An Application of Water Conflict Resolution in the Kum River Basin, Korea

Dr. Richard N. Palmer
Jae Hyun Ryu, Research Assistant
Department of Civil and Environmental Engineering
The University of Washington, Seattle, WA 98195
Dr. Sangman Jeong
Department of Civil and Environmental Engineering
The Kongju National University, Kongju, Korea
Dr. Young-Oh Kim
Department of Civil and Environmental Engineering
The Seoul National University, Seoul, Korea

http://www.tag.washington.edu

Overview

- Project Description
- Water Resource Conflict
- Daechong and Yongdam Dam
- Review of Water Conflict Resolution Model
- Model Application
- Results of Model
- Future Work

Kum River Project

- Length of Project
- Funded by Korea Government (KICT)
- Participants
  - Dr. Richard N. Palmer (UW, Seattle)
  - Jae Hyun Ryu (UW, Seattle)
  - Dr. Sangman Jeong (KNU, Kongju, Korea)
  - Dr. Yong-Oh Kim (SNU, Seoul, Korea)


NORTH KOREA
Demarcation Line
0 50 100 km
0 50 100 mi
Kangnŭng
SEOUL
Ullŭng-do
Inch'ŏn
Wŏnju
Pukp'yŏng-dong
Suwŏn
Sea of Japan
Taejŏn
Yellow Sea
P'ohang
Kunsan
Taegu
Chŏnju
Ulsan
Kwangju
Masan
Chinhae
Pusan
Mokp'o
Yosu
Strait
Korea
Cheju-do
JAPAN

N
Yongdam
Dam
Daechong
Dam
CH'UNGCH'ONG
NAM-DO
-DO
CHOLLAB
-DO
SANGNAM
-DO
Pusan
Kwangju
CHOLLANAM
-DO
Cheju-do

