Creating Fish Habitat for the First Time

vol.2

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The University of Shiga Prefecture, School of Environmental Sciences,
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Japan RiverFront Research Center

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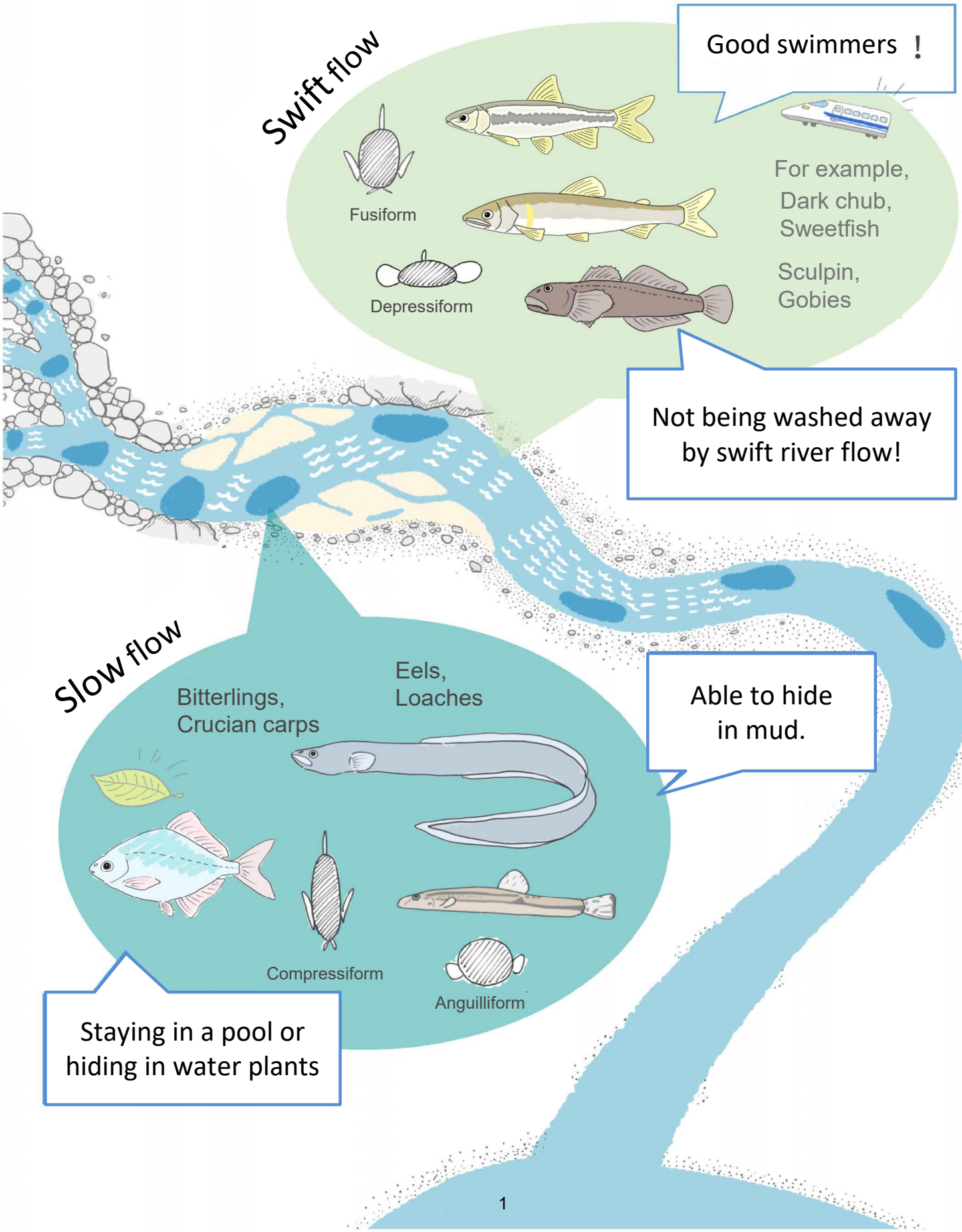
River flow and fish



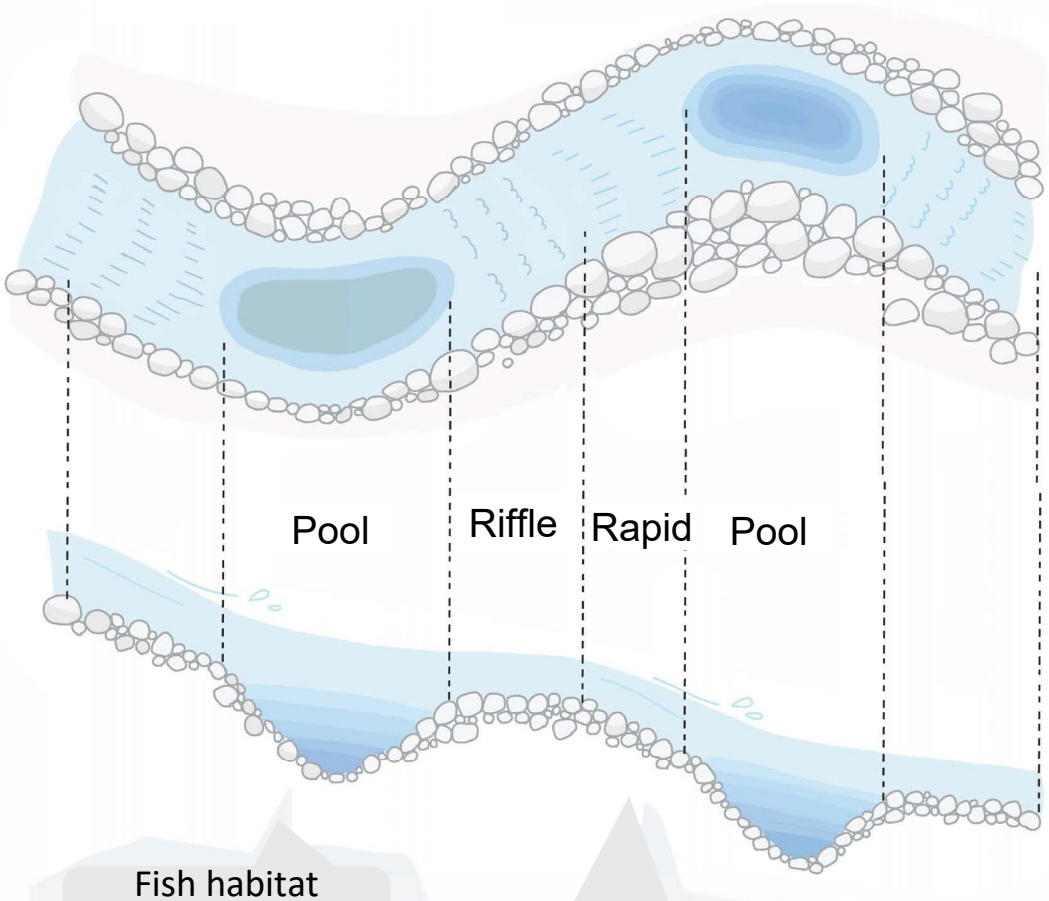
1 Best Places for Fish to Live

Riffles / Pools

Meandering river channels have:

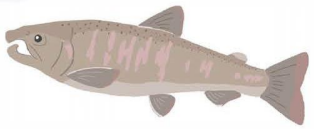
Swift and shallow sections called **Riffles**

Slow and deep sections called **Pools**



Fish habitat during flooding or drought

Sand gravels with grain size suitable for a spawning bed of Sweetfish and Biwa Salmon



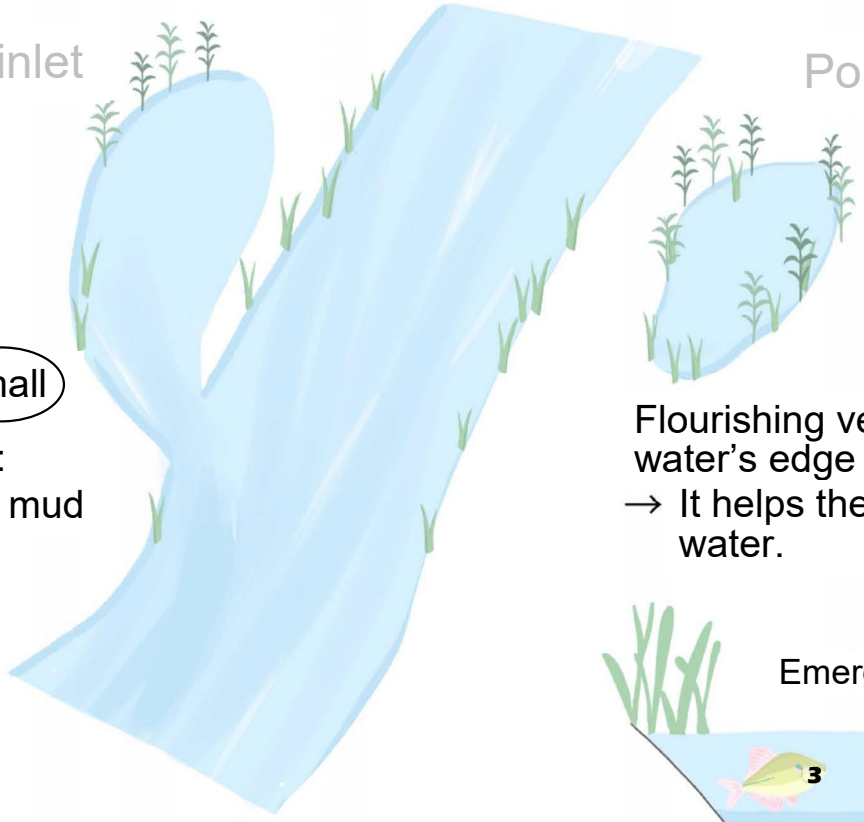
River flow variation matters for fish and other creatures.

