SaeManKeum Project and the Related Scientific Topics

JAE SAM YANG

Department of Oceanography, Kunsan National University

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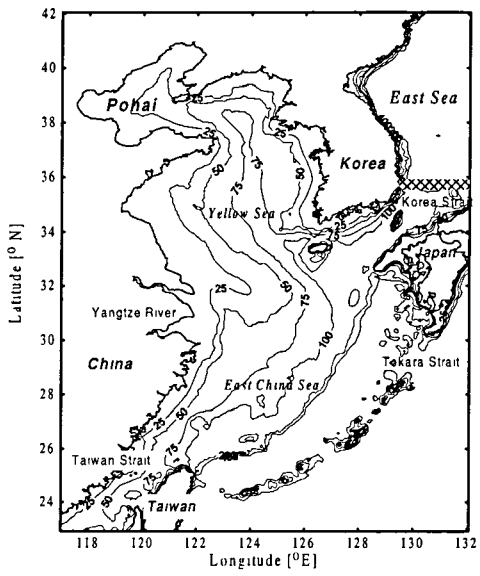
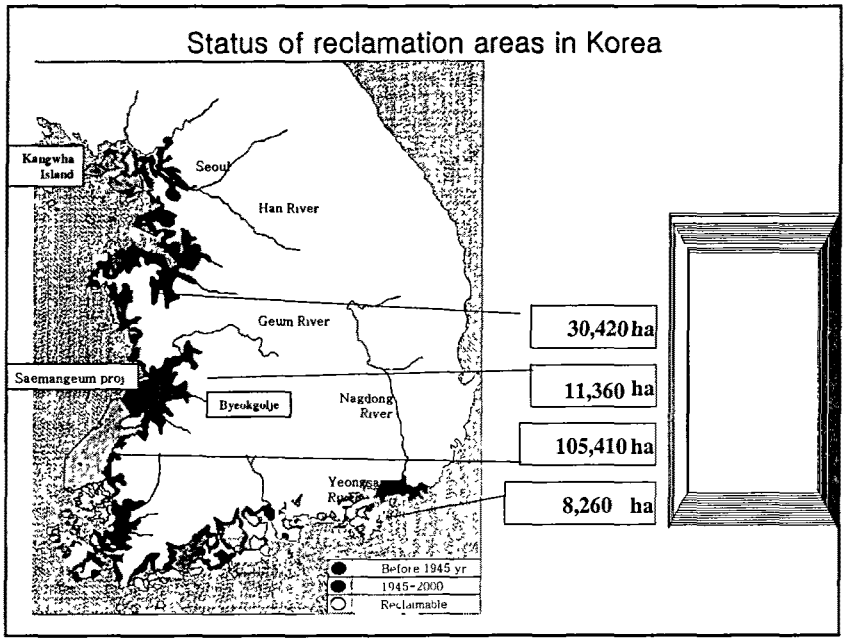
Geographic Setting

- Shallow depth: 40 m in average
- High sedimentation rate: 4 – 5 cm/year
- Tidal flat: wide up to 10 km from the coast
- High tidal range: 7.5 m max. in SMK area
  4.5 m in average





SaeManKeum (SMK) Project

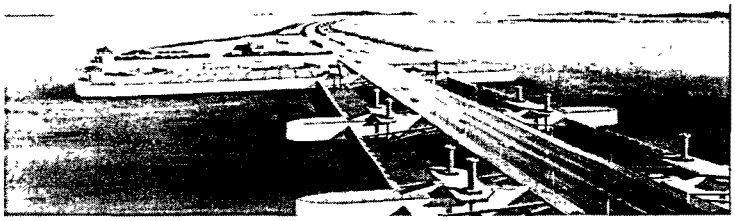
- Designed since 1970
- Started in 1992
- Dyke construction completed in 2006
- Development of the newly-formed land will be continued until 2012
- Budgets

  1200 m$ (up to 2002),

  2800 m$ (up to 2012)

