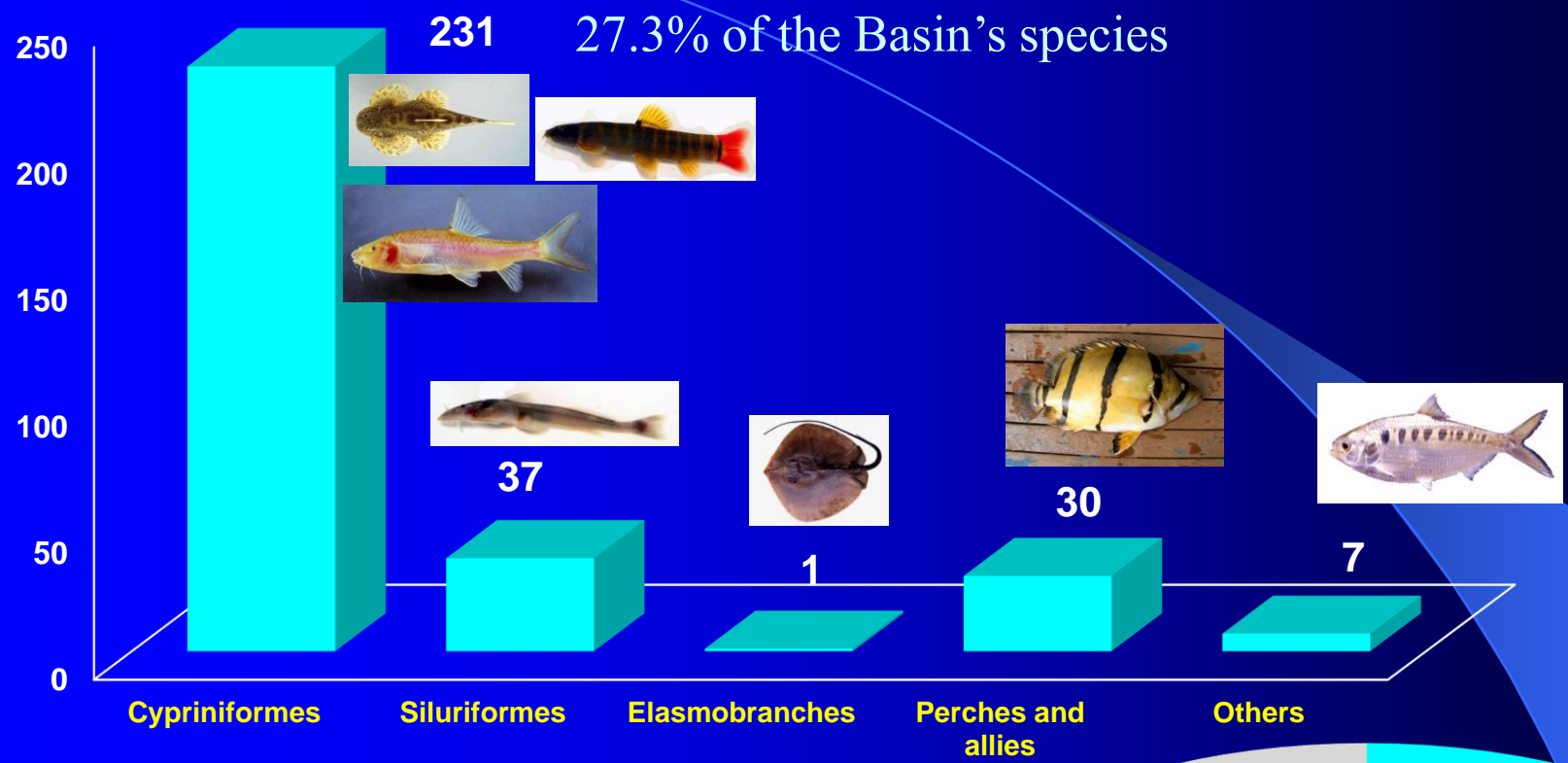
Up to 150 taxa  
unresolved



In 1997-2017,  
>160 new  
fishes  
described  
from the  
Mekong Basin



# 306 Mekong Endemic fishes



**Threatened = 12.75% of Mekong Endemic species**

# Characteristics of the main fish groups



**White fish:** undertake long distance migrations between mainstream and major tributaries and lower floodplains

**37% of species: 36% of capture**



**Black fish:** Floodplain resident fish, limited lateral migrations from the river onto floodplains;

**13% of species: 50% of capture**



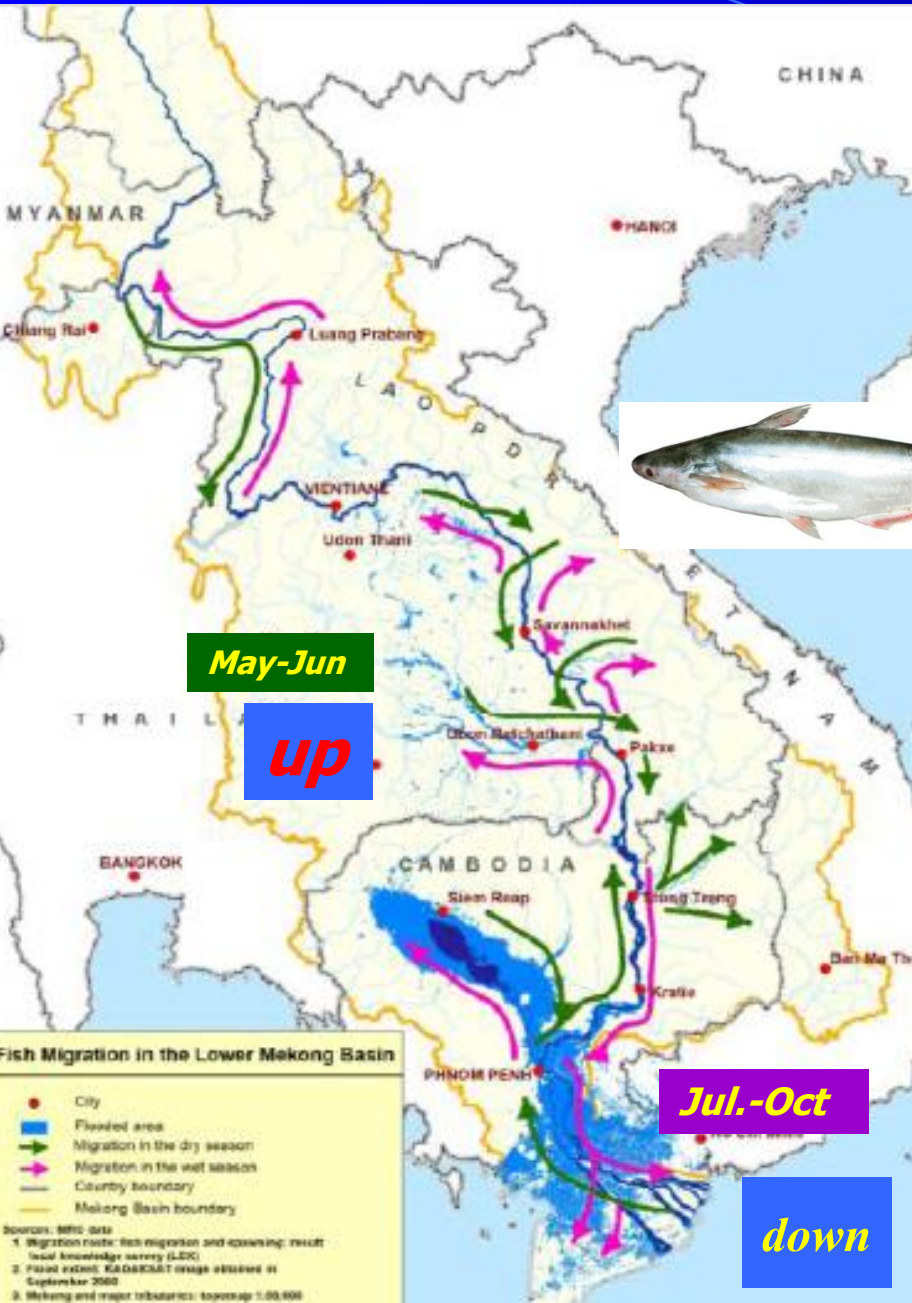
**Grey and generalist fish:** spend dry season in floodplain ponds and wetlands and do not undertake long distance migrations.

**50% of species 14% capture**



# Fish Migrations

More than 300 species are migratory, both long and short distances



May-Jun

up

Jul.-Oct

down



# Seasonal Habitat Switching



ปลาขาว **White fishes**

**Grey fishes**



**Riverine benthic**



***Turbid torrent river***



***Clear rocky streams and islands***

# Biotic Key Environmental Asset (KEA) of LMB



Reptiles/amphibians

Flora/vegetation

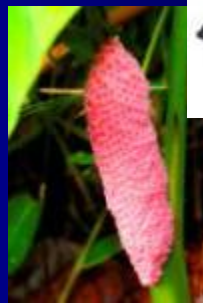
Fish & shellfish



Odonata (dragon-damsel flies)



Alien species



**Exploited ~7,000,000 water snakes of 10 species annually, from the Cambodian Great Lake to the Delta (from Brook, Allison & Reynolds, 2007)**



## Utilization

- **Meat**
- **Hides**
- **Feedmeal** for crocodile farms
- **Exported to China (whole)**  
**Thailand (hides)**

# Pressures on Mekong fish and fisheries



From: Ian Cowx et al. 2017, Fish and Fisheries in MRC BioRA  
Preparation Meeting 10-12 May 2017, Vientiane

# Fisheries of the lower Mekong Basin



- ⇒ 200+ species; 30+ of high commercial importance
- ⇒ More than 50% of total fish catch in the lower Mekong basin (about 1.3 million tonnes worth US\$2.5 billion) dependent on migratory fish
- ⇒ Fish migrate all seasons of year
- ⇒ Total first-sale value is US\$7.0 billion per year
- ⇒ Per capita consumption average is about **46 kg/person/year**