1 Best Places for Fish to Live

Small inlets and Ponds

Still section connected to the mainstream is called **Small inlets**

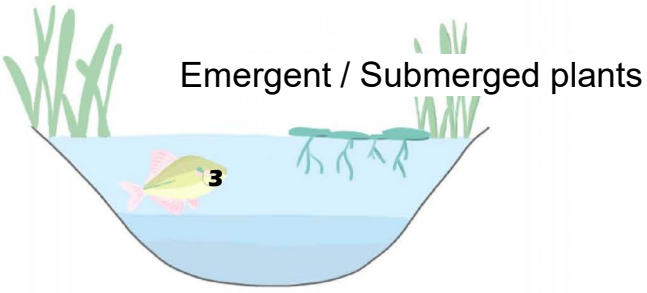
Still sections closed to the mainstream with little water replacement is called **Ponds**



Velocity: (small)

Sediment:
Sand and mud

Flourishing vegetation at the water's edge
→ It helps the pond maintain the water.



Features

- Provide temporary evacuation spots for swimming fish when the velocity increases during floods.

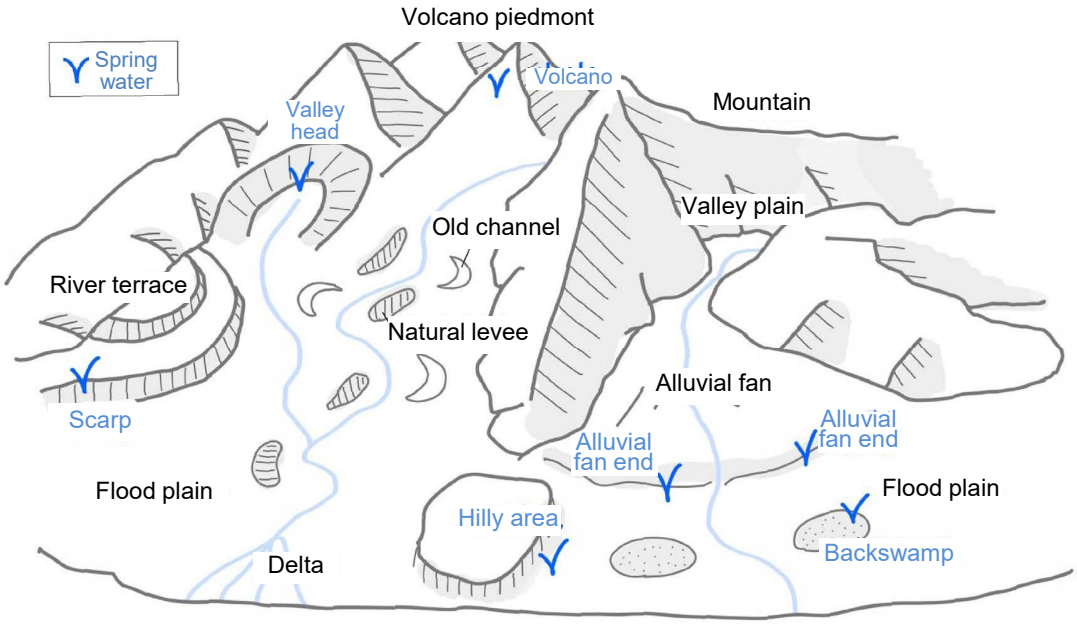
  ↔ Provide temporary shelters for swimming fish as water remains when the river dries up or during droughts. !
- Provide the living, growing, and reproduction environment of various native species.

1 Best Places for Fish to Live

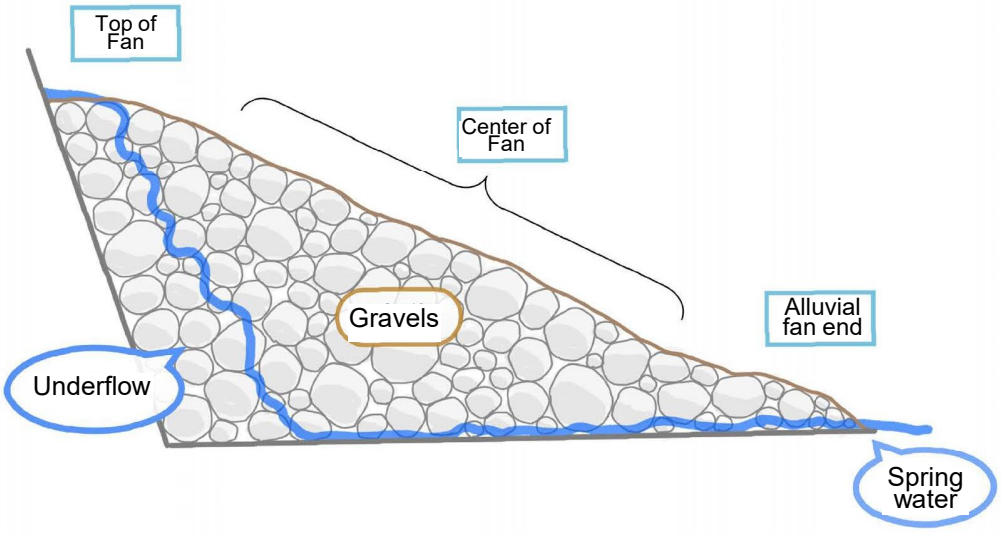
Spring water

Spring water is groundwater emerged from underground source onto the surface.

Places where spring water likely to occur



Spring water in Alluvial fan



Features of Spring water

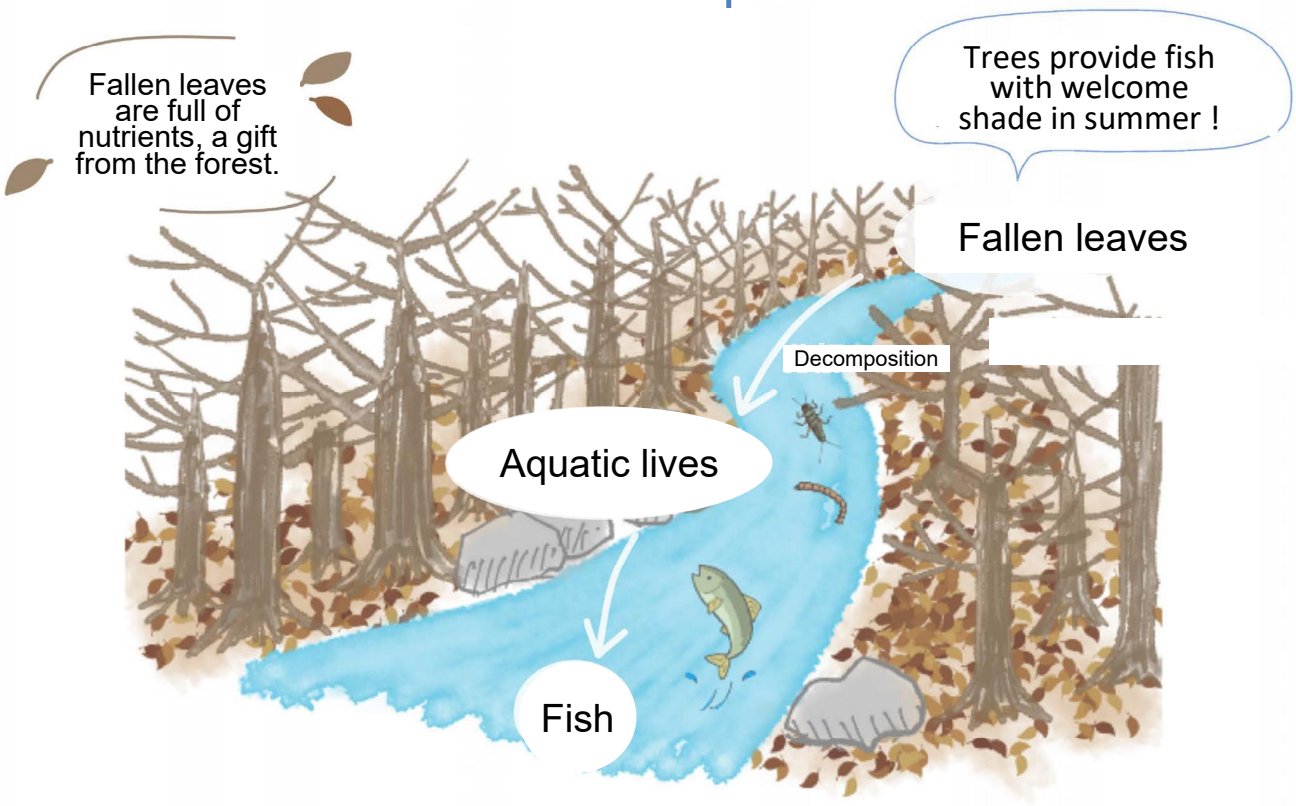
- Stable water temperature throughout the year.
- Good water quality

