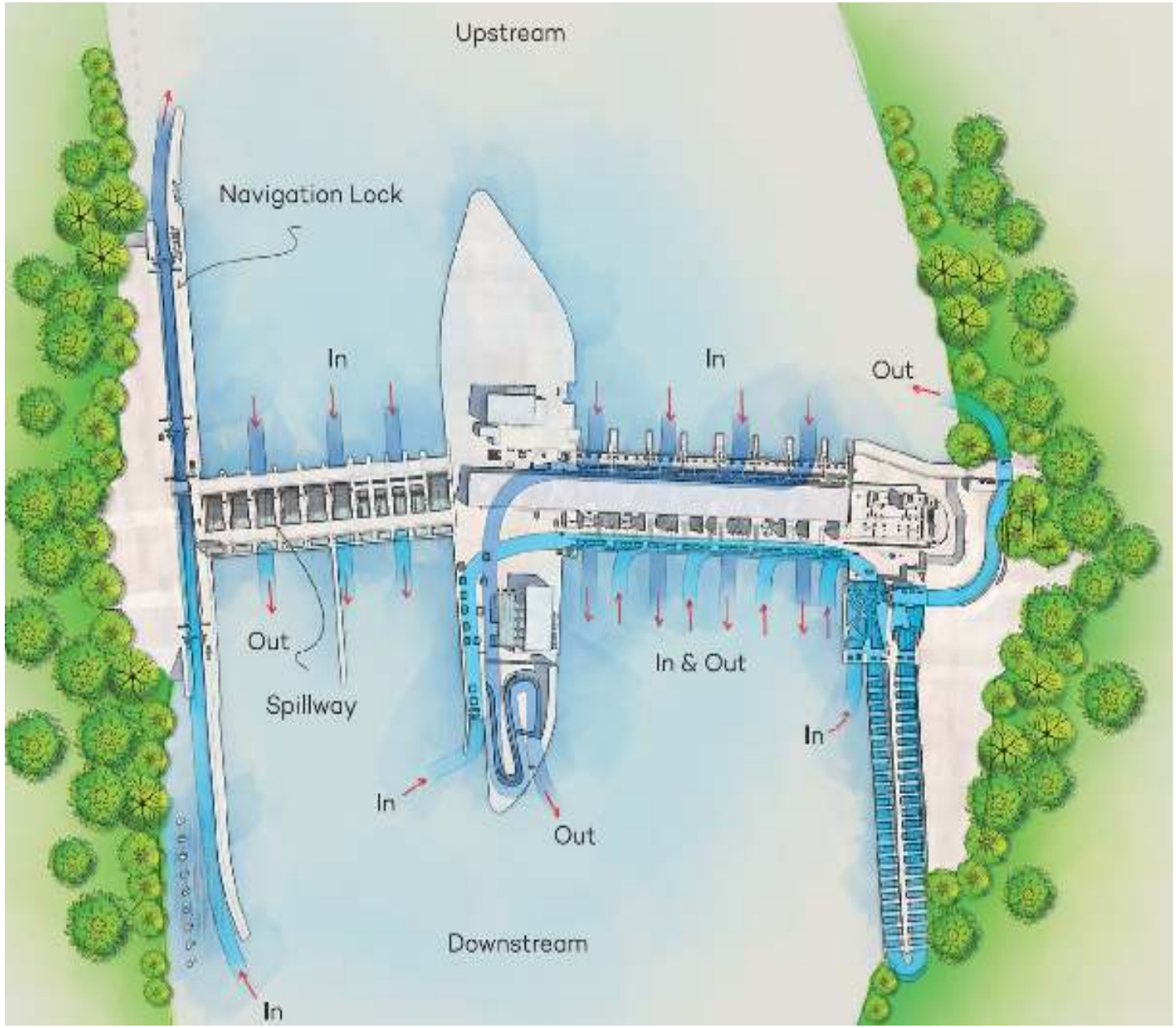
Update on Xayaburi and Luang Prabang Fish passage solutions

