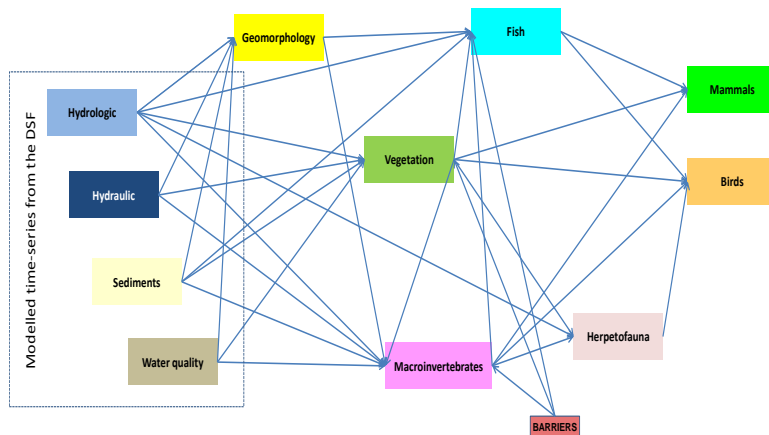


# MRC Council Study: Water Quality, Sediments & Geomorphology Update

www.mrcmekong.org

## Indicators and Linked Indicators



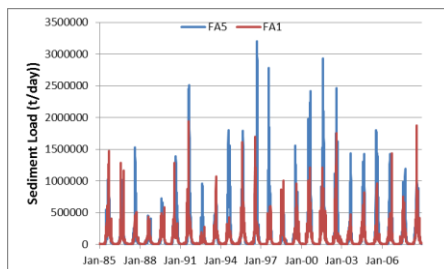
## DRIFT Sediment Indicators

- Sediment indicators are external & apply to all Focus Areas
- Derived from DSF:
  - Sediment concentration (mg/L)
  - Sediment Load (t/day)
  - Sediment grain-size ( $D_{50}$ )
  - Onset of sediment delivery (week number)
  - Duration of sediment delivery (week number)
- Calibration data set = combination of TSS & SSC results from MRC
  - Daily time series based on rating curves
  - 1985 – 2008 = Reference data set



www.mrcmekong.org

## DRIFT Sediment Indicators



- Geomorphology indicators linked to sediment indicators & hydraulics
- Geomorphology indicators reflect changes to habitats
- Link to Geomorph indicators rather than sediment indicators

www.mrcmekong.org

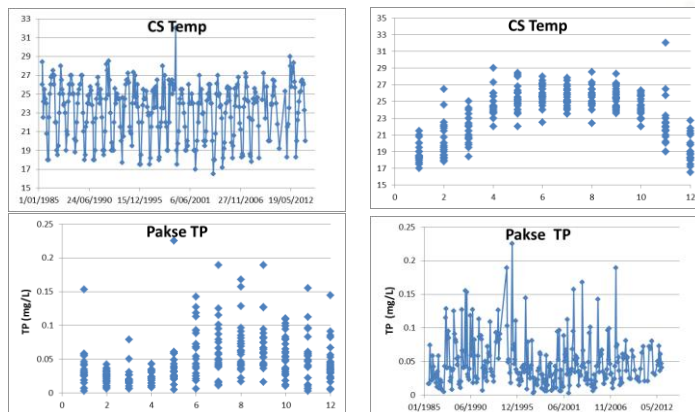
## DRIFT Water Quality Indicators



- Water Quality indicators are external indicators
  - Apply to all Focus Areas
- Derived from DSF:
  - Temperature            -  $\text{NO}_{2+3}$
  - pH                         -  $\text{NH}_4^+$
  - DO                         - Si
  - Salinity/EC             -  $\text{PO}_4$
  - COD                      - TN
  - TP
- Calibration data set = MRC WQMN results
  - Summary information available (1985 – 2015)
  - 1985 – 2008 = Reference data set

www.mrcmekong.org

## Examples of WQMN Results



- Time series & monthly trends available for WQMN parameters for representative site in each FA
- WQMN results include temporal changes

www.mrcmekong.org

## Water Quality Indicators



- Parameters most likely **not** available from DSF
  - Alkalinity
  - Sulphate
  - *Do not link to these unless critical*
- Additional water quality indicators identified as necessary
  - Herbicides
  - Insecticides
  - Response curves should be based on % change relative to present (2015) conditions