**World's highest fish production: 3.9 million tonnes eq. US\$ 4-7 billion/annually**  
**More than annual FW capture fish production of USA**  
**Per capita as FW Edible species 41-51 kg/an.**  
**About 2% of world capture fishery**

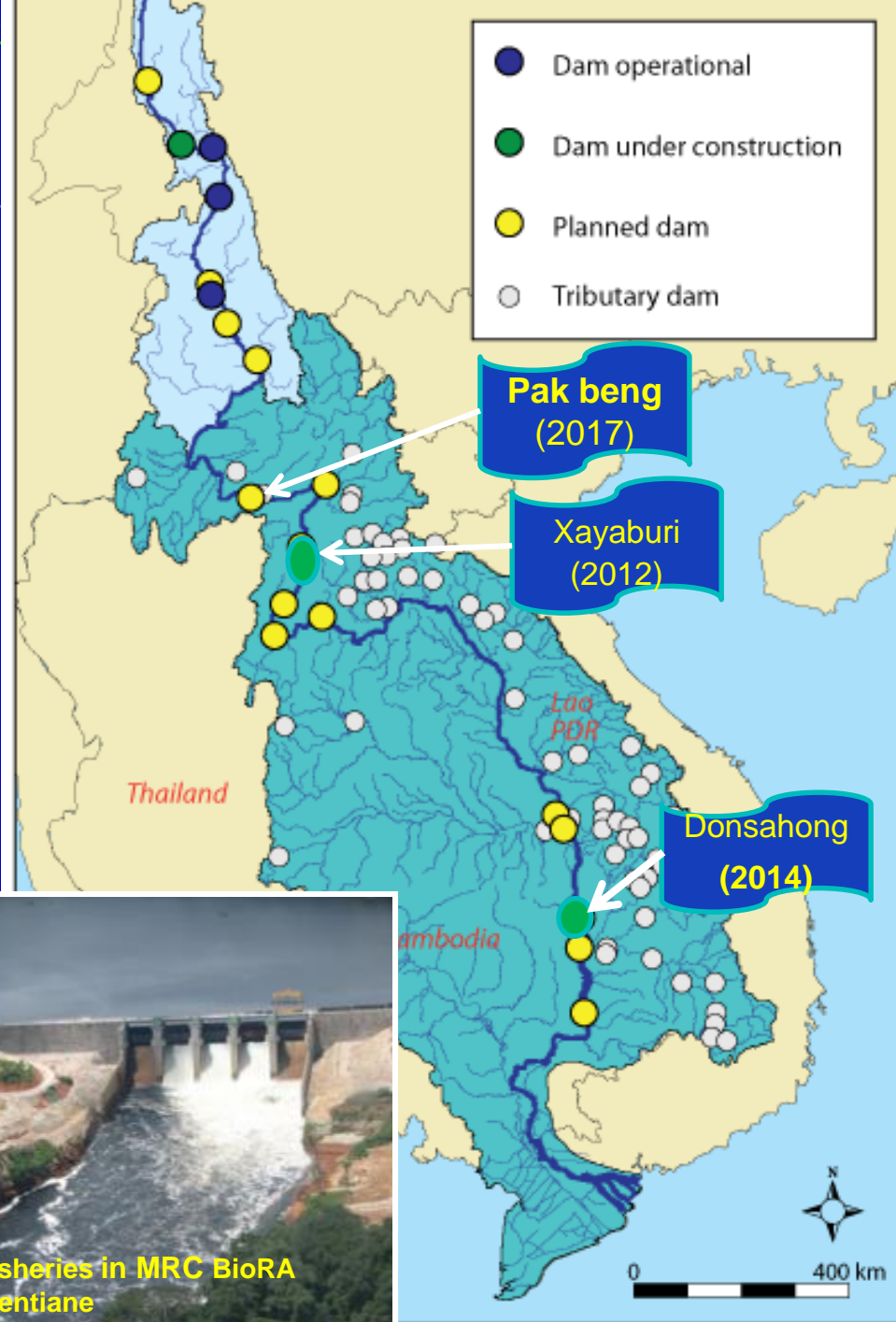


# Pressures on fisheries

- Fisheries harvesting pressure
- Aquaculture linked to invasive species
- Land use changes
- In-channel barriers
- Impoundments
- Run-of-river abstractions
- Irrigation
- Urbanisation
- Industrial and urban pollution
- Agricultural pollution
- Mining pollution
- Sediment mining
- Climate change

# Biggest potential threat is considered hydropower dams

- ❖ 9 planned dams on LMB (mainstream) – two under construction.
- ❖ 23 existed dams (> 20 MW) on tributaries
- ❖ Many more tributary dams are projected or under construction



From: Ian Cowx et al. 2017, Fish and Fisheries in MRC BioRA Preparation Meeting 10-12 May 2017, Vientiane