Xayaburi Hydroelectric Power Project

Fish Passing Facilities of XHPP



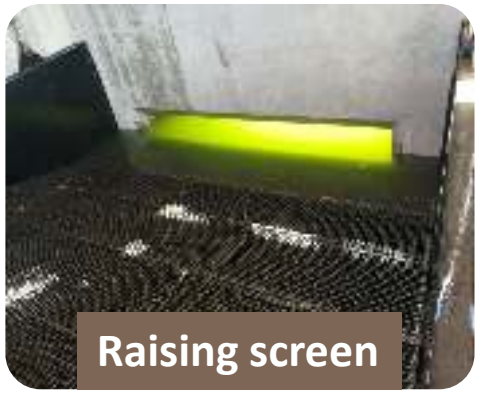
Main principles of fish migration

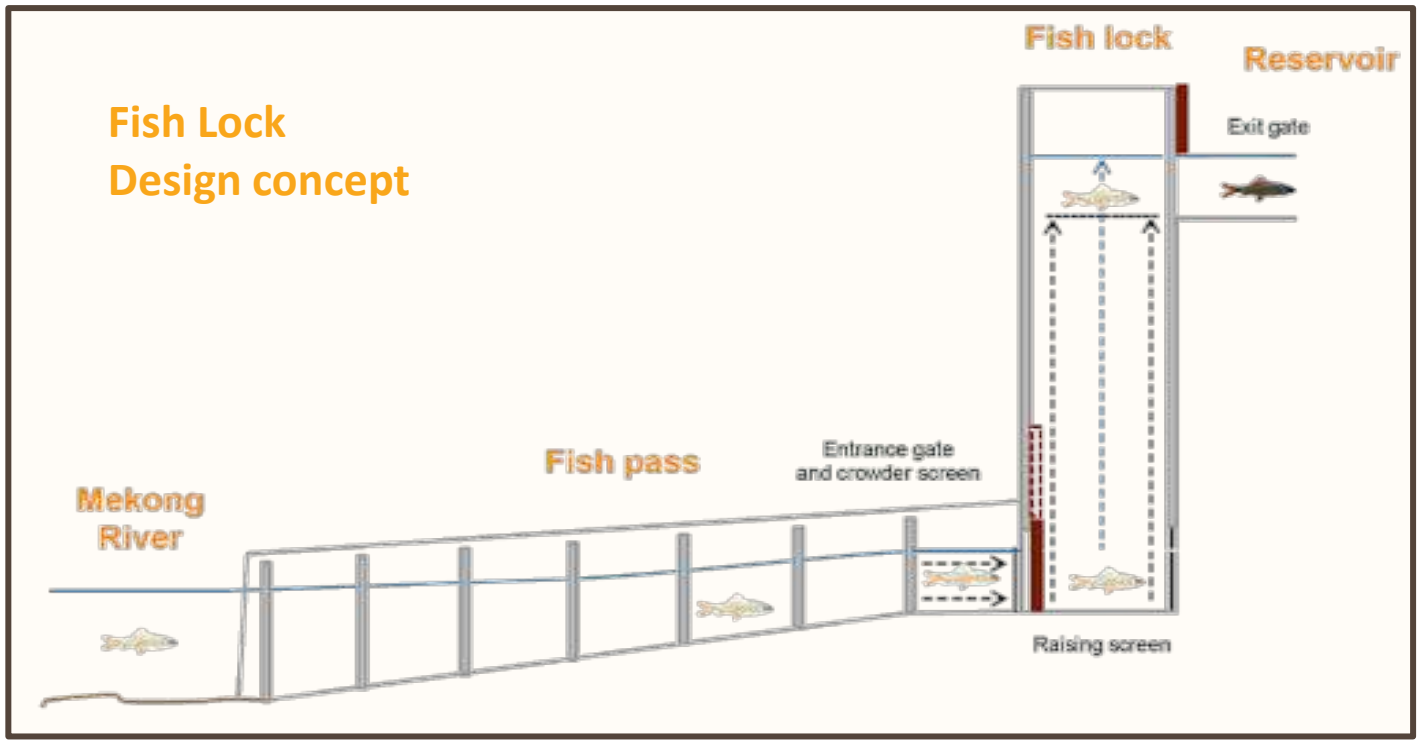
- Fish migrate from **downstream to upstream** to reach their spawning grounds (**light blue**)
- Young fish, egg and larvae migrate **downstream** to reach habitat areas where they mature before returning back to their spawning grounds (**dark blue**)
- Upstream migrating fish actively **swim against** the flow of the river
- Downstream migrating fish, egg & larvae passively **drift** with the flow of the river

What needs to be done to allow fish to pass the project in both directions?

- To provide multiple entrances at the downstream side of the powerhouse to allow fish to enter the safe passage upstream migration facility
- Upstream migrating fish will be attracted by the suitable attraction flow from the project
- Downstream migrating fish need safe passage either through the turbines or the downstream migration channel

Fish locks operation





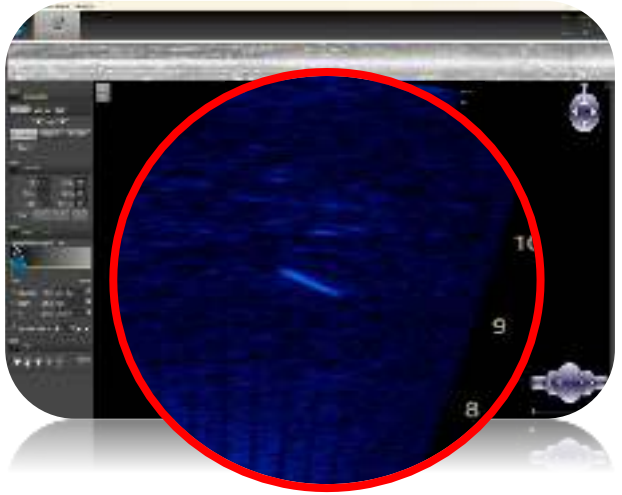
Fish biomass monitoring by hydroacoustic camera

Locations

Exit of U/S Fish passage (upper channel)

D/S area of Xayaburi project

Data analysis



Fish species investigation of XHPP

Fish species study before construction of XHPP (2012 -2013)

120 species from 26 families were collected and identified

Fish species study during construction phase (2015 – 2019)

62 Fish species were collected and identified

Fish species study during operation and maintenance phase (2019 – 2024)

132* Fish species were collected and identified

*As of Dec 2024

Fish Trapping & Fish abundance

Fish Trapping

XHPP's Fish monitoring station

Species identification, Size measurement by XPCL's staff





Fish abundance monitoring

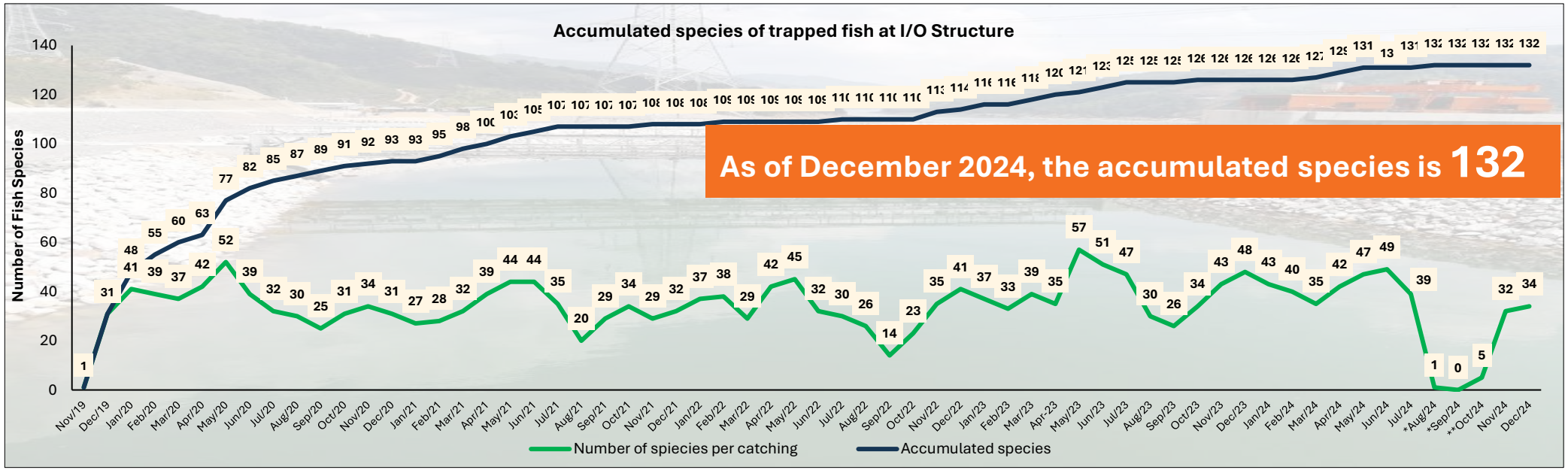
Fish caught by local fisherman from U/S and D/S