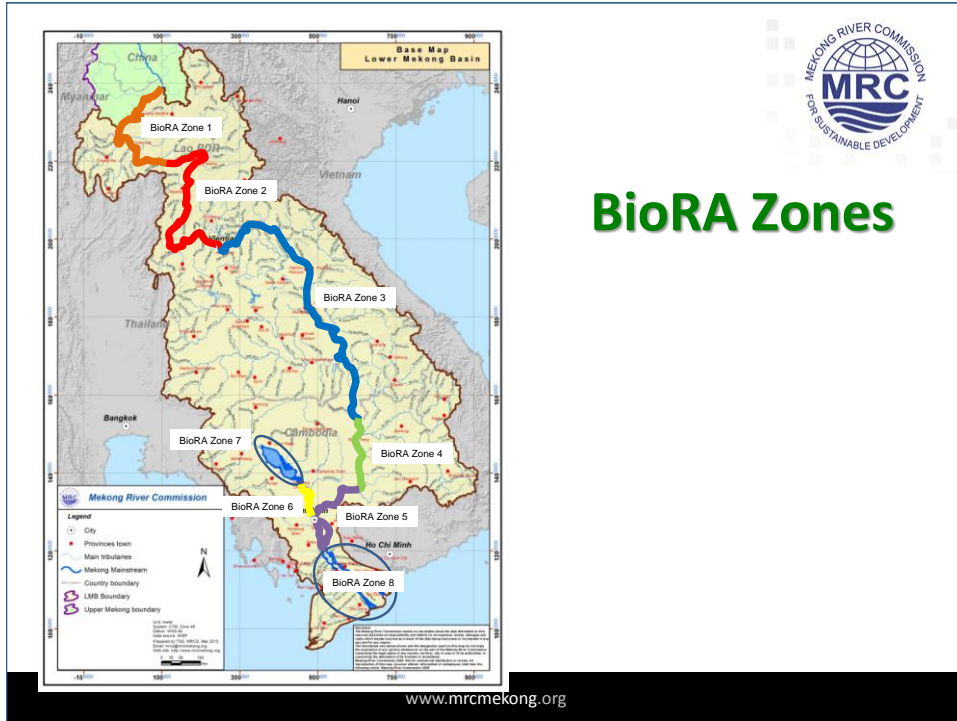
www.mrcmekong.org

## Geomorphology indicators



Code	Indicator
Erosion	Erosion (bank erosion or deposition, bed incision or aggradation)
BedSedW	Wet season bed sediment median size
BedSedD	Dry season bed sediment median size
Sandbars	Availability of sandy bars, islands and insets (subaerial)
Rockreefs	Availability of rocky substrate (subaerial)
PDepth	Bedrock pool depth
Clarity	Water clarity

www.mrcmekong.org



## Geomorphology Indicators

Legend:	Sites							
	FA1-Pak Beng	FA2-Vientiane	FA3-Se Bang Fai	FA4-Stung Treng	FA5-Kampong Cha	FA6-Tonle Sap Riv	FA7-Tonle Sap Lak	FA8-Delta
<span style="color: green;">■</span> Used								
<span style="color: yellow;">■</span> To be added, (A)dd								
<span style="color: red;">■</span> To be deleted, (D)elete / (U)ndelete								
<b>Birds</b>								
<b>Fish</b>								
<b>Geomorphology</b>								
Erosion (bank / bed incision)	■	■	■	■	■	■		
Ave bed sediment size (DRY)	■	■	■	■	■	■		
Ave bed sediment size (WET)	■	■	■	■	■	■		
Availability sandy habitat on banks	■	■	■	■	■	■		
Availability rocky habitat on banks	■	■	■	■	■	■		
Depth of bedrock pools	■	■	■	■	■	■		
Water clarity								■

www.mrcmekong.org

## Erosion

- Includes changes to banks & river bed
- Negative erosion is deposition
- Applies to Fas 1-6
- Linked to:
  - Shear stress
  - Duration of wet
  - Sediment load
  - Sediment concentration
  - Onset sediment delivery
  - Duration sediment delivery
  - Sediment grain-size
  - Within day range of discharge



www.mrcmekong.org



## Erosion

Erosion (bank / bed incision)

Mean: **98.31** Min: **54.10**  
Median: **97.95** Max: **139.32**

Modifiers

Dependence on prev year (%)  10

Return to median levels:

Increase from %<PD (years)  1

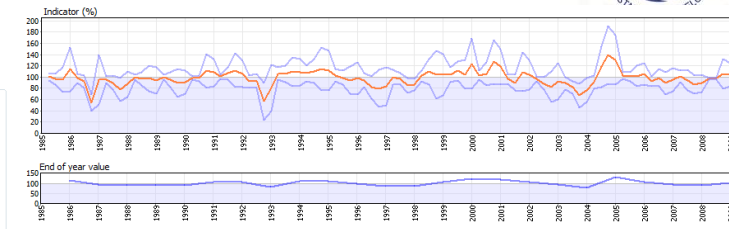
Decrease from %>PD (years)  1

Minimum % of PD (%)  5

Maximum % of PD (%)  2000

% inc from very low (%)  50

Density dependence:



- Link to erosion for changes to habitat
  - Caveat : *separate indicators for sand bars, rocky reefs*
- Link to underlying hydraulic / sediment indicators if *directly* affects other indicator
  - Shear stress if bugs directly swept away by flow
  - Erosion if bugs affected by removal of sand

www.mrcmekong.org



## Average Bed Sediment Size-Dry



- Median grain-size of the **bed** material relative to present
- Linked to erosion & grain-size distribution of incoming sediment
- Applies to Fas 1-6
- A 10% change is equivalent to a change in the median grain-size of 1 grain-size class

Median Grain-size	Present	Median Texture
>16 mm		Coarse pebbles and larger
2-16 mm		Gravel & pebbles
1-2 mm		Very Coarse sand
0.5-1.0 mm	FA1	Coarse sand
0.25 - 0.5 mm	FA2, 3, 4?, 5, 6?	Med sand
0.12 - 0.25 mm	FA8	Fine Sand
0.06 - 0.125 mm		V fine sand
0.002 - 0.06		Silt
<0.002		Clay

www.mrcmekong.org

## Average Bed Sediment Size-Wet



- Median grain-size of the **bed** material relative to present
- Linked to erosion
- Applies to FAs 1-6
- A 10% change is equivalent to a change in the median grain-size of 1 grain-size class

Median Grain-size	Present	Median Texture
>16 mm		Coarse pebbles and larger
2-16 mm		Gravel & pebbles
1-2 mm		Very Coarse sand
0.5-1.0 mm	FA1	Coarse sand
0.25 - 0.5 mm	FA2, 3, 4?, 5, 6?	Med sand
0.12 - 0.25 mm	FA8	Fine Sand
0.06 - 0.125 mm		V fine sand
0.002 - 0.06		Silt
<0.002		Clay

www.mrcmekong.org

## Availability of Sandy Habitat



- Includes sand bars, banks & sandy insets
- Applies to FA1-6
- Linked to:
  - Erosion
    - increase in erosion decreases availability
  - Duration of dry season
  - Channel depth
  - Within day flow range



[www.mrcmekong.org](http://www.mrcmekong.org)

## Availability of Rocky Habitat



- Includes bedrock substrate
- Applies to FA1 – FA4
- Linked to:
  - Erosion (increase in erosion increases availability)
  - Duration of dry season
  - Channel depth
  - Within day flow range



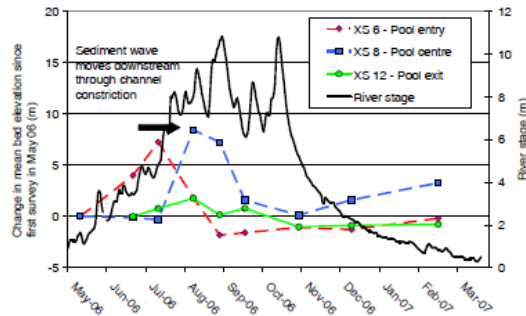
[www.mrcmekong.org](http://www.mrcmekong.org)



## Depth of Bedrock Pools



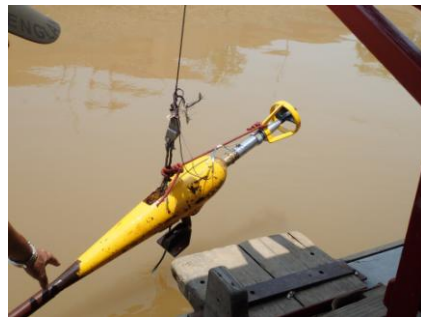
- Based on understanding of hydraulics of bedrock pools
- Does **not** include thalweg/alluvial pools (erosion)
- Applies to FA4, FA5
- Linked to:
  - Shear stress
  - Duration of wet
  - Sediment load
  - Sediment onset
  - Sediment duration



www.mrcmekong.org

## Water Clarity

- No turbidity data available
- Applies to all FAs
- Linked to:
  - Grain-size distribution
  - Suspended sediment concentration



www.mrcmekong.org



**Thank you  
Stay tuned for Status  
& Trends....**



[www.mrcmekong.org](http://www.mrcmekong.org)