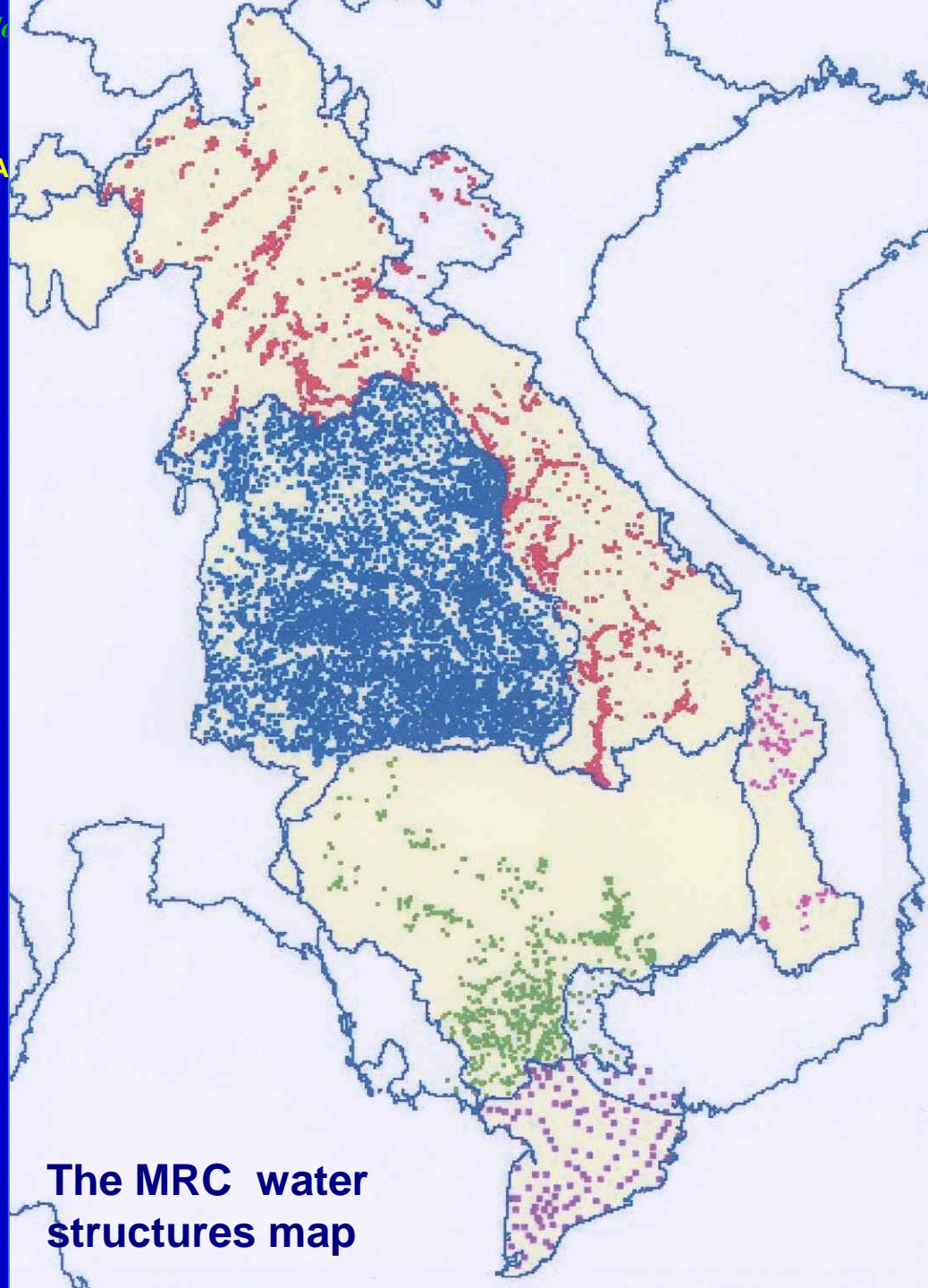
*National Water Resources Institute, Vientiane, Laos, 16 November 2017*

# It isn't just about damming rivers.....!

From: Ian Cowx et al. 2017, Fish and Fisheries in MRC BioRA  
Preparation Meeting 10-12 May 2017, Vientiane

## Floodplain & basin connectivity

- Every dot is a registered water control structure
- Loss of connectivity = loss of productivity in floodplain/riverine fisheries