Cooler in summer
&
Warmer in winter
than the mainstream temperature

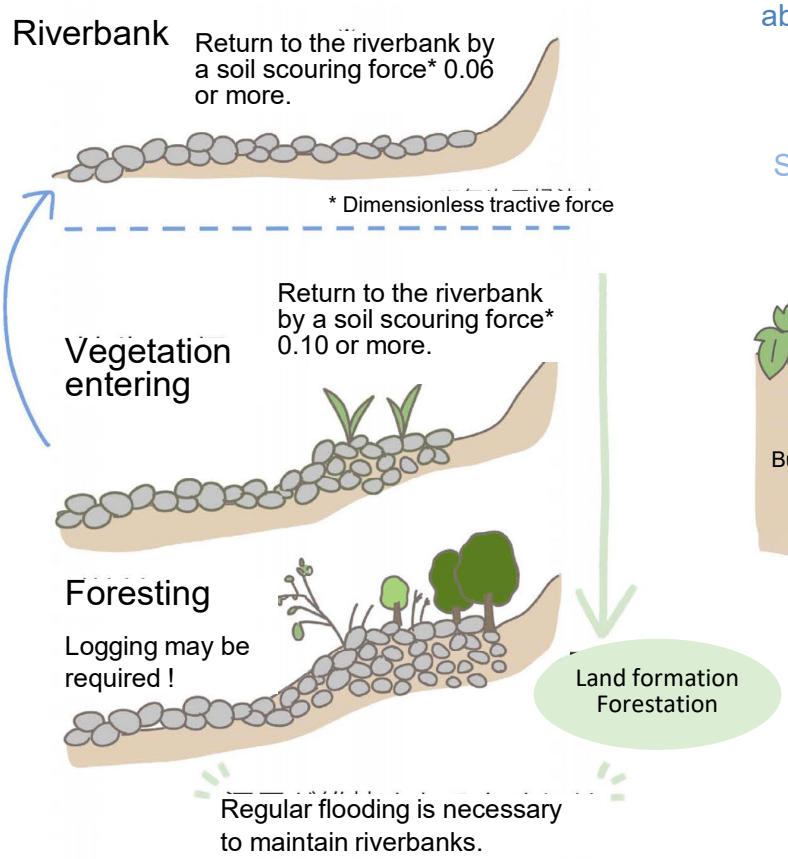
Constancy

1 Best Places for Fish to Live

Waterside plants

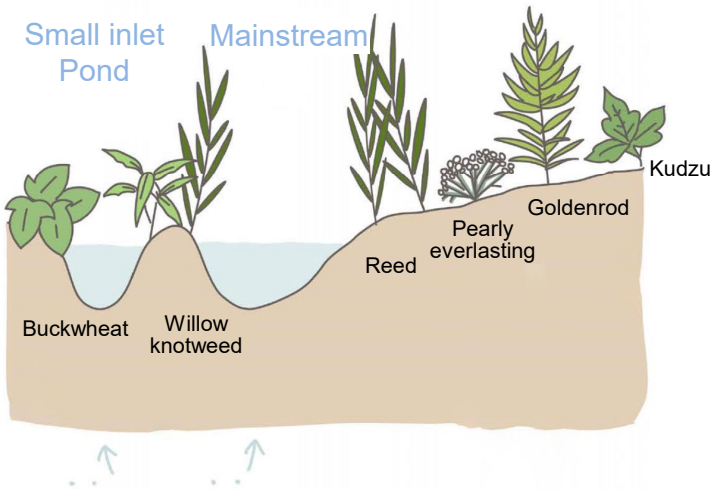


How a sandbank can be maintained ?



Regular flooding is necessary to maintain riverbanks.

Plant species can be identified by their height above the water surface.



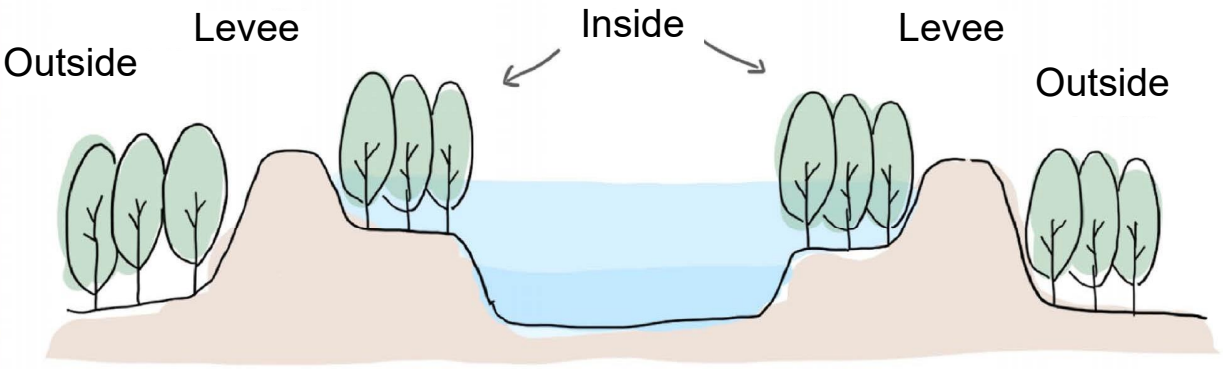
Different types of plants depending on whether the water runs fast or slow.

Special forests

Defensive forests

Forests

function to protect the hinterland during flooding and to mitigate flood damage.



Effects

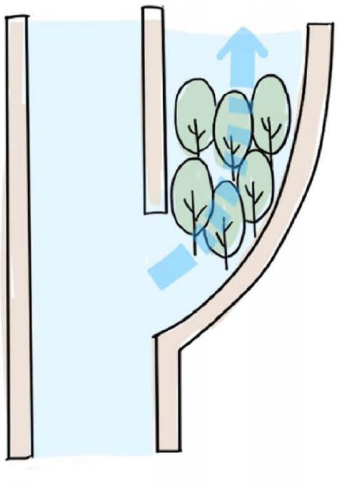
1. Reduce the force of water.
2. Protect the levee.
3. Catch sand/soil and garbage.

Fix by revetment

Velocity increases.

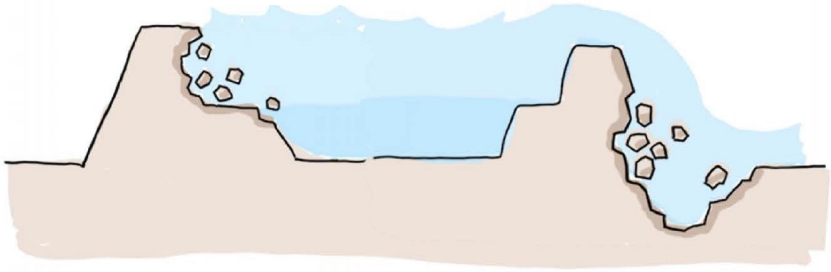
A cavity inside may be hazardous if unaware !

Opening of an open levee



Eroded by water force

Spillway



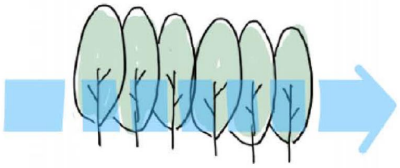
Scoured by water force

The levees are prone to breakage !

Special forests

Defensive forests

A defensive forest is **Semipermeable levee** that allows water to pass through gently.



- Maintenance is a difficult problem.
- Too many trees may cause overflows.

→ Keep what needs to be kept.

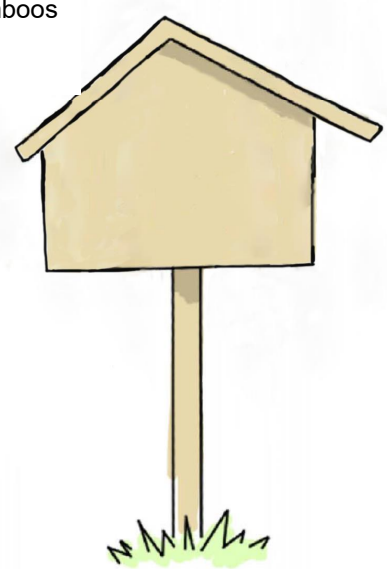
Determine if:

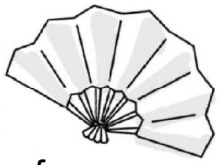
trees do their part in maintenance management;
and
have plenty of discharge capacity.

Relation to Local Industry

There is a standing signboard near a defensive forest along the Ado River in Takashima City, describing “Gensai thickets” in Ota Village as excerpted below:

Since the Ado River was defenseless against flooding in the middle of the Edo Era, Ota Village mourning the damage planted bamboos on the embarkments to withstand floods as recommended by Dr. Gensai and successfully grew a fine bamboo forest. The bamboo forest later provided blessings to the people there for a long time (e.g., fan bones for the local industry.



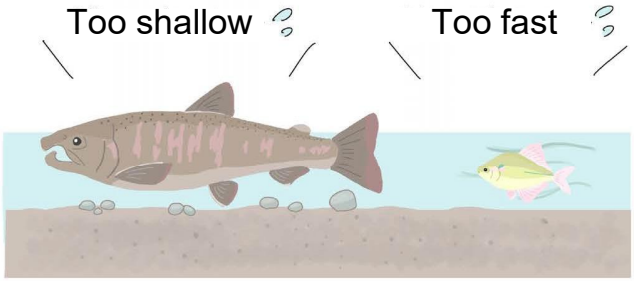


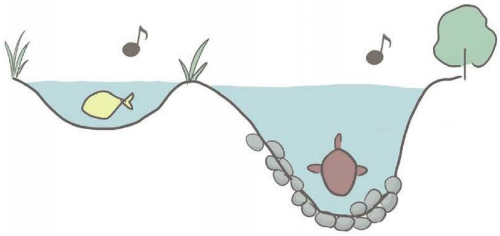
Takashima Fan Bones

Most domestic fans (made of bamboo) use bamboo from Takashima for the bones.

Topic

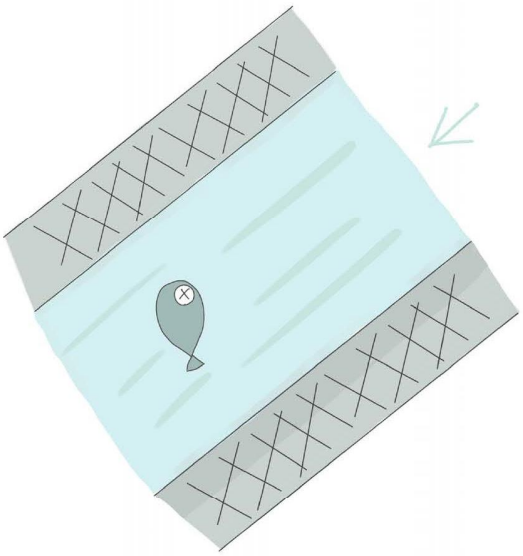
Why a flat channel is an uncomfortable place for fish?



