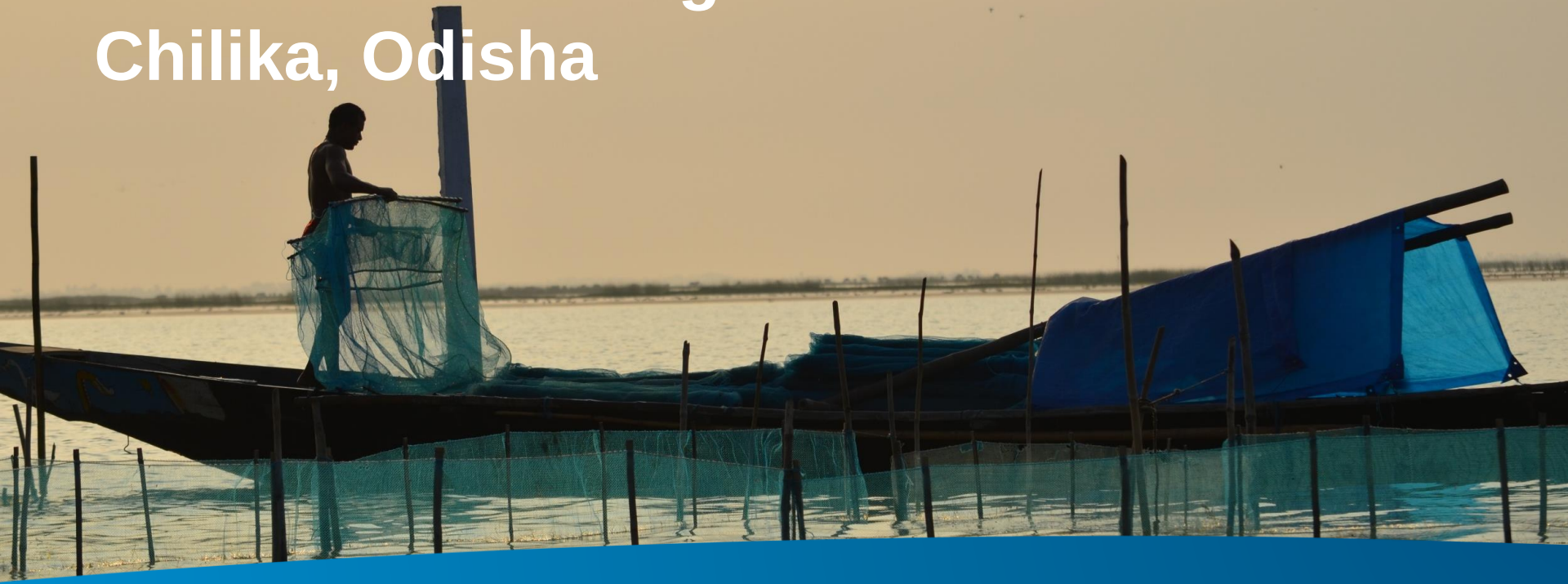
Hydro-biological monitoring for sustainable management of Lake Chilika, Odisha



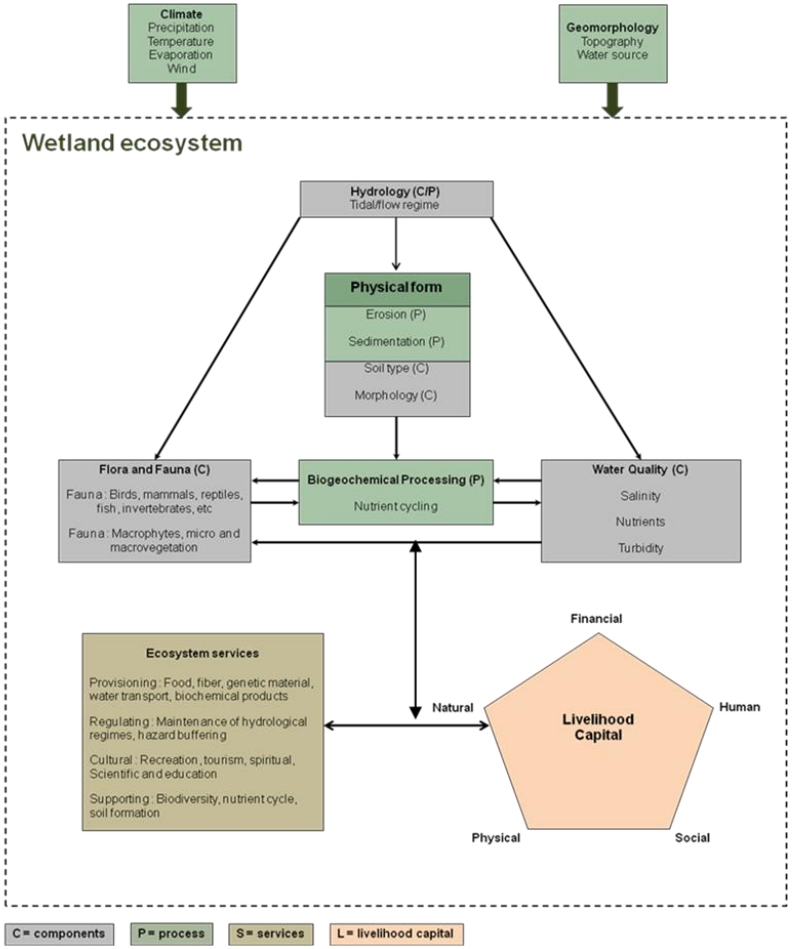
Dr. Ritesh Kumar, Wetlands International South Asia
Dr. Ajit Pattnaik, Chilika Development Authority

