Jun 23rd, 2:15 PM - 2:30 PM

Session D5: Current Status of Fish Passages in South Korea

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Current status of fish passages in South Korea

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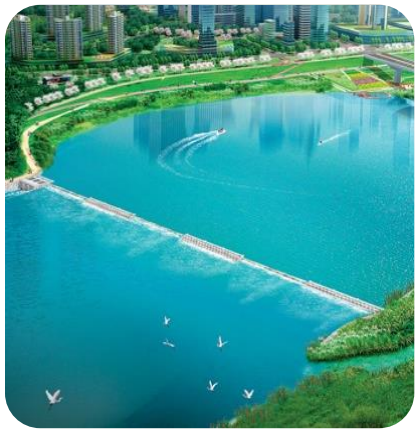
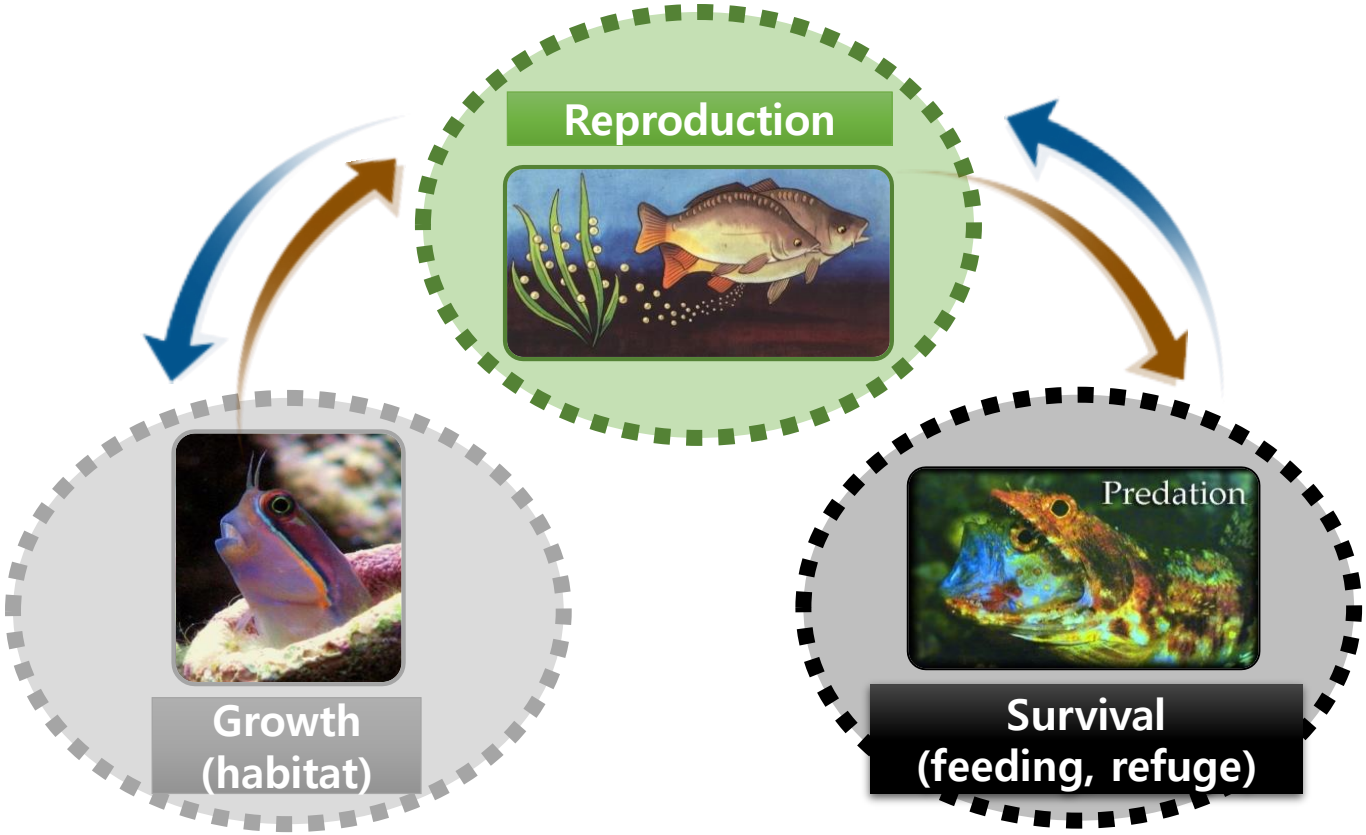



Introduction

Why do fish migrate?