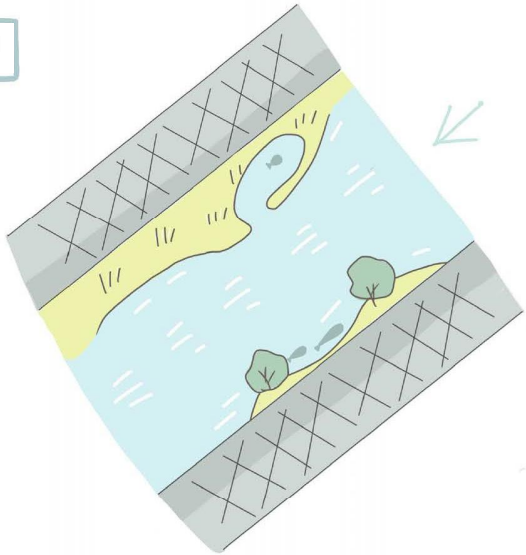


A flat channel is uncomfortable for any fish to live.

Every fish can choose its preferred place to live if a channel is diverse.

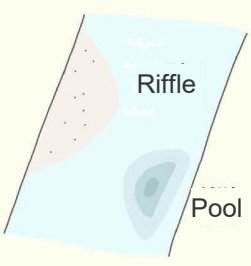


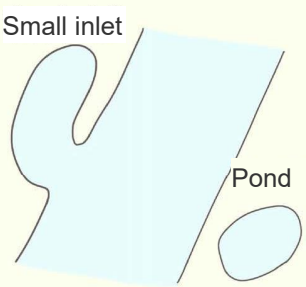
During flood

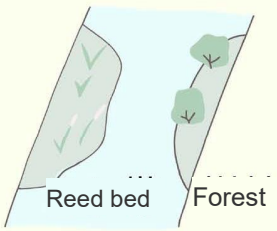


Diversity of river channels

The diversity of a river channel is the complexity of its system.
A river basin with complex channels is home to a diverse range of fish.



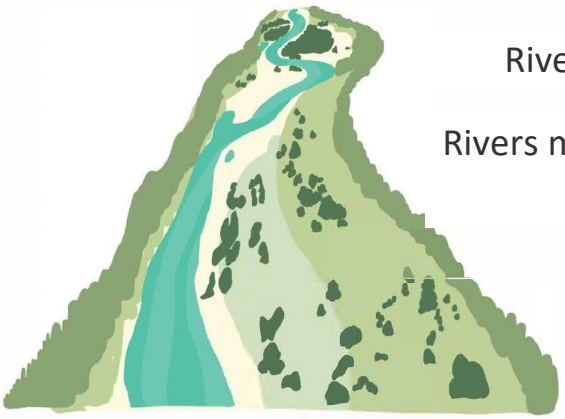




2 Creating Fish Habitat

Key points

Premise 1 River topography is variable.

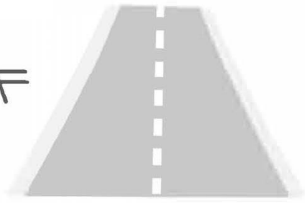


Rivers are natural public properties.

Rivers move with the force of water and can lose their shape.

Unlike roads

≠



Premise 2 Approach without interfering water flow

When installing structures in a river, keep in mind:

- They could be broken or washed away by a large flood; and
- Natural materials should be used for structures as much as possible.

Premise 3 Many trials and errors

When dealing with living creatures and nature, things happen that are just unpredictable.)

So, don't be afraid of making mistakes.

〔 Topic 〕

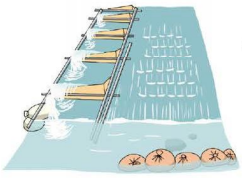
Collaborative Nature Restoration* plays a big role.

Yamune River

Prototyping

1st unit

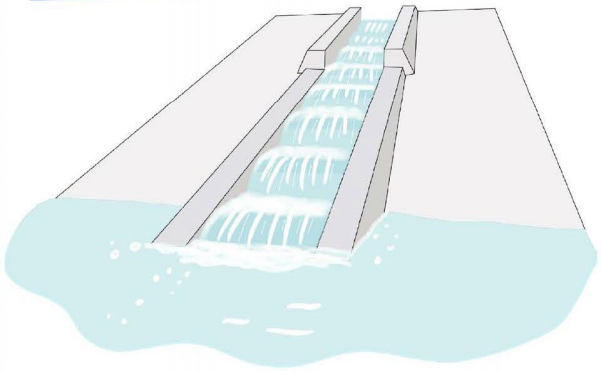
Purchase materials at a DIY store!



3rd unit

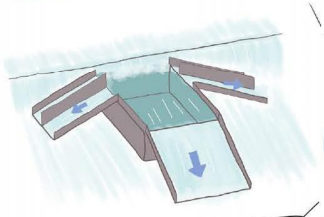
2nd unit

Installation



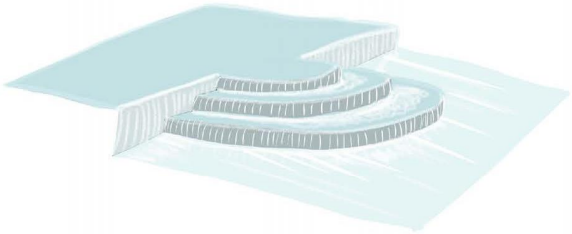
Amano River

Prototyping



Refrigerate Biwa trout eggs → Release next year

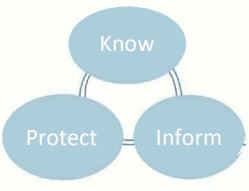
Installation



Five consecutive units are installed !

Integrated Town Planning !

Maibara City Biwa Trout Town Planning



2013

*Collaborative nature restoration is….

homemade nature restoration proposed and collaborated by everyone.

2 Creating Fish Habitat

Before

Collaborative Nature Restoration

3 Types of Approach

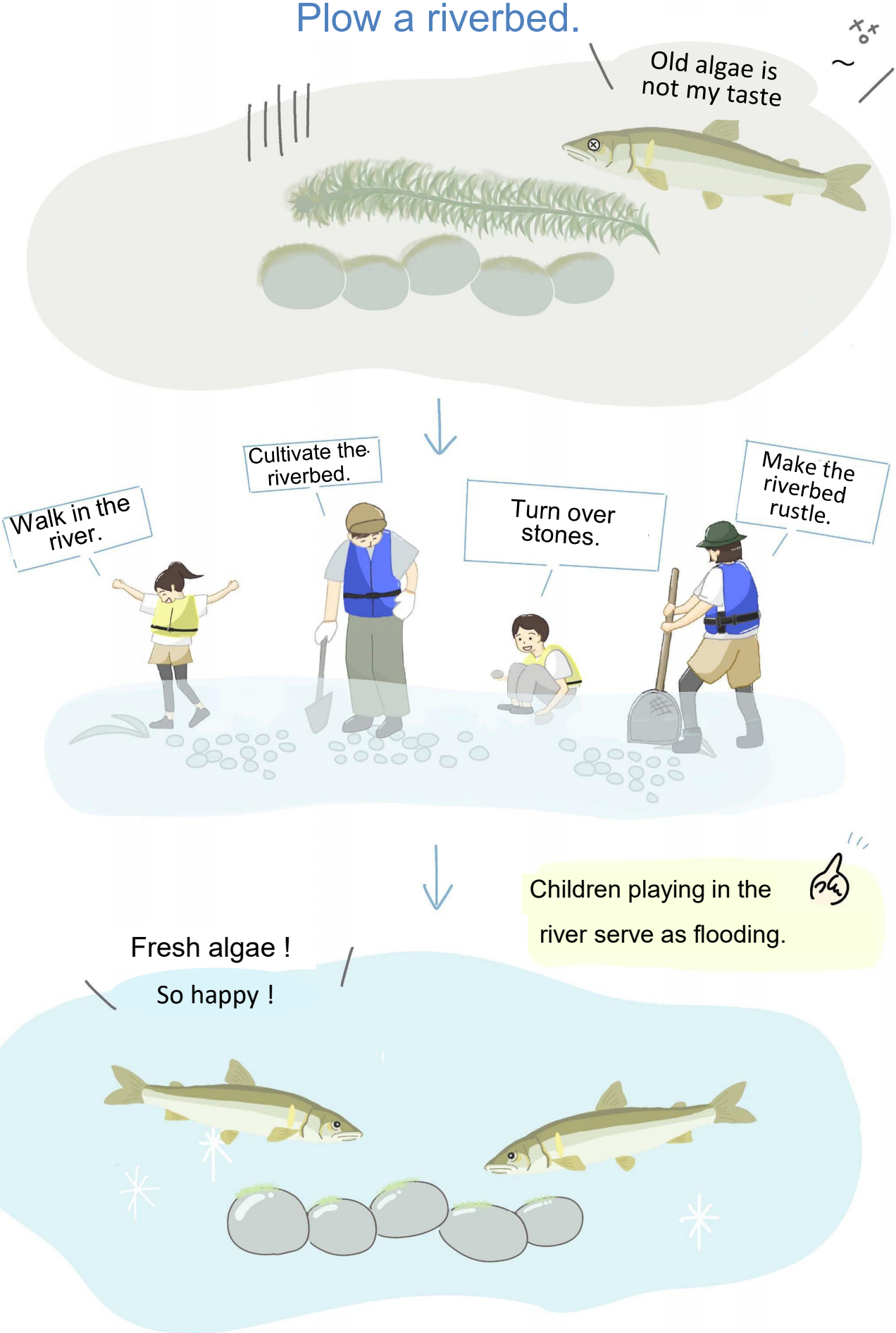
- Get rid of drop-offs.
- Create diverse flows.
- Cultivate the riverbed.