Wetlands INTERNATIONAL

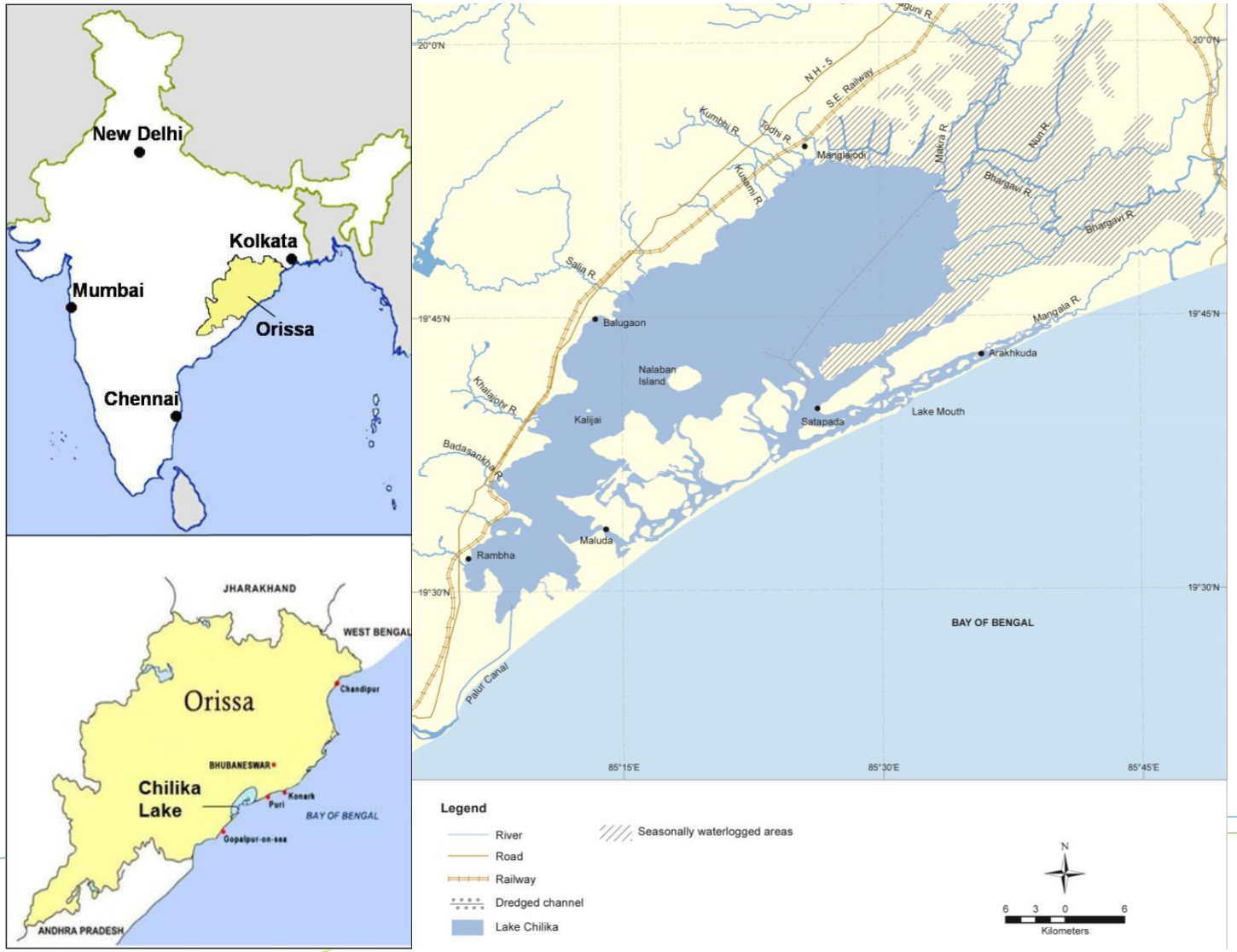
Hydro-biological monitoring

Relevance for wetland management

- Wise Use commits managers to the goal of ‘maintenance of ecological character’
- State of ecological character is influenced by biophysical as well as social processes
- Monitoring system required to assess
  - Assess status and trends
  - Risk of adverse change



Chilika



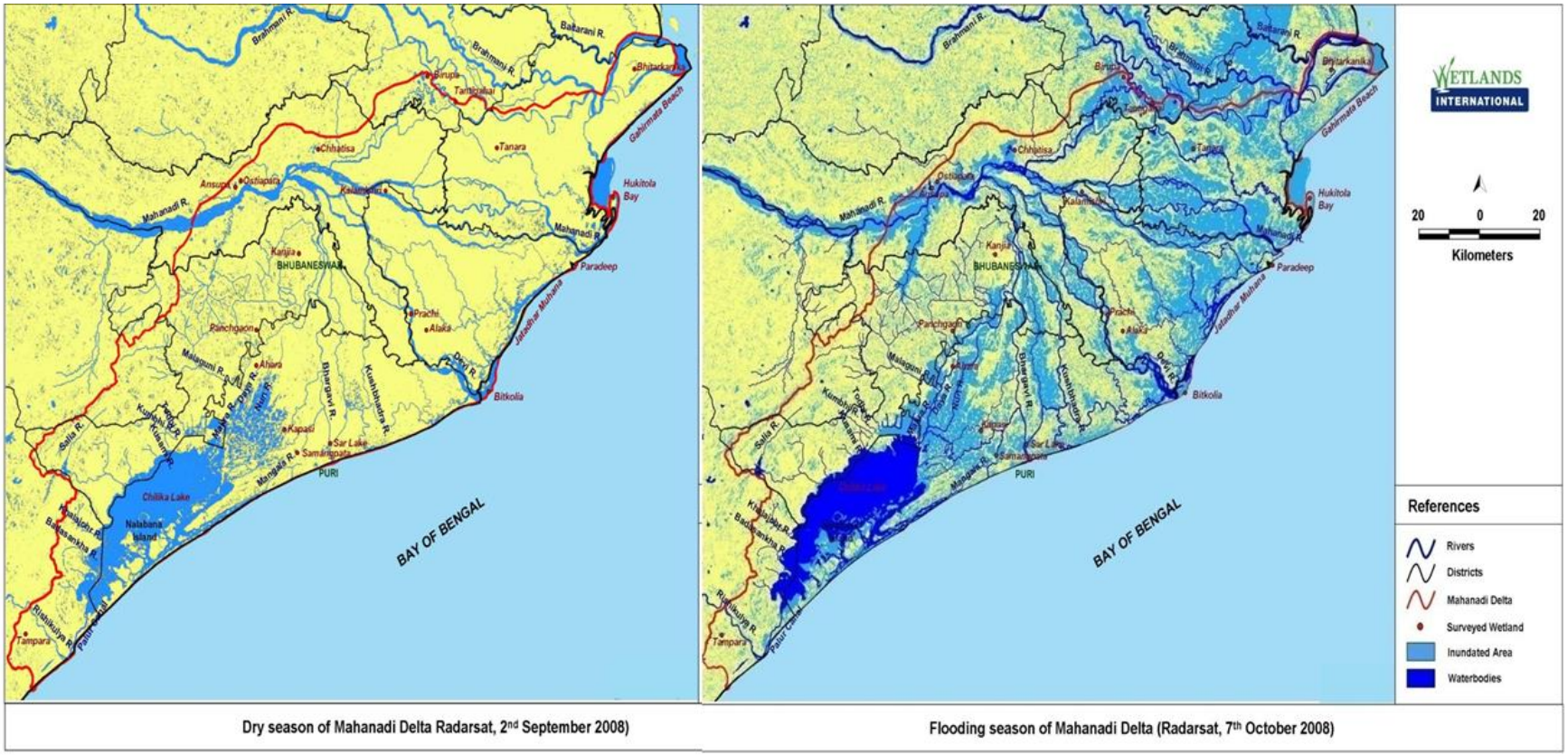
Wetlands INTERNATIONAL

Biodiversity and ecosystem service values

211 bird species; largest Irrawaddy Dolphin population; ~ 300 fish species, livelihood of 0.2 million fishers