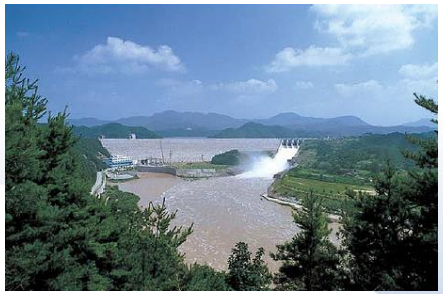
- Fish migrate to find better environments for their **growth, survival and reproduction** (Northcote,1998).



Introduction

In-stream structures (physical alteration)

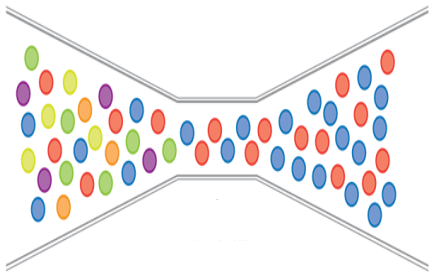
Construction of waterway cross (dam or weir)

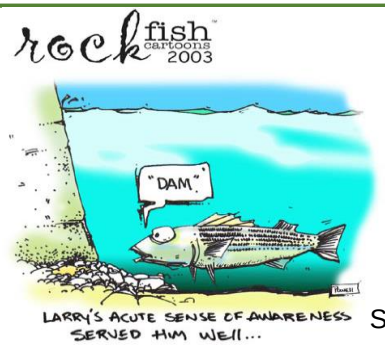


Habitat alteration

and stream fragmentation

- **Hamper fish migration, reducing ecological connectivity, genetic blockage and etc.**





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Introduction

Fish passage (fishway, fish ladder)

Definition

“A series of pools built like steps to enable fish to ascend a dam or waterfall” -Oxford dictionary-

However,

Most target species: Salmonidae

commercially & recreationally important

(Laine et al. 2002)

From the late 20th

Non-salmonid species

(Mallen-Cooper and Stuart 2007)

Introduction

Weirs (low-head dams) in S. Korea

Traditionally: agricultural purpose + Currently: flood control, leisure and so on

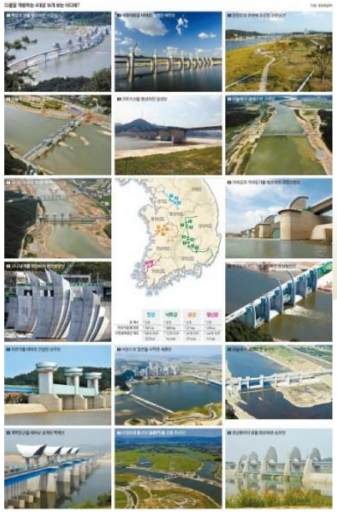
- **The number of weirs**

  → 33,718 weirs (until 2012)

- **Total length of Korean streams**

  → 27,484.66 km (Kwater, 2011)

- **1.22 weir / km (arithmetically)**



The number of weirs is still increasing

Introduction

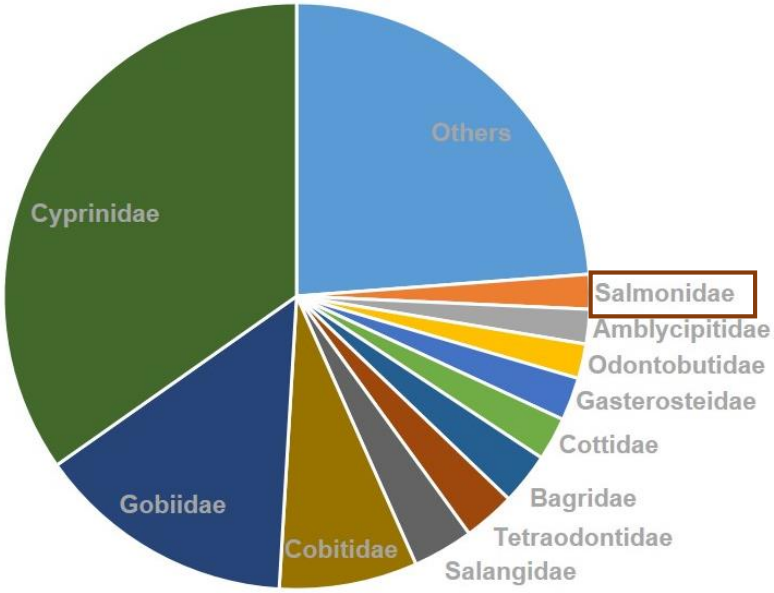
Fish fauna in S. Korea

Carassius auratus

- **216 species, 39 families, 17 orders**
- **Dominant family**

  : Cyprinidae (73 species) & Gobiidae (30 species)
- **Salmonidae**

  : only 4 species (one exotic species)