Species identification, Size measurement by XPCL's staff




Recorded data from Fish Trapping & Fish abundance

Fish Trapping : Nov 2019 – Dec 2024



Remark: *Skip activity due to EAP level. 3, ** Bucket guide roller has been damaged

Fish abundance : Feb 2022 – Dec 2024

44 Species

Accumulated species from **D/S**

29 Species

Accumulated species from **U/S**

Xayaburi PIT Tag overview

Cooperations

- Install PIT antenna to XHPP fish passing facilities
- Establish Fish research center For PIT tagged fish retention experiment
- Using electrofishing for fish samples collection
- Conduct PIT tagging and monitor them by PIT antenna

Partners

National University of Laos

Living Aquatic Resources Research Center

Charles Sturt University

Charles Sturt University

Funding

Australian Government
Department of Foreign Affairs and Trade

Australian Centre for International Agricultural Research

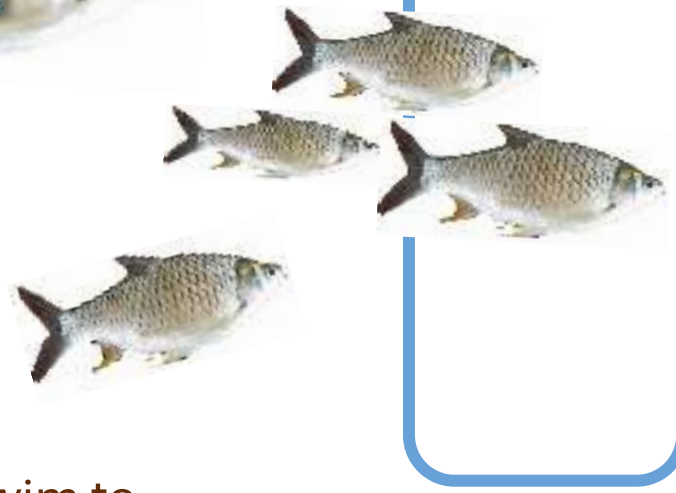
Xayaburi Power Company Limited

Ministry of Energy and Mines, Laos PDR

Timeline

- **Consult with CSU** — 2017
- **Antenna system testing** — 2018
- **Install antenna at XPCL fish pass** — 2019
- **Start tagging and monitoring** — 2019 - present
- **Install additional antenna at exit of fish pass** — 2022

PIT System overview



Tagged fish swim to PIT tag antenna

PIT tags are powered electromagnetically, the signal will be detected when fish swim pass to PIT tag antenna

Send a unique signal (15-digit identification number) by PIT tag antenna and record to Database