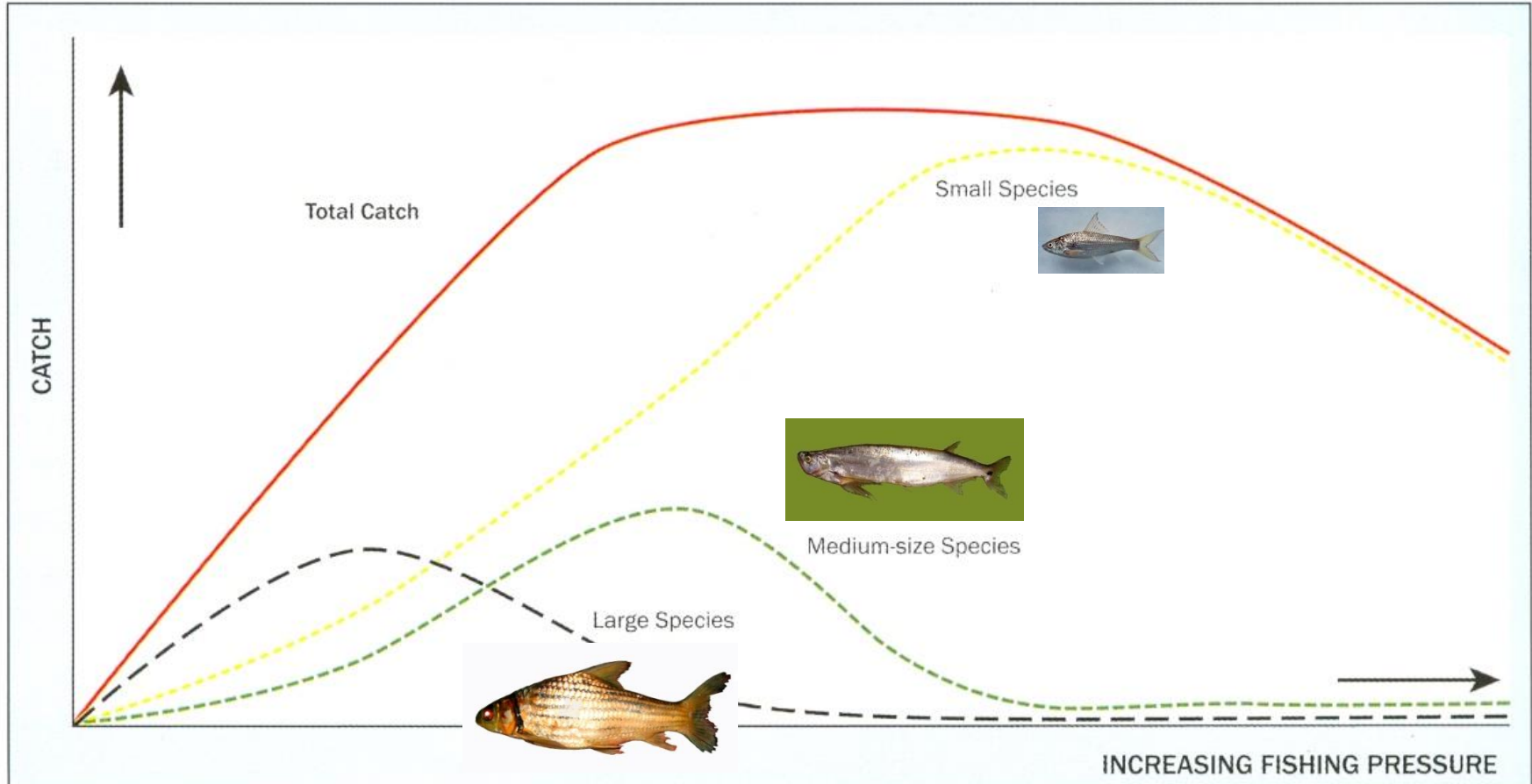


The MRC water structures map

# How respond to Mekong increasing fishing pressures



## Overfishing + Overpopulation



From So Nam and Eric Baran, *FISH AND FISHERIES OF TONLE SAP GREAT LAKE, CAMBODIA*. Sustaining Fisheries Diversity, Fisheries and Aquaculture in the Mekong Basin  
Ubon Ratchathani University 03-05th September



# Biodiversity Indicators in Mekong Fishes (7 headlines)

- I. Species Richness
  - II. Bio-Integrity Indices
  - III. Red List Index
  - IV. Trends in diversity of fish species of major socioeconomic importance
  - V. Trends in abundance and distribution of selected species/assemblage
  - VI. Trends in invasive alien species (Threat)
  - VII. Trophic integrity
  - VIII. Indicator of the status of indigenous and traditional fishing (Ethno-diversity)
- Ecosystem integrity, goods & services
- Wild Commodity Index,  
Biodiversity for food & medicine
- Living Planet Index

*Modified from Biodiversity Indicator Partnership 2010*

## Criteria for indicator

- Sensitive species
  - Endemic species
  - Specialist (stenotopic) spp.
  - Can be used as Flagship species
- Red List Index
- Alien invasion

## Habitat integrity

- Intactness and continuity
- Existing of Keystone species/Umbrella spp.