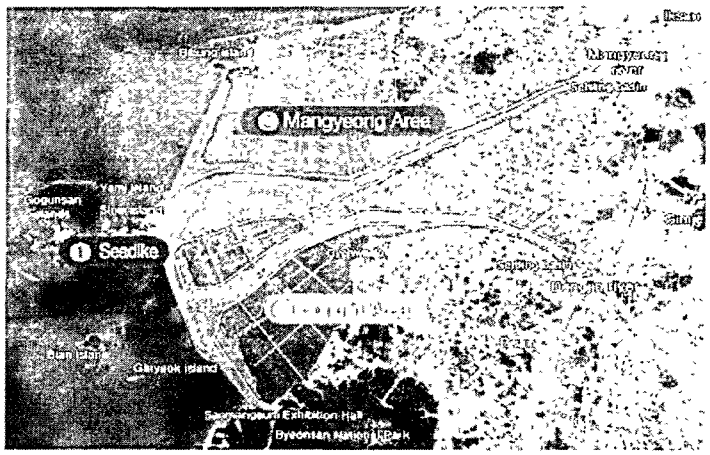
- Research Stage I : 2002~2006

(until completion of sea dyke)



- Research Stage II : 2007~2012

(period of tidal land development)

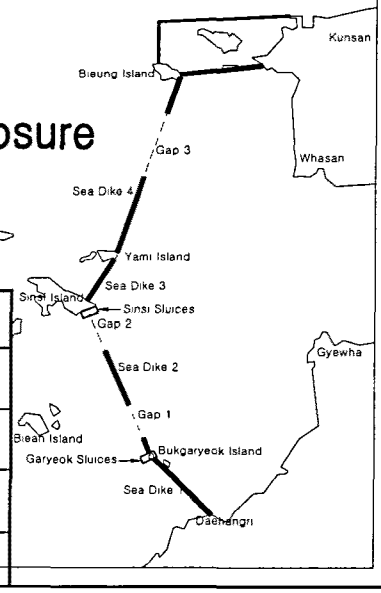


※ Proposed SMK freshwater lake is fed by two major river systems, the Dongjin and the Mangyeong rivers

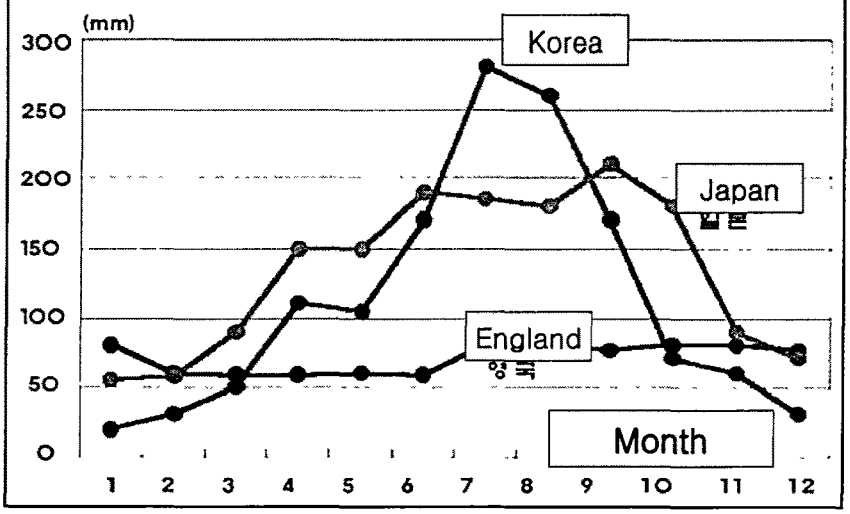
Scenario of Dike Closure

(unit: m)

Test No.	Gap 1 (depth)	Gap 2 (depth)	Gap 3 (depth)	Garyok sluice	Sinsi sluice
Calbr.	2500 (10)	1300 (23)	3600 (6.8)	close d	close d
Current plan	1600 (10)	1100 (16)	1800 (8)	open	open
Case 1,2	1600 (10)	1100 (16)	closed	open	open
Case 3	closed	1100 (16)	closed	open	open



Monthly Distribution of Precipitation



Budgets

- 50 % from national budget
- 50 % from
  "Crop-Land Transformation Fee"
  by developers such as apartment building companies etc

Topics

- Marine sciences
  - biogeochemical roles of tidal flat
  - relationship between tidal flat and coastal ecosystems
  - growth rate of tidal flat etc
  - anadromous fish migration

Remediation of Environmental Impacts

- Artificial tidal flat
- Artificial wet land
- Restoration of eel grass bed
- Fishway for young eels *etc.*