Water Conflicts

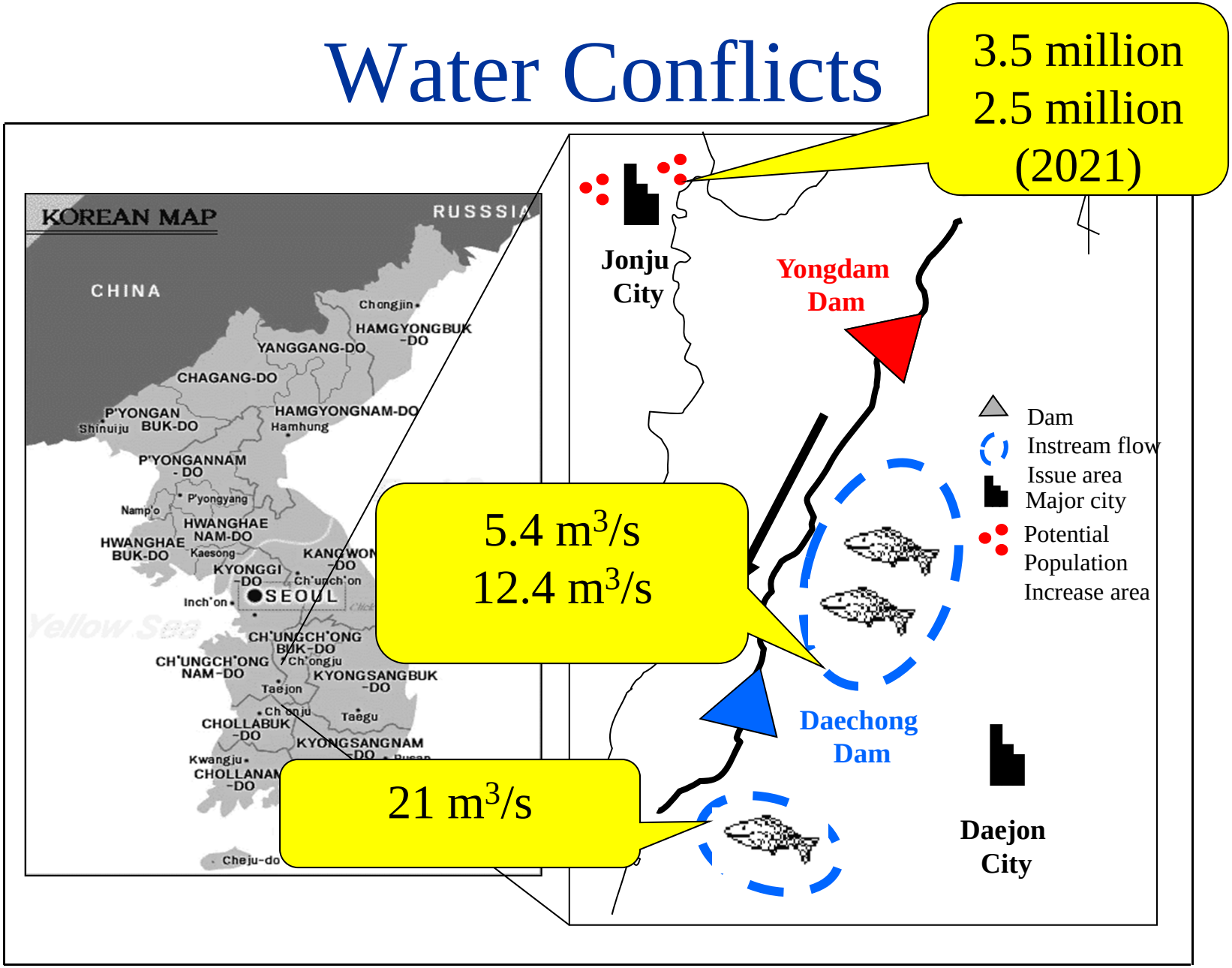


Figure 1. Map of Water System in Kum River Basin

Concerns contributing to the water conflicts

1. What was the safe yield of the Daechong Dam before Youngdam Dam was constructed?
2. What is the safe yield of both dams, if they are operated for a single, downstream user and there is no required environmental flow?
3. How much of this yield is lost if there are required environmental flows between the two dams?
4. How much yield is lost when there are required environmental flows downstream on Daechong Dam?

Background

- Kum River Basin
  - 9,800 km^2 (3,780 mi^2 : watershed area)
  - 400 km (250 mile : mainstem length)
- Daechong Dam
  - Constructed in 1971
  - Multi-objective dam
  - 1,500 million m^3 (53,000 mil. ft^3: reservoir size)
  - 3 million people
- Yongdam Dam
  - Constructed in 2001
  - Multi-objective dam (water supply)
  - 815 million m^3 (29,000 mil. ft^3 :reservoir size)
  - 1.5 million people