Creating Fish Habitat

After

2 Creating Fish Habitat

Plow a riverbed.



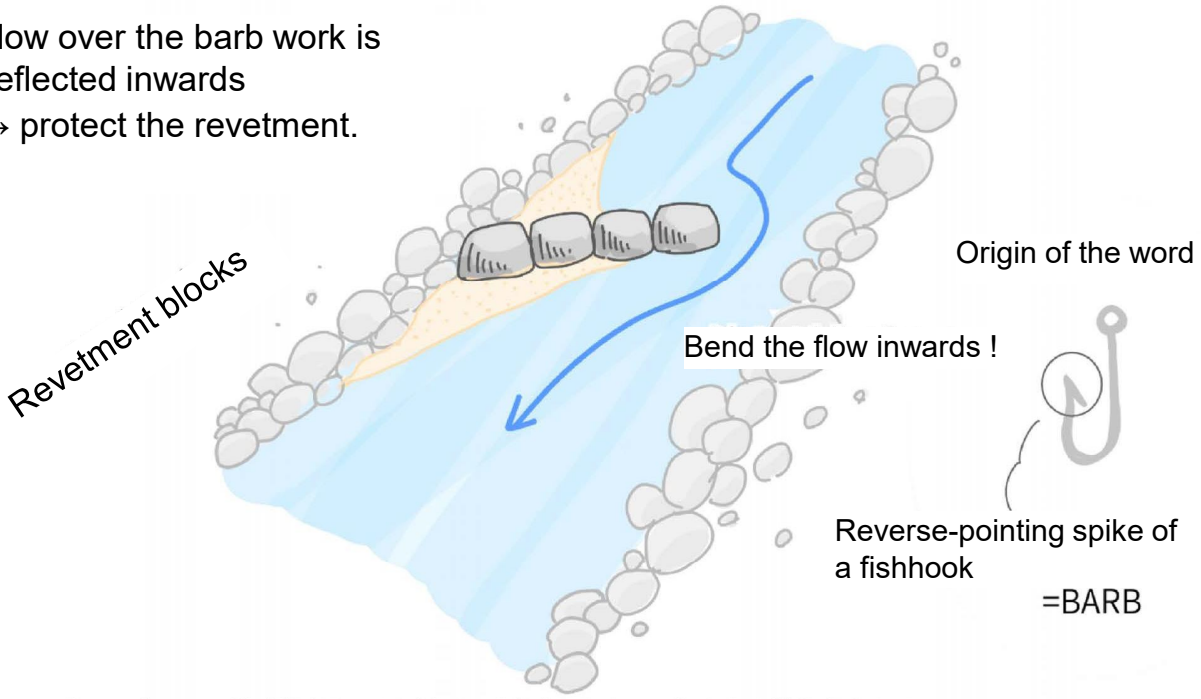
2 Creating Fish Habitat

River groyne

Structures installed in a river redirect flow away.

A river groyne installed into the course of a flow with an angle to upstream is called: **Barb work.**

Flow over the barb work is deflected inwards
→ protect the revetment.



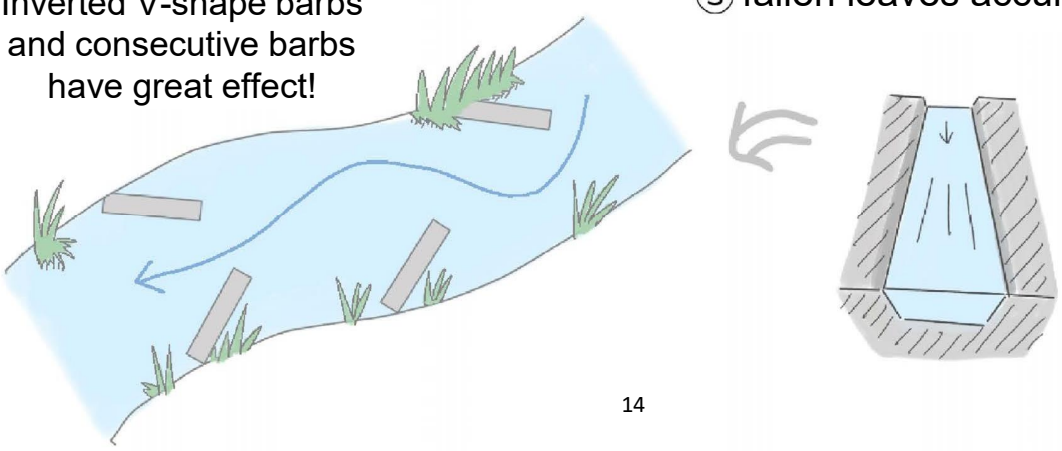
The flow speeds up at the top of the barb and scours the riverbed.
The flow slows down at the bottom of the barb so that sediment accumulates and forms a sandbank.

Effects of barbs

Changes in the flow makes:

① riffles and pools formed,
② revetment protected, and
③ fallen leaves accumulated.

Inverted V-shape barbs and consecutive barbs have great effect!



2 Creating Fish Habitat

Barb works

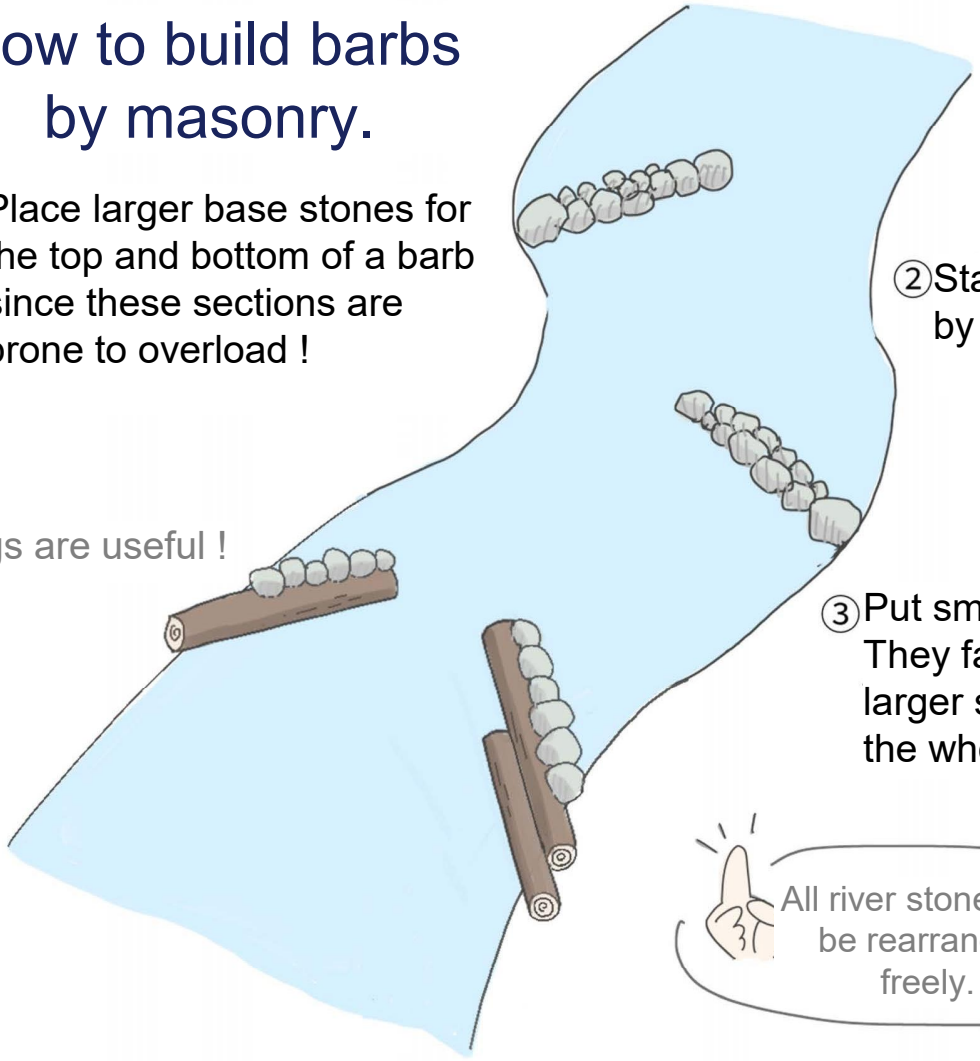
How to build barbs by masonry.

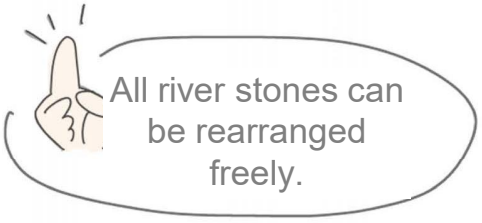
①Place larger base stones for the top and bottom of a barb since these sections are prone to overload !

②Stack more stones by hand-carry.

