Freshwater input as multiple stressors on coastal ecosystems under a changing ocean: Implications of possible mitigation effect

2014. 04. 16

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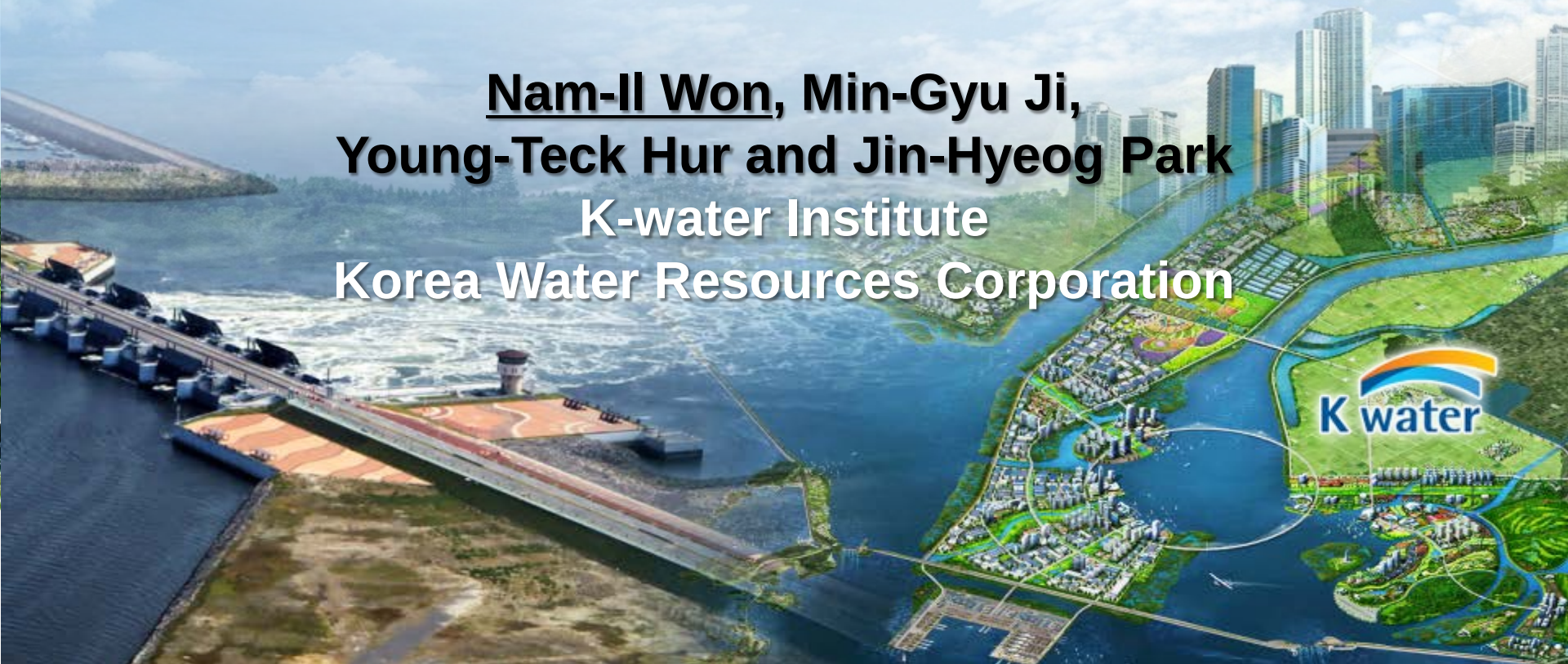
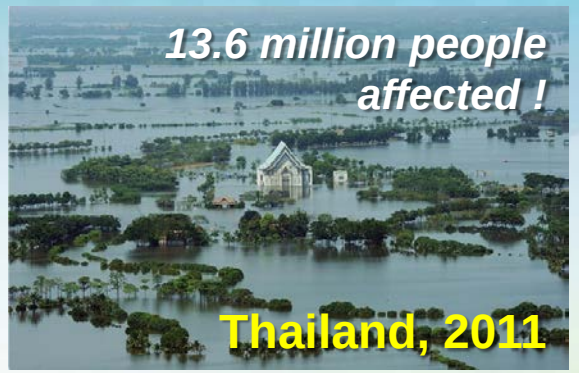
Korea Water Resources Corporation



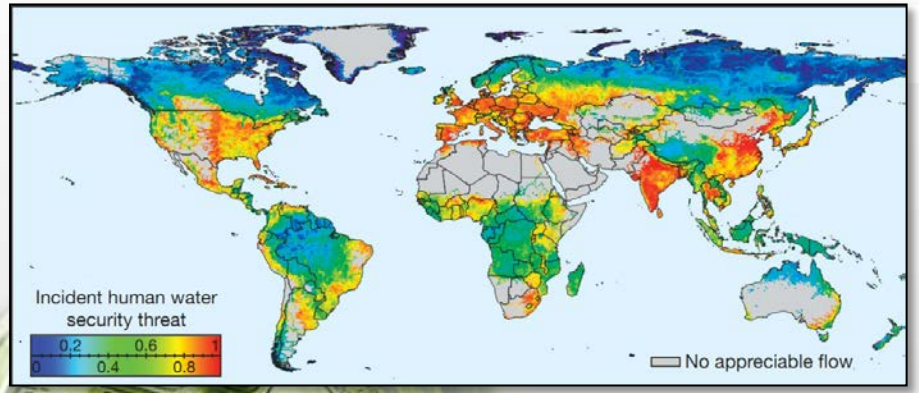
Contents

Global water issues

- **Water threat : floods**



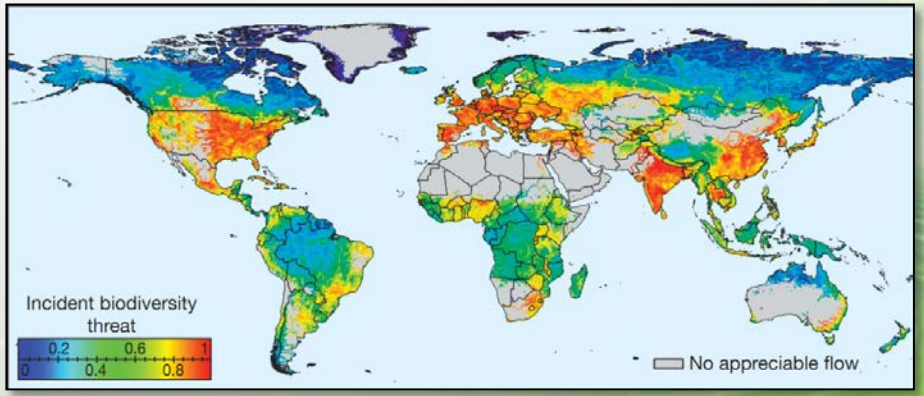
- **Water security & river biodiversity**



◀ water security threat

(Vörösmarty et al., 2010)