Water Conflicts

Table 1. Major Conflicts in Kum River Basin

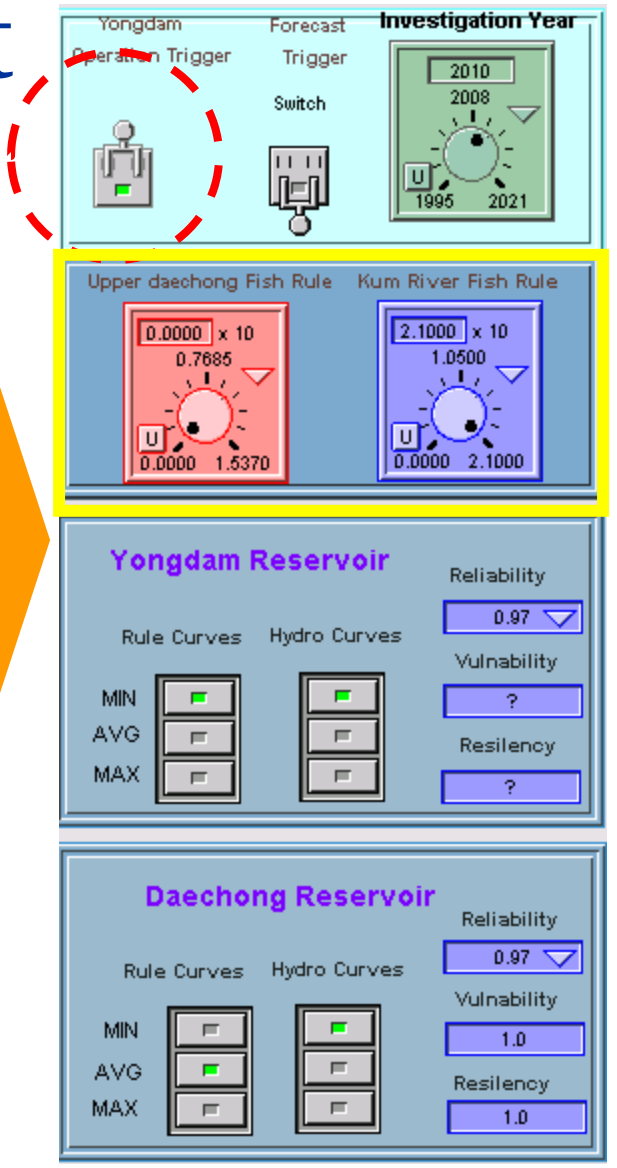
	Daechong Dam in downstream	Yongdam Dam in upstream
Instream flow of between dams	12.4 m^3/s	5.4 m^3/s
Yongdam dam operation	Disagree	Agree
Population forecast for Jonju city	2.5 million	3.5 million
Instream flow of downstream of Daechong Dam	21 m^3/s	Less than 21 m^3/s

Models used in Conflict Resolution

1. Provide insight into questions and concerns generating conflicts
2. Include information that present the interests and perspectives of all participants,
3. Obtain equitable benefits for all participants, and
4. Provide the opportunity for a high level of involvement by all stakeholders

STELLA® Modeling Environment

	Daechong Dam in downstream	Yongdam Dam in upstream
Fish flow of between dams	12.4 m^3/s	5.4 m^3/s
Yongdam dam operation	Disagree	Agree
Fish flow of downstream of Daechong Dam	21 m^3/s	Less than 21 m^3/s