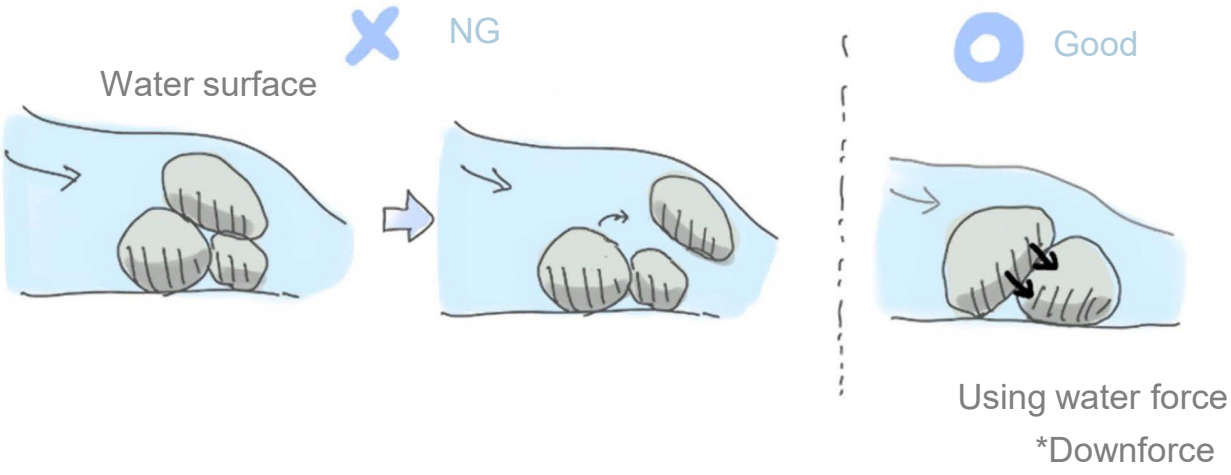
Logs are useful !

③Put smaller stones on. They fall in between larger stones to fortify the whole barb work.





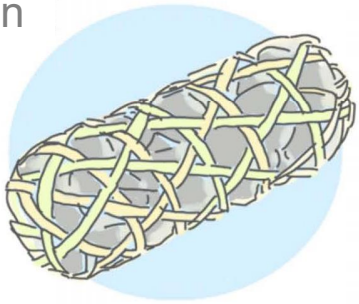
Tips for masonry



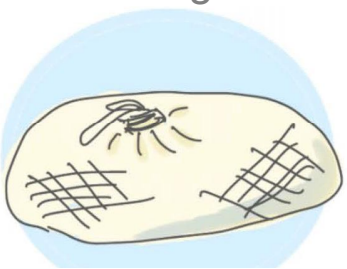
2 Creating Fish Habitat

Building Barb works with Different Materials

Bamboo gabion

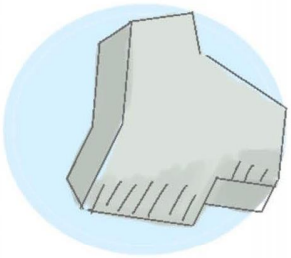


Rubble stone bag



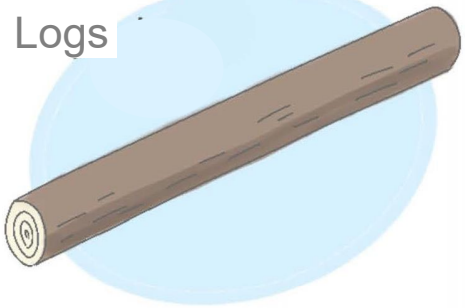
Anchor to prevent it from drifting away !

Block



Sandbag

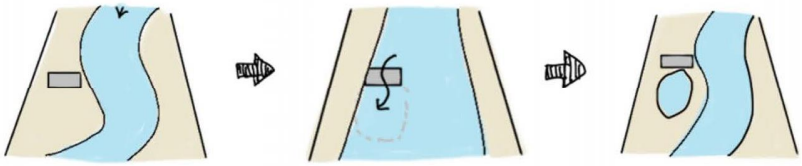
Logs



Chu-Seigyu (literally, sacred cow) groyne

Place a structure in a river to change the flow, which scours and deepens the area around.

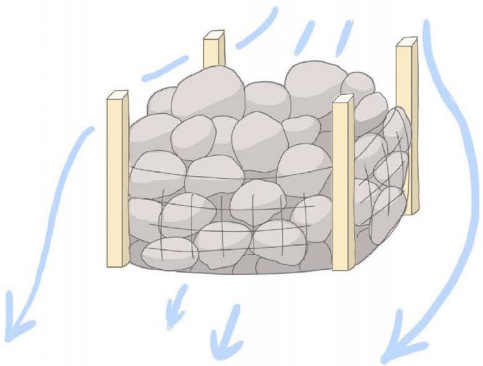
When the water level rises:



2 Creating Fish Habitat

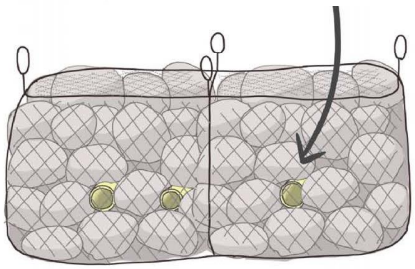
Rectangle gabion

The flow becomes slower.



Using timbers

Including bamboo tubes may be effective !?

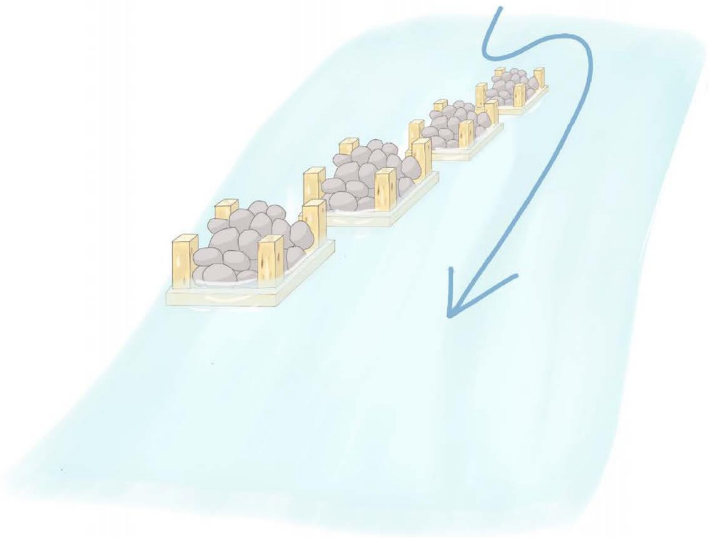


Just stacking stones is good enough !

Key points

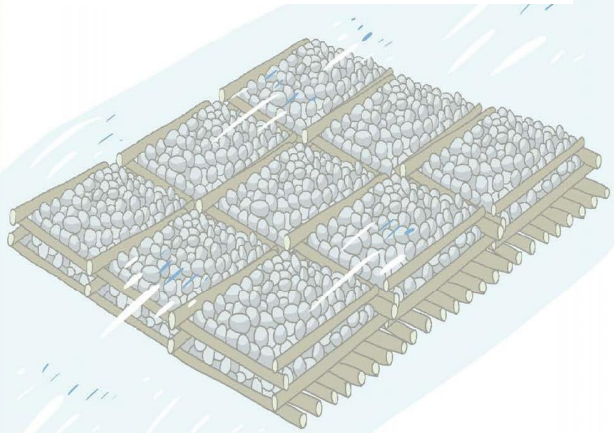
In order not to interfere the flow, let's use small-scale gabions !

Combination of rectangle gabions can form a barb work !



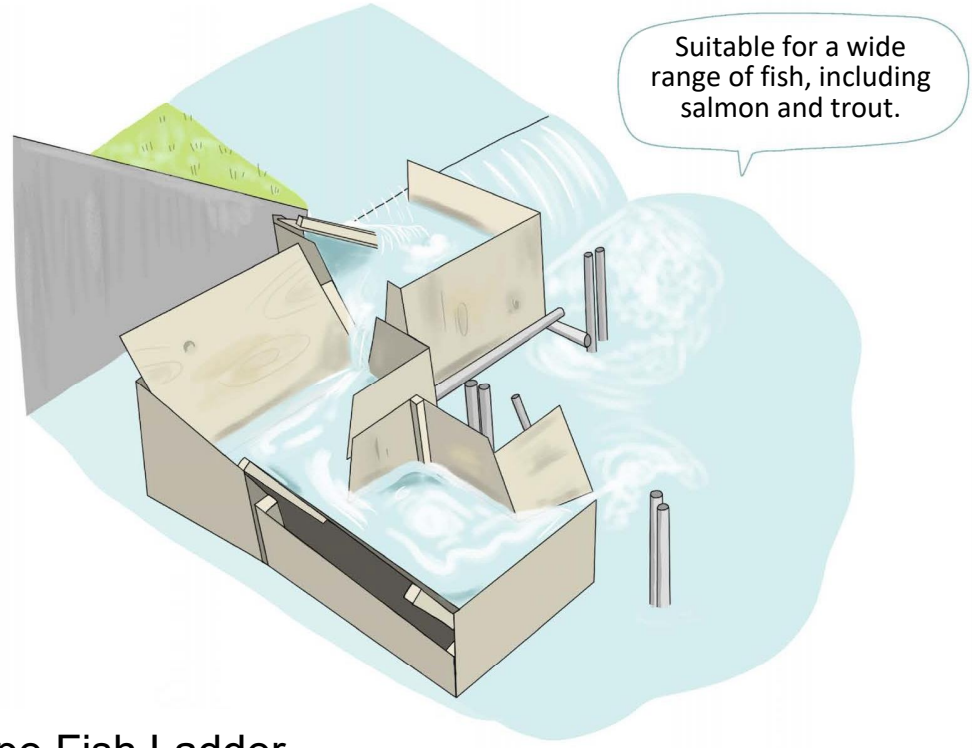
+ Wooden mattress

Wooden mattress is a traditional river engineering technique to prevent the riverbed from declining.
Like a rectangle gabion, it attracts fish.