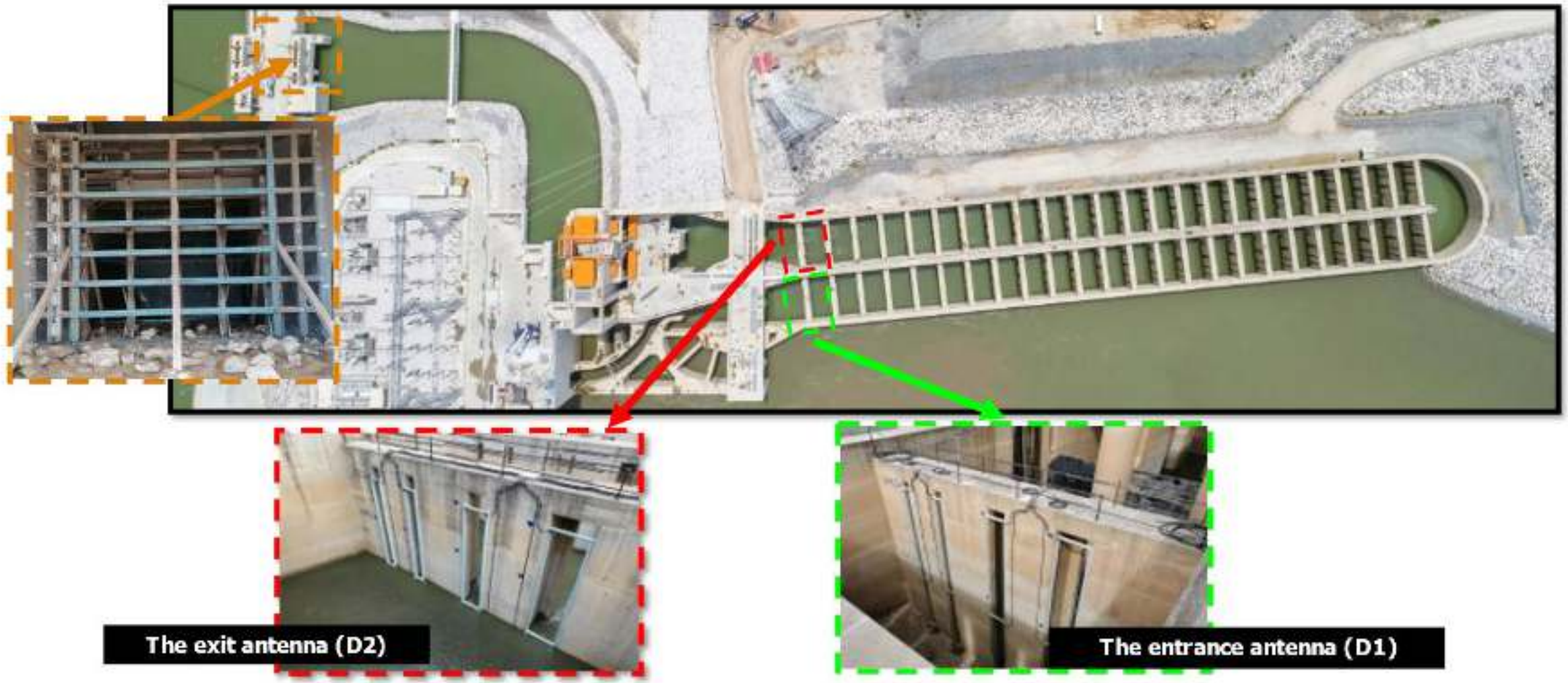
PIT Antennas Pilot Study

Fish Ladder Slot (approx. 16m height)

Pilot Study (CSU, Albury, Australia)

PIT system operating in XHPP

Location of first PIT System installed in fish ladder and I/O structure of XHPP



PIT tag initial results

- To determine actual passage efficiency, XPCL performs PIT tagging of target fish species
- This project is carried out with Charles Sturt University from Australia and partially funded by the Australian Government.
- Research ongoing since 2018 and just be extended for another 5 years until 2028
- **A total of 5,787 fish from 42 different species tagged and released downstream of the project as of December 2024**
- XPCL purchased 10,000 PIT tags; the catching and tagging is constantly performed and ongoing
- These are some of tagged fish caught by fisherman in the impoundment upstream of Xayaburi

Charles Sturt University

Australian Centre for International Agricultural Research

Australian Government
Department of Foreign Affairs and Trade

Electrofishing activity

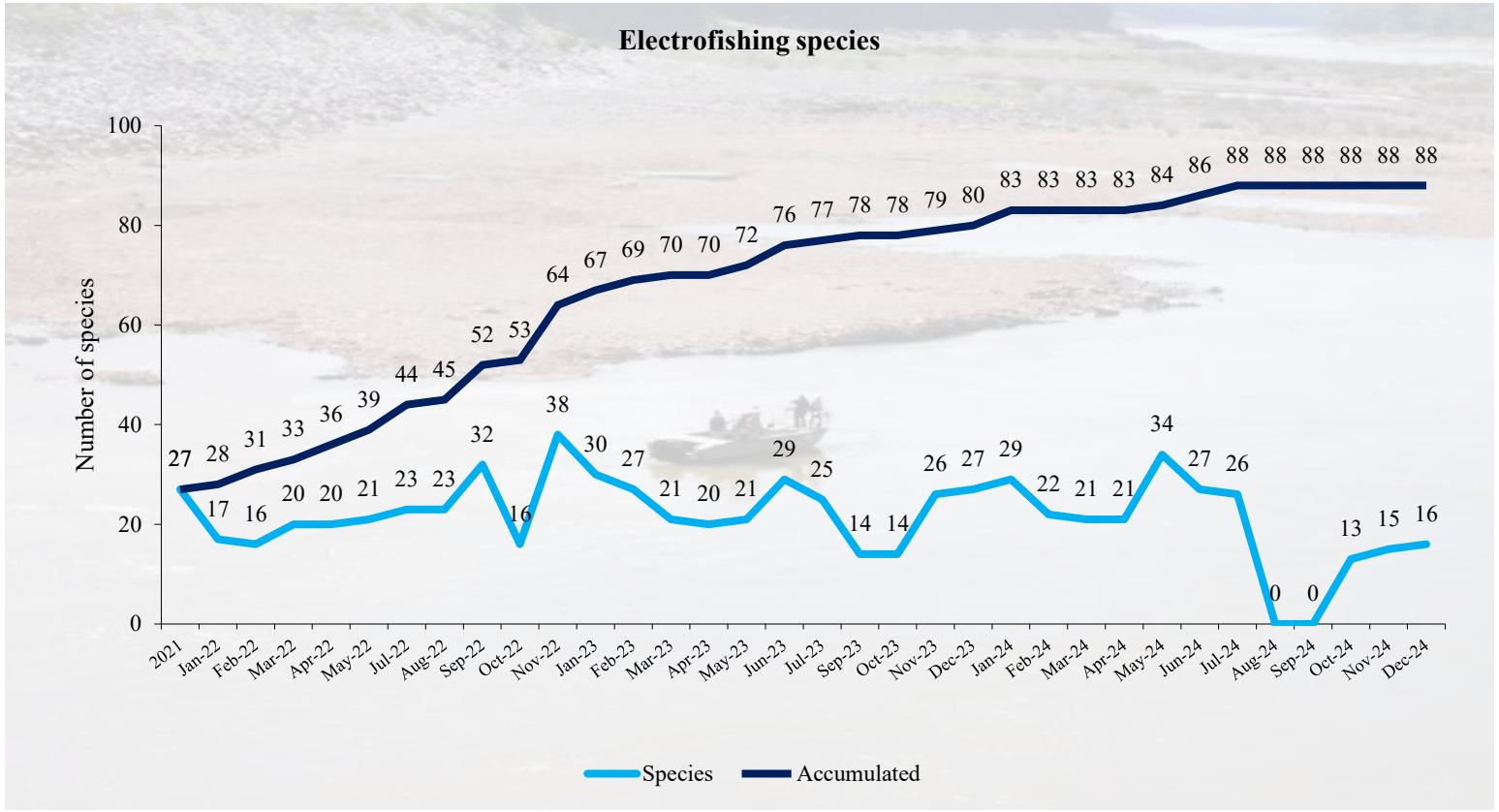
Collect fish samples from Mekong river using electrofishing boat