River biodiversity threat ▶

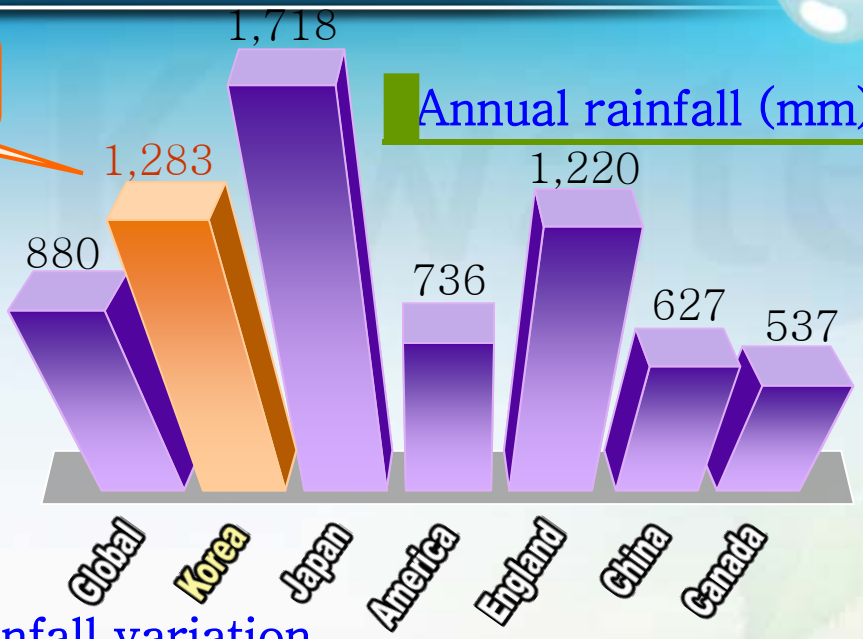


Water security ***demands integrated approach for water and related all sectors*** **(UNEP)**

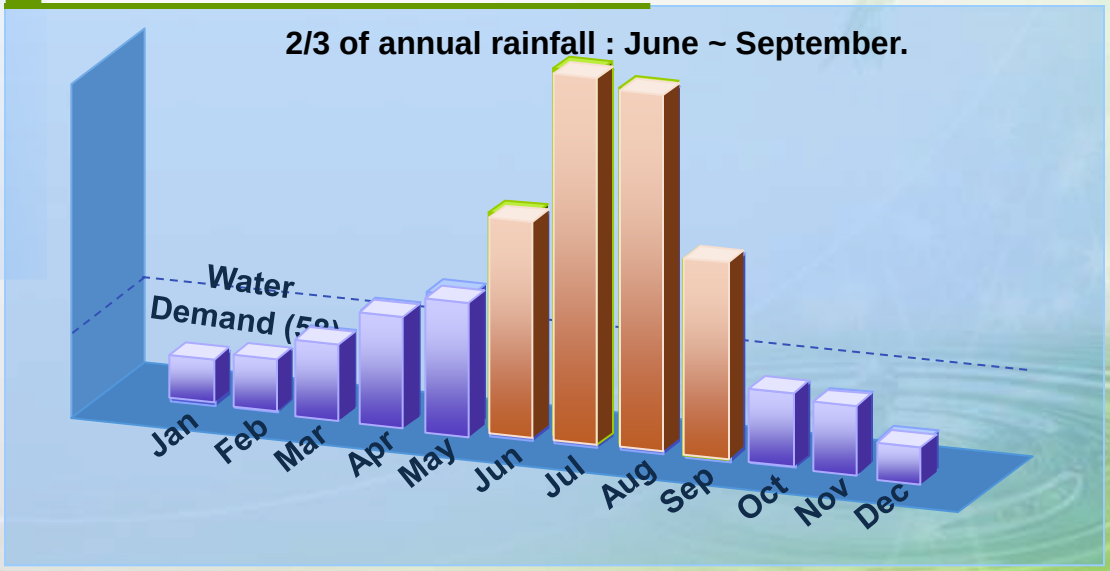
Precipitation in Korea

Global
1.4 times

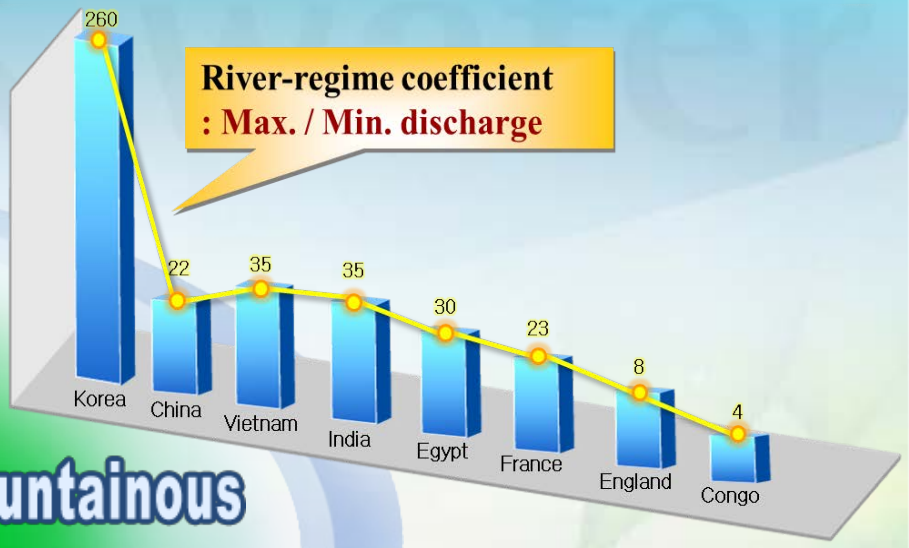
Annual rainfall (mm)



Rainfall variation



Topography of rivers in Korea



65% of the country's land is mountainous

65% of the country's land is mountainous

River slopes are steep

Rainfall flows fast with wide fluctuations of flow

Contents

Objectives & Methods

Under human efforts for water management

- **To examine freshwater input into coastal ecosystem**
- **To describe several types of freshwater discharge affecting coastal ecosystems**

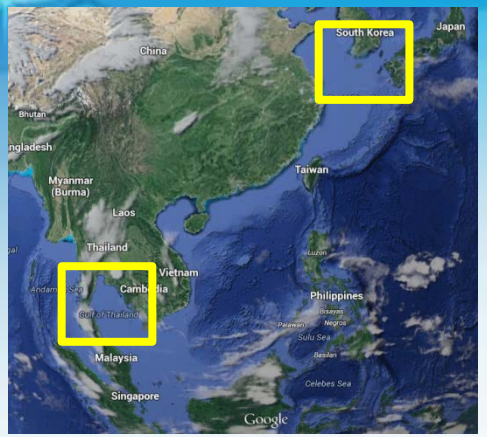
For downstream environment from water mgnt. facilities such as dams, channels, etc..

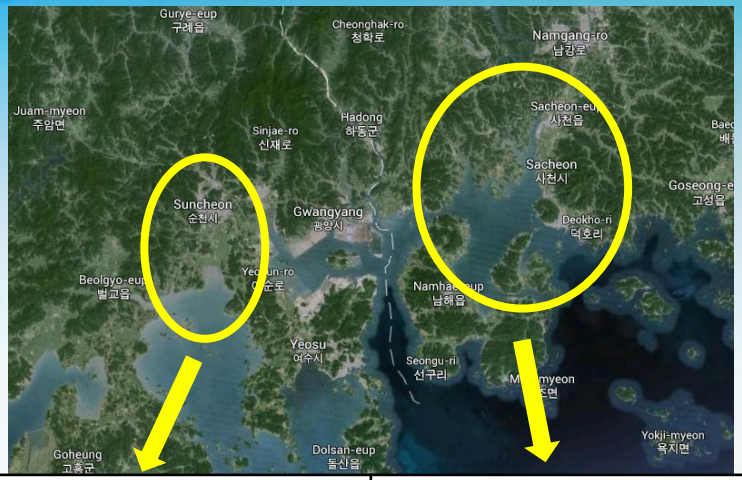
- **field monitoring**
- **numerical modeling**

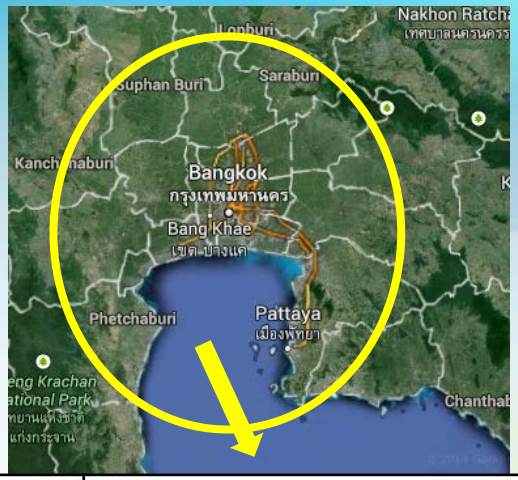
Our on-going research will examine ecosystem effects.

