

Opening Lao floodplains for migrating fish: not just an uphill battle

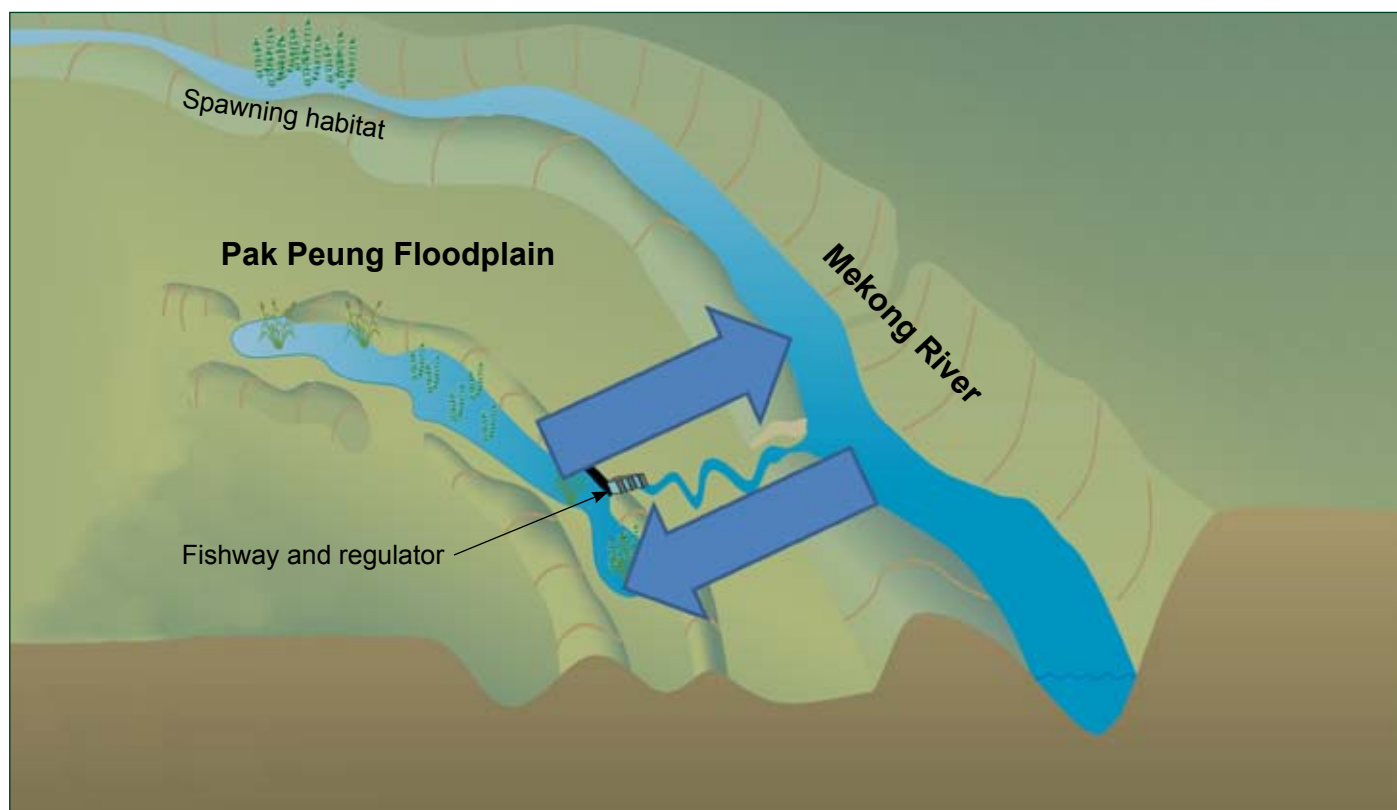
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Pak Peung Wetland in the central Lao province of Bolikhamxay is about to become the first "holistic" wetland fish-passage demonstration and evaluation site in the Lower Mekong Basin. It promises to greatly enhance the ability to determine the environmental, social and economic benefits from best-practice irrigation and fish-passage works.

Regulators and other water-control structures on rivers and wetlands support irrigated cropping on floodplains and are critical to the economic and social well-being of communities of the Lower Mekong Basin (LMB). There is also potential to

retrofit these infrastructures with mini-hydropower to generate electricity and support renewable energy generation and associated economic activities. But an unintended impact of this irrigation infrastructure is that it can block fish migrations and prevent fish accessing important breeding and feeding habitats.