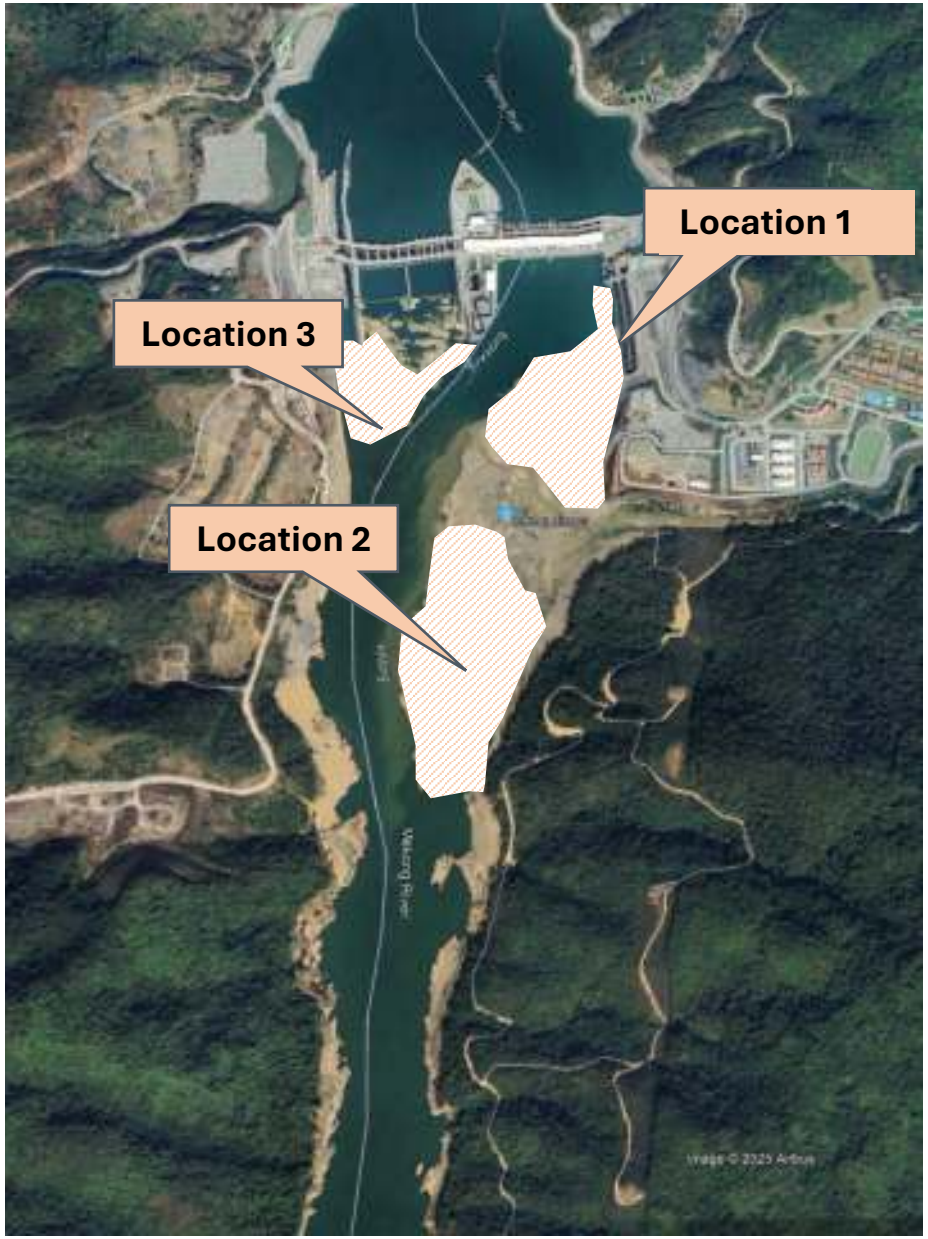
- Location : D/S of Xayaburi project
- Fish species investigation
- Size measurement

Fish will be PIT tagged and released to Mekong River to study fish migration behavior through PIT antenna

Electrofishing boat

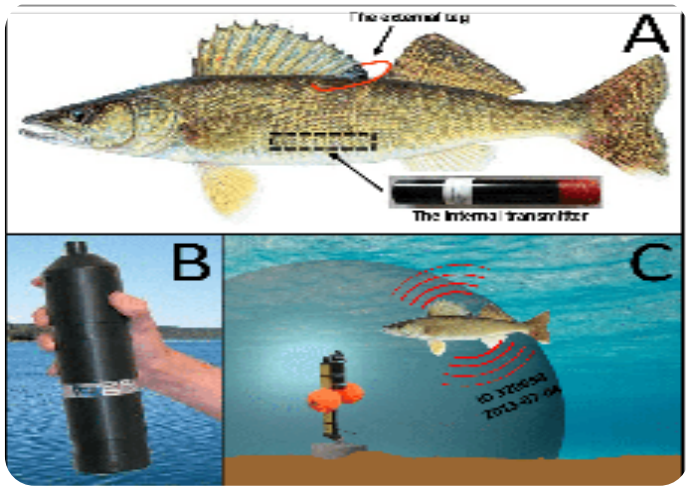
Electrofishing Results





Tentative plan with CSU (5 years cooperation)