Wetlands INTERNATIONAL

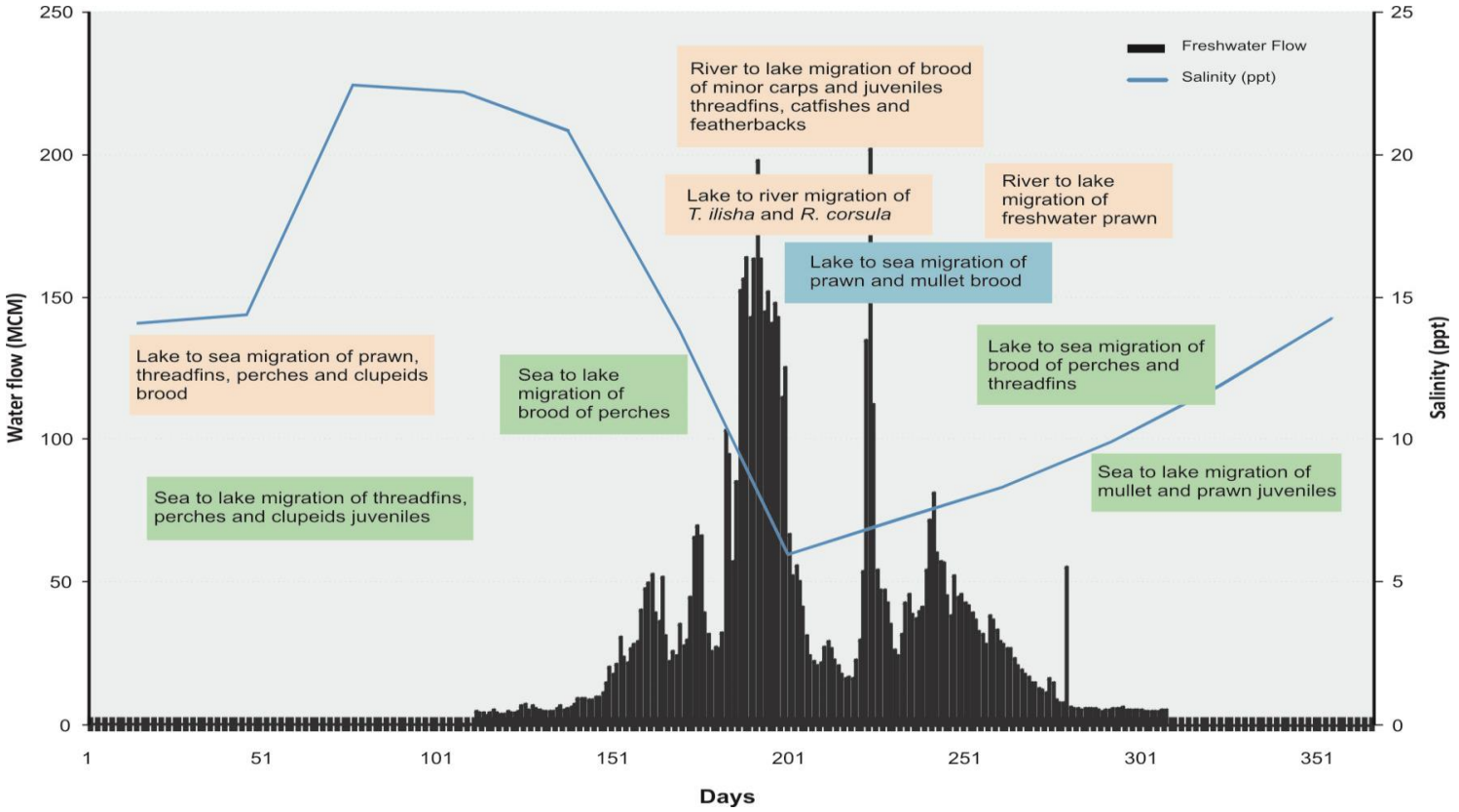
Riverine and coastal processes



Dry season of Mahanadi Delta Radarsat, 2nd September 2008)

Flooding season of Mahanadi Delta (Radarsat, 7th October 2008)

Riverine and Coastal Processes



Wetlands INTERNATIONAL

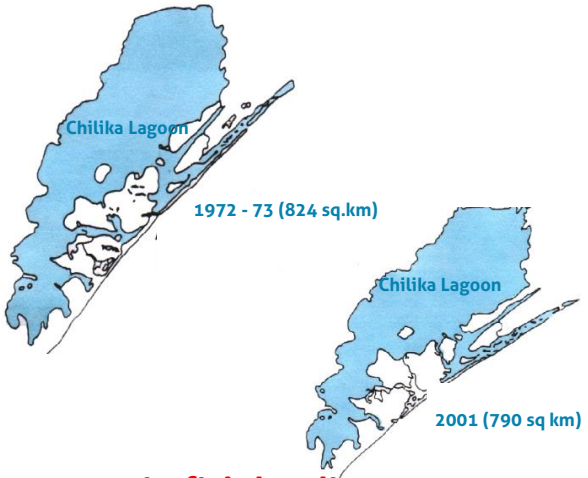
Lake degradation

Choking of mouth to the sea

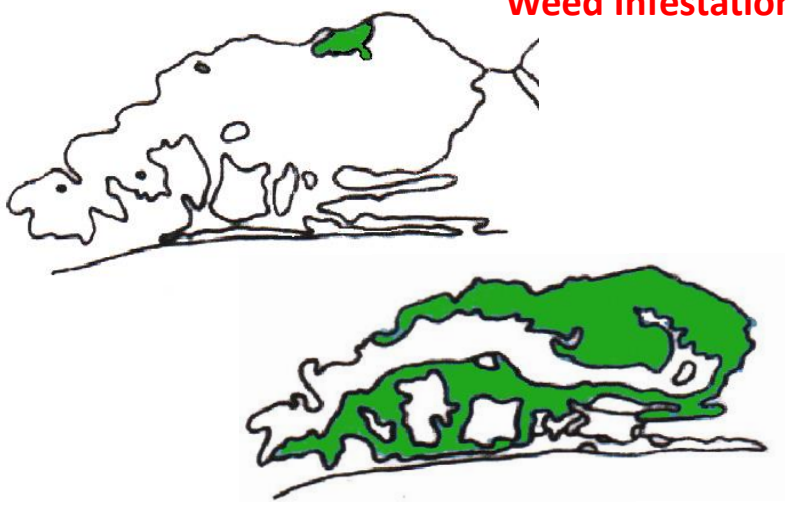
Dominance of freshwater environment

Included in Montreaux Record in 1993

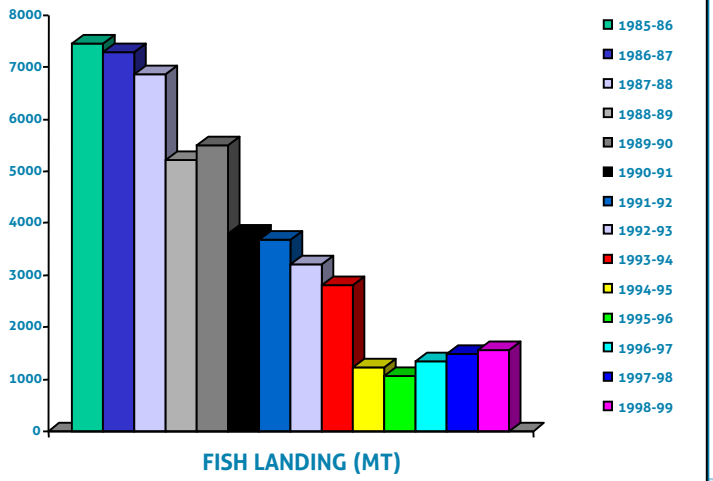
Shrinkage in lake area and volume



Weed Infestation



Decrease in fish landing



Wetlands INTERNATIONAL

Putting governance in place

Governing Body

CHAIRMAN (CHIEF MINISTER)

Working Chairman (Minister of Environment)