Contents

Cases : 3 different bays

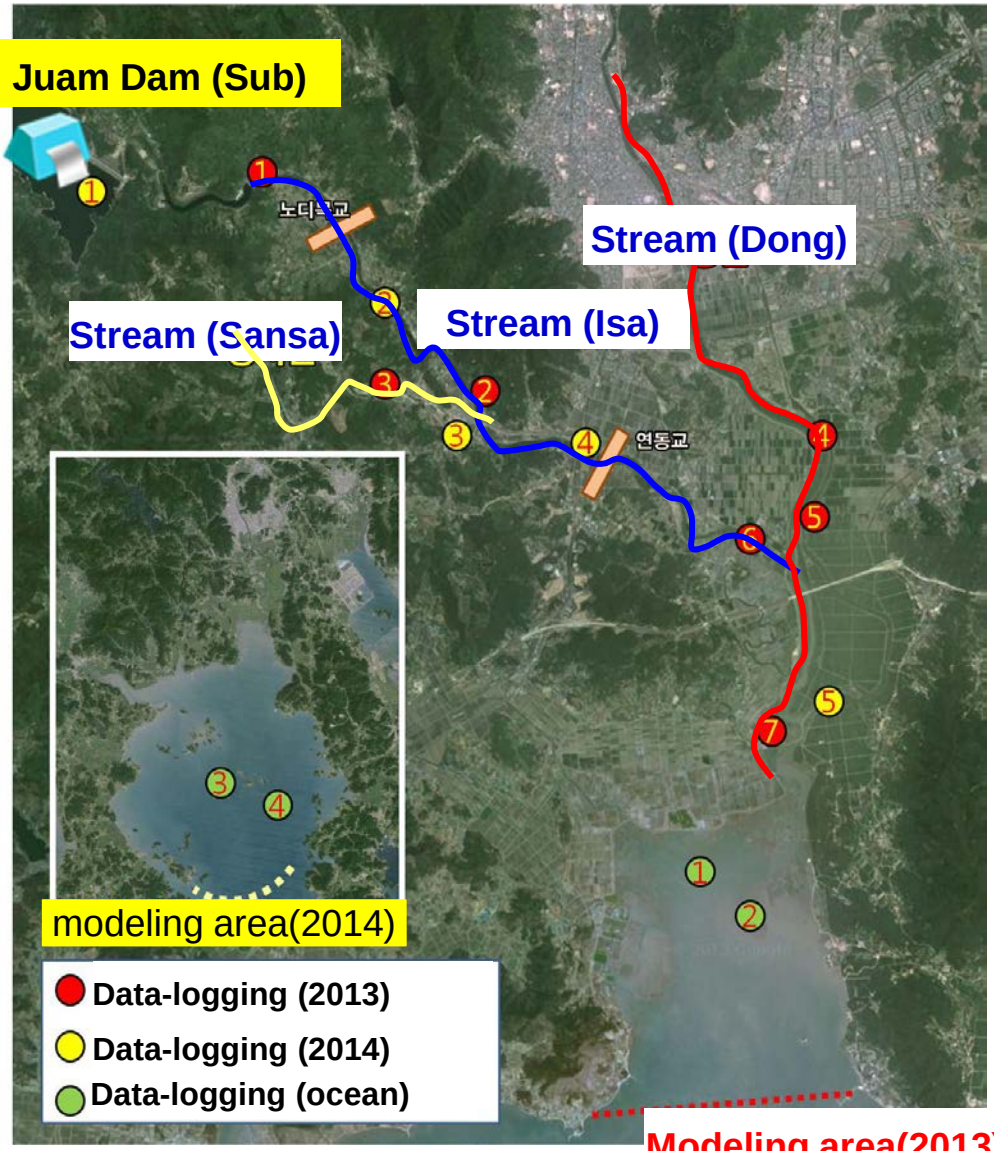






	Suncheon Bay (Korea)	Sacheon Bay (Korea)	Bangkok Bay (Thailand)
Water Mgnt.	Dam	Dam	Channel
Status	Operating	Operating	Planned
Discharge	Year-round	Rainy season	Rainy season
Type	Direct, Low temp.	Direct	Detoured
Geography	Small	Medium	Large
Monitoring	O	O	X
Modeling (EFDC)	O	O	O

Cases 1 : Suncheon Bay

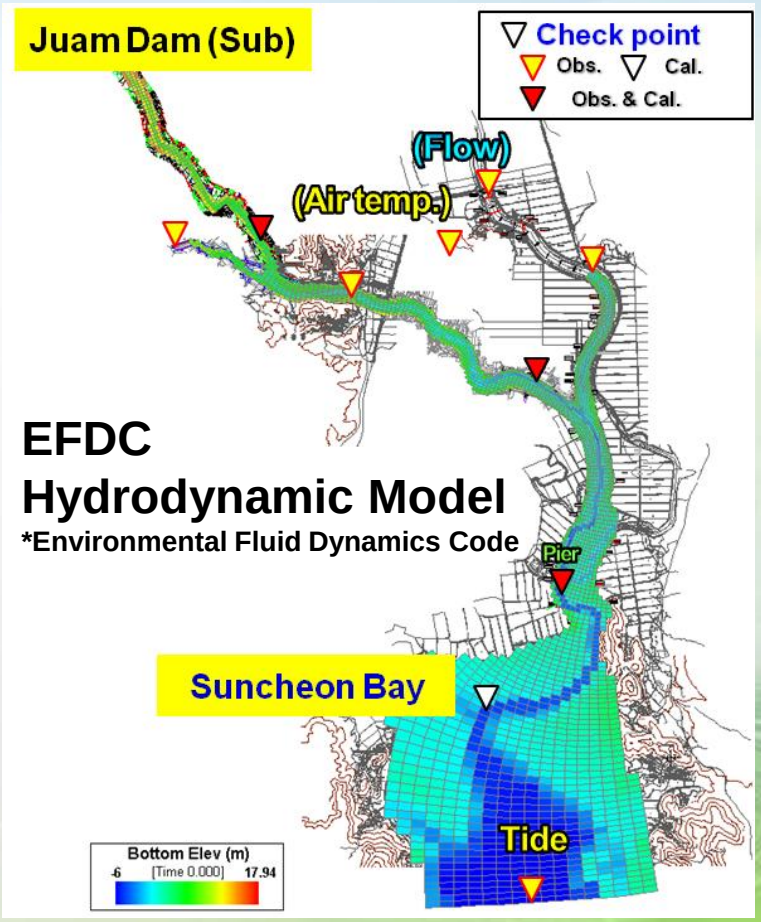


Dam : “Juam”