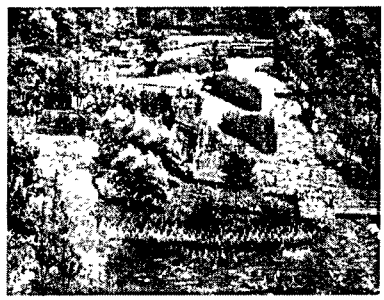
⑤ **Habitats and Shelters for Migratory Birds**

- Survey for species, number and their seasonal changes of migratory birds
- Ecological characteristics such as eating habits of migratory birds
- Function and contribution of the SMK area as migratory route

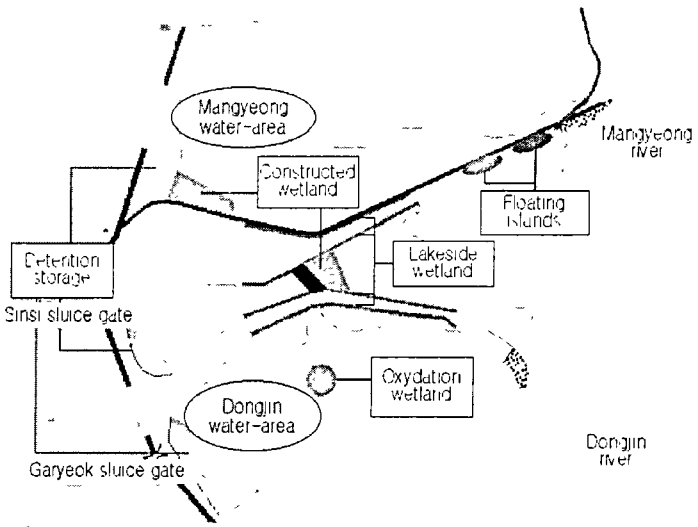
- Prediction and analysis of the status of migratory birds in the SMK and neighboring lake areas
- Preparation of habitats, and water supply and drainage system for water quality conservation against bird waste

⑦ **Construction of Ecological Parks**

- Layout of spaces for halophyte garden, aquatic plant garden, eco-pond, etc.
- Facility plan in the park considering surrounding environment
- Providing habitats for fish, birds, plants, etc.
- Operation and management plan for the park

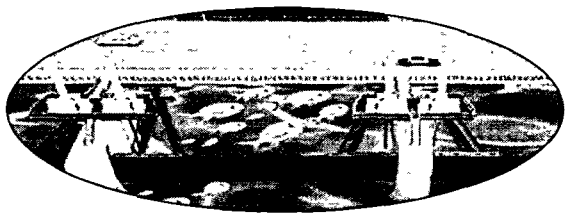


Remediation of environment



Fishway Operation

- Suggestion of proper spawning place and fish habitats in the lake
- Conservation of rare and economic fish species
- Preparation of fishway management guideline