MEMBERS

Members of Parliament

Secretaries of key departments

Representatives from premier organizations

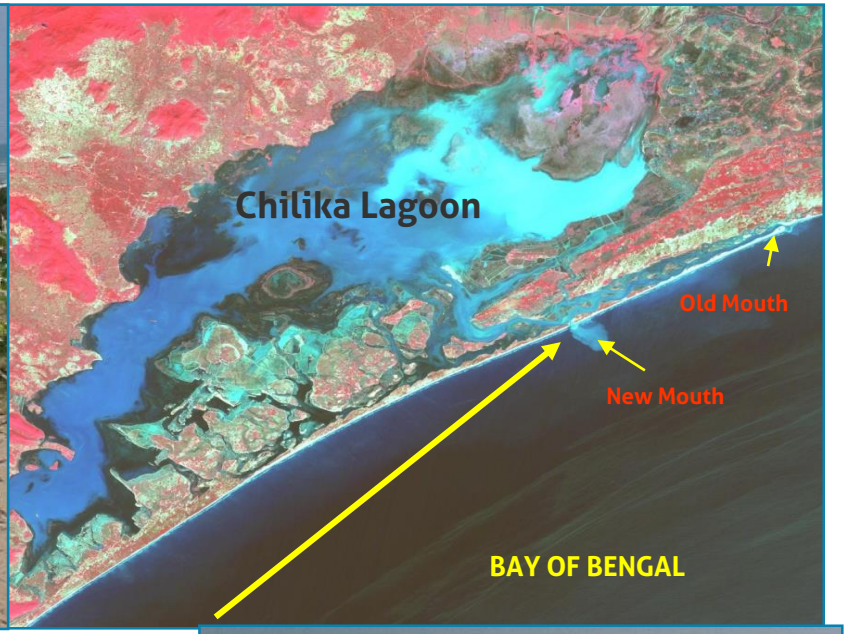
Representatives of Fishermen Federations

Executive Body

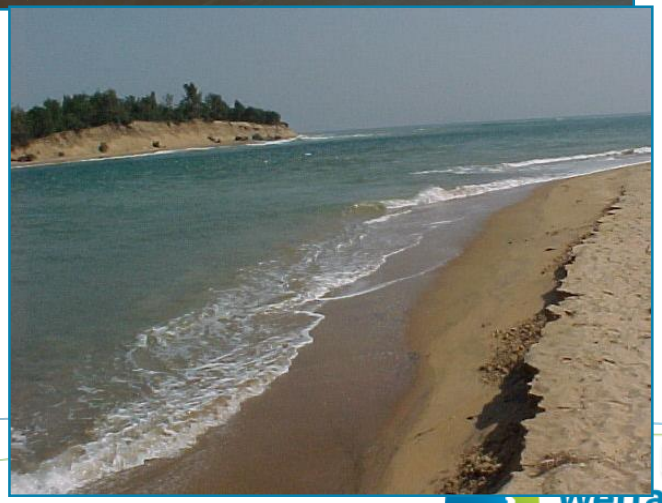
Chair: Principal Secretary (Forest and Environment)
Member: Director (Environment)
Convenor: Chief Executive, CDA