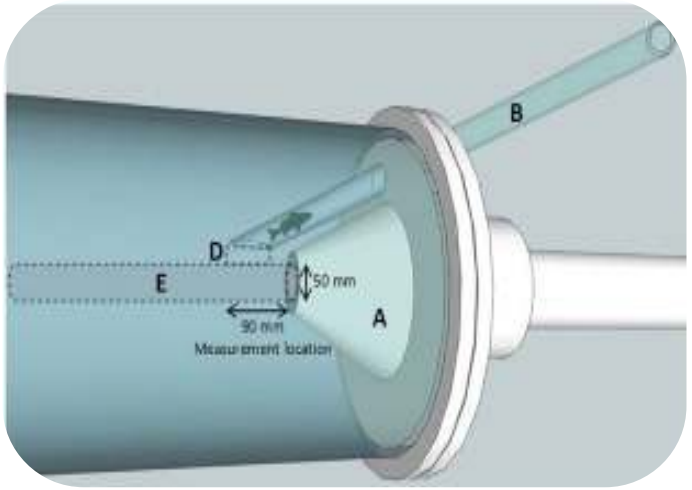
Continue PIT Tagging Program



Implement Acoustic tagging

Continue Electrofishing

Barotrauma experiment

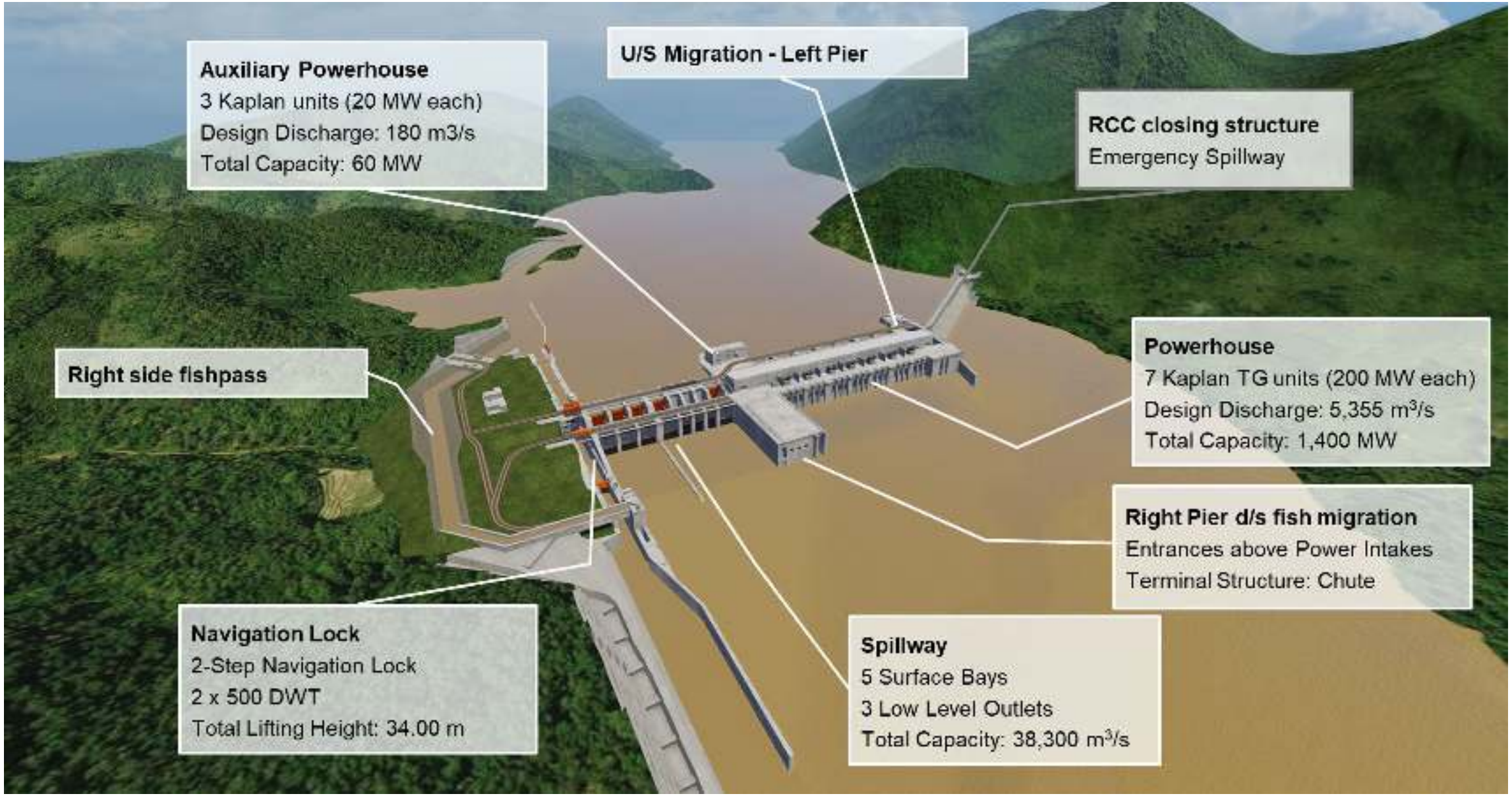


Shear stress test

Improve Fish Research Center

LUANG PRABANG HYDROELECTRIC POWER PROJECT

Project layout and overview



Fish passage Overview

Main upstream migration system at Powerhouse with 2 fish locks

Supplementary system at right bank with fish lock

Downstream migration system located along the powerhouse

Design criteria according to MRC guidelines