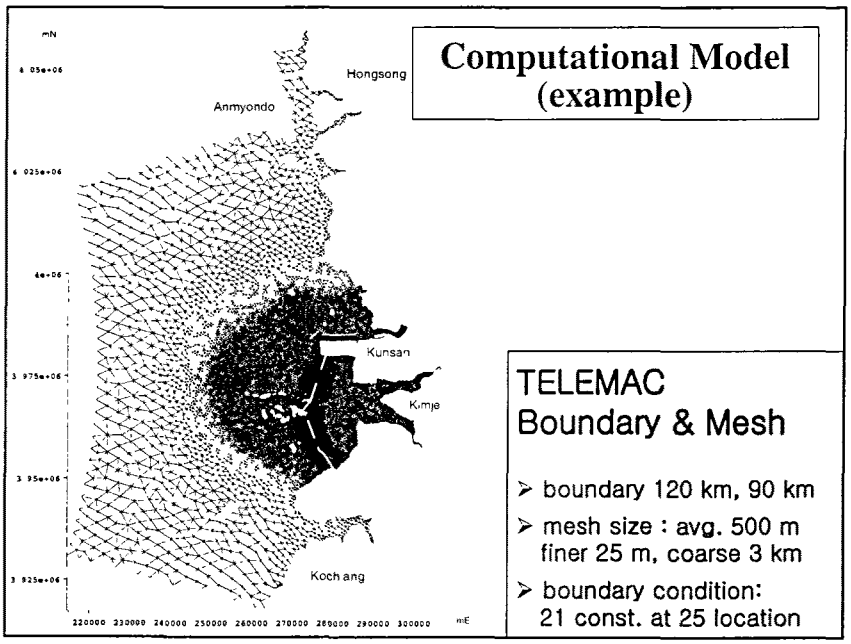
Planning of newly formed land

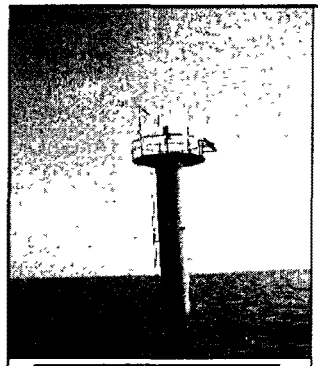
- Mainly designed for crop land
- Increased need for industrial complexes by local government
- Development of environment-friendly industries:

  tourism, bioengineering, and film-making

Funding Agencies for SMK project only (annual)

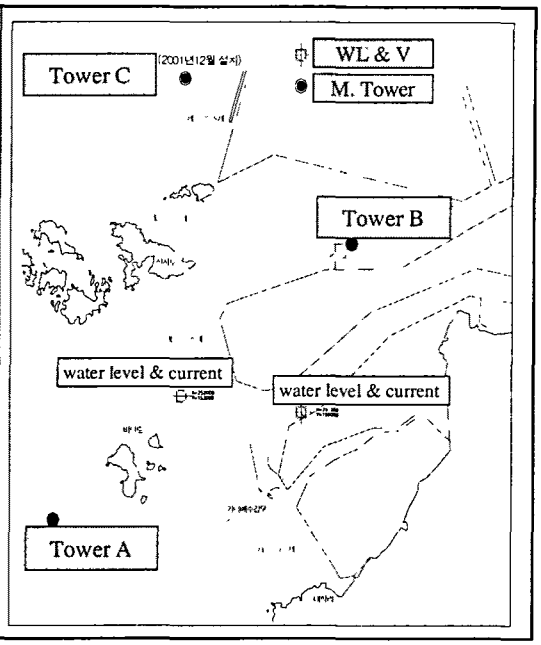
- Ministry of Agriculture
  - Monitoring of SMK area (land side) : 0.25 M$
  - Mesocosm study : 0.25 M$
  - Appropriate crops and plants etc: 5 M$
  - Water quality modeling: 1 M$
- Ministry of Maritime Affairs
  - Monitoring of SMK area (ocean side): 3 M$