Onchorhynchus mykiss

Introduction

Fish passages in S. Korea

- Due to fish fauna of S. Korea

  → Non-salmonid species are target fishes

  → Thus, Korean government focuses on biodiversity of aquatic ecosystem

Legislation of Inland Fishery (2010)

- Newly constructed dams and weirs should have proper fish passages

Until 2009

No standard form

No regulation

No responsibility to build

After 2010

Changed

Objectives

Investigation of fish passage in S. Korea

- **Connectivity**
- **Fish passage type**
- **Location**
- **Utility**
- **Morphological characteristics**

Identify current status of fish passages

- **Slope**
- **Entrance, exit**
- **Internal problem**
- **Sedimentation**

- **Development of fish passages specialized on Korean fish**
- **Make a management strategy and plan for fish passage**

Methods

Fish passages distribution and current status

Study sites

- **Entire streams in S. Korea**

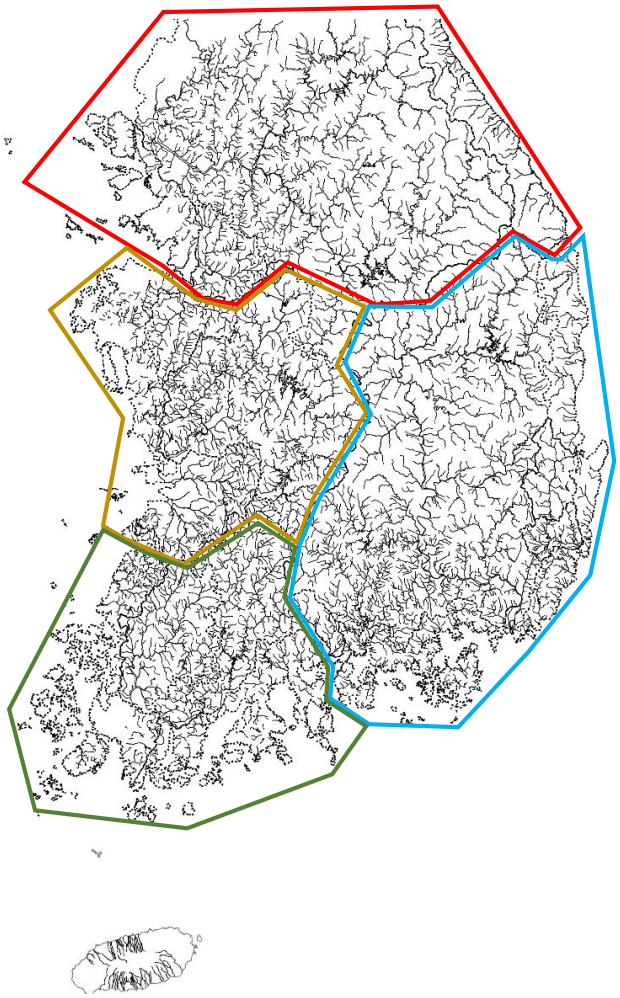
  : Han River (919 streams),

  Nakdong River (1186 streams),

  Geum River (899 streams),

  Yeongsan-Seomjin (802 streams)

  Jeju Island (60 streams)



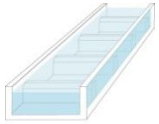
Study periods

- **2010-2011**

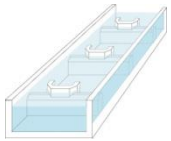
Methods

Measurement of fish passage

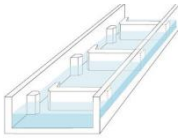
Types of fish passage



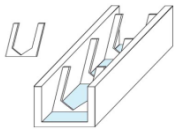
Pool and weir



Ice-Harbor



Vertical-slot



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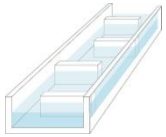
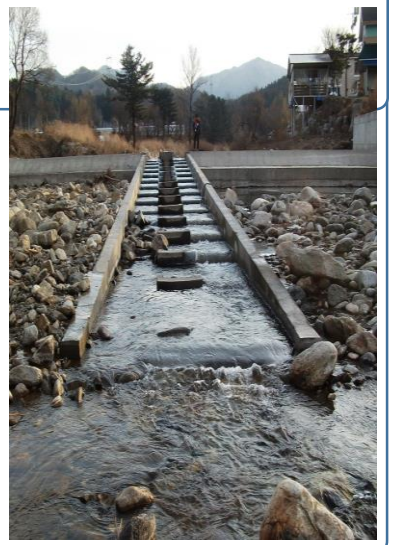