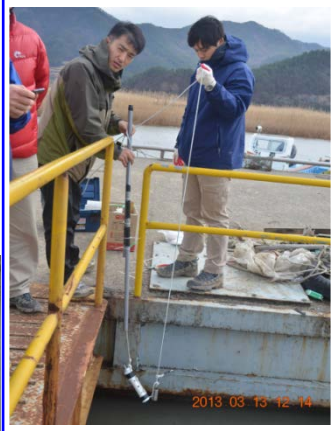
Double Dam (Main & Sub) system

Subsurface water from Main to Sub

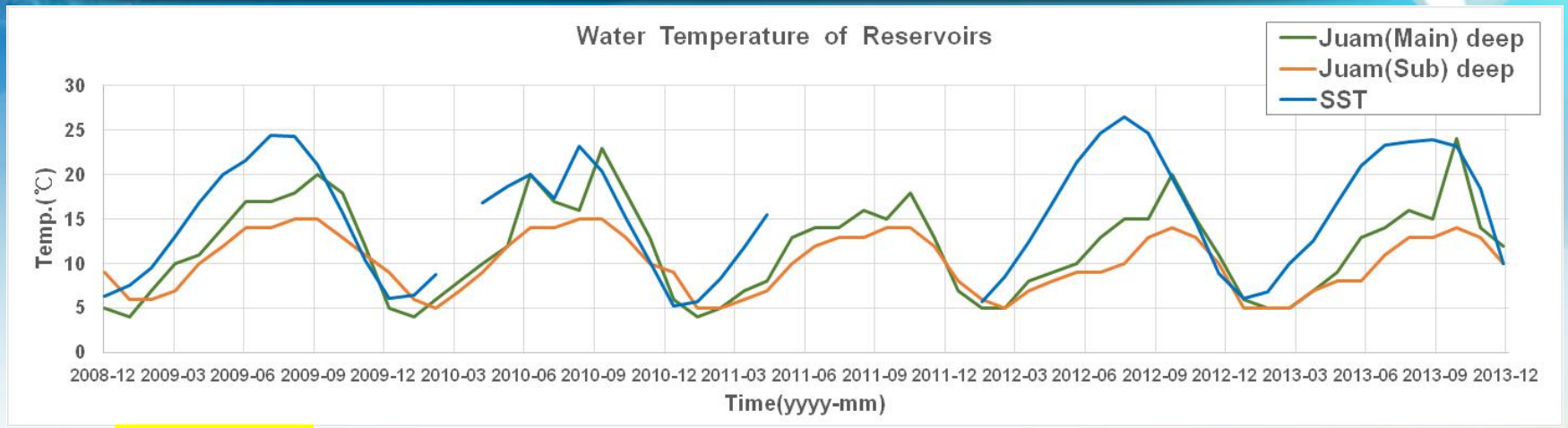
Discharge from Sub into Suncheon Bay



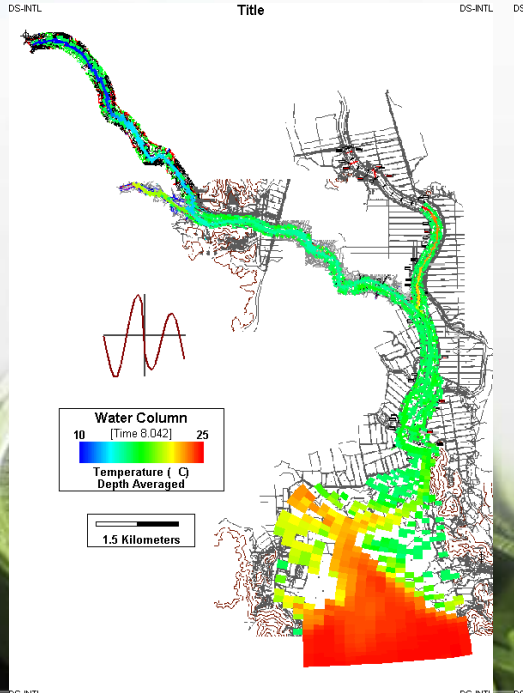
Cases 1 : Suncheon Bay - Monitoring



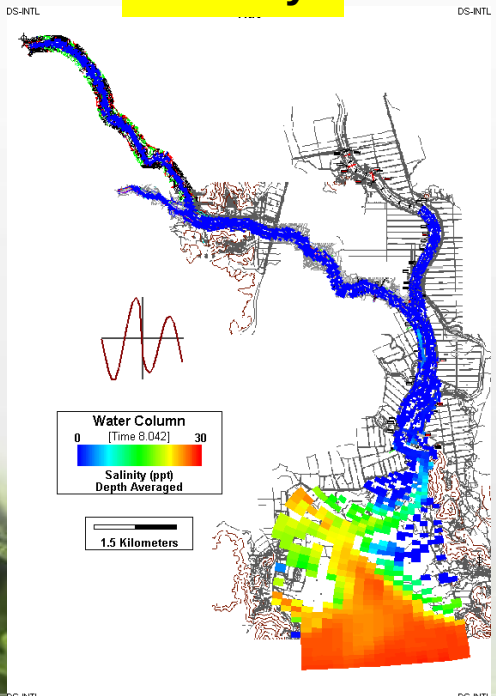
Cases 1 : Suncheon – Results & Discussion



Temp.



Salinity



Temperature effects :

"Warm" water discharge

- mid-Oct. to mid-Feb

"Cold" water discharge

- the other period

Ecosystem effects:

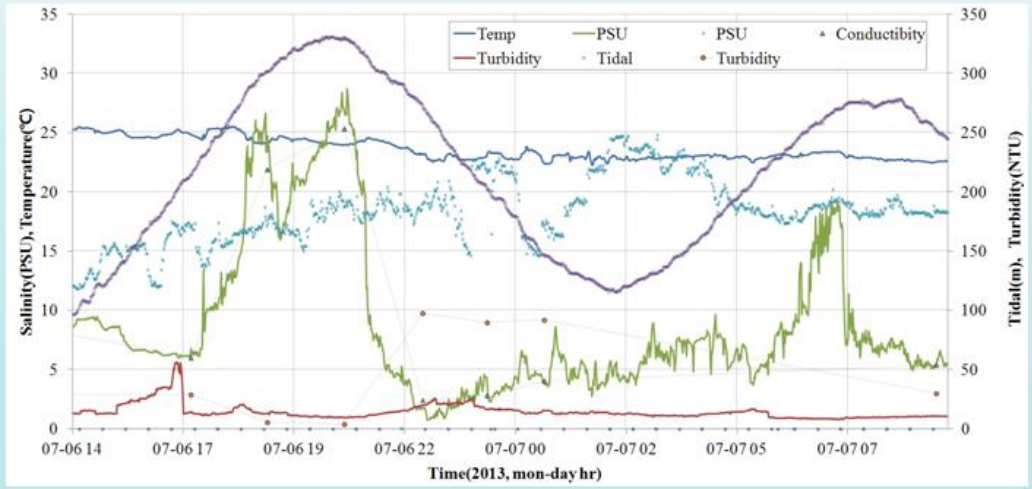
Under on-going research

***Possibly,* local impacts on overwinte ring history of organisms.**

Cases 2 : Sacheon - Monitoring

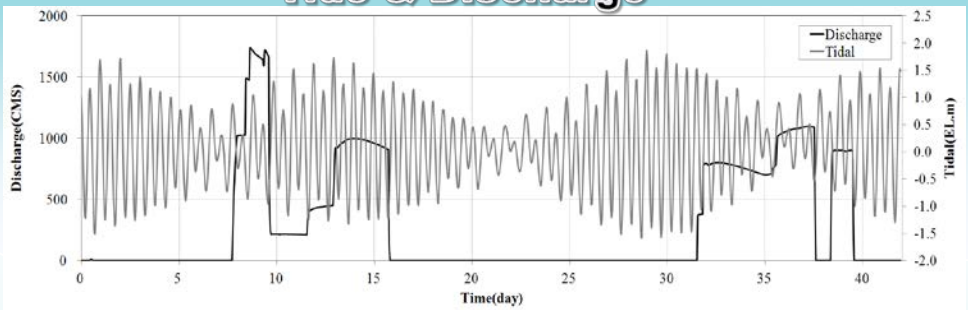
Dam : “Namgan”