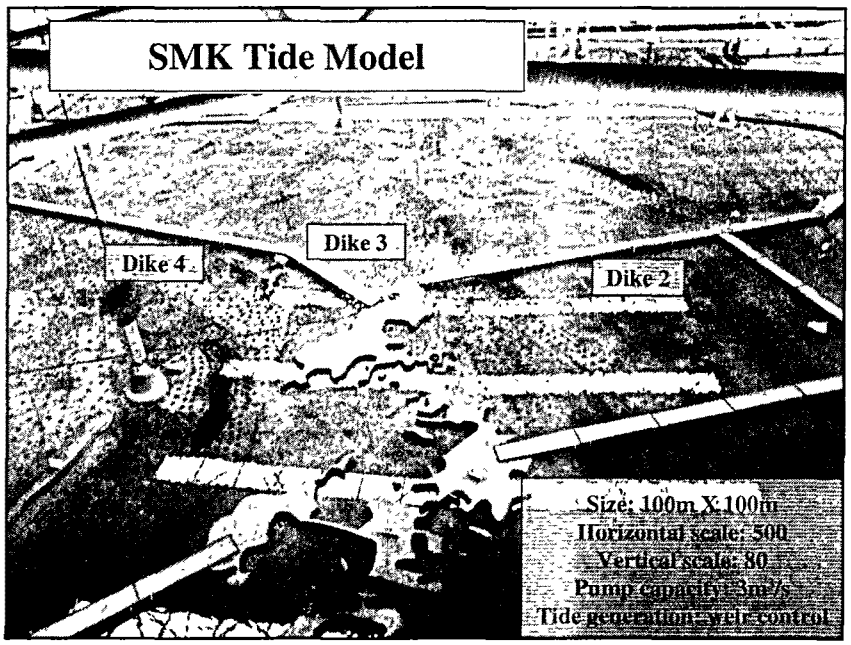




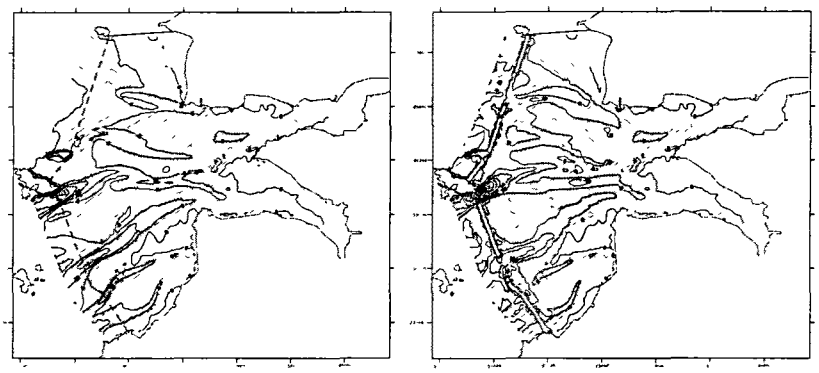
Monitoring tower

water level.
tidal current.
wave height.
wind, temperature.
salinity, water quality





Bathymetry due to Dike Construction



before (1988)　　present (2001)

Kunsan National University

- 300 faculty members (50 in SOST)
- 8,000 undergraduate students
- Marine science related institutes
  - SMK Environmental Research Center
  - Red-tide Research Center
  - Fishery Research Center
  - Coastal Research Center
  - Tidal Flat Research Center
- School of Ocean Science and Technology (SOST)
  - Depts. of Oceanography, Bioengineering, Aquaculture, Ocean Engineering, and Food Processing
  - Dept. of Navigation and Machineries

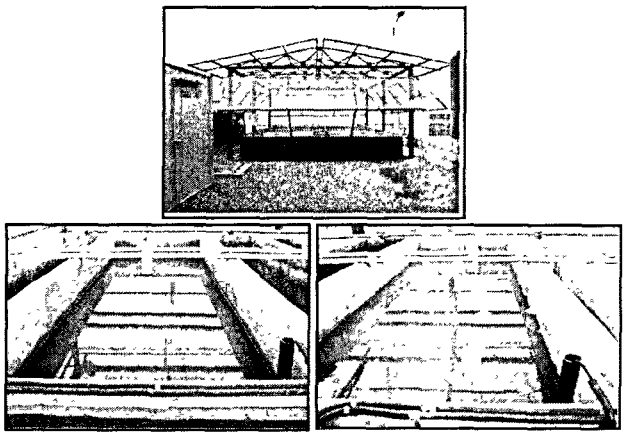
Energy flow

of carbon, nitrog[illegible]nd phosphoru[illegible]

gh sediment-water interface in th[illegible]

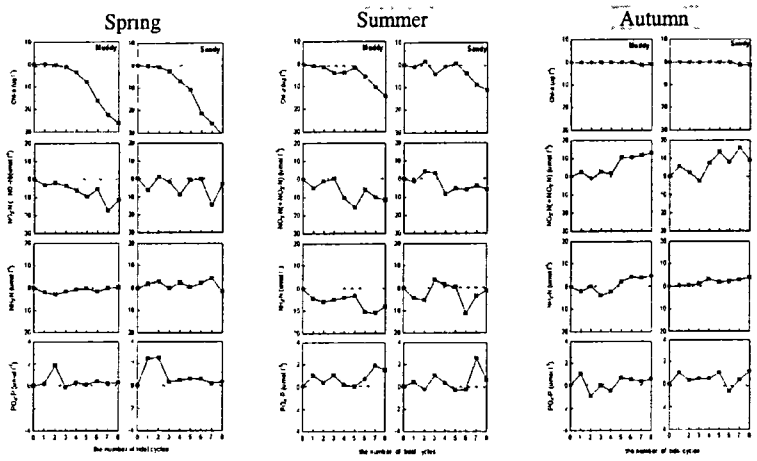
YEONG-TAE KIM & JAE SAM YANG

Department of Oceanography, Kun[illegible]