Wall type

Nature-like

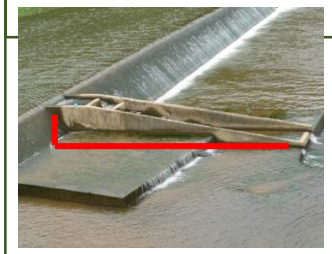
Status of fish passage

1. Longitudinal connectivity & location
   - Excellent, Good, Poor, Impassible



2. Entrance, internal, exit gap
   - <10cm, 10-20cm, 20-30cm, >30cm

3. Slope
   - >1:20, 1:10-20, <1:10, multi



4. management
   - Good, Sedimentation, Broken, Erosion,

Results

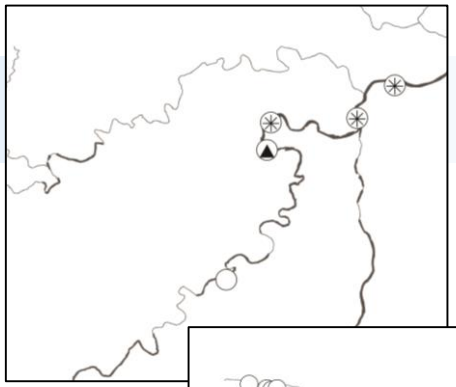
Installation (%) of fish passages

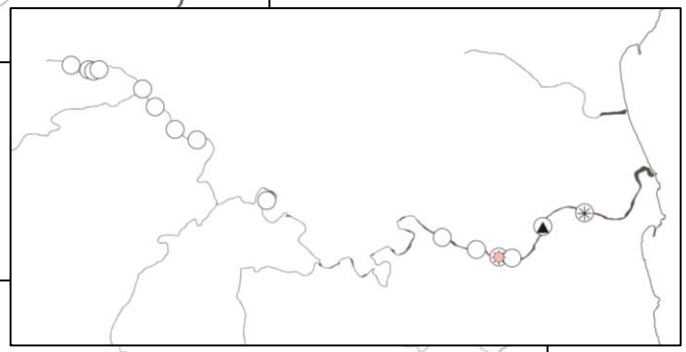
	Total length of streams (km)	Number of weirs	Number of fish passages	Installation (%)
Han River	8,566.95	7,035	1,309	18.60
Nakdong River	9,547.46	12,140	1,606	13.23
Geum River	4,504.8	7,148	808	11.30
Seomjin River	2,610.18	5,040	886	17.58
Yeongsan River	2,255.27	2,355	493	20.93
Total	27,484.66	33,718	4,496	13.33