Single Dam system; Direct discharge into Bay during only rainy season

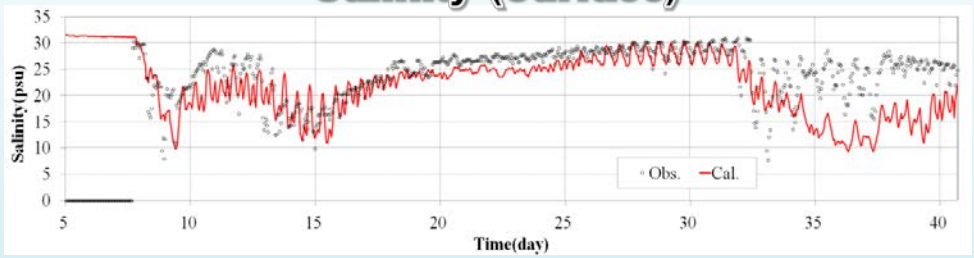


Cases 2 : Sacheon – Results & Discussion

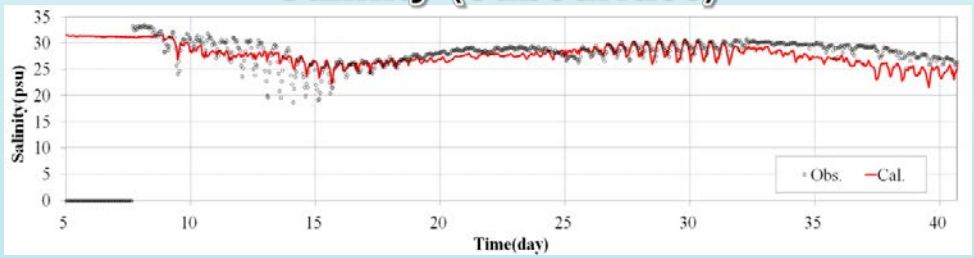
Tide & Discharge

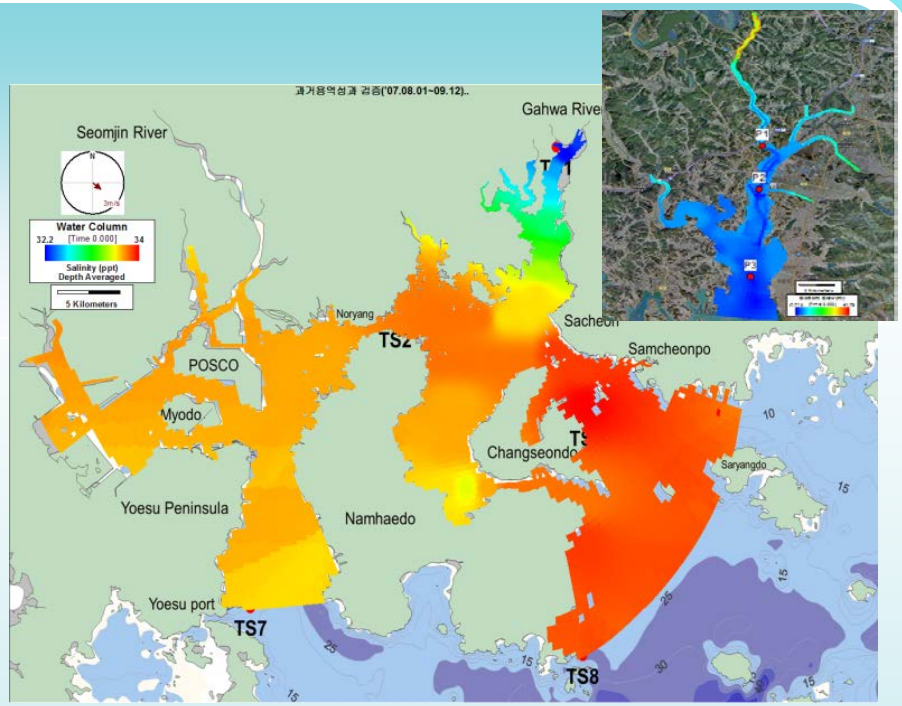


Salinity (surface)



Salinity (subsurface)





Salinity effects :

Temporary but large area affected

- only rainy season

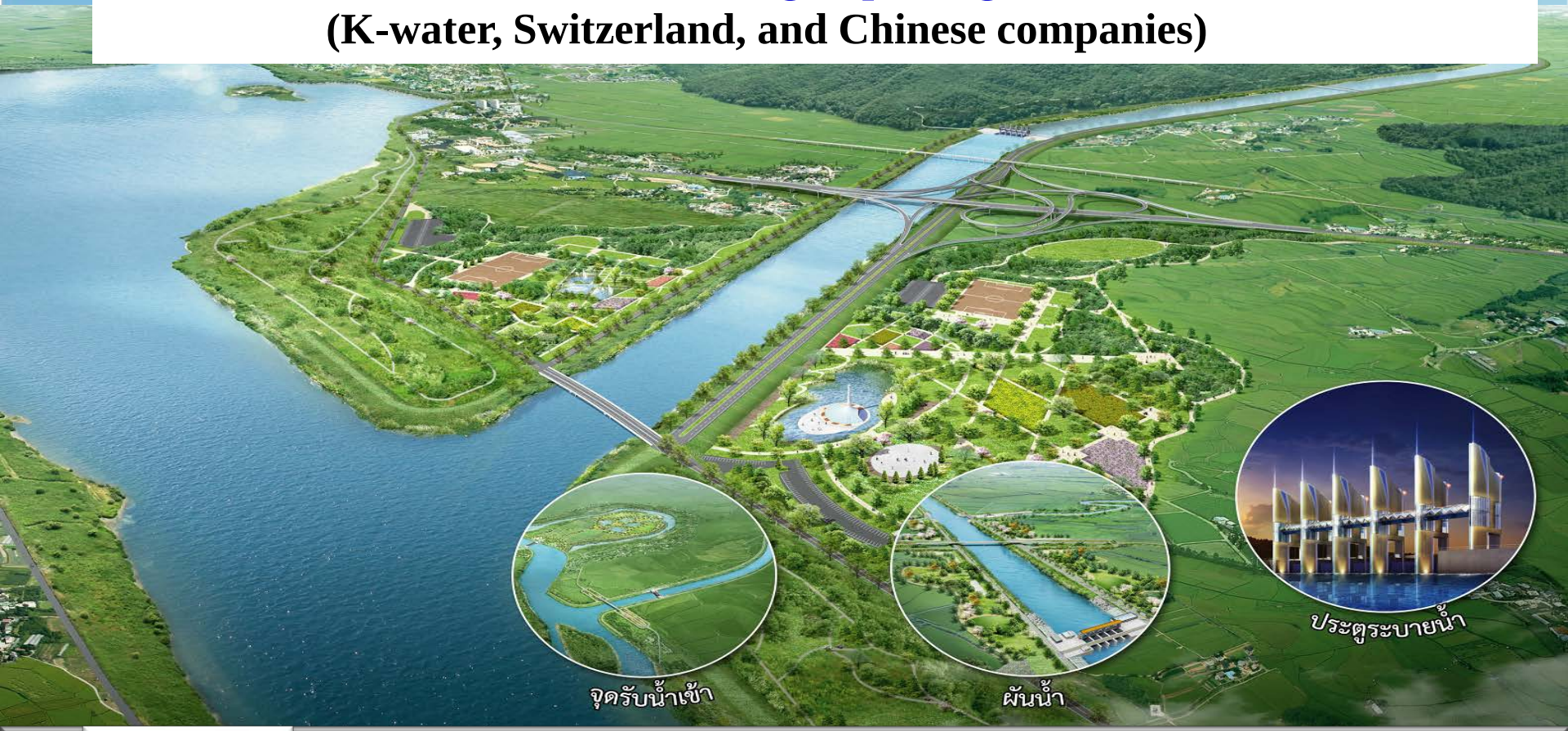
Ecosystem effects:

Only short-term effects : not serious

***Possibly,* long-term & off-shore effects**

Cases 3 : Bangkok

Channel : **Planning for construction (since 2014)**
under Thailand water mgnt. plan against flood
(K-water, Switzerland, and Chinese companies)



Cases 3 : Bangkok

Current status of water resources – Flood

Floods in Thailand killed 815 people and affected 13.6 million people

Cases 3 : Bangkok - Planning

Flooding will be avoided by detouring primary waterway

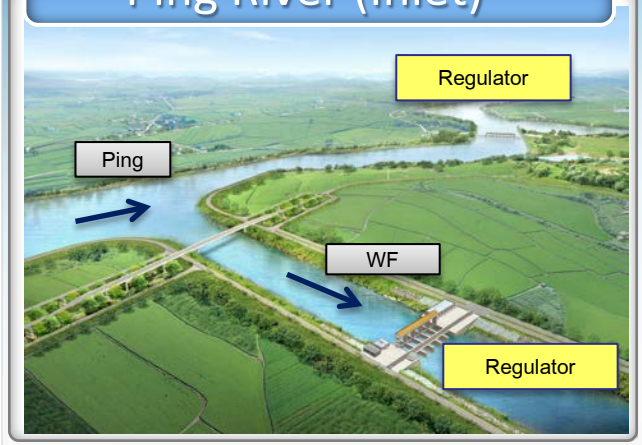
MODULE A5

The Construction of Flood Diversion Channel

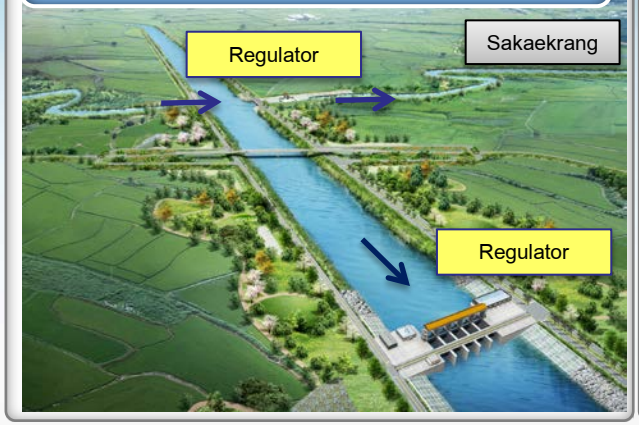
Cases 3 : Bangkok - Construction

Waterways will be detoured by newly constructed channels

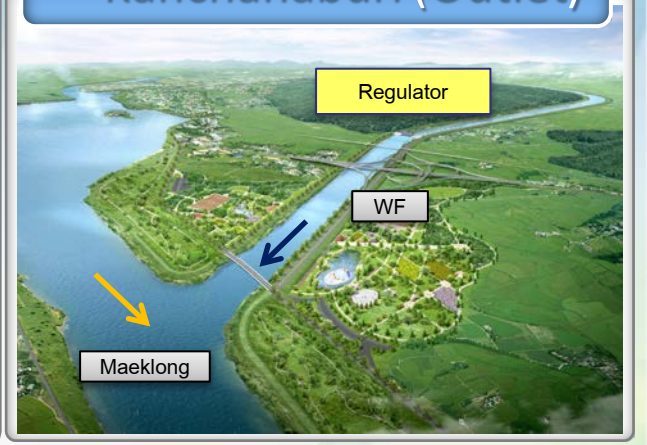
Ping River (Inlet)



Sakaekrang River



Kanchanaburi (Outlet)