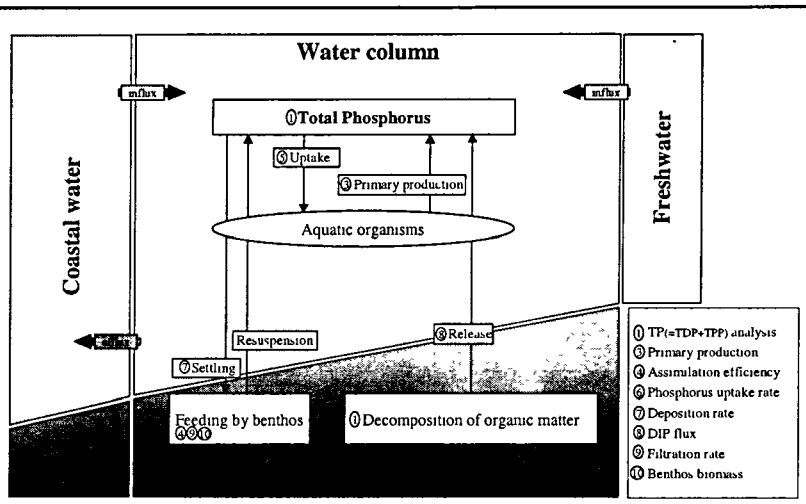


Muddy sediment Sandy sediment

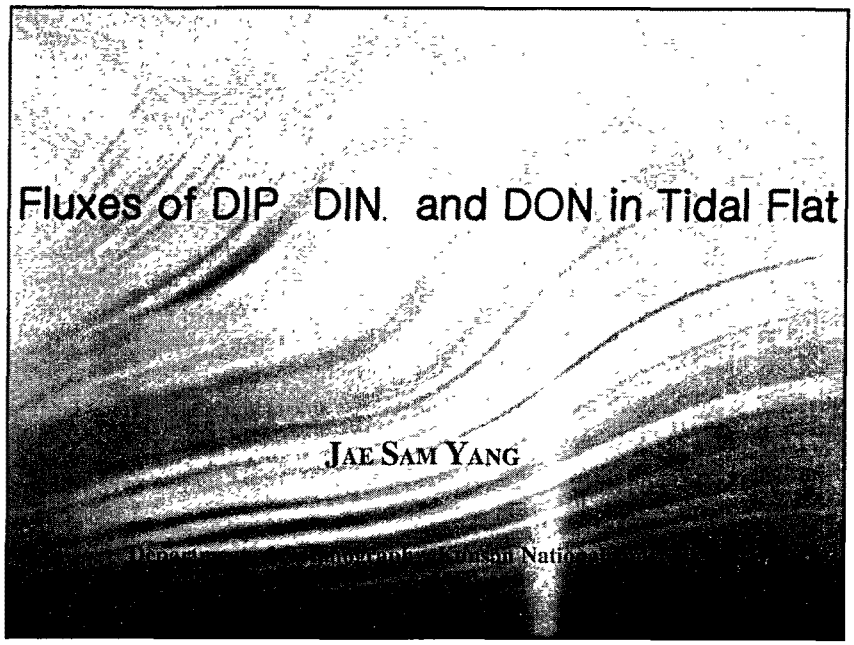
Photograph of mesocosm



The variations of Chl-*a*, [nitrate+nitrite], ammonium, phosphate on tidal cycles.



Phosphorus flow through sediment-water interface.



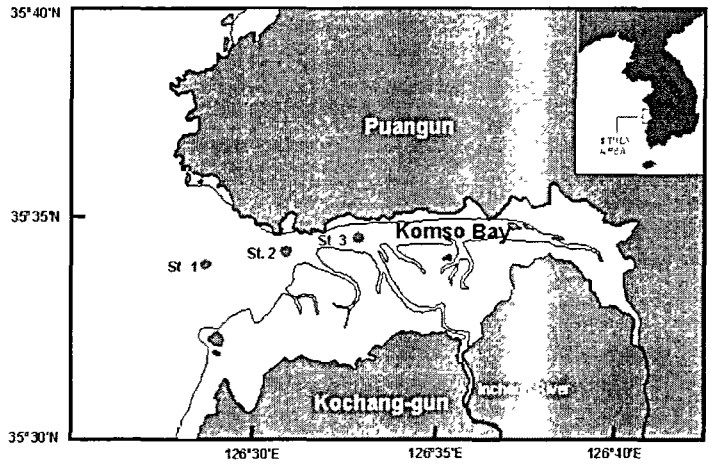


Fig. 1 Sampling site of the Gomso Bay

Assumptions

- Steady state of water balance
- Water consists of 3 sources
  - Terrestrial (rain + sewage)
  - Mixing by tidal flow
  - Residual flow from the bay
- Conservative character of salinity
- Tidal flow through the main channel