Without safe passage, as much as 70 percent of fish species in the LMB, which are highly migratory, are under threat. Protecting fish passage in the region is of significant social and economic importance as it the largest freshwater fishery in the world. More than 80 percent of rural households are involved in capture fisheries and 26 percent of the protein intake of people



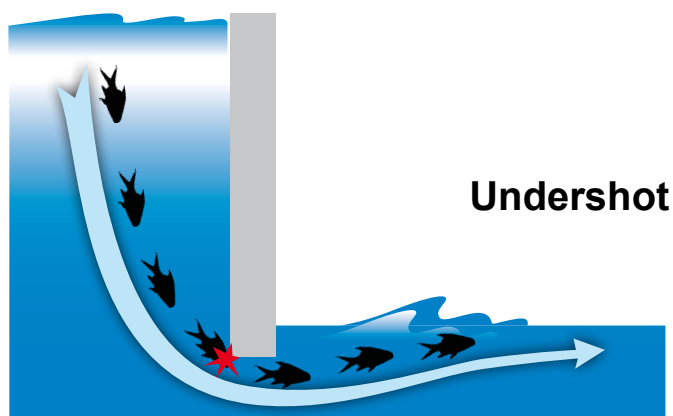
Location of fishway and regulator on the Pak Peung Floodplain in the central Lao province of Bolikhamxay

ILLUSTRATION: LA TROBE UNIVERSITY/MURRAY-DARLING FRESHWATER RESOURCE CENTRE



Fyke net at the Pak Peung regulator. Over a 24-day period, fyke and larval netting collected more than 100 species moving out of the wetland.

PHOTO: CRAIG BOYS



Undershot



Overshot

Pilot experiments in Australia and Lao PDR show that more fish are injured or killed by undershot weirs (above left) than overshot weirs (above right). Overshot weirs are particularly effective if a deep plunge pool is maintained below the weir.

ILLUSTRATION: CHHUT CHHEANA

in countries such as Lao PDR consists of fish. There is therefore no doubt that if regional development is to occur in the LMB, environmental sustainability needs to be a key objective, with progress in agricultural production being closely aligned with best-practice fish passage and fishery management.

In 2010, the Australian Centre for International Agricultural Research (ACIAR) completed research into the effectiveness of low-cost fishways on small barriers in central Lao PDR of up to six metres (see *Catch and Culture*, Vol 17, No 1). Since that time, ACIAR has continued to support research efforts that have seen barriers to fish passage prioritised and the construction of a permanent fishway at a wetland in Pak Peung in Bolikhamxay Province, Lao PDR (see *Catch and Culture*, Vol 18, No 1). The fishway is exceeding expectations, with more than 170 species of fish already passing the structure into productive breeding, nursery and feeding habitats, well in excess of the expected 100 species.

But what goes up, must come down

The recent focus on restoring upstream passage in the LMB has been associated with little or no activity to protect fish during critical downstream migrations on their return to the Mekong River. At the Pak Peung fishway site, like thousands of others across the LMB, fish require return passage out of wetland habitats and back to the main river where they continue to contribute to the fishery.

Unfortunately, downstream passage out of wetlands is being substantially impacted by

water-control structures across much of the LMB. When fish do pass these regulator gates, the hydraulic conditions are often extreme and cause injury or death. This was investigated by a recent ACIAR-funded study that used controlled experiments at the Nong Teng Hatchery site in Vientiane. The study showed that in some cases up to 90 percent of fish can be injured or killed on their downstream passage through undershot wetland regulators. A positive finding, however, is that proper infrastructure design and operation can play a huge role in mitigating these impacts. Similar research from the Murray-Darling Basin in Australia has shown that significant numbers of larvae and small-bodied fish can be killed if they pass weirs where water is discharged underneath a gate ("undershot" weir design). Far fewer fish die when they pass structures that discharge water



"Fish-friendly" overshot LayFlat gates like this one have successfully replaced undershot gates at more than 50 sites in Australia. These gates are also known as tilting weir gates and results in fewer fish injuries or deaths.

PHOTO: AWMA PTY LTD?



These gates at Pak Peung use the undershot method of discharge that results in high levels of fish injury and mortality. Unfortunately, most irrigation structures throughout the Lower Mekong Basin use this method. To reduce fish injury and mortality, fish-friendly overshot gates are being retrofitted upstream from these gates. Refurbishment is due for completion in mid-2016.

PHOTO: CRAIG BOYS

over a crest ("overshot" design) – particularly if a deep plunge pool is maintained below the weir.

Completing the migration cycle

A four-year project is now underway that plans to refurbish the existing Pak Peung regulator to ensure it meets best-practice standards for fish passage and the maintenance of wetland levels for irrigation. As a preliminary step to this, the project is also quantifying the biological, ecological and socio-economic benefits of downstream fish migration out of wetlands using fish-passage technology. Australian engineers will assist refurbish the gates, and have recently met with district irrigation officers to discuss water-control and fish-passage needs at the site. The refurbishment is due for completion midway through 2016.

By upgrading Pak Peung regulator gates for safer downstream passage, Lao PDR will showcase the first holistic, wetland fish-passage demonstration and evaluation site in the LMB. For the first time

in the region, both upstream and downstream fish passage remediation works can be viewed side by side and the environmental, social and economic benefits evaluated.

Regardless of how "fish-friendly" irrigation infrastructure may be, it will not receive broad adoption if it does not perform its primary role – to effectively regulate water for irrigated agriculture. A primary objective of ongoing research is therefore to ensure that best-practice gate design is evaluated from both a water-control and fish-passage perspective. By ensuring the needs of irrigators and migrating fish are being met, the ultimate aim is to support agriculture and protect fish passage, therefore supporting agriculture and fisheries economies.

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