Wetlands INTERNATIONAL

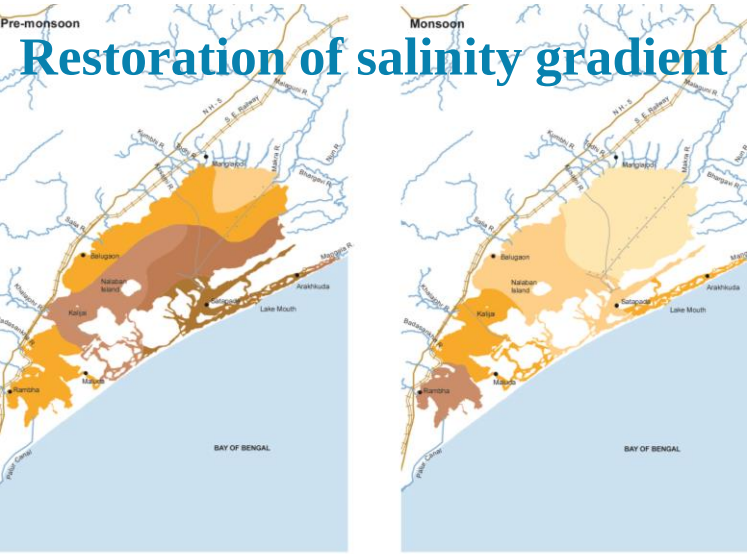
Hydrological Intervention - 2000



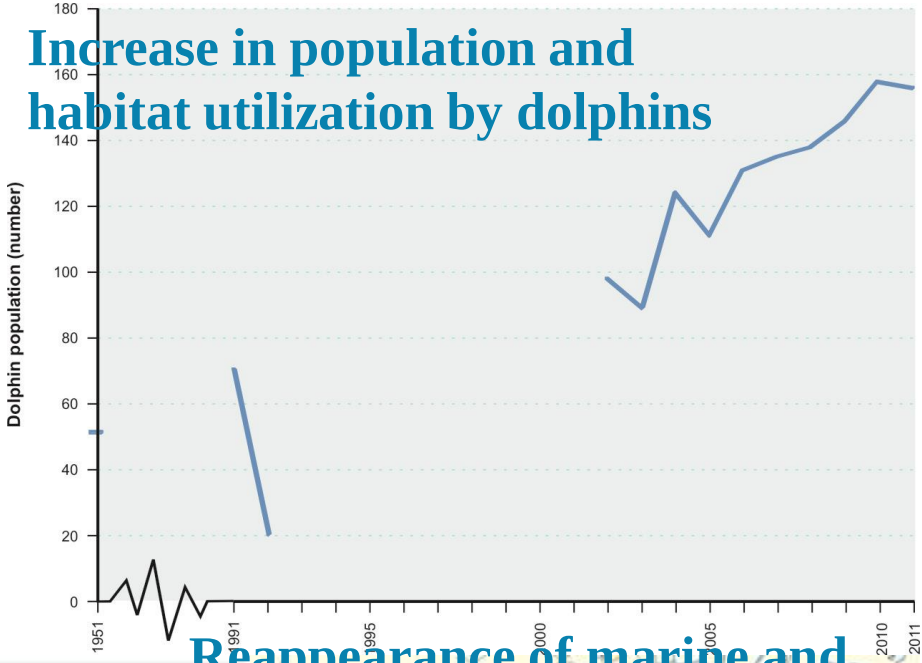
Rejuvenating sea connectivity



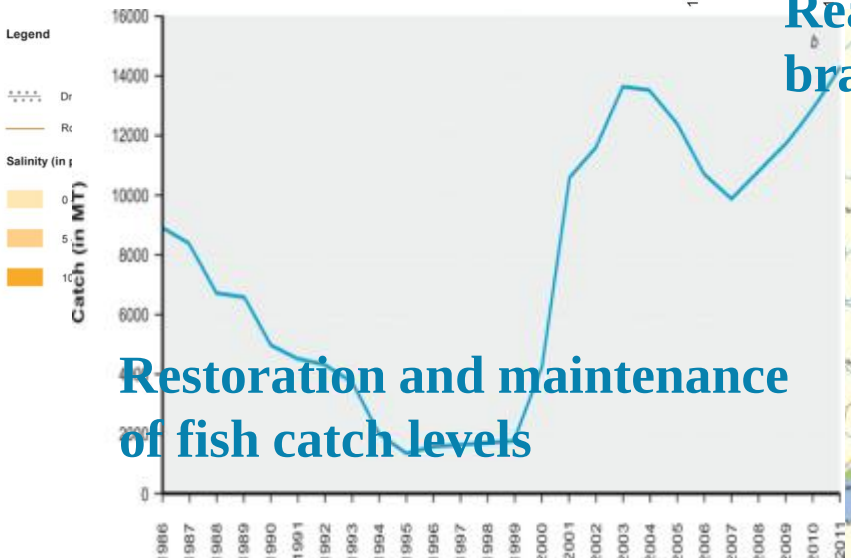
Ecological impacts



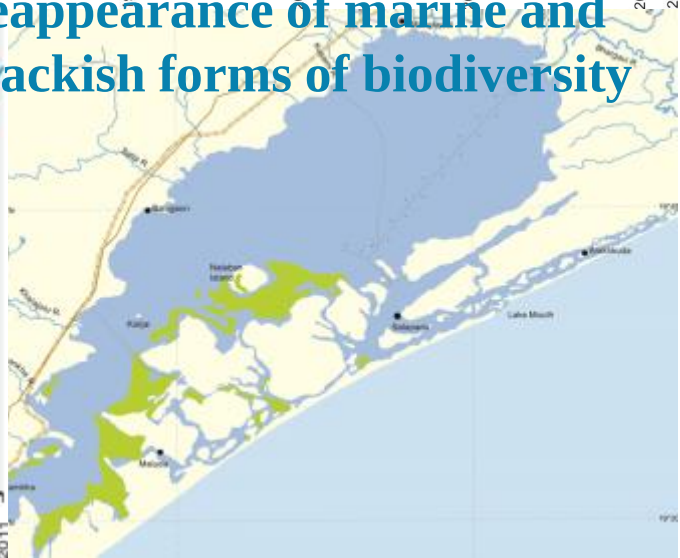
Restoration of salinity gradient



Increase in population and habitat utilization by dolphins

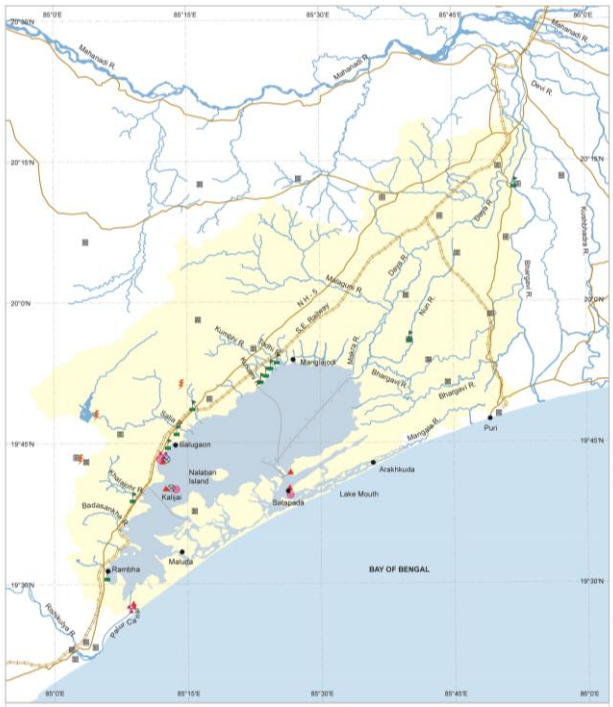


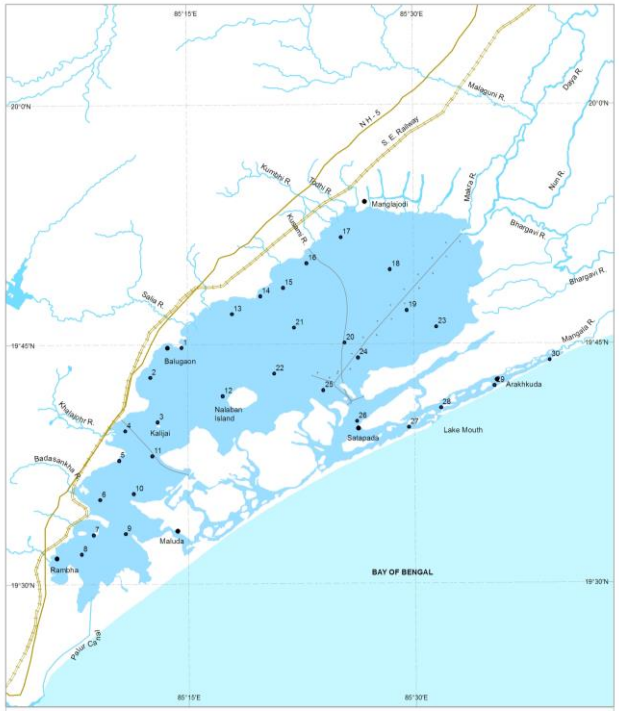
Restoration and maintenance of fish catch levels



Reappearance of marine and brackish forms of biodiversity

Monitoring Stations





12 Hydrological monitoring stations + 3 Meteorological yards

5 Tide Gauge Stations

30 Water Quality and Ecological Sampling Stations

Wetlands INTERNATIONAL

Institutional Coordination

Wetland Research and Training Center

- Auditorium, Training Room and Conference Room
- Lake monitoring laboratory
- Library
- Computing facilities
- Scientist Hostel (12 rooms)

Wetland Research and Training Center

Chemical / Instrumentation

- Water quality (physico-chemical and nutrients)
- Geochemical fractionation (heavy metal, metal accumulation, petroleum hydrocarbons)

Biology

- Spatial and temporal dynamics of plankton and macro-benthos
- Fisheries

Modelling

- Seawater, freshwater exchange, bathymetry, inlet dynamics, ecological modelling

Bio-technology

- Molecular analysis of macrophytes-microbe interaction
- Molecular analysis of pico and nano phytoplankton
- Bioprospecting of novel bacteria

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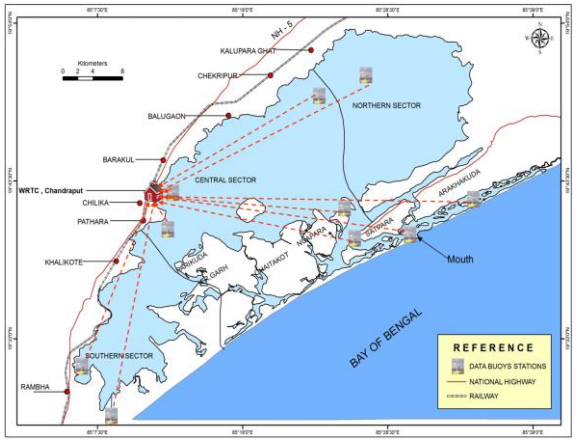
Real-time water quality monitoring

Sensors mounted on floating buoys

Automated transmission of data every 15 mins

Calibration unit at WRTC

Salinity, temperature, conductivity, DO, pH, Depth, Turbidity, Chlorophyll-a, Blue Green Algae