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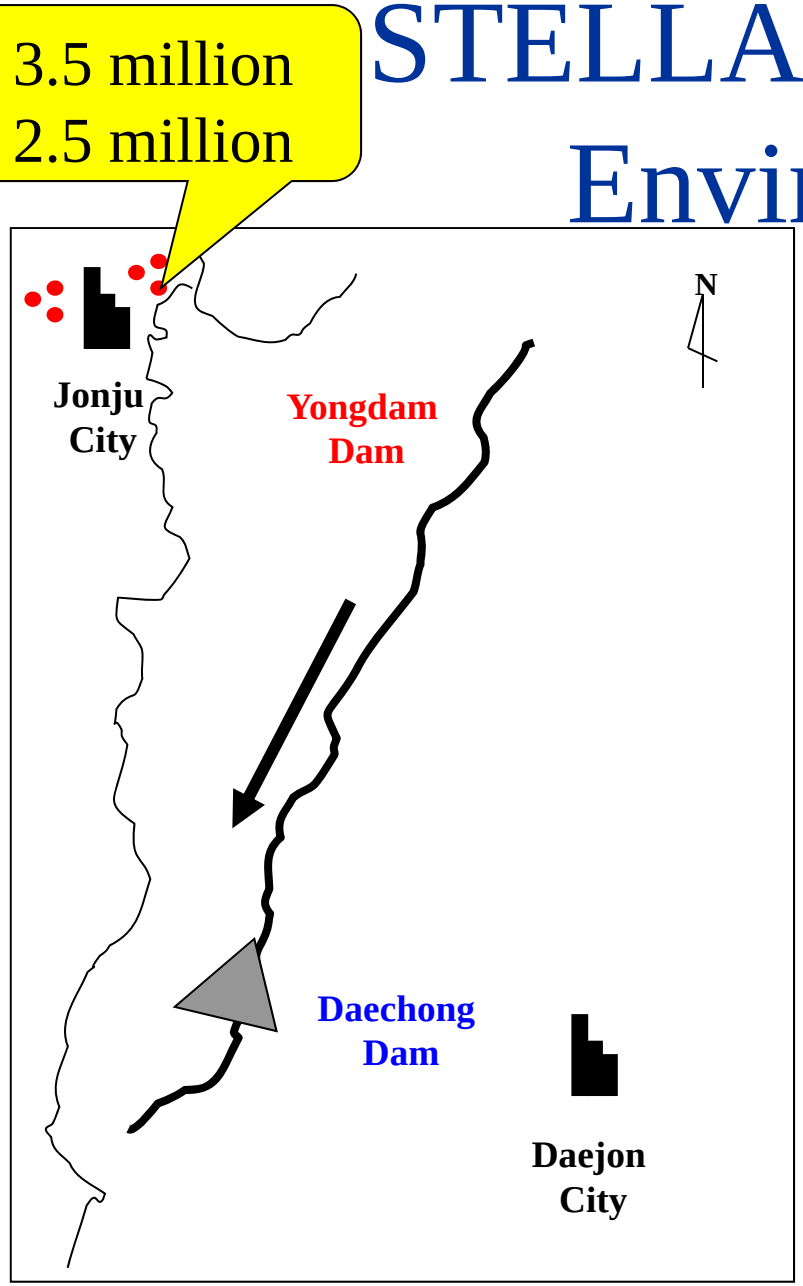
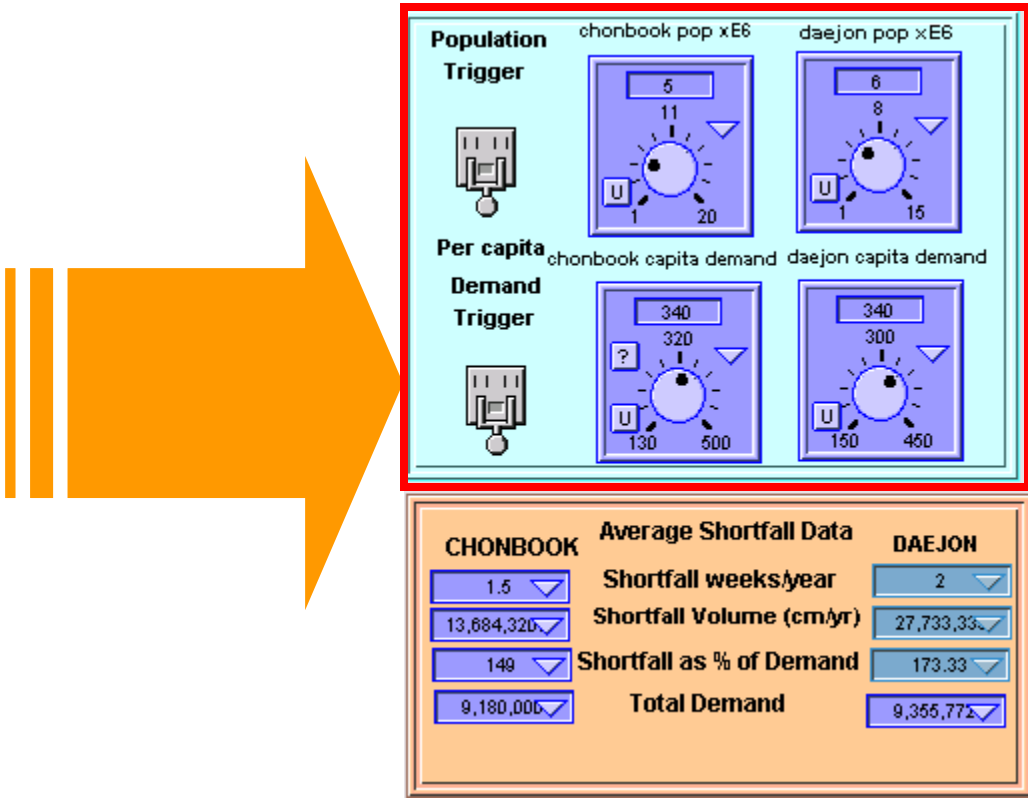