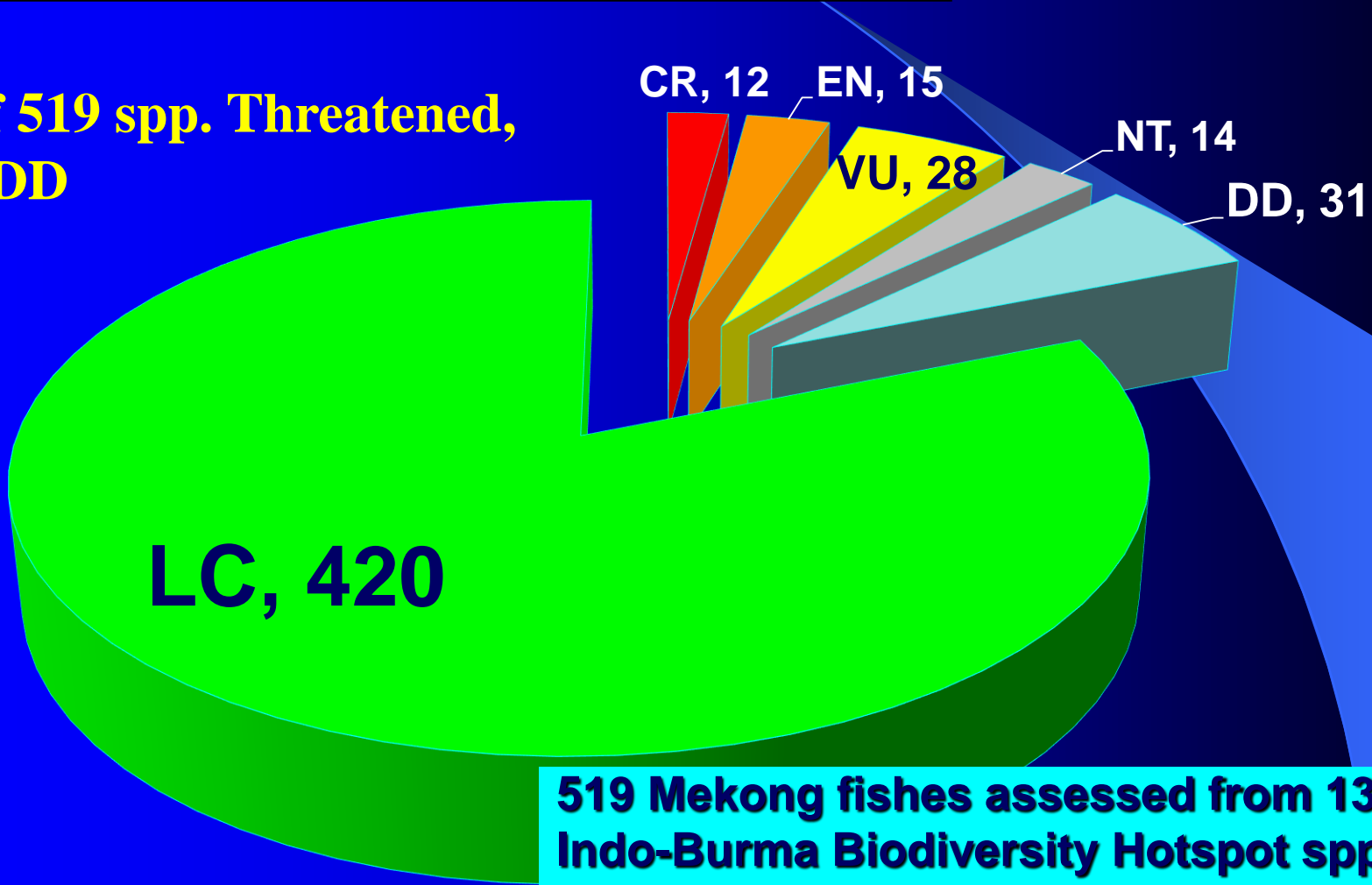
## Sensitive species

- Endemic species : good in local base
- Specialist (stenotopic) spp. : good in habitat base
- Wide ranging taxa: best for all ranges and types
- Large/top predatory and trophic diversity: Ecosystem health and fish stocks