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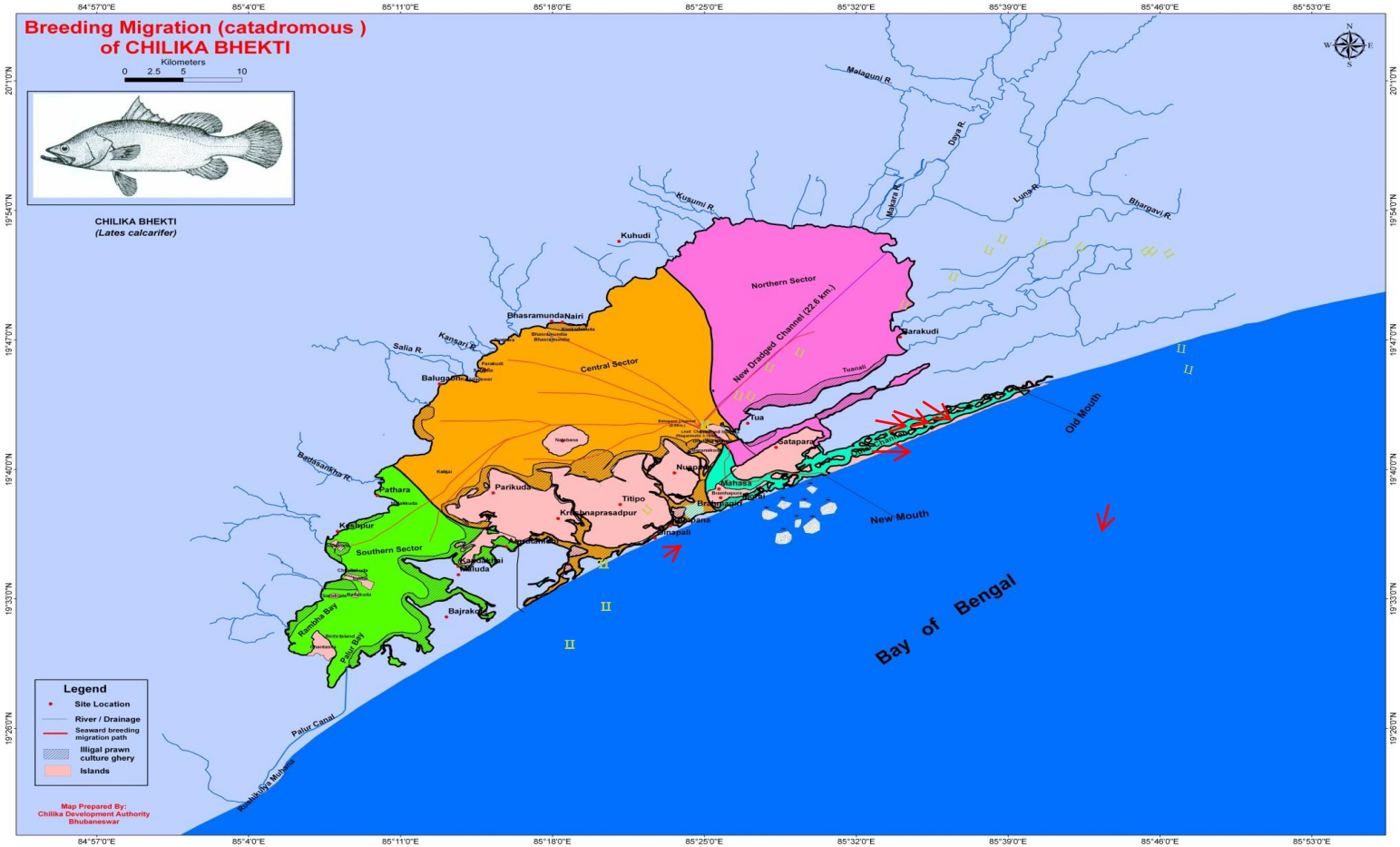
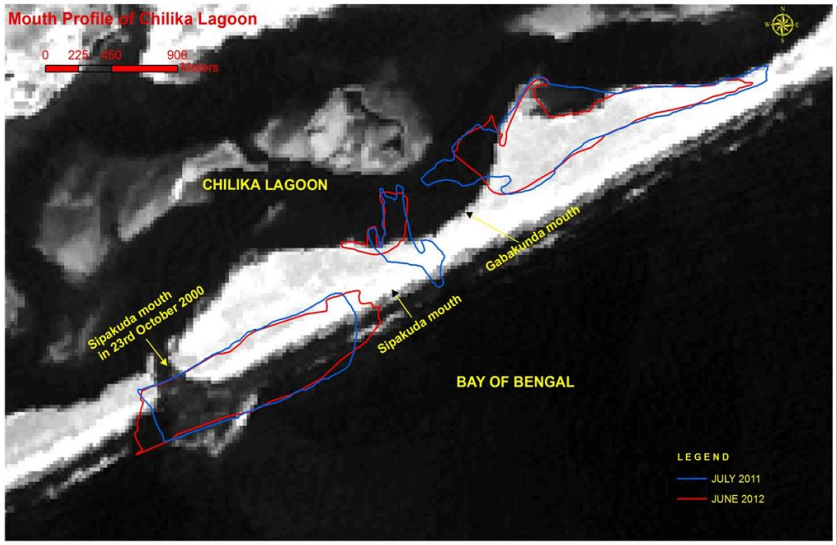
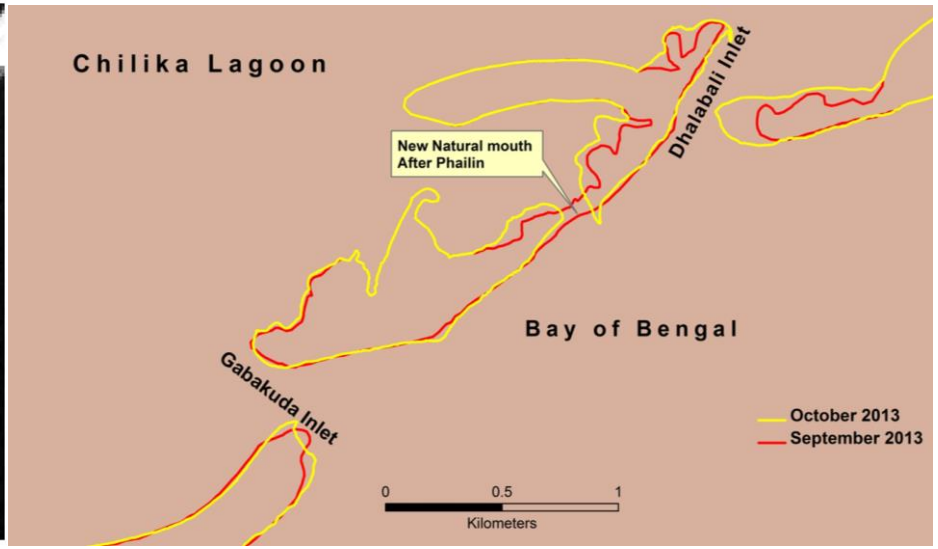
Monitoring ecological processes



Monitoring coastal processes





- Inlet monitoring (GIS based) bi-monthly +Monthly GPS Surveys
- Daily tide-gauge