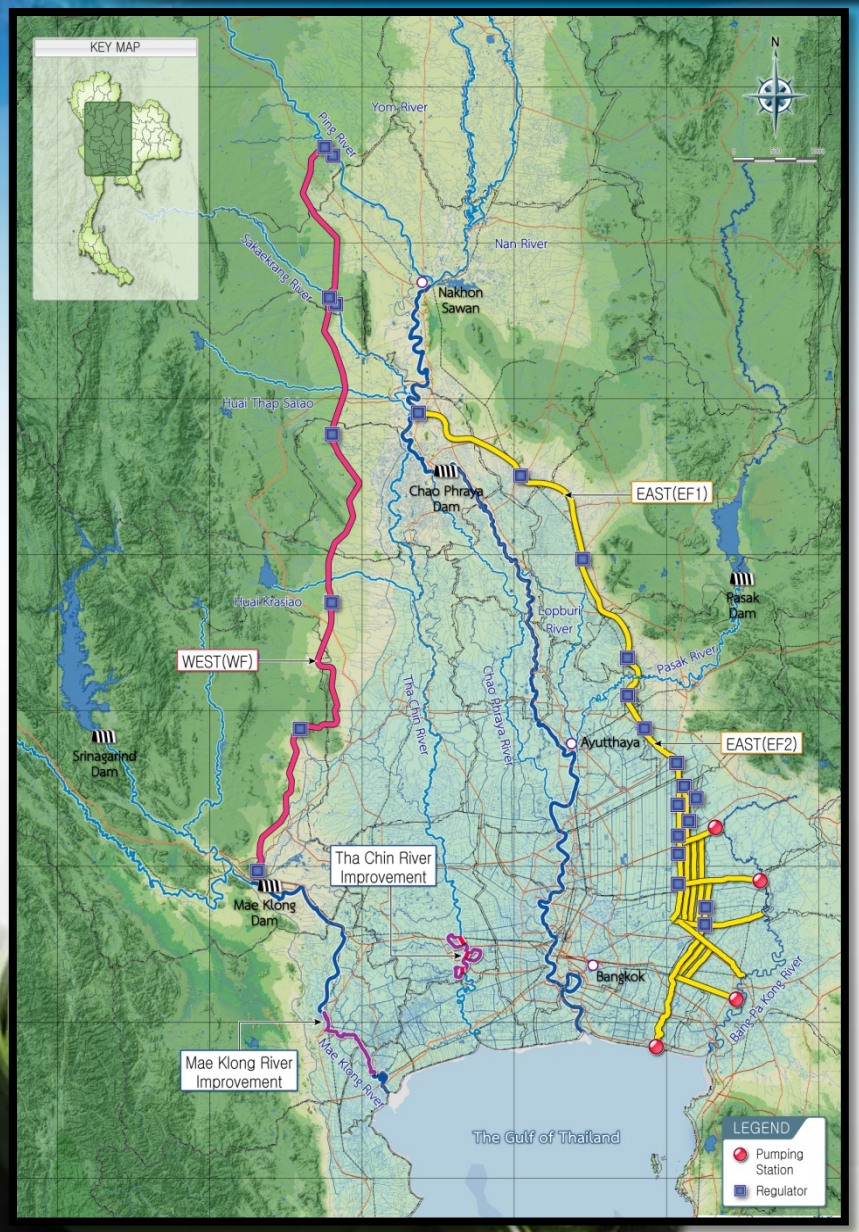


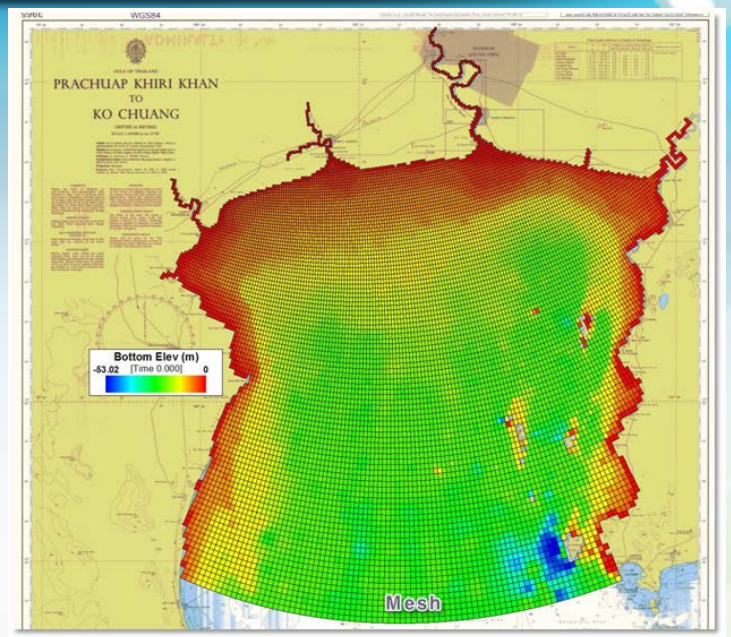
Regulator

4-lane road (Left Side)

Road bridge

Cases 3 : Bangkok – Results & Discussion





Temp. & Salinity effects :

"Freshwater" shock

- incoming pattern changed
  (2 month earlier arrival)
- local & temporary impacts -

Ecosystem effects:

Research will be soon initiated

***Possibly,* wide and long-term effects**

Contents

Changing Ocean : Oceanic

SST hindcasted & projected by ROMS for 2000 and 2030
(Jung et al., 2014, in press)

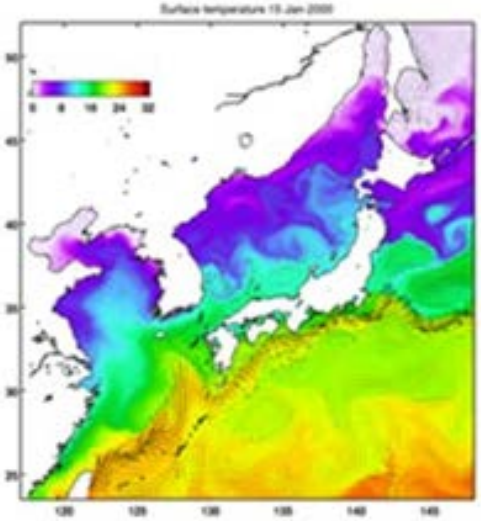
Warmer
Winter & Summer ???

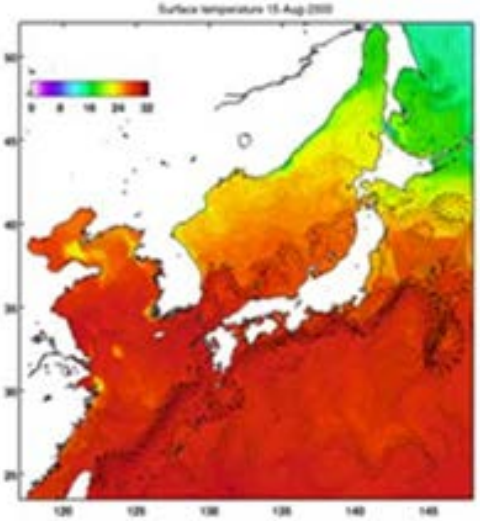
Temp.

Winter

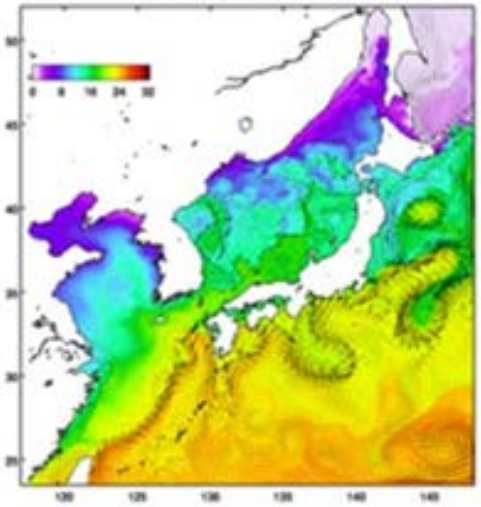
Summer

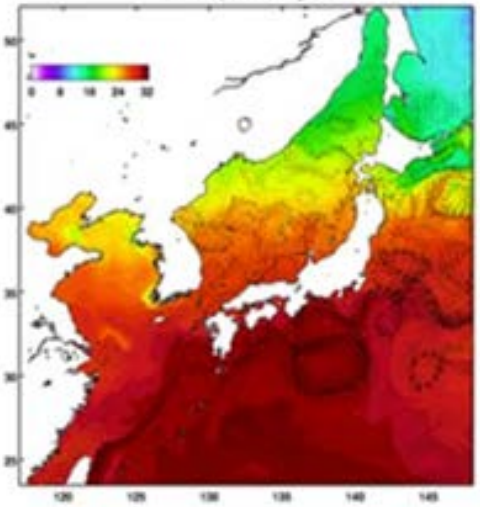
2000





2030





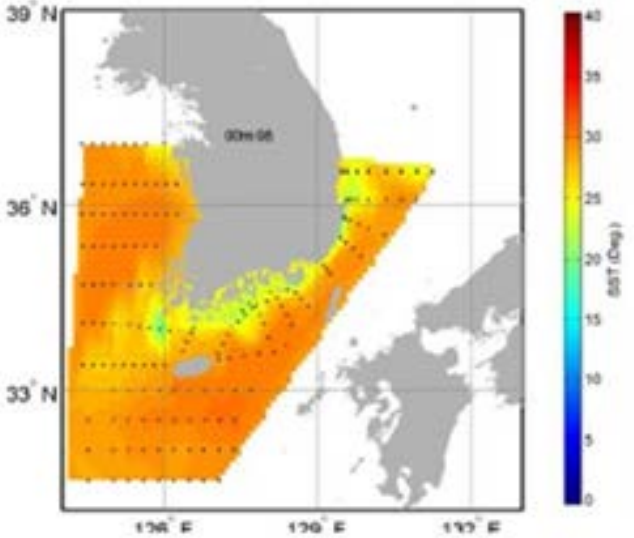
Changing Ocean : Coastal (summer)