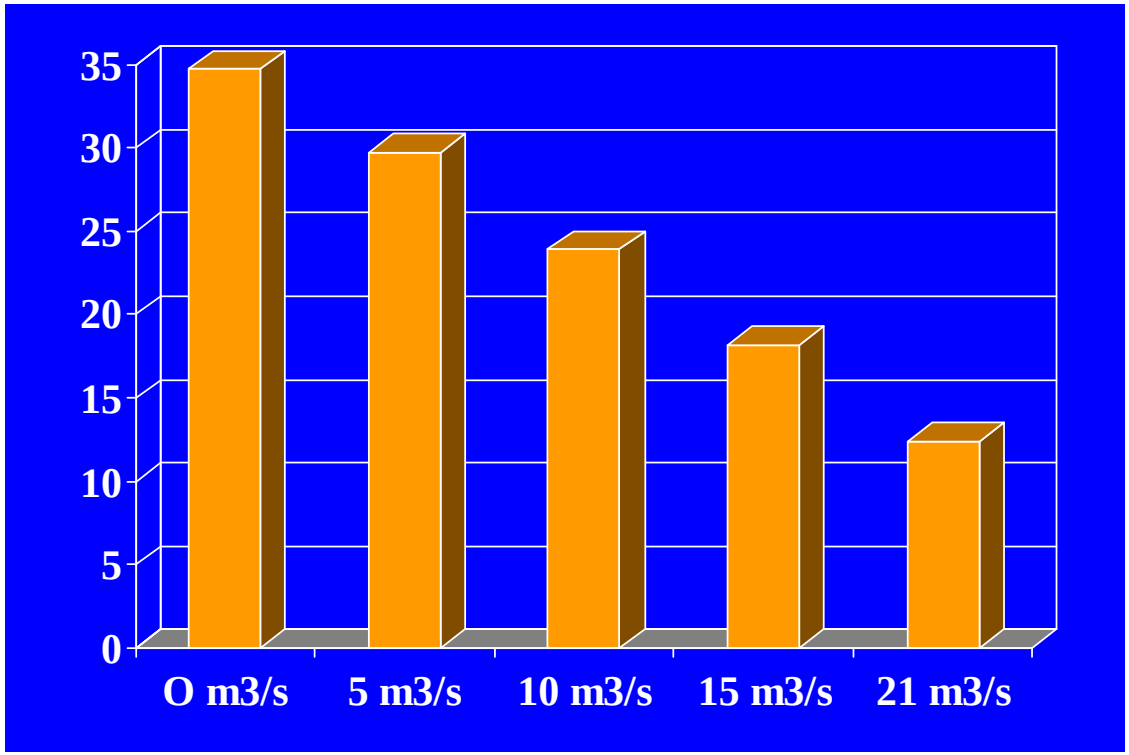
Concerns contributing to the water conflicts

1. What was the safe yield of the Daechong Dam without Youngdam Dam and how is the yield impacted by fish flows?

Analysis Output

Table 2. Safe yield of Daechong Dam with varying fish flows without Yongdam Dam

Fish below Daechong Dam	Safe Yield
0 m^3/s	34.7 m^3/s
5 m^3/s	29.7 m^3/s
10 m^3/s	23.9 m^3/s
15 m^3/s	18.2 m^3/s
21 m^3/s	12.4 m^3/s