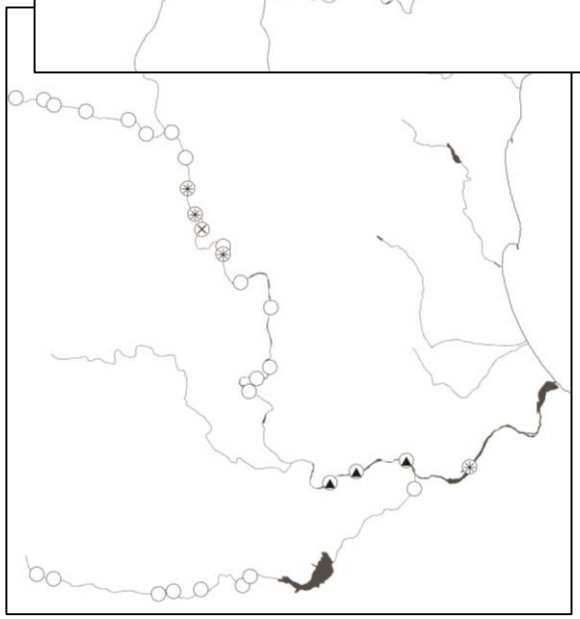
Results

Example of connectivity

Eastern part of S. Korea





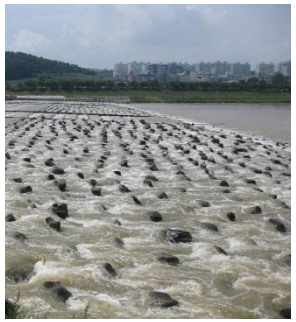


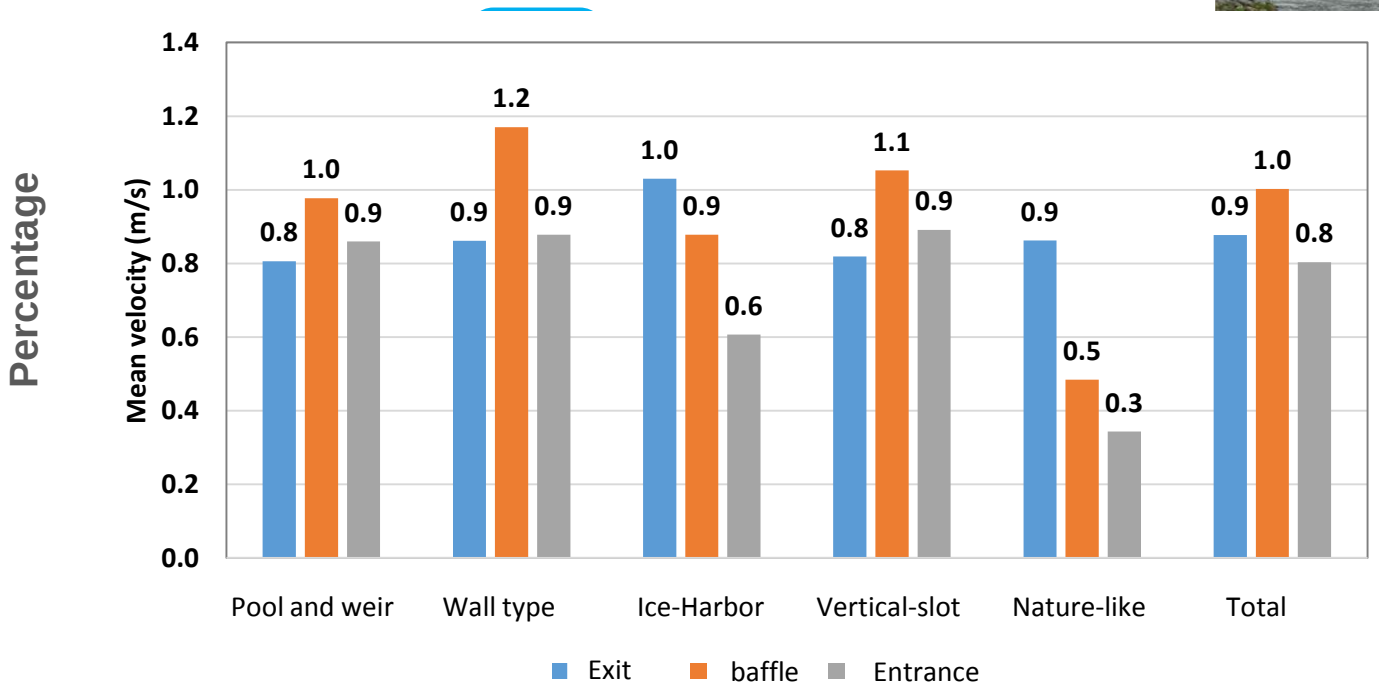
● Excellent ▲ Good

* Poor X Impassible

Results

Types of Fish passages in S. Korea





- Recently, Ice-Harbor type fish passages are predominantly constructed
- However, this fish passage also for Salmonidae