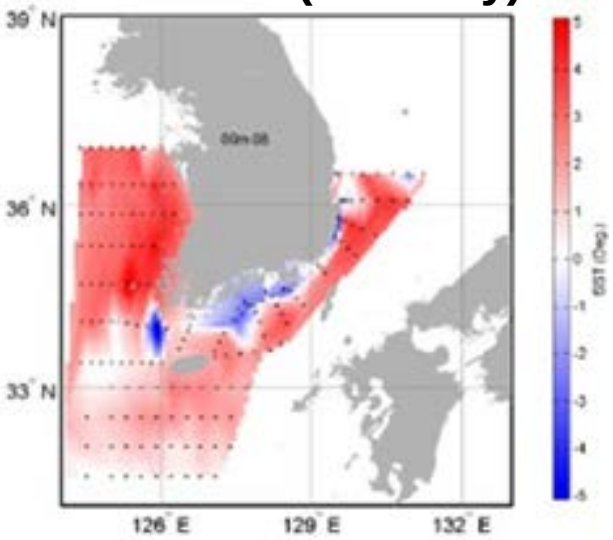
Temp.

2013

1980-2012(anomaly)

Surface

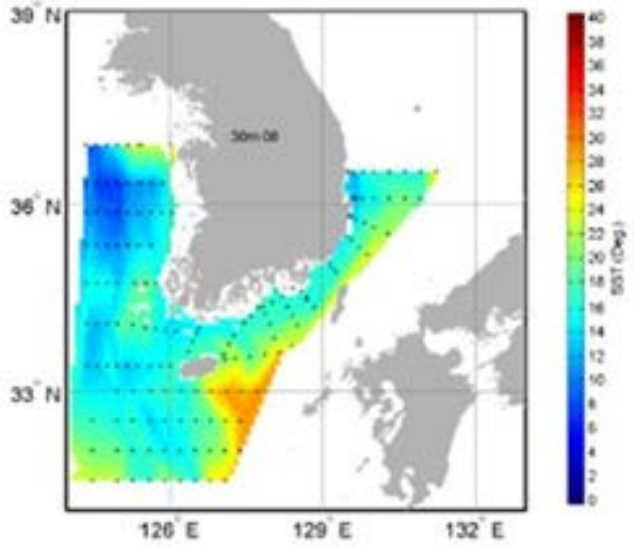


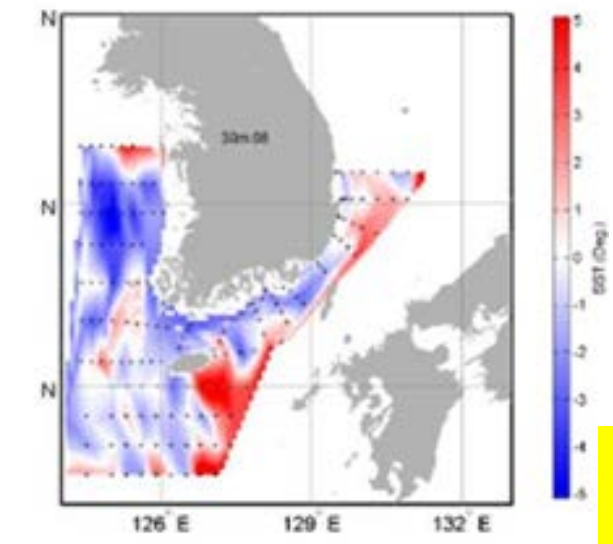


Warm
Offshore

Cold
Coastal

30 m



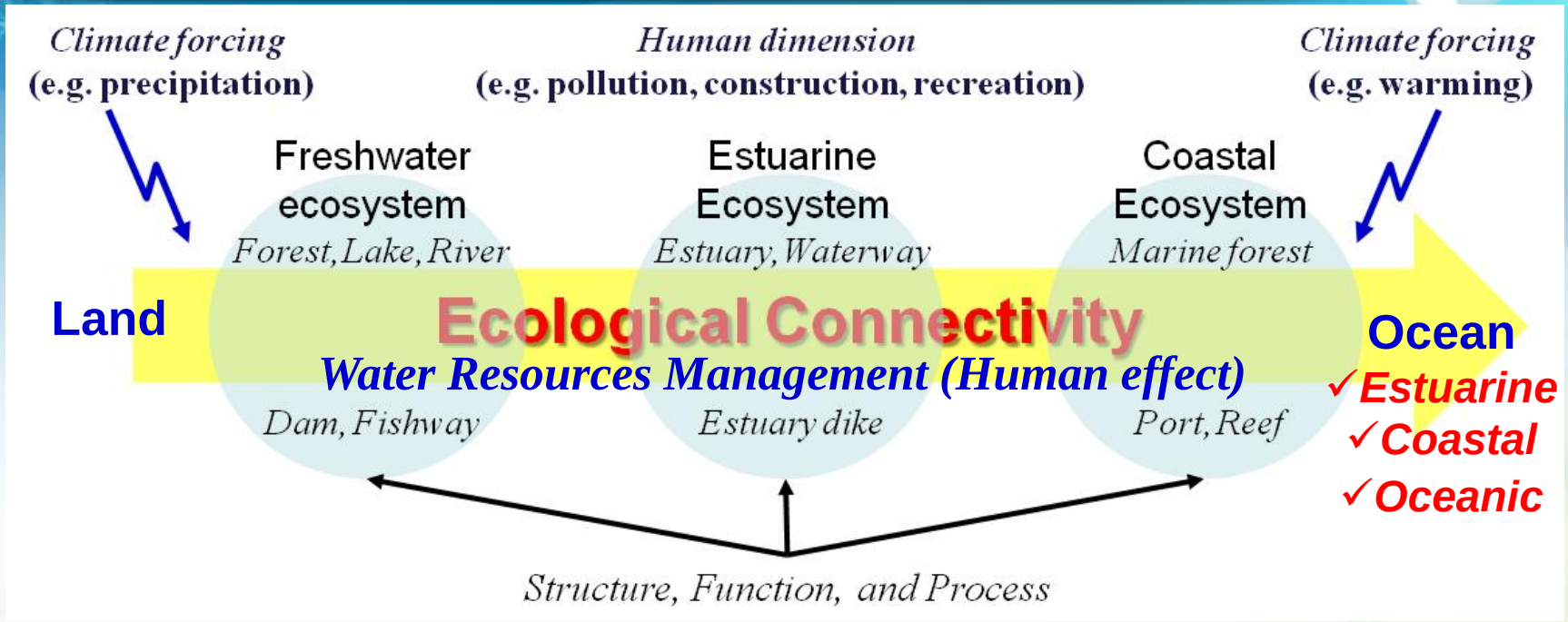


Cold
Ocean

Dramatic
Yellow Sea

Cho et al., unpublished

Synthesis & Conclusion



"Freshwater" will be affected by human efforts to manage water resources

The impacts on land-to-ocean ecological connectivity could be given to marine ecosystems in various ways leading to mitigation or enforcement effects.

Thank you for your attention !