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Passage of aquatic species

The impact of hydropower schemes on the annual migration of significant fish species needs to be adequately assessed. Where warranted, fish ladders or other mitigation strategies can be utilised to facilitate fish passage.

Issue

A number of fish species require passage along the length of rivers during at least short periods of their life-cycle. In places the migration of fish is an annual event and dams and other instream structures constitute barriers to their movement. In some cases the long-term sustainability of fish populations depend on this migration, and local economies can be reliant on sustainable fish populations as a source of income.

A number of fish species migrate from freshwater to saltwater and back again at various stages of their life cycle. Salmon and eels are examples of anadromous fish, in which the adults migrate upstream to spawn and the young descend downstream. Catadromous fish are species such as eels, which do the reverse – adults migrate downstream to spawn and the young migrate upstream. Other freshwater fish move within river systems such as up tributary streams to spawn. Depending on their location, dams can present barriers to these species for migration in both upstream and downstream directions. As well as creating direct physical barriers, flow and water quality characteristics of the natural river regime which may act as migratory cues.

Whilst hydroelectric schemes can block passage of native or commercial fish, they can also facilitate passage of pest species into uninfested waterways through water transfers around the system.

Where species are of commercial value, considerable dollars have been spent by the hydropower industry in facilitating the passage of these fish both upstream and downstream of dams, although not always with success.

Management

The passage of fish is an issue that needs to be considered during the design and planning stage of proposed developments (dam site selection), and adequate consideration should be given to appropriate mechanisms for their transfer. It is essential that adequate research is dedicated to understanding the aquatic ecosystem that will be affected, as each is unique, and solutions for one scheme can rarely be directly applied to other schemes.

Fish ladders or mechanical fish elevators are often focussed on as a management measure to assist fish with their upstream migration, although these can be of mixed success. Catch and release programs are commonly undertaken for both the upstream and the downstream migration, and hatcheries and re-stocking programs are employed where necessary. Fish hatcheries can help maintain populations of native species that thrive within the reservoir but cannot successfully reproduce.

To address downstream migration issues, many measures have been employed to divert fish away from the turbine intake to safer passageways, such as purpose built channels or pipes going around or through a dam wall. Diversion methods can include fish screens, strobe lights, sound or air bubbles, and electrical fields. Assisted cues, such as changes in water chemistry or operational conditions, can be utilised, as can controlled releases or additional spill at appropriate times of year. Improvements in turbine, spillway and/or overflow design can minimise fish injury or mortality on the downstream migration.

Ultimately, the mitigation solutions to address fish passage risks needs to be considered within the context of an over-arching cost-benefit analysis for a hydropower scheme.