Results

Characteristics of fish passages in S. Korea

Principle component analysis

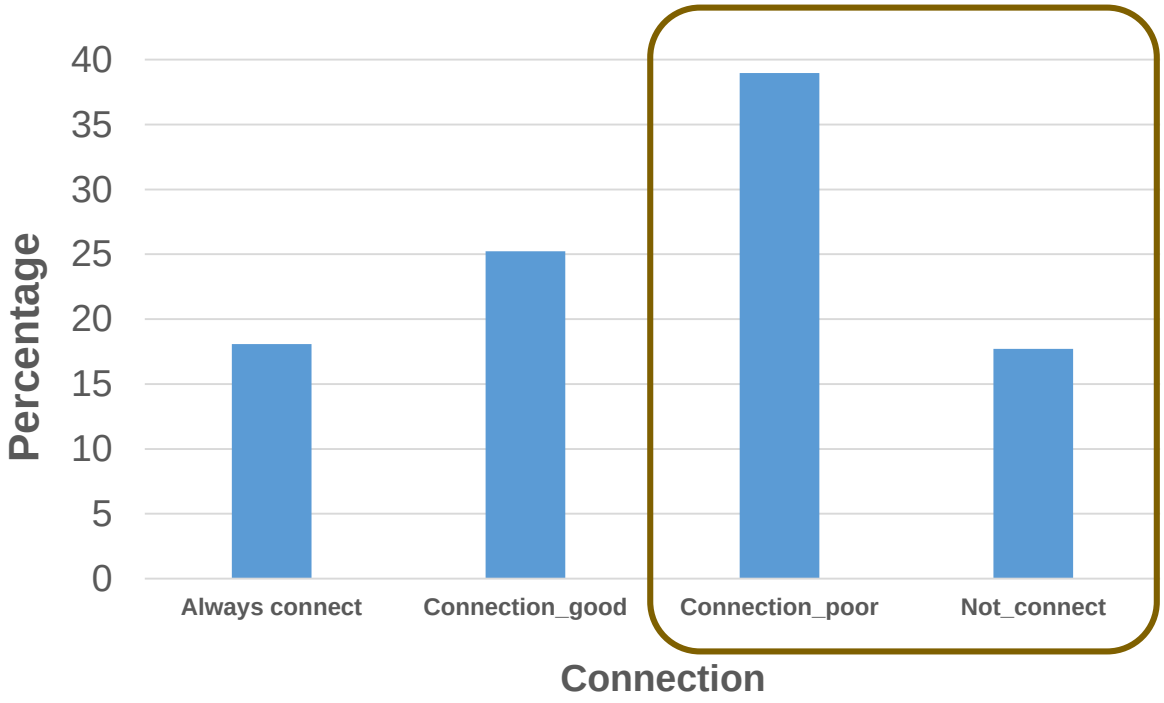
	Component		
	1	2	3
Conn	.703	-.089	-.622
Conn_loc	.675	-.099	-.645
En_G	.457	.480	.099
Ex_G	.561	.562	.159
In_G	.485	.560	.314
Slope	.095	.213	-.007
En_sta	.606	-.413	.306
Ex_sta	.533	-.417	.329
status	.551	-.407	.412

- Connectivity of fish passage is first factor
- Structural status are second factor

(Analysis performed by SPSS 20.0)