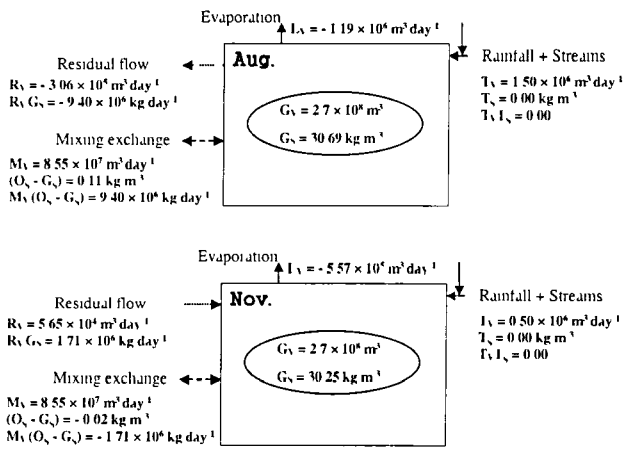


Fig 2a Box diagrams illustrating daily fluxes of **water** and **salt** in the Gomso Bay
The abbreviated pluses (+) represent influx into the bay, the minuses (−) represent efflux from the bay

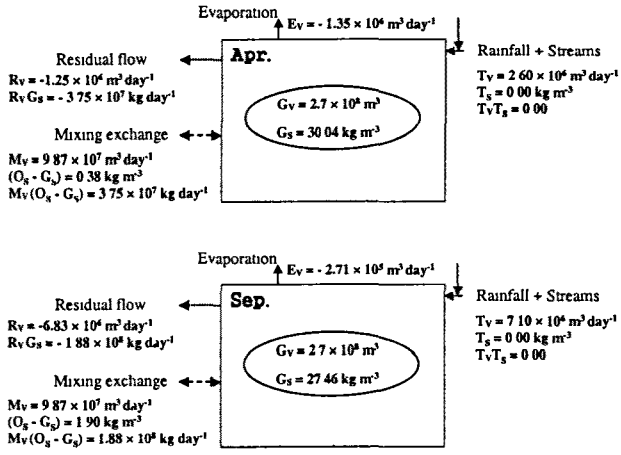


Fig 2b Box diagrams illustrating daily fluxes of **water** and **salt** in the Gomso Bay.
The abbreviated pluses (+) represent influx into the bay, the minuses (-) represent efflux from the bay.

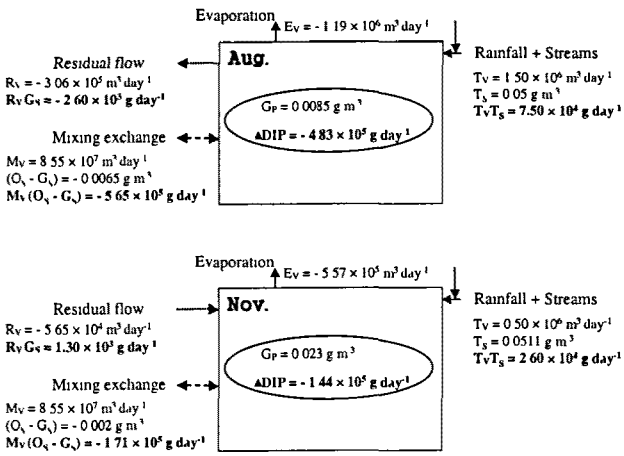


Fig 3a Box diagrams illustrating daily fluxes of water and **DIP** in the Gomso Bay
The plus deltas (+) represent influx into the bay, the minus deltas (-) represent efflux from the bay