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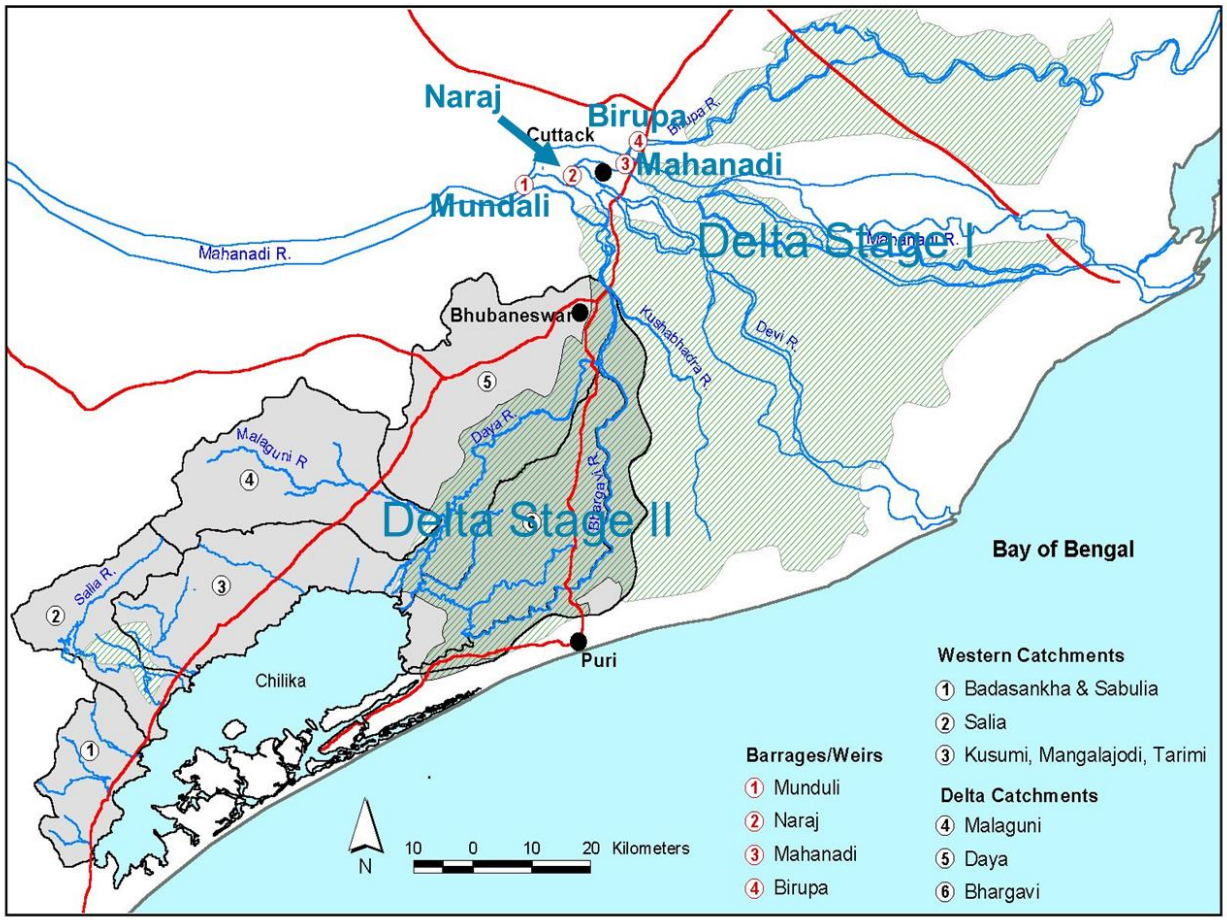
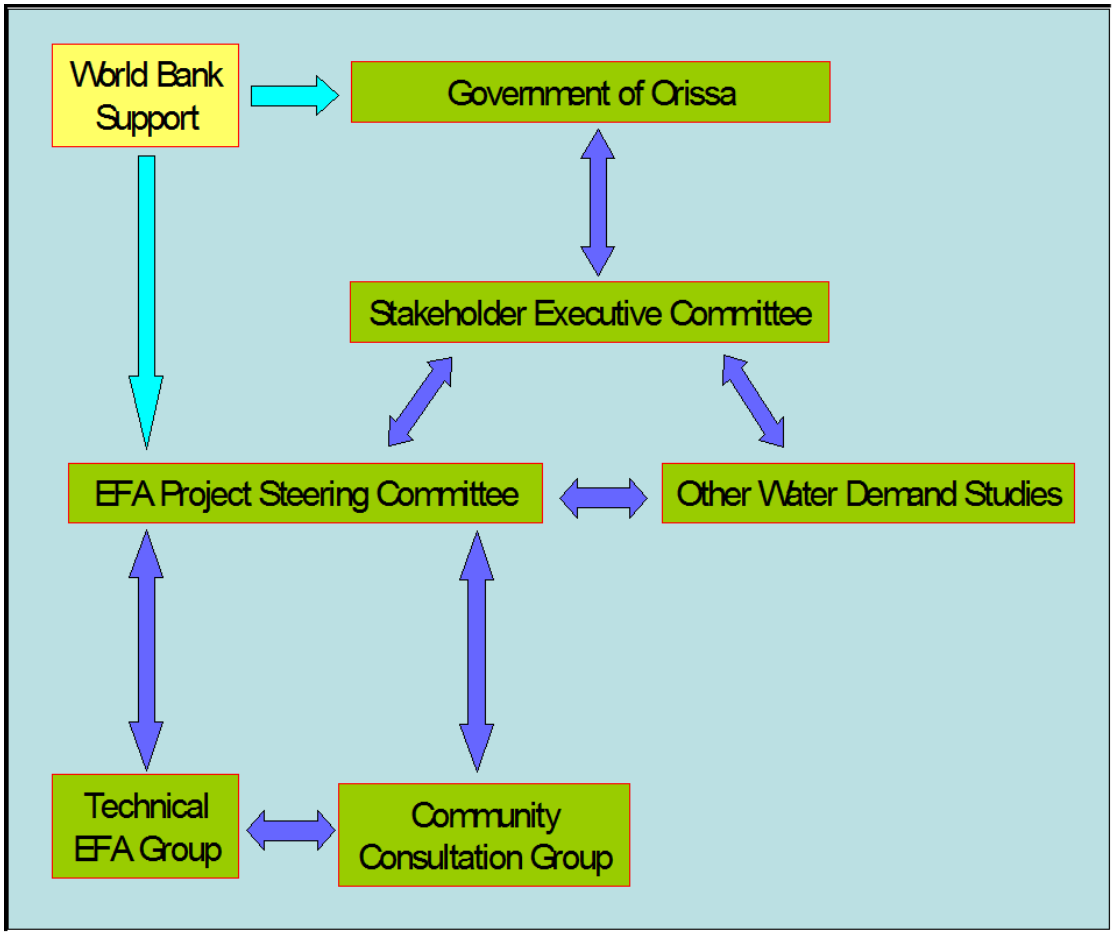
Environmental flows for Chilika

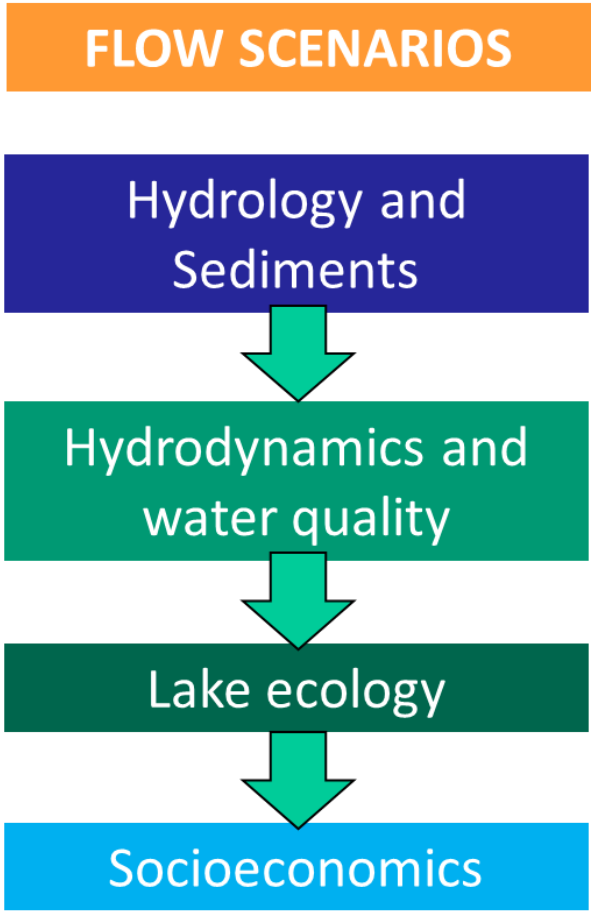


Question – How much water do you need ? When do you need it ?