# Status of Mekong Freshwater /Estuarine Fishes in IUCN Red List = 4.8% Threatened from 1,118 spp.

## Red List Index

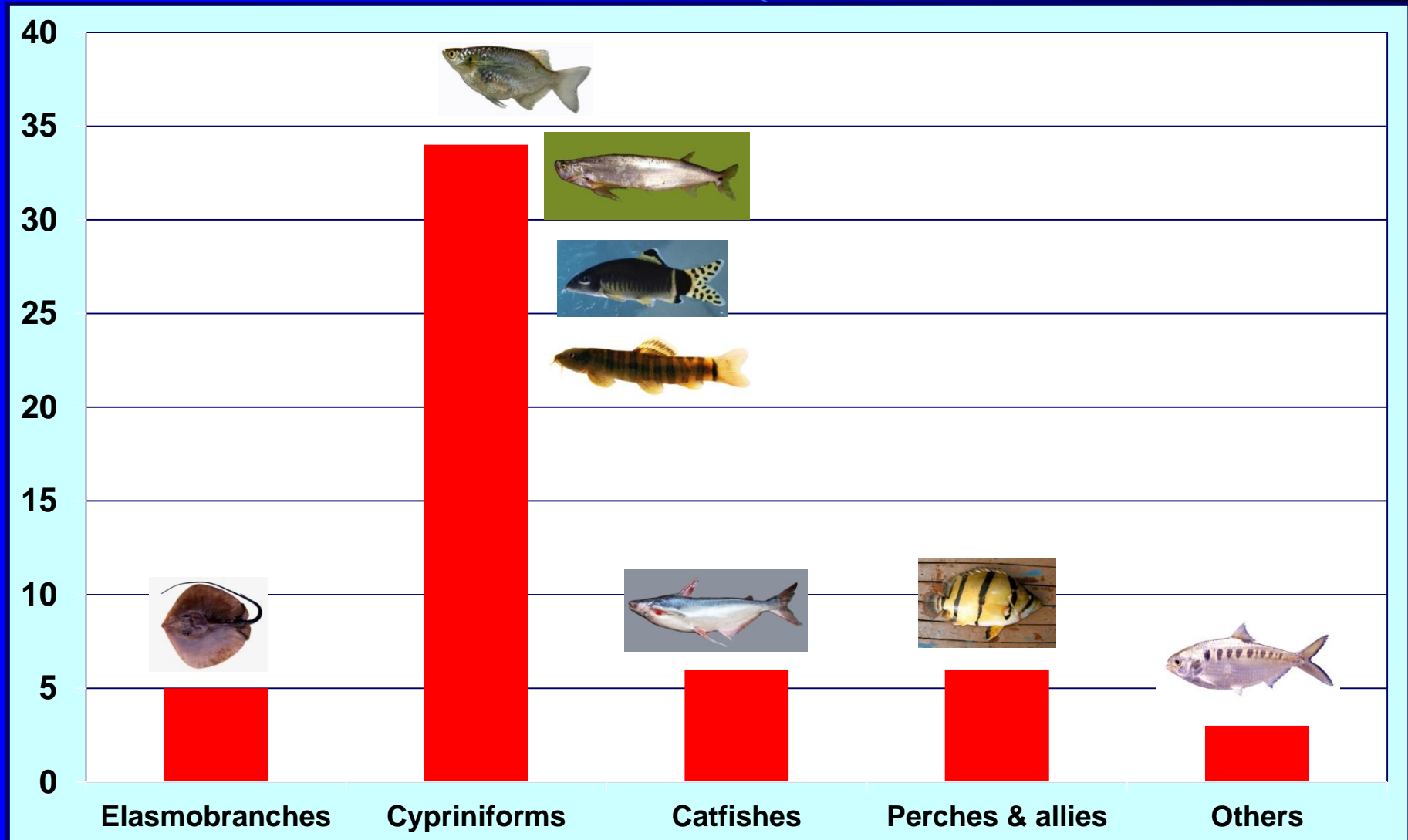
99 of 519 spp. Threatened,  
NT, DD



519 Mekong fishes assessed from 1386  
Indo-Burma Biodiversity Hotspot spp.  
CEPF/IUCN FBU



# 55 Mekong Red Listed fishes



# 55 IUCN Red List Species

## + 45 NT/DD



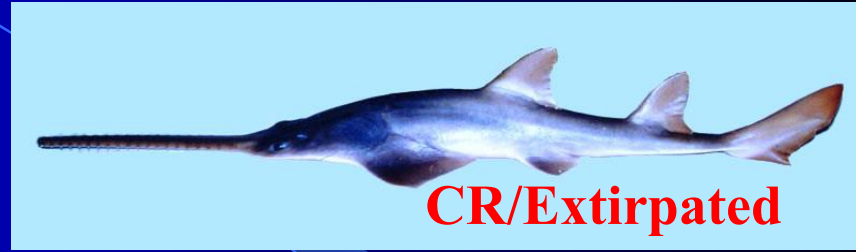
EN



EN



EN



CR/Extirpated



CR

VU



CR/PE



Mekong economic important fishes  
**No resilience for Dam**

Extinct??