Results

Connection of fish passage

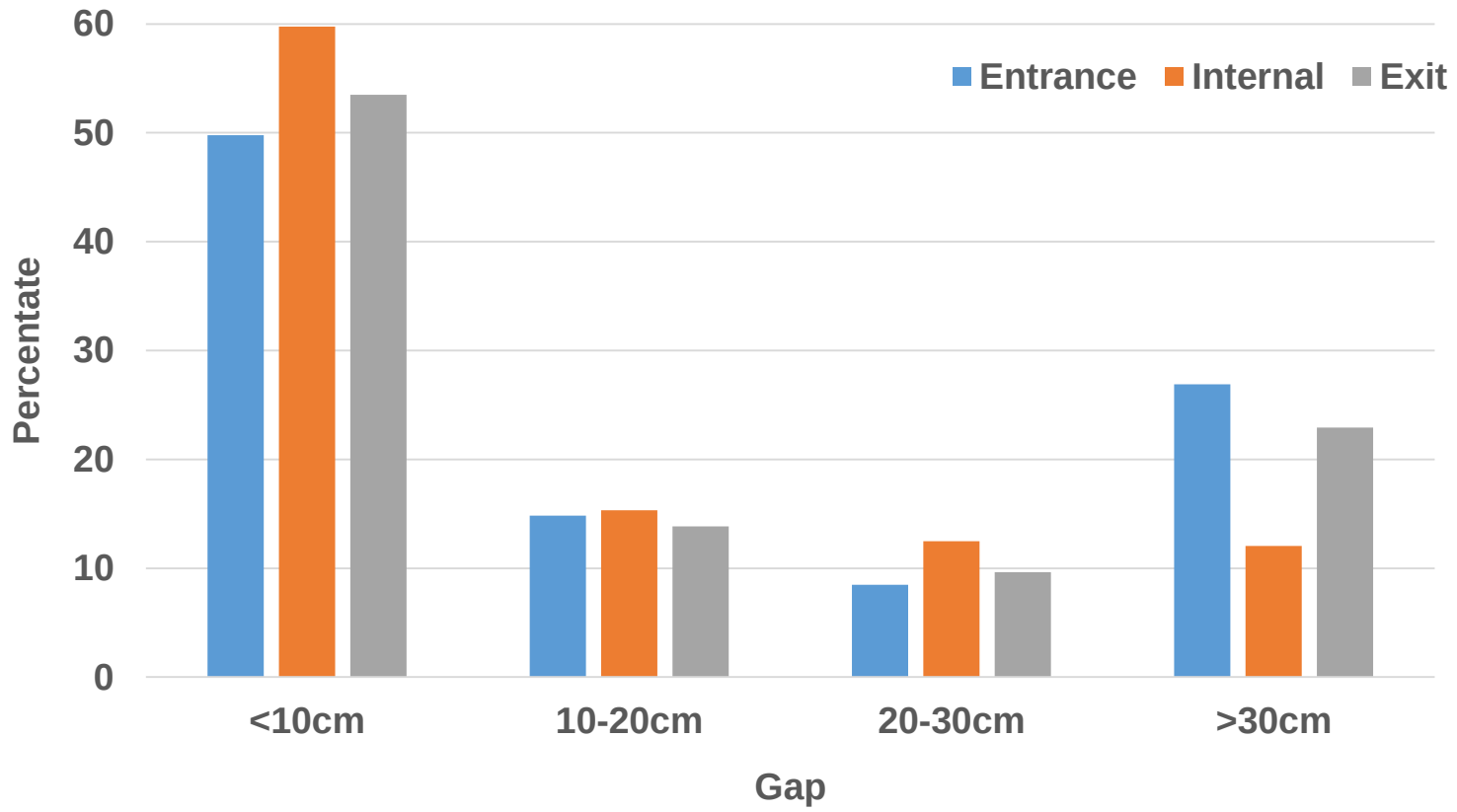


Wrong place

- **56.7% of fish passage' connectivity is poor condition**
- **Urgent repair is required**

Results

Structural status

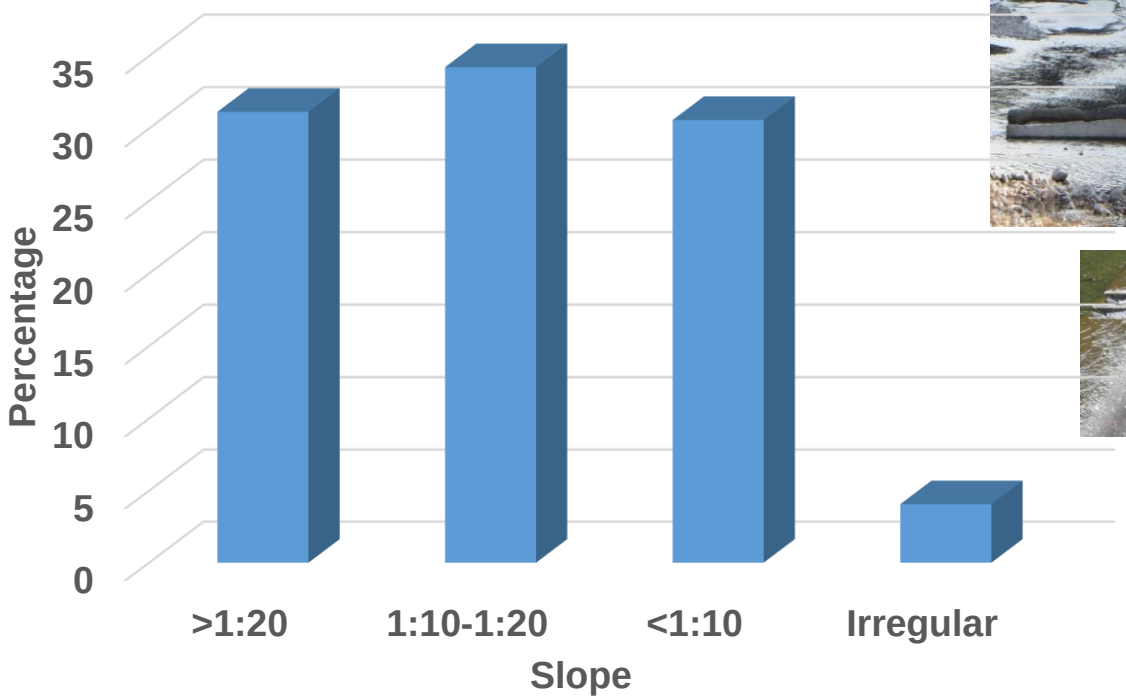


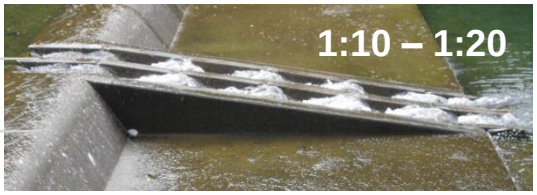
- **Swimming ability of small Cyprinidae is relative poor**