Fish passage – Main Upstream Migration Facilities

Entrances

14 on two elevations provided along D/S face of Powerhouse

2 openings provided on right side **3** on left side of Powerhouse

1 Spillway entrance provided for wet season

Fish Collecting Galleries

Along the entire length of the powerhouse

Connects all entrances

Leads to the fish locks at the left pier

Fish Locks

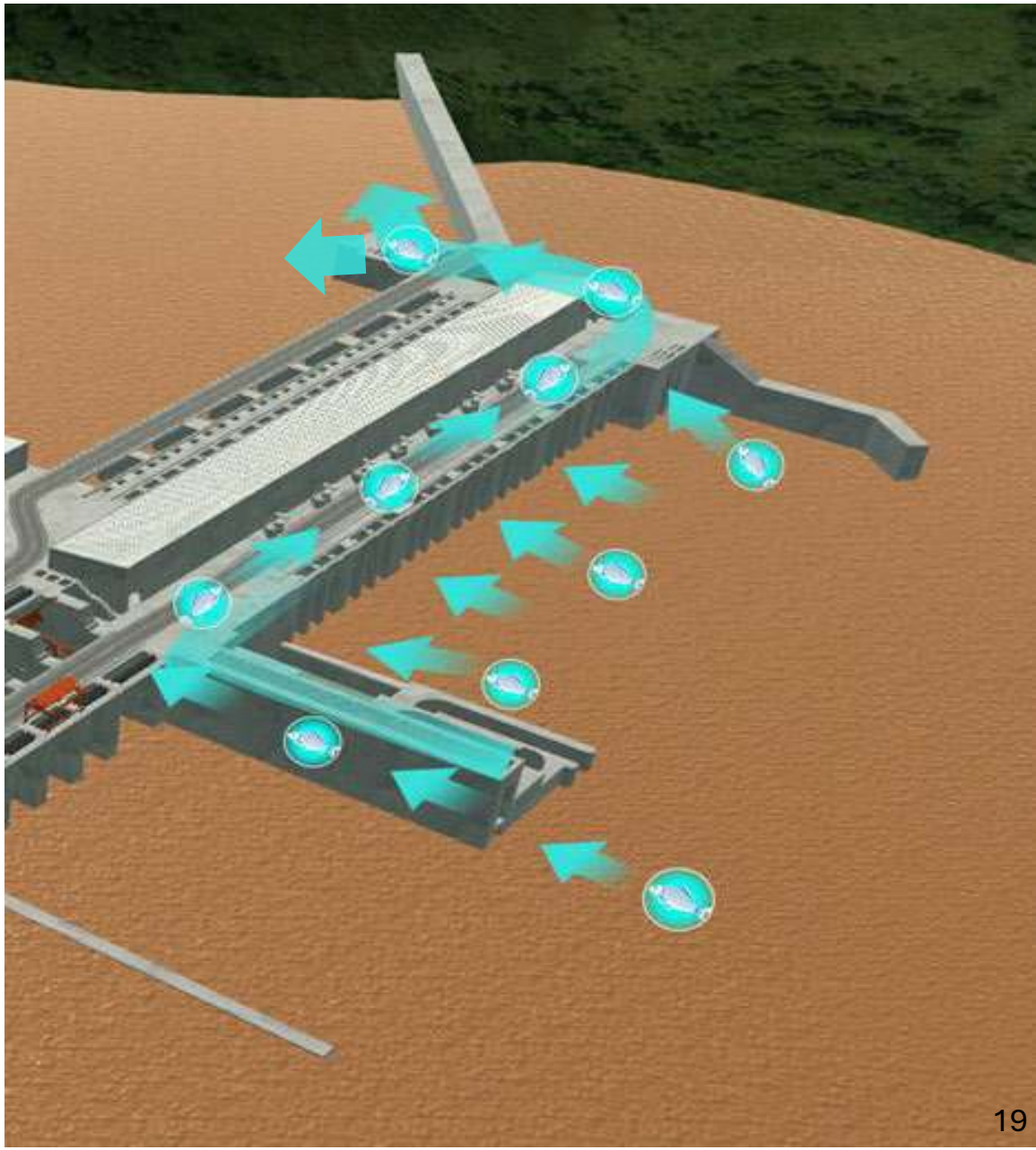
Two fish locks

Moveable screen floor

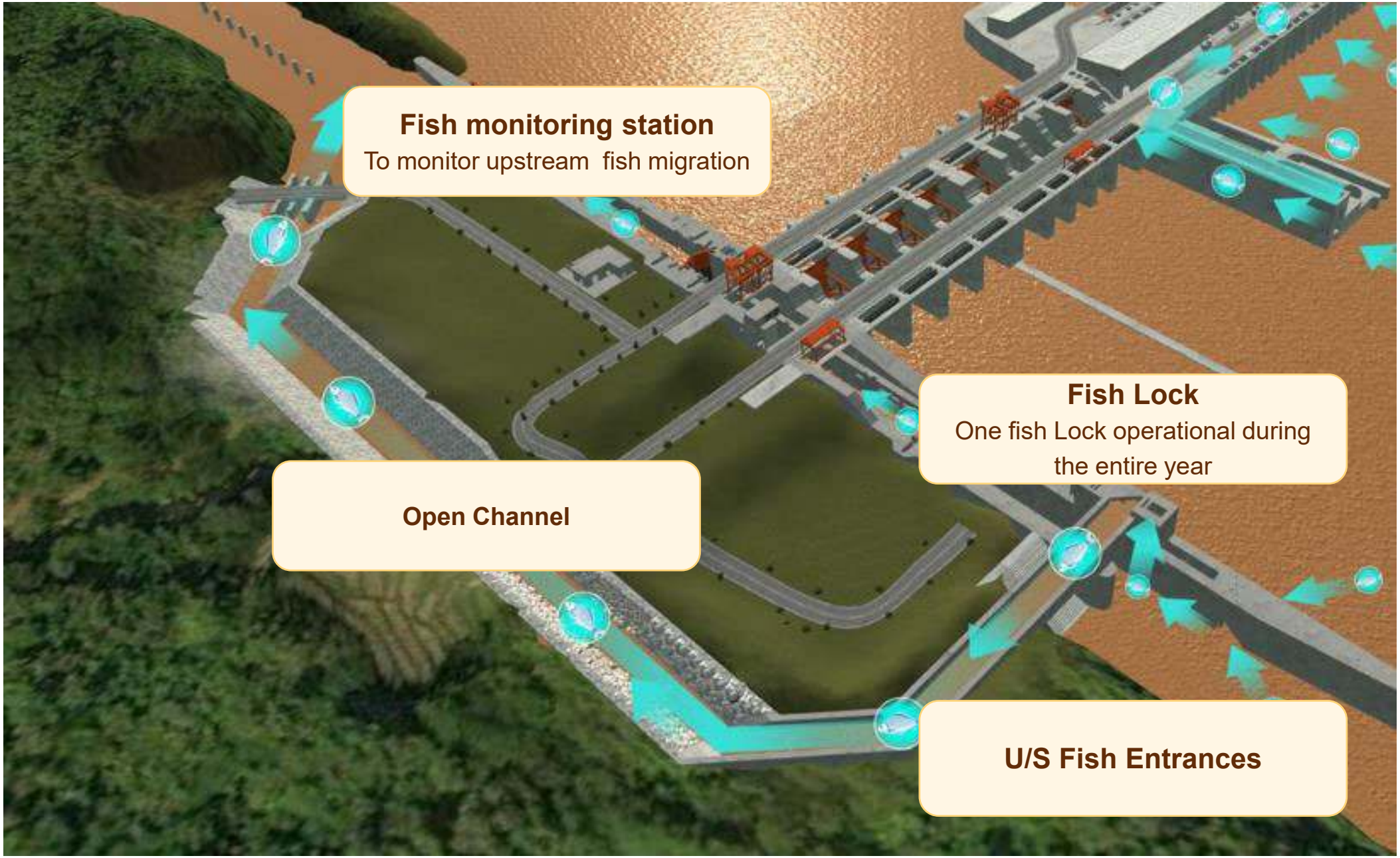
Fish crowder to «move» fish into the fish lock

