APPROPRIATE OF INDIGENOUS FISH PASSAGE FOR THAILAND AND SOUTHEAST ASIAN COUNTRIES.

OVERVIEW

SEAFDEC in collaboration with the Department of Fisheries of Thailand therefore implement the project on **"Application of fish passage design principles to enhance sustainability of inland fishery resources in the Southeast Asian region"** with funding support from the Australian Centre for International Agricultural Research (ACIAR). The project would be implemented for the period of 22 months starting from May 2015 to April 2017, with objectives to:

1) Develop a **regional collaborative approach** on fish passage through the conduct of an expert workshop;
2) **Design and construct** experimental fish passage facilities in Thailand; and
3) Provide a **pathway for further research** to improve knowledge on appropriate designs that could facilitate upstream migration of indigenous fish.

In June 2015, SEAFDEC and the DOF Thailand convened an informal discussion and came up with initial recommendations for designing fish passage model to be experimented under the project. Initial experimental fish passage model was also put-up at SEAFDEC Training Department in Samut Prakan, Thailand.

SEAFDEC therefore plans to convene an **"Expert Workshop on fish passage Design"** to seek views from regional/international experts on issues/factors to be considered in designing fish passage that are effective for the Southeast Asian region,

OBJECTIVES OF FISH PASSAGE

1. Fish undertake migrations for a number of reasons, including spawning, feed and seeking refuge. These migrations are also essential to ensure the dispersal of species and maintain genetic fitness within fish communities. Fish passage, also known as fish ladders or fish passes, are structures placed on or around constructed barriers (such as dams or weirs) to **give fish the opportunity to migrate**

2. **Each weir or dam on a river that is targeted for fish passage construction represents a unique situation.** There are many aspects that need to be considered within the design of a fish passage, the species diversity and size of the migrating fish community varies from site to site.

3. Improve appropriate hydraulic design conditions within a fish passage need to **provide both enough depth for large fish whilst ensuring the velocity is suitable for smaller fish**

FISH PASSAGE DESIGN

Design of fish passages needs to **study on various factors**, such as **fish behavior, engineering and biology together are the principles of design** as follows.

1. The **habits and biographies of fish that will use fish passes**, such as their **ability to swimming, size of fish, season where migratory fish travels and species of fish**. This must be studied thoroughly to the results of the design of fish passage.

2. The **size of the fish passages**, i.e. width, depth and length, must be considered as follows.
   a) The **water velocity** through the fish passage.
   b) The **amount (volume) of water** passing through the fish passage.

PRELIMINARY FEATURES OF FISH PASSAGES

1. Fish passage shall **be appropriate for the species available in the resources.** So that most of the fish can swim across through a barrier is easily accessible.

2. Must **be practical for migration at the right time / season**.

3. Whether the amount of **water flowing through the fish passage how much more or less is always available.**

4. Fish must be able to **swim without injury**.

5. Fish can **easily find the entrance to the fish passage**, without hesitation or stray.

IMPORTANT COMPONENTS OF FISH PASSAGE

1. **Entrance (Fish Entrance)** is the first part of the entrance to the fish passage. Fish entrances are the most important parts of fish passage.

2. **Passage (opening)** is the opening between pools for fish swimming during the journey.

3. **Pools** are a series of artificial pools arranged by vertical baffle like ascending steps, enabling migrating fish to swim upstream.

4. **Fish exits** are the last part of a fish leaving passage to the upstream.
   To consider
   1)**Flow velocity** through the passage opening.
   2)**Flow control** during the changing of upstream level.
   3)**Preventing devices** from sticking up of garbage, scum and etc.
   4)**Auxiliary water supply** for the purpose of attracting fish to travel into the fish passage.

SLOPE OF FISH PASSAGE

Slope of fish passage **depends on the terrain and the type of fish** was. The slope of the fish way **typically ranges from 1 to 4 to 1 to 30** and these fish passage often has flat resting and/or turn pools for height dams. In design, must consider the suitability of other factors, such as the capability of fish to pass the passage water velocity, the dam/weirs height or obstruction and construction materials.

Southeast Asian Fisheries Development Center

Australian Government
Australian Centre for International Agricultural Research

Department of Fisheries, Thailand

APPROPRIATE OF INDIGENOUS FISH PASSAGE

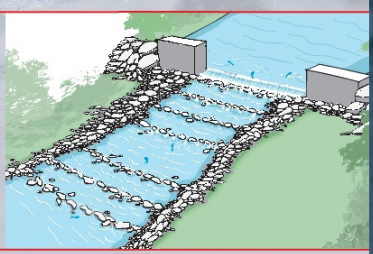
FOR THAILAND AND SOUTHEAST ASIAN COUNTRIES.