Concerns contributing to the water conflicts

1. What was the safe yield of the Daechong Dam without Youngdam Dam and how is the yield impacted by fish flows?

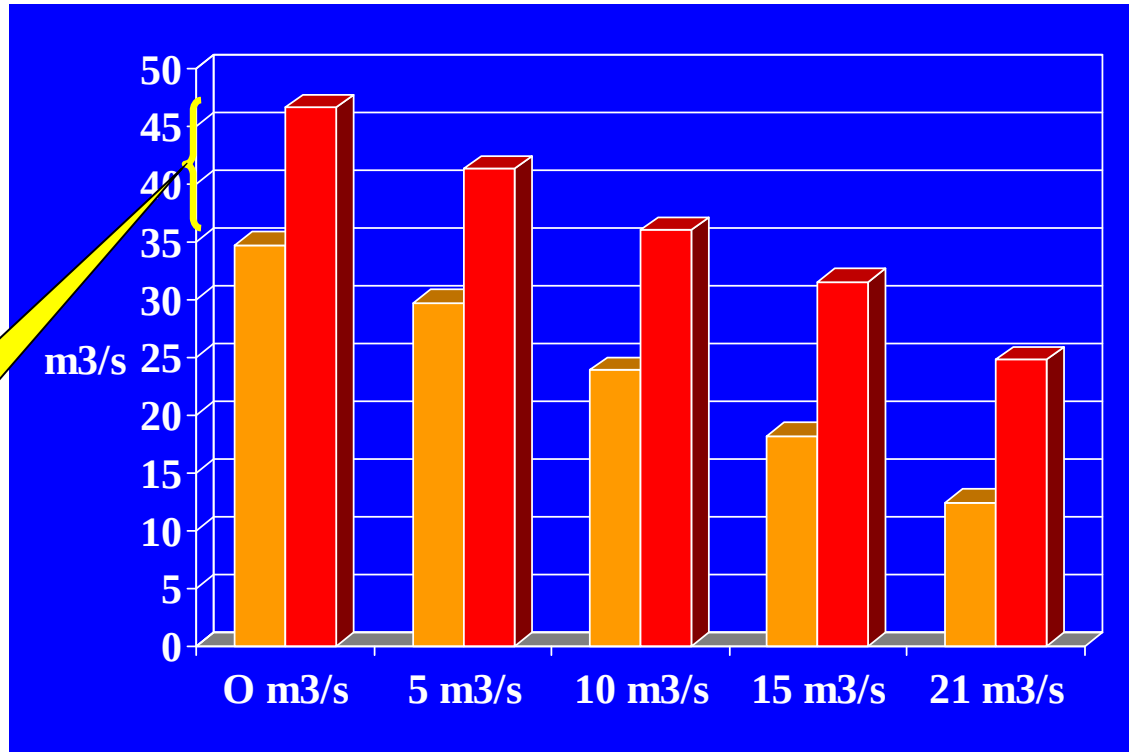
2. What is the safe yield of both dams, if they are operated for a single, downstream user and there is no required environmental flow?

Analysis Output

Table 3. Safe yield of Daechong Dam with varying fish flows with Yongdam Dam that support Daechong Dam

Fish below Daechong Dam	Safe Yield
0 m^3/s	46.6 m^3/s
5 m^3/s	41.3 m^3/s
10 m^3/s	36.0 m^3/s
15 m^3/s	31.5 m^3/s
21 m^3/s	24.8 m^3/s