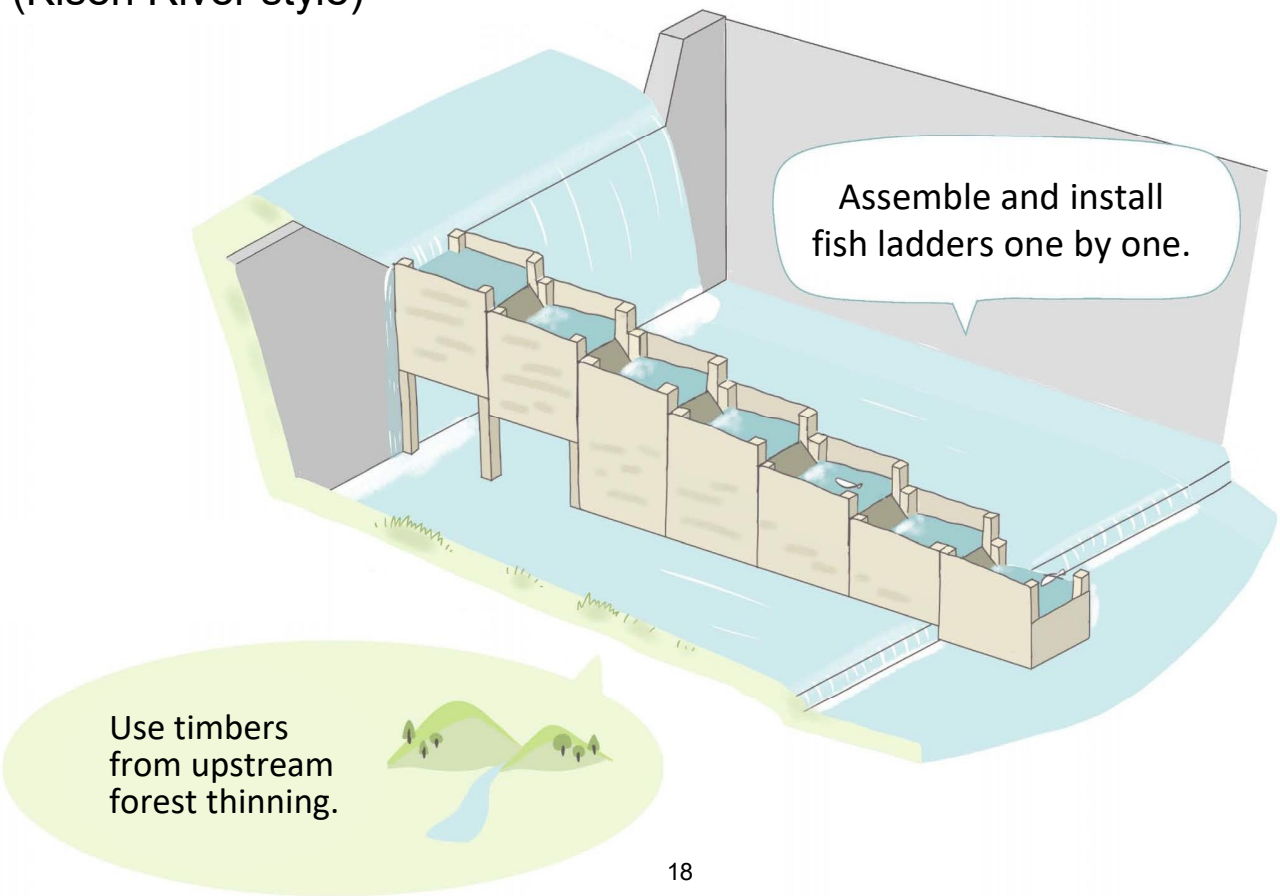


Fish Ladders

Wooden box-type Fish Ladder

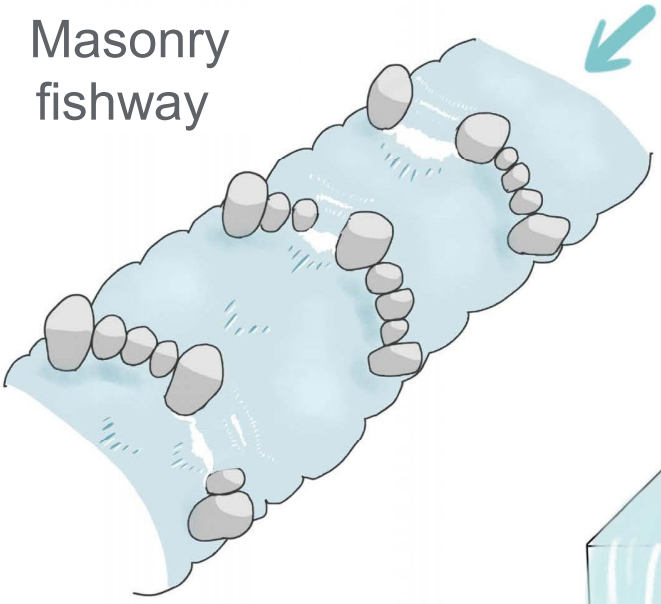


Wooden box-type Fish Ladder (Kisen River style)



Fishways

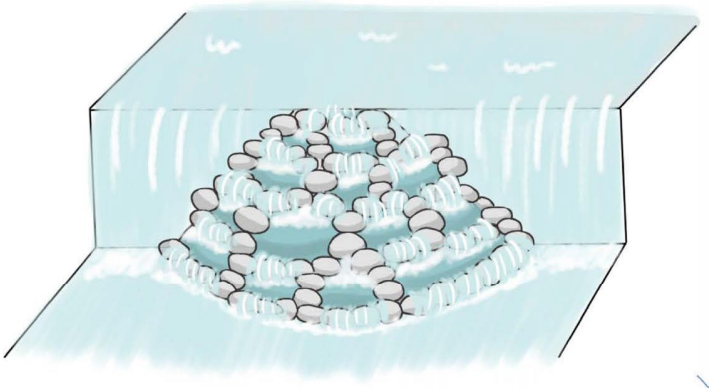
Masonry fishway



Assemble fishways into an arch shape

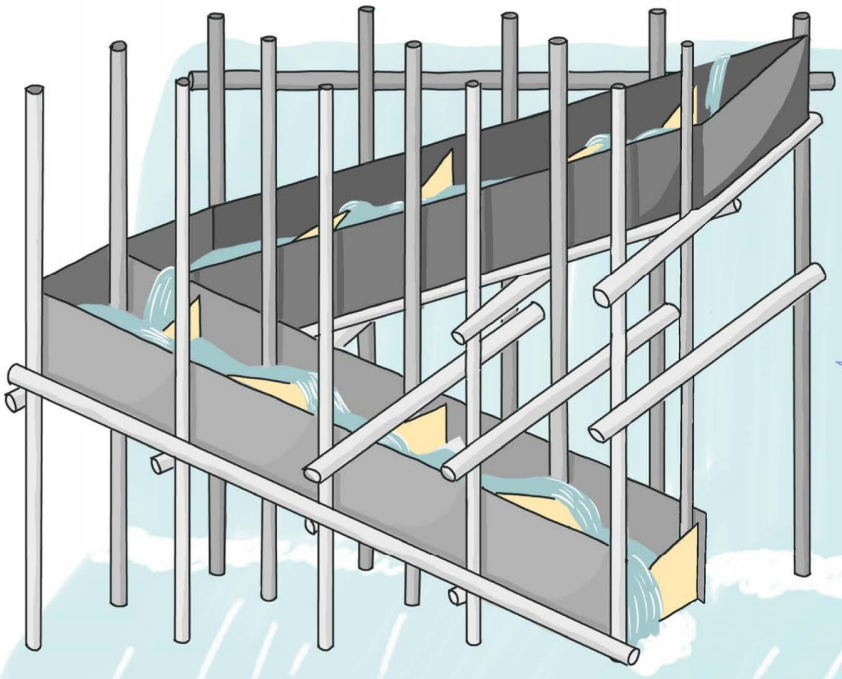
Small pool fishways

A series of small pools form fish ladders.



A number of successful examples !

Corrugated pipe fishway



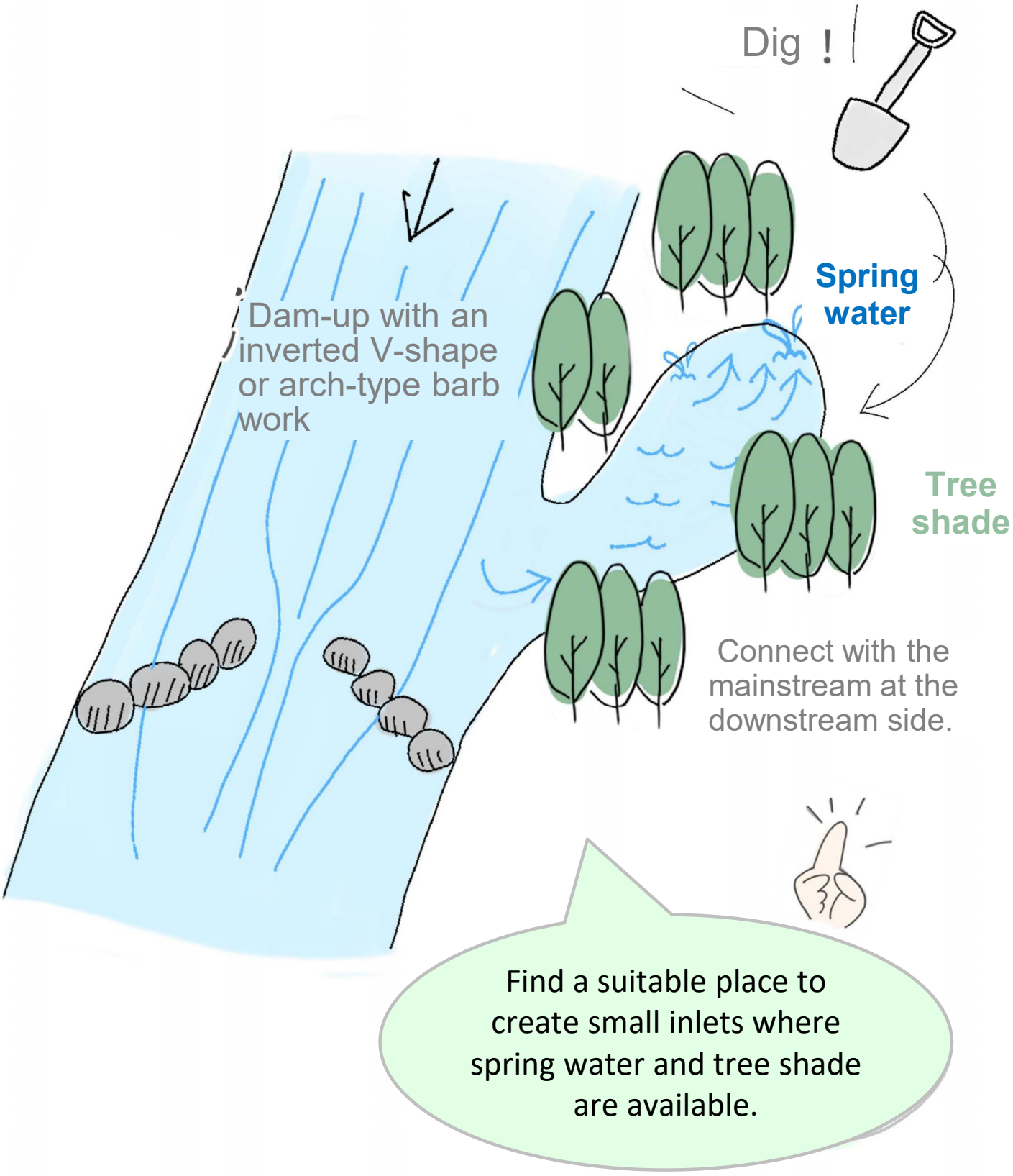
Biwa trout can run up to a drop of more than 2 m.