THE APPROPRIATE TYPE OF FISH PASSAGES

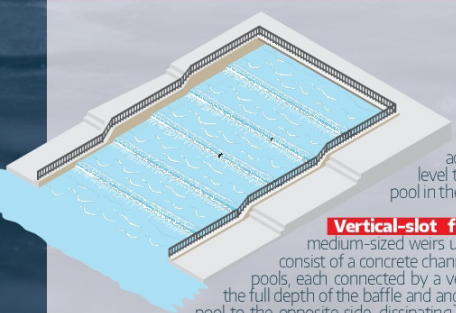
CLOSE-TO-NATURE TYPE

Rock-ramp, fish passage is most commonly used **for barriers less than 2 meters in height**, the general concept consists of a series of pools created by rock ridges or a ramp of rocks placed below the barrier that are connected through continuous water flow from one pool to the next.

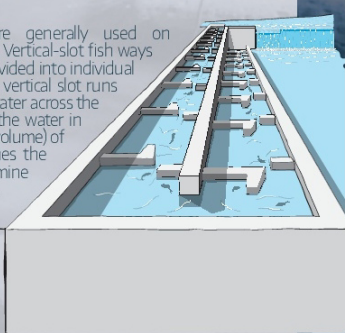
The size of the pool and head loss between pools determines the water velocities and turbulence through which the target species of fish have to pass to move upstream. Rock ramp, fish passage is useful for returning juvenile species in nature. But not only fish, other aquatic fauna such as shrimp can be migrating through rock ramp type.



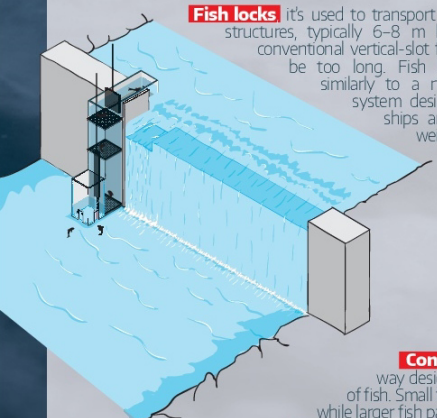
TECHNICAL TYPE



A **Pool and Weir** is one of the oldest styles of fish passage. It uses a series of small dams and pools of regular length to create a long, sloping channel for fish to travel around the obstruction. The channel acts as a fixed lock to gradually step down the water level to head upstream, fish must jump over from pool to pool in the passage.

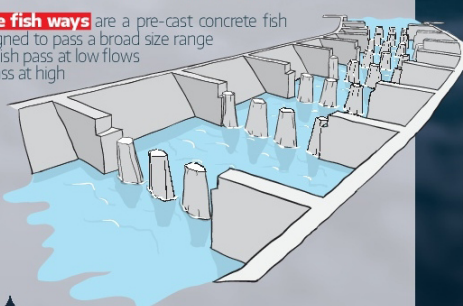


Vertical-slot fish ways are generally used on medium-sized weirs up to 6 m high; Vertical-slot fish ways consist of a concrete channel structure divided into individual pools, each connected by a vertical slot. The vertical slot runs the full depth of the baffle and angles the jet of water across the pool to the opposite side, dissipating the energy of the water in each pool. The vertical drop between each pool, the size (volume) of the pool, and the width of the slot connecting each pool determines the turbulence and velocity parameters of the fish way, which in turn determine the size and species of fish that are capable of utilizing the fish passage.



Fish locks it's used to transport fish over high structures, typically 6–8 m high, where a conventional vertical-slot fish way would be too long. Fish locks function similarly to a navigation lock system designed to move ships and boats over weirs and dams and are able to pass a wide diversity and size range of fish.

Fish locks, have a chamber located on the downstream side of the barrier. Fish are drawn into the chamber using attraction flows. The chamber is periodically closed (the duration of lock cycle will be dependent on the target species of fish), and the chamber is filled with water until it reaches the same level as the upstream weir pool. An exit flows for encouraging fishes to move out of fish locks into the water upstream.



Cone fish ways are a pre-cast concrete fish way designed to pass a broad size range of fish. Small fish pass at low flows while larger fish pass at high flows. The cone shaped baffles which make up a series of ridges through which fish pass are designed to have conservative hydraulics (low velocities and turbulence levels) at low discharge to allow small bodied fish to pass while at higher flows the velocity and turbulence levels increase along with the physical dimensions of the gaps within the fish way therefore allowing larger fish to pass.

Southeast Asian Fisheries Development Center

Australian Government
Australian Centre for International Agricultural Research

Department of Fisheries, Thailand