12 m^3/s



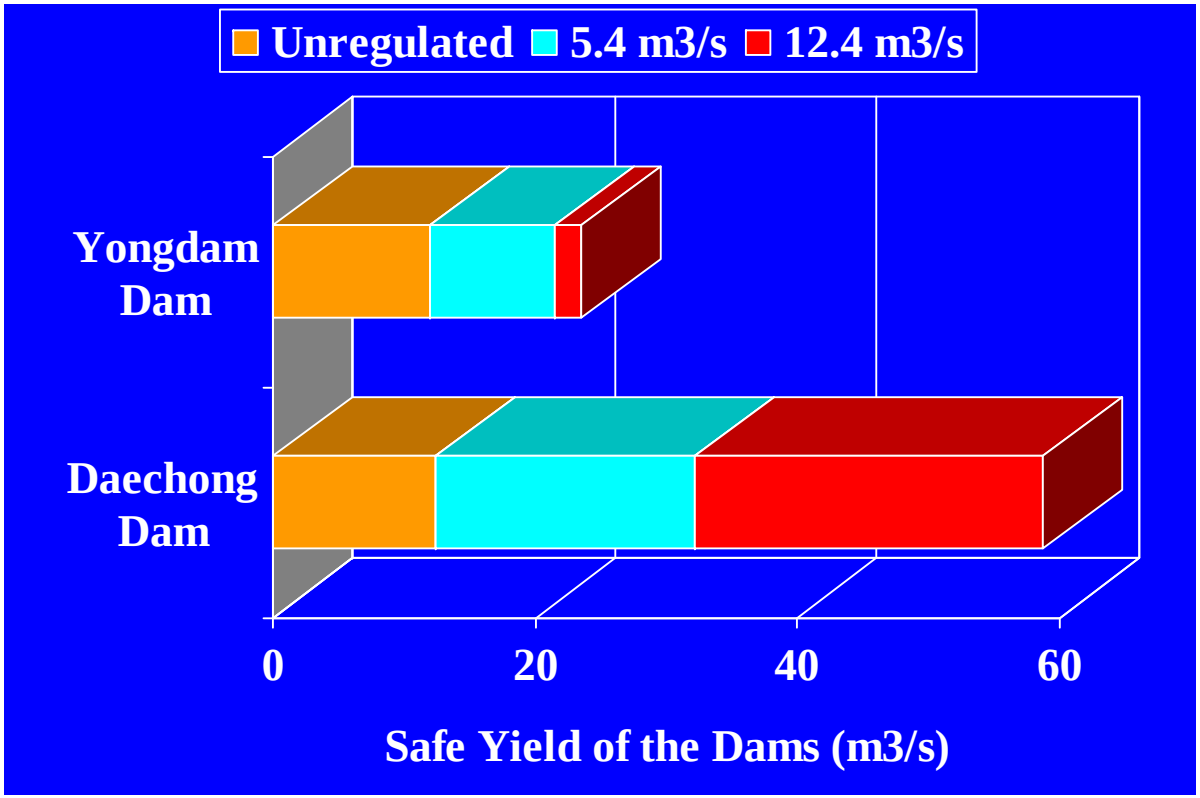
Concerns contributing to the water conflicts

1. What was the safe yield of the Daechong Dam without Youngdam Dam and how is the yield impacted by fish flows?
2. What is the safe yield of both dams, if they are operated for a single, downstream user and there is no required environmental flow?
3. How much of this yield is lost if there are required environmental flows between the two dams?
4. How much yield is lost when there are required environmental flows downstream on Daechong Dam with Youngdam Dam ?

Analysis Output

Table 4. Safe yield of Daechong Dam with fish targets between the Dams

Water demand year	Fish below Daechong Dam	Fish between Dams	Safe Yield of Daechong Dam	Safe Yield of Yongdam Dam
2010	21 m^3/s	5.4 m^3/s	19.8 m^3/s	9.5 m^3/s
2010	21 m^3/s	12.4 m^3/s	26.5 m^3/s	2.0 m^3/s