Fish Monitoring station

Fish monitoring station at the outfall structure towards the reservoir



Fish passage – Additional U/S passage at right bank



Fish passage – Main Downstream Migration Facilities

Entrances

Totally **14** entrances provided along U/S face of Powerhouse above power intakes . The size of each entrance is 2.5 x 3.0 m

Fish Collecting Galleries

Along the entire length of the powerhouse
Connects all entrances
Leads to the downstream chute at right pier

Downstream Chute

Continuous operation of D/S chute

Fish monitoring

Fish species survey from local fisherman catch

Jan 2023 – Dec 2024

1

Investigate the sampling station

Two stations at downstream and Two stations for upstream area

2

Contact local fisherman

Local staff contact to fisherman for collecting fish sample

3

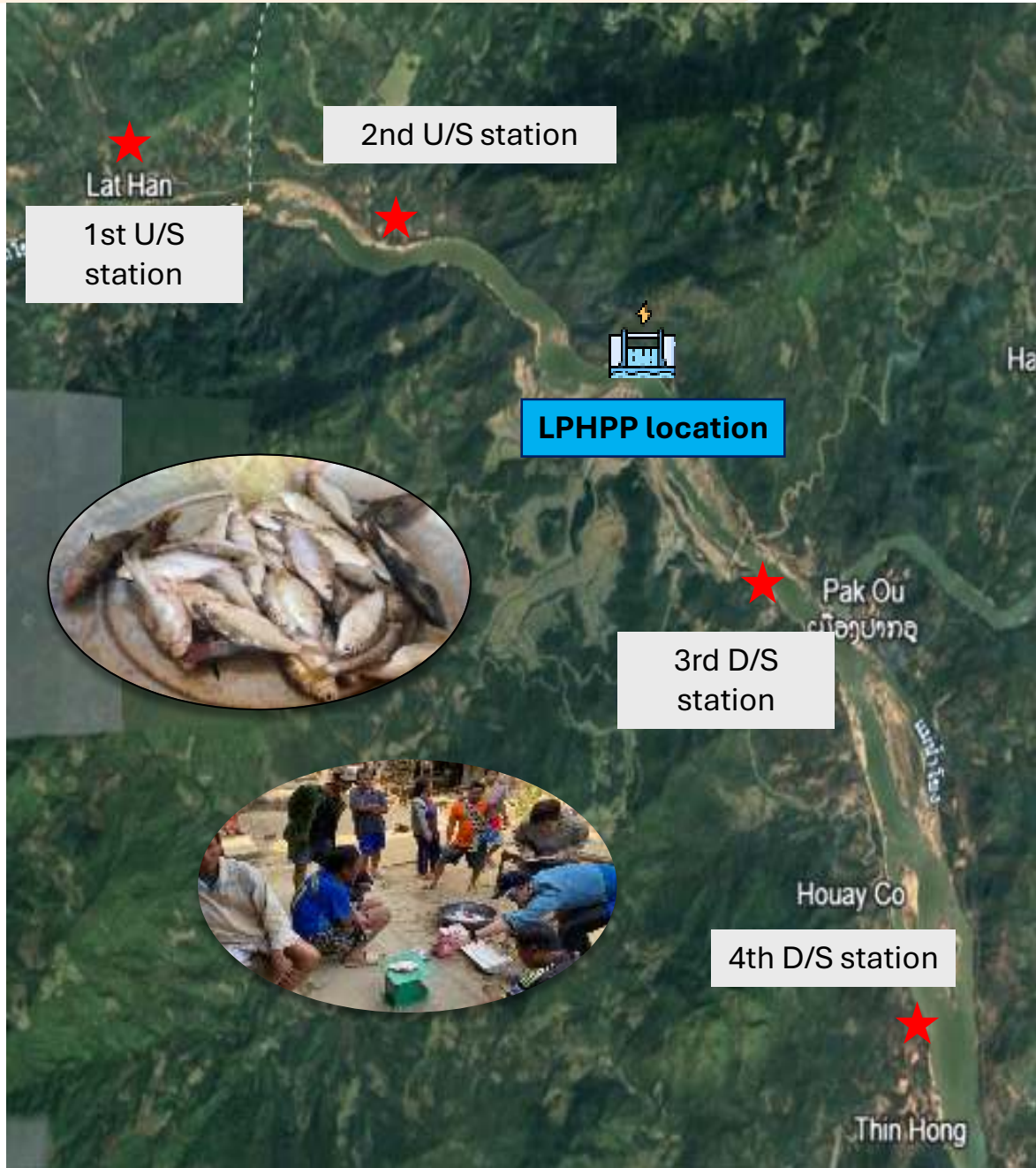
Fish collecting by local fisherman

Gill net, fishing rod etc., have been used for fish collecting

4

Fish Identification

Species, Weight, Length will be identified and recorded by LPCL's staff



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Thank You