



# PIANC WORKING GROUP 127 - InCom

## TERMS OF REFERENCE

### FISH PASSAGE

#### **1 HISTORY**

Improving fish passage through navigation locks, dams and weirs is recognized as an important way to restore river ecosystems. Weirs and dams are a major cause for the decline and extirpation of populations of migratory fish species on a worldwide scale. Declines in aquatic habitats and abundance of large river fish since the construction of many navigation control structures have only recently been quantified in large rivers.

Many commercially important and endangered species require mitigation measures like fish passes and artificial breeding programs to maintain existing population levels. Facilities to enhance upstream as well as downstream migration at navigation dams are of utmost importance since they can provide access to large areas of spawning sites, juvenile habitats or feeding grounds. Programmes to restore longitudinal connectivity to navigable waterways have been employed in Europe and in parts of North and South America, Asia and Australia.

A variety of approaches have been used to enhance fish movements over dams including both structural and non-structural measures. However, many measures are not or only partly successful because of poor construction of fish passes and insufficient knowledge of the requirements of target species to maintain healthy populations (e. g. number or percentage of upstream migrants needed to reach spawning sites, area of spawning sites and juvenile habitats needed for a fish population, etc.). Quantifying the success of these measures has been less consistent, particularly for those measures addressing passage for warm-water fish species.

#### **2 OBJECTIVE**

The objective of this Working Group is to summarize existing knowledge on effective fish passes for upstream migration as well as on special devices for a safe downstream migration in waterways. The requirements of migratory fish species to maintain or re-establish healthy populations in waterways and adjacent waters will be defined. The Working Group shall elaborate common definitions, standards, and measurements to restore or maintain longitudinal connectivity for migratory fish species using structural and non-structural fish passage strategies at locks and dams while minimizing detrimental effects on navigation.

### **3 MATTERS TO BE INVESTIGATED**

Detailed information will be assembled on the following subjects:

- Structural and non-structural fish passage methodologies that restore longitudinal connectivity in waterways. Identify new types of structures as well as reviewing existing installations.
- Effective bioresponse monitoring techniques for quantifying the success of fish passage structures on large rivers.
- Biological and hydraulic computer simulation techniques for predicting the effects of fish passage structures on fish behaviour and determining the hydraulic effects of fish passage structures on navigation.
- Requirements of migratory fish species on connectivity, habitat availability, etc. to maintain or re-establish healthy populations in waterways.
- Computer simulation techniques to predict the effects of enhancing longitudinal connectivity, habitat availability and quality, fisheries related mortality, etc. on population size of important target species (salmonids, sturgeons, shads, etc.).
- Examine comparative cost and economic benefit of installations taking into account size of river and height of dam.

### **4 METHOD OF APPROACH**

The Working Group will evaluate existing fish passages for upstream and downstream migration and monitoring methods for effectiveness and lessons learned. It will determine design parameters for desirable head differential, current velocity, depth, gradient, length of pools and riffles, resting areas, methods to add hydrodynamic diversity, flow, location, operational and maintenance impacts, flood impact and costs for the fish passage.

Non-Structural alternatives include: increased open river conditions and assisted fish lockage.

Structural alternatives include: rock ramps, technical fishways, modified gate bays, notches through overflow spillways with and without rock ramps, fish lifts and other methods. To aid in selection of effective programmes to maintain, re-establish or enhance populations of migratory fish species in waterways by improving connectivity as well as by other means like enhancing essential habitats, computer simulation methods will be examined.

### **5 SUGGESTED FINAL PRODUCT OF WORKING GROUP**

The goal is to document existing practices for the current state-of-the-science for fish passage that will aid designers when building new or modifying existing locks and dams. These structures will increase the opportunity for fish passage through dams, thereby increasing access to upstream habitats and helping to facilitate restoration of self-sustaining populations

of native migratory fish populations. The final report will also compare longitudinal connectivity with other ecological factors to evaluate under which circumstances improvements of connectivity can be expected to result in improvements of fish stocks of target species.

## **6 DESIRABLE DISCIPLINES OF MEMBERS**

Members of the Working Group should include practitioners from the private sector or government agencies and researchers with experience in addressing the fish passage issues outlined in these TOR. Disciplines may include, but are not limited to:

- Civil/Structural Engineers
- Hydraulic Engineers
- Fisheries Biologists
- Aquatic Ecologists
- Computer Simulation Modellers
- Fish Migration Monitoring Specialist

## **7 RELEVANCE TO COUNTRIES IN TRANSITION**

Participation in, and products of this Working Group, would be useful for Countries in Transition to effectively develop river systems for navigation (and use of hydropower) while maintaining the longitudinal connectivity and thus parts of the native fish population including stocks of commercially important species.

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