Results

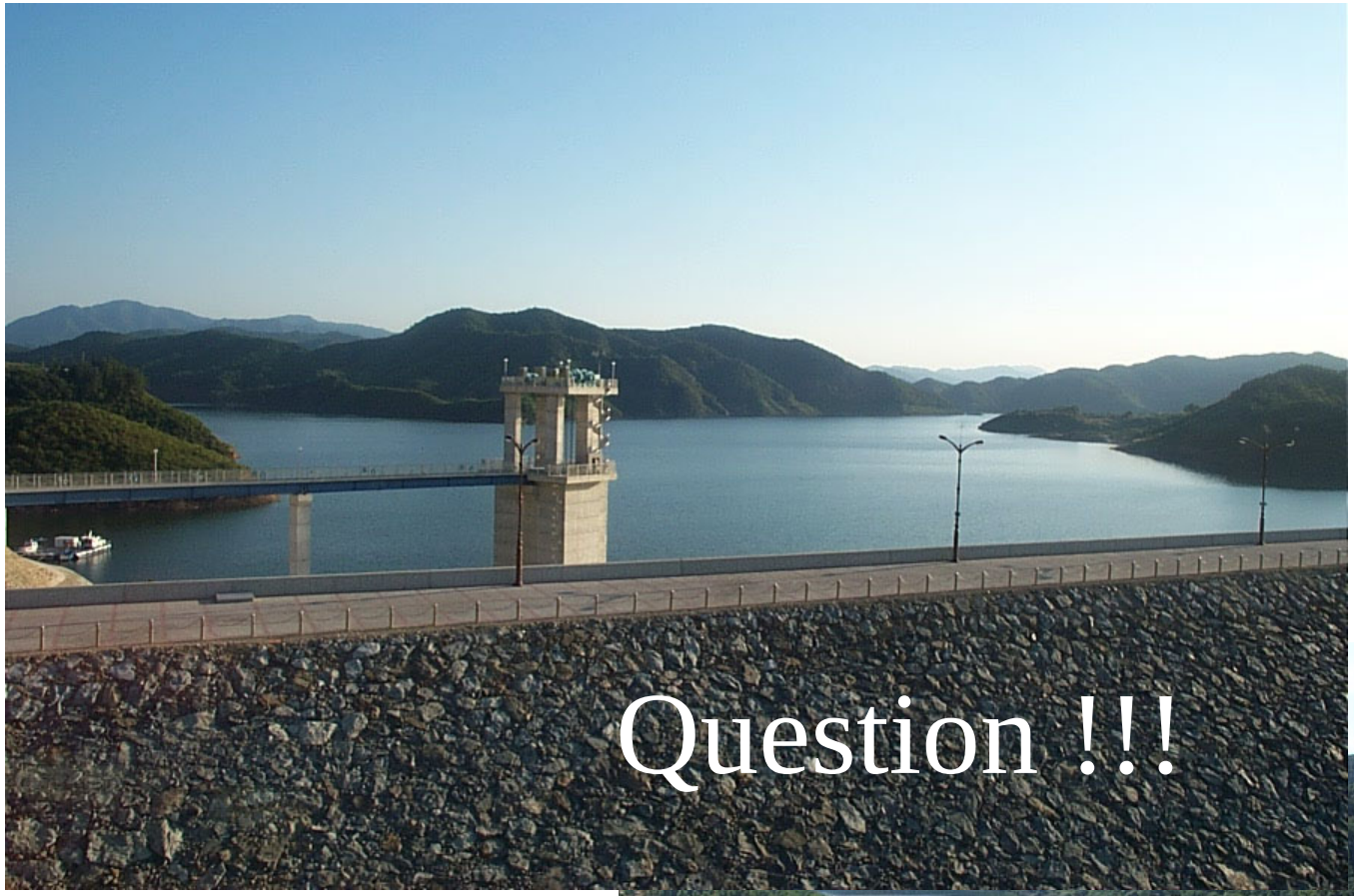
1. Youngdam Dam can provide benefits to both upstream and downstream users
2. Youngdam Dam could also provide additional water during drought period to downstream user
3. There are also clear conflicts between the fish flow between the two dams and the ability to supply water from Youngdam Dam
4. There are clear conflicts between the fish flow below Daechong Dam and municipal, industrial, agricultural water supply from that Dam

Future Work

- Development of the Drought Management Plan
- Development of evaluation criteria (reliability, resiliency, and vulnerability) for system operation
- Advanced analysis of instream flow
- Suggest the trade-offs between fish and people based on cost-benefit analysis

Future Work -cont'd

- Stream flow forecast with ESP technique (BASIN)
- Optimize dam operation using genetic algorithms based on Matlab environment
- Optimize dam operation with stochastic streamflow input and stochastic uncertain demand



Question !!!