*Percocypris retrodorsalis* Photo from Tyson R. Roberts



*Bangana*

*Aptosyax grypus*



*Probarbus*



*Pangasius sanitwongsei*



Ca' Bong lao  
*Pangasius krempfi*

Long distance  
migration/movement



Mekong giant catfish

# Ecosystem integrity, IBI

Sentinel species



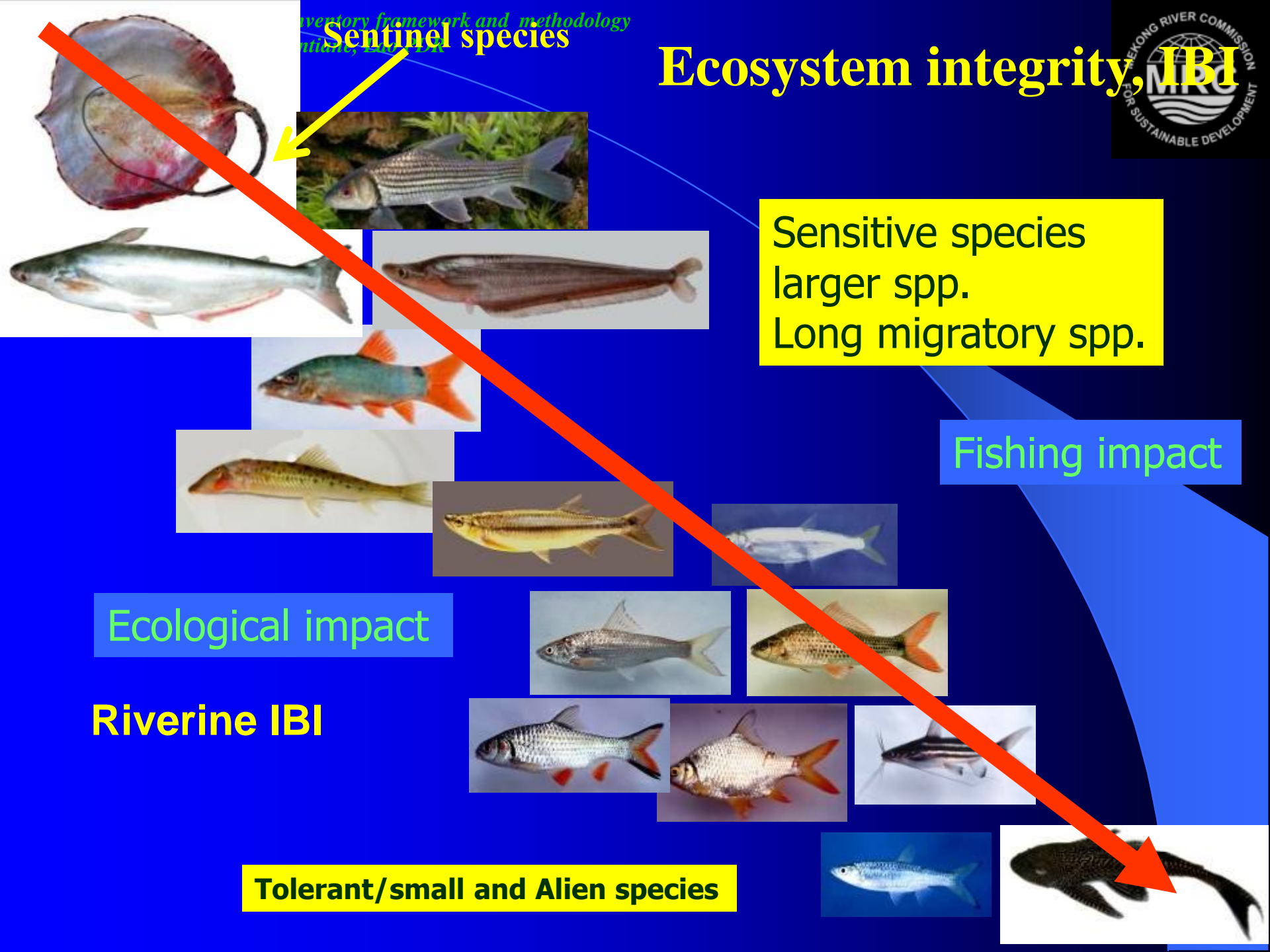
Sensitive species  
larger spp.  
Long migratory spp.

Fishing impact

Ecological impact

Riverine IBI

Tolerant/small and Alien species





WWF-Canon/Chavalit V.



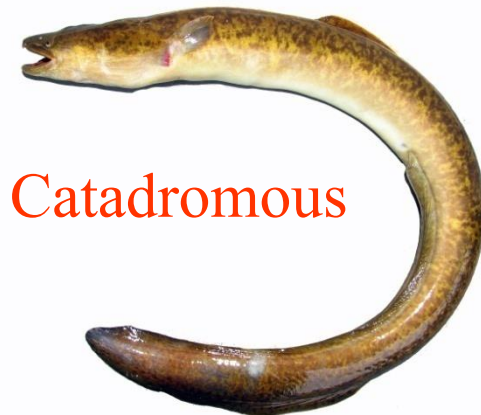
Elasmobranches



Extirpated??



Rocky rapid specialist



Catadromous

Sensitive and larger species

Selective Indicator Species

IG RIVER COMMISSION  
DEPARTMENT



**Planktivores**



**Small predator**



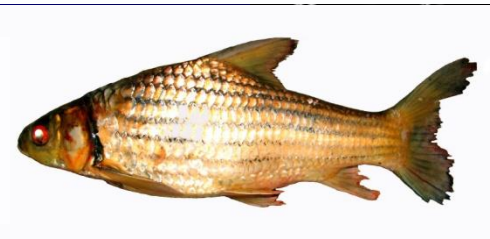
**Insectivore**



**Larger piscivore**



**Large/small herbivore**



**Benthic carnivore**

**Trophic Integrity and Juveniles diversity**

**Benthic herbivore**



# Threat to Biodiversity: Trends in Invasive Alien Species



Over 10 alien fishes populated in the basin  
5 fishes are invasive, including *Pomacea*  
snails which threaten ecosystems  
Over 30 alien fishes found and more taxa  
introduced subsequently.



*Pomacea canaliculata*  
*P. insularum*



*Gambusia*



pecus



Armour sucker catfishes



*Oreochromis* spp.



*Clarias gariepinus* hybrid



*Cichlasoma* hybrid

# Over 250 Fishing gears/methods within the Mekong Basinwide



**Ethno-Diversity Index**







## Conclusion

- IBA for birds done; why not FW fish (Important Fish Areas designation )
- Application of Biodiversity Indicator will indicate to; Eco-flow, sustainable use, CC impact, Area/stock management etc., of the Basin
- Lack of political will to FW biodiversity is the Main Threat and Biggest Challenge to FWF survival in the Mekong and global scale.



**Thanks to**



**Arrow-shape fence trap in Tole Sap lake**

**From So Nam and Eric Baran, *FISH AND FISHERIES OF TONLE SAP GREAT LAKE, CAMBODIA*. Sustaining Fisheries Diversity, Fisheries and Aquaculture in the Mekong Basin Ubon Ratchathani University 03-05th September**