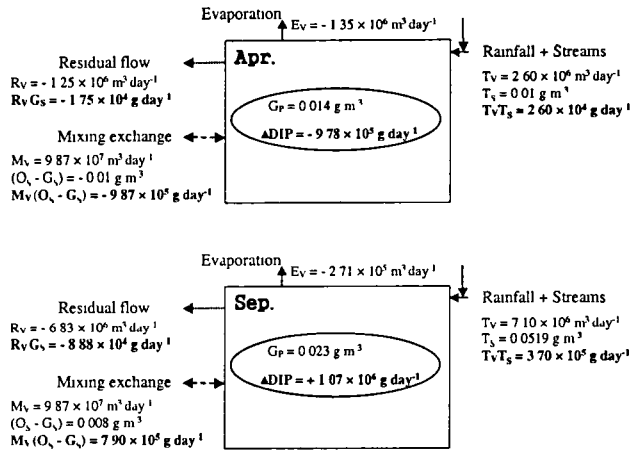


Fig 3b Box diagrams illustrating daily fluxes of water and DIP in the Gomso Bay
The plus deltas (+) represent influx into the bay, the minus deltas (-) represent efflux from the bay

Conclusions

- DIP

  Net efflux during spring, dry summer & winter
  ($-2.7 \times 10^5 \sim -1.4 \times 10^6$ g P m^{-2} day^{-1})

  Release rate of DIP from sediment : 2 ~ 16 mg P m^{-2} day^{-1}

  Net influx after heavy rainstorm (Sept. 1999)

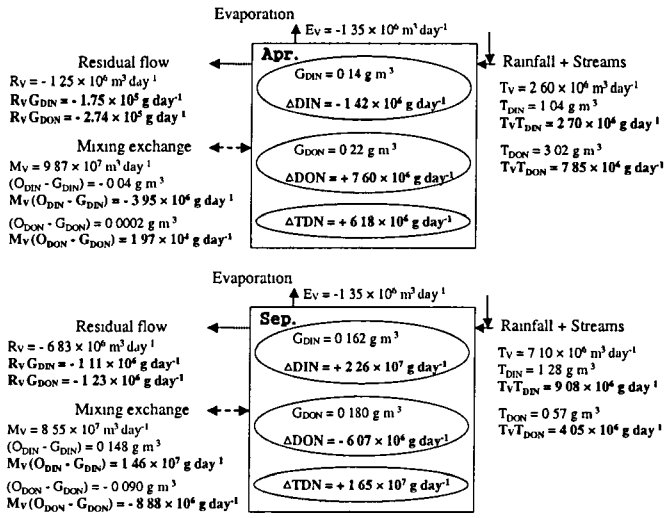


Fig 4a Box diagrams illustrating daily fluxes of water, DIN, and DON in the Gomso Bay
The plus deltas (+) represent influx into the bay, the minus deltas (−) represent efflux from the bay

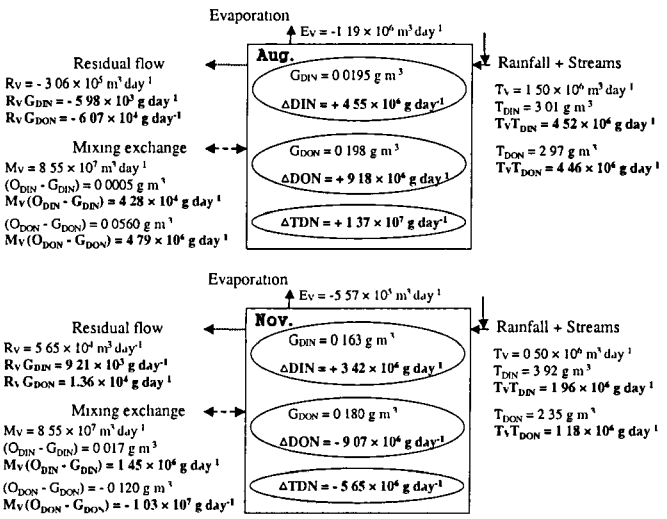


Fig 4b Box diagrams illustrating daily fluxes of water, DIN, and DON in the Gomso Bay
The plus deltas (+) represent influx into the bay, the minus deltas (−) represent efflux from the bay

Conclusions

- DIN & DON
  - Influx during dry summer
    due to high consumption by biota
  - Efflux during spring & wet summer
    due to excessive input from land
  - Efflux during winter
    due to low consumption by biota

Future Research

- Field measurements on :
  - net sedimentation rates
  - benthic primary productivity
  - benthic secondary productivity
- Mass balances on/during/after episodic events like heavy storms


Thank you