➔ **if gap is big, fish feel hard to negotiate with fish passage**

Results

Slope

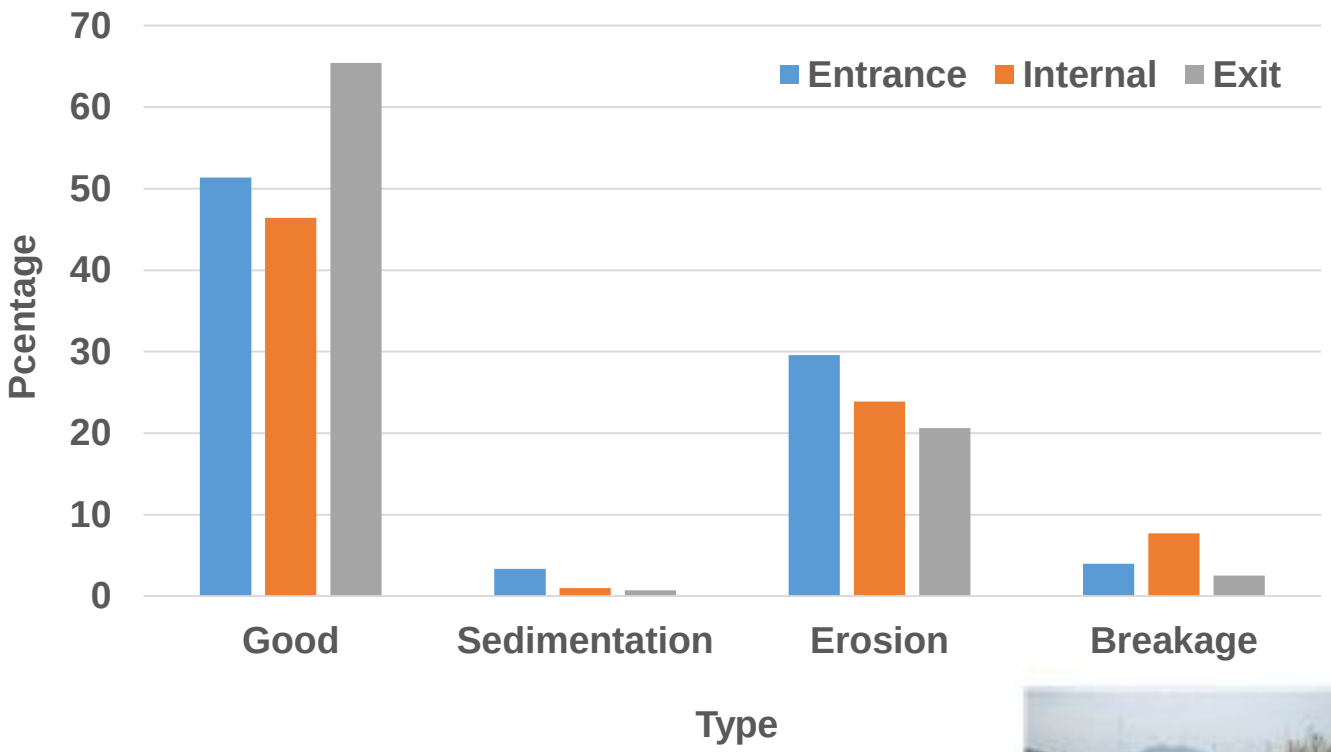




- **Recommended slope is more than 1:20**

Results

Management aspects



Summary

- Fish passages were installed only in 4,496 weirs (13.3% of installation rate)
- Pool and weir type fish passage showed the greatest number (36%)

  → 8.1% of them are Ice-Harbor type (recently favored)
- 18.1% of installed fish passages were good condition, and urgent repair is needed for 56.7%
- Fish passages of 31.3% were the recommended slope range of Korea (1:20).
- Most of problems are related water flow, poor entrance, breakage and sedimentation
- Discontinuous installation of fish passages generates poor continuity of streams

Conclusion

Study data : estimation results of weirs and fish passages

Development of weir and fish passage management system : decision making

Development of fish passage for Korean species

1. Ecology and biology of target species
   : swim speed, behavior
2. Site analysis
   : Hydraulics, geology, topology
3. Structure and design of fish passage
   : attraction, passing rate, slope

- **Repair or maintenance**
- **Dam removal**
- **Build new fish passage**

Thank you

For your attention