It takes only one day to install and remove this fishway !

2 Creating Fish Habitat

Small inlet

Practical application

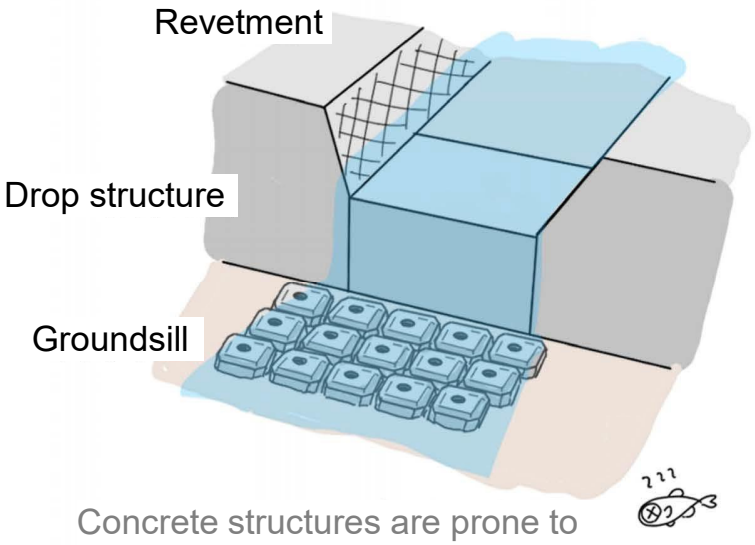


2 Creating Fish Habitat

Eco-Friendly Riverbed

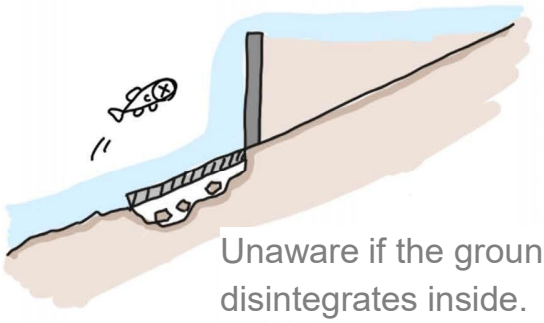
Practical application

Install groundsill as little as possible. Try to reduce drop-offs.

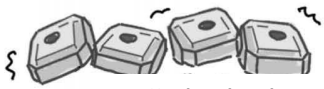


Concrete structures are prone to temperature rises.

Fish cannot overcome big drop-offs !

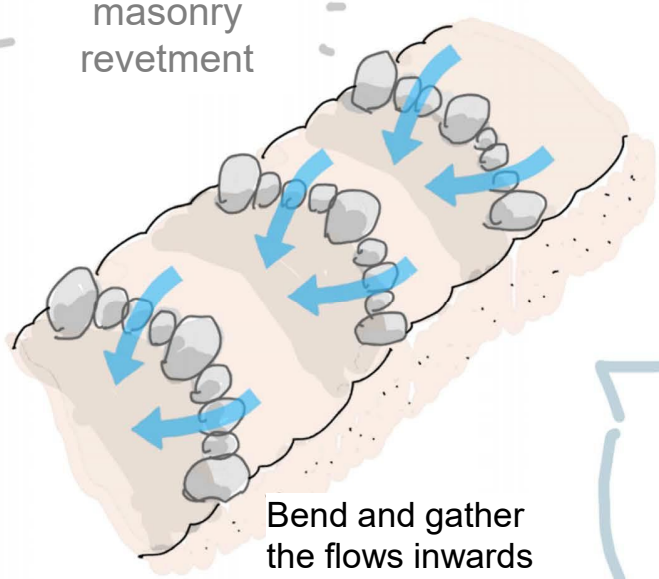


Unaware if the groundsill disintegrates inside.



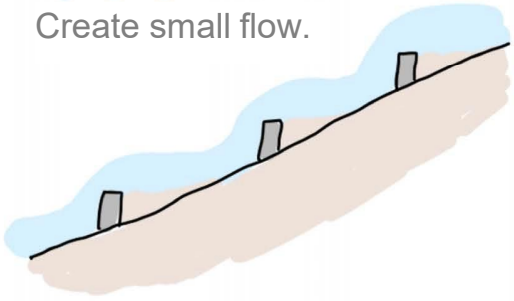
scattering in pieces ….

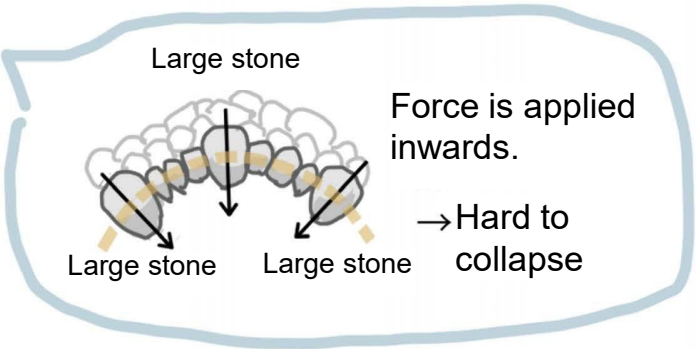
Arched stone masonry revetment



Bend and gather the flows inwards

Create small flow.

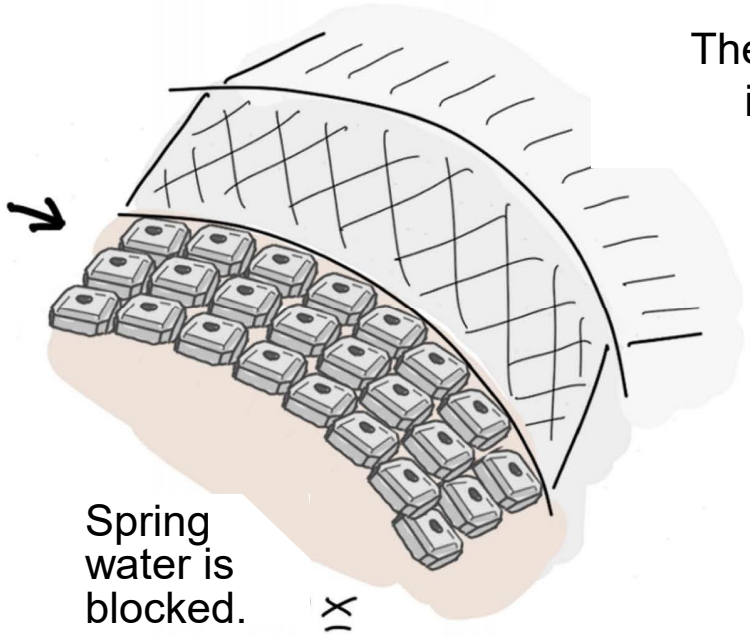




2 Creating Fish Habitat

Eco-Friendly Riverbed

Practical application

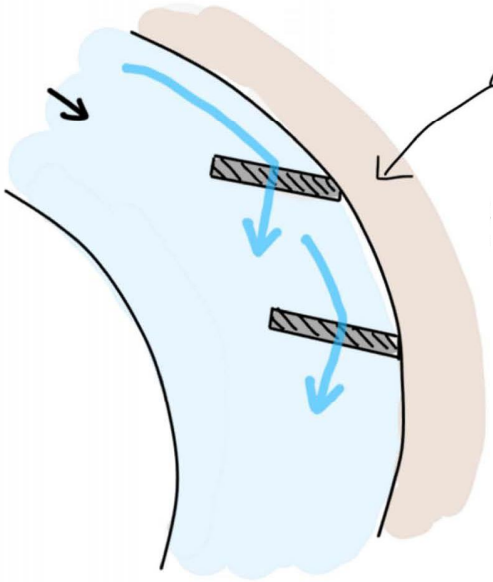


The outside of the curve is prone to erosion.

→ The area tends to be covered with concrete...

Spring water is blocked.

Instead, installing **barbs**



the barbs bend the flow

to protect the riverbank.

Creating Fish Habitat for the first time *vol.2*

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