EF Team: World Bank, CDA, Wetlands International, CSIRO , Department of Water Resources, CWPRS

Decision support system





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Defining flow scenarios

Scenario 1: Pre Barrage

60% undivided Mahanadi flow through Naraj

Scenario 2: Multi Objective

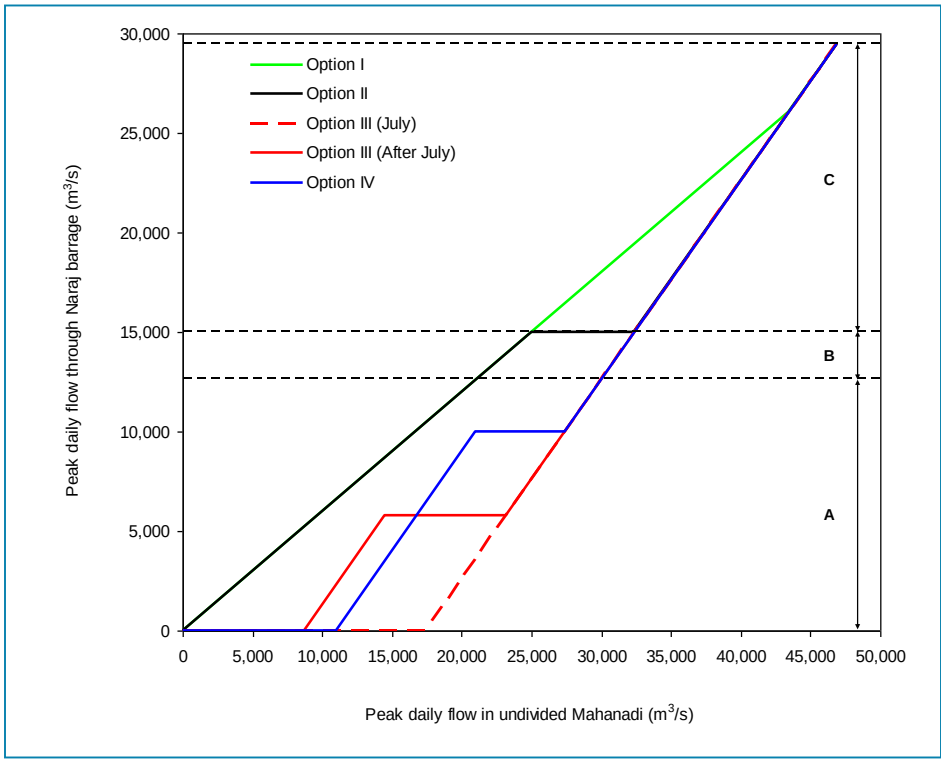
Regulate flows above 15,000 m³/sec to control large floods d/s Naraj

Scenario 3: Sediment Control

No flows in July , first month of monsoon

Scenario 4: Euroconsult II

Control sediments and minimize structure failure risk



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Flow perceptions

Structural Engineers

Reduced flows -> Reduced silt -> Longetivity of wetland systems

Fishers

Floods - > Flush the system and keep mouth open -> high fish productivity

Farmers

Floods - > bring silt - > high agricultural productivity

Embankments create waterlogging

Knowledge Systems

Scientific measurements ⟷ Anecdotal

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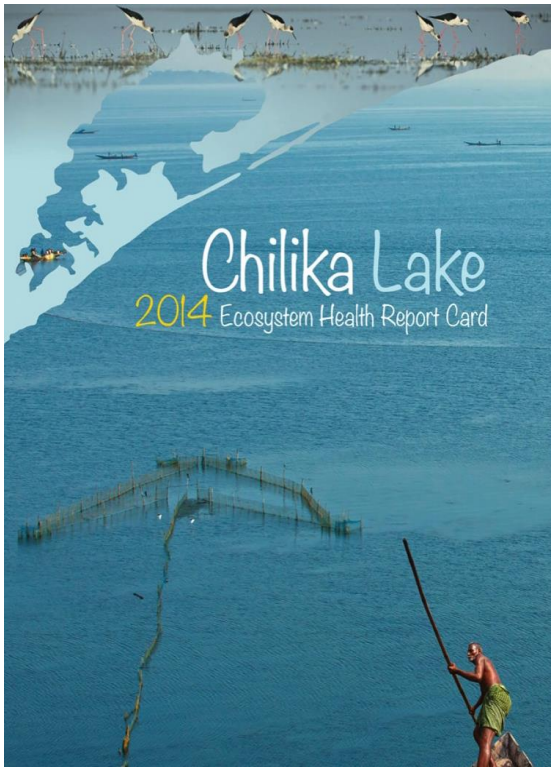
Communication and outreach

Category	Indicator	Desired condition
Water Quality	Water clarity	≤ 30 NTU
	Dissolved oxygen	≥ 5 mg/L or 60% sat.
	Total chlorophyll	≤ 5 µg/L
Fisheries	Total catch	% deviation above or below maximum sustainable yield (11,500 t/yr)
	Commercial species diversity	Ratio of species landed:desired (45 sp. desired)
	Size	Proportion of species landed above a sustainable size limit. *M. cephalus*: 219 - 461 mm; *P. monodon*: 116 - 197 mm; *S. serrata*: 87 mm
Biodiversity	Bird count and richness	Ratio to maximum bird count and diversity recorded since 2003
	Dolphin abundance	Ratio to maximum dolphin count recorded since 2001
	Benthic infauna diversity	Simpson's Index of Diversity (1-D)
	Phytoplankton diversity	Simpson's Index of Diversity (1-D)



Grades

- A 100-80%
- B 80-60%
- C 60-40%
- D 40-20%
- F 20-0%

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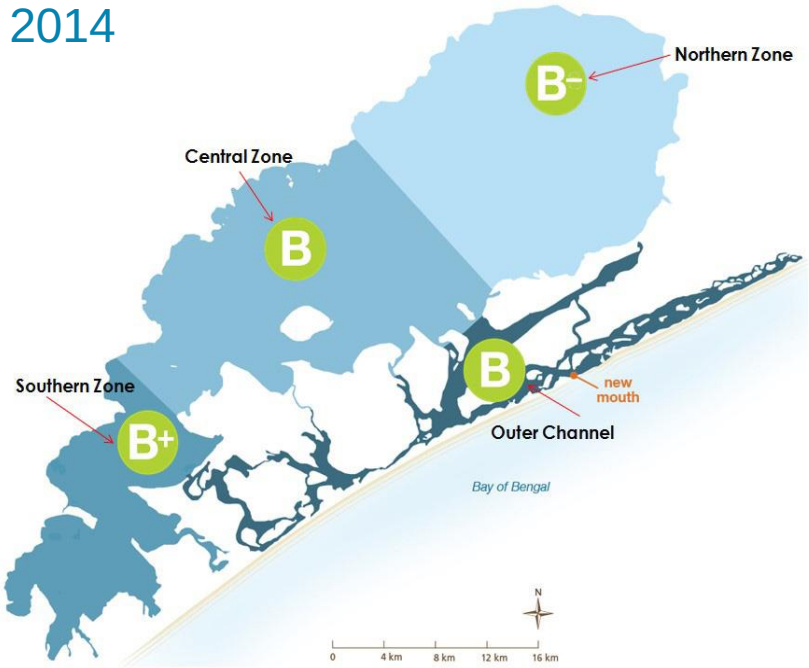
Communication and outreach

2012

2014



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Conclusions

- Robust monitoring as the basis of adaptable management
- Monitoring systems should be purposive and address management needs
- Stakeholder communications should be made a part of monitoring system design

Wetlands INTERNATIONAL

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