

## **ShIRBD Freshwater Morphology POMS Study**

### **Progress Update in support of SWMI Report – June 2007.**

#### **THE RATIONALE FOR THE STUDY**

Morphology pressures have been identified across many Member States as exerting significant pressures which might result in waterbodies failing to achieve their WFD status objectives. These pressures or engineered modifications can either directly remove habitat or indirectly change the natural structure or flow of our waters.. The Irish Article 5 analysis for freshwater morphology considered the following activities:

#### **Rivers**

- channelisation, dredging and river straightening,
- flood protection and embankments,
- impounding,
- water regulation; and
- intensive land use.

#### **Lakes**

- inlet channelisation and dredging,
- flood protection and embankments,
- impounding; and
- intensive land use.

Within Ireland's Article 5 Report freshwater morphology pressures accounted for placing 1720 (or 38.5%) of river water bodies at risk or probably at risk and 135 (or 18.1%) of lake water bodies at risk or probably at risk.

Whilst the extent of activities exerting freshwater morphological pressures has been identified during the initial characterisation risk assessment, morphological quality is not systematically monitored in Irish rivers and lakes so there remains uncertainty as to the actual impact of these morphological pressures.

Specifically with regard to historical channelisation and dredging works and ongoing maintenance dredging there is uncertainty as to the long term impacts of these activities which the Article 5 report stated would be investigated post initial characterisation.

## **THE OBJECTIVES**

The primary objective of the Freshwater Morphology POMS Study is to resolve the uncertainties identified in Ireland's Article 5 report in relation to the two key freshwater morphology assessments (i.e. channelisation and intensive land use).

The second objective is to develop a management framework and assessment methods with respect to freshwater morphology so that:

- Rivers and lakes can be monitored and classified;
- Alterations to rivers and lakes can be managed and controlled
- Steps can be taken to ensure the physical condition of rivers and lakes can support Good Ecological Status

## **THE APPROACH / METHODOLOGY**

The study terms of reference, as agreed by the PCG, are being progressed on the basis of 6 work packages as follows:

- Work Package 1 – Data Collection, Literature Review and Benchmarking
- Work Package 2 – Channelisation Recovery Assessment
- Work Package 3 – Identification of Pilot Waterbodies
- Work Package 4 – Identification of Fieldwork Requirements
- Work Package 5 – Fieldwork and Risk Assessment Refinement
- Work Package 6 – Tool Development

An additional work package was appended to the scope and approved by the Freshwater Morphology POMS Steering Committee in November 2006:

- Work Package 7 – Barriers to Migration Assessment

### **WP1: Data Collection, Literature Review and Benchmarking**

The literature and benchmarking review is the first step towards executing the study brief. It is necessary to review the work other Member States, in particular our Eco Region neighbours, are undertaking in addressing the need to monitor the physical condition of rivers and lakes. The main objective is to identify the scope of relevant ongoing research and to draw upon significant findings with respect to best practice measures, monitoring, regulatory measures and decision support tools for regulators.

## **WP2: Channelisation Recovery Assessment**

The significance of fish as a biological indicator of morphological quality is widely recognised. The objectives of *Work Package 2 - Channelisation Recovery Assessment* are to use fish stock and other biological data to establish recovery rates of fish and other populations following channelisation works and to establish the effectiveness of habitat enhancement measures. The tasks for this assessment are as follows:

- Collate datasets and reports from fisheries agencies relating to fish stock recovery post dredging activities and post habitat enhancement schemes.
- Incorporate recovery datasets for other relevant indicators e.g. Q system time series for designated watercourses (i.e. designated for watercourse maintenance by drainage authorities)
- Establish the effectiveness of enhancement measures.
- Establish timescales for biological recovery rate post morphology activities. Assess both capital dredging schemes and maintenance dredging activities.

## **WP3: Identification of Pilot Waterbodies**

In preparation for fieldwork taking place within this POMS Study it is necessary to identify pilot waterbodies that would represent the range of scenarios to be investigated. Since channelisation and intensive land use pressures were the key activities identified by the Article 5 risk assessment, pilot waterbodies should be selected so that these pressures can be isolated from others such as pollution and abstraction to ensure meaningful field survey results. Furthermore, high status sites, sites which are provisionally designated as "Heavily Modified" and sites subject to overgrazing pressures should be included.

## **WP4: Identification of Fieldwork Requirements**

Methodologies for assessing freshwater morphology have been researched and developed both nationally and across Europe. The methods range from field surveys along 500m reaches (rivers) or a portion of the shoreline (lakes) to the utilisation of detailed aerial imagery and GIS technology to assess physical condition remotely. Irish research previously undertaken appraised several methods used across the world and made recommendations for their application to Irish rivers. In particular, the role of remote sensing as applied nationally was recommended. This work package aims to identify the different methods that should be trialled and implemented to refine thresholds, classify rivers and lakes, and contribute to an overall management framework. This also includes the collection of biological data.

### **WP5: Fieldwork and Risk Assessment Refinement**

Approximately 50 waterbodies, containing approximately 100 sites are to be selected for fieldwork surveys throughout the life of the POMS Study. The aim of this work package is to collate and analyse field data to determine the relationship between observed impact of morphology pressures on supporting elements and ecology status to identify thresholds for “sustainable” levels of pressure which are consistent with supporting good status in waters. Using this, the risk assessment results reported to Europe under Article 5 can be refined. Furthermore, it is necessary to trial the techniques identified in Work Package 4 with a view to applying the most appropriate methods to Irish rivers and lakes.

### **WP6: Tool Development**

Based on reapplication of revised thresholds, areas needing restoration measures (or possible revised pHMWB designations) can be identified and included in the first River Basin Management Plan.

A management response framework for the EPA and Local Authorities must be developed to enable river and lake classification, monitoring and to assess future developments which might impact on their physical form. This will be a GIS tool which encompasses the recommended field and remote sensing techniques within an overall process.

It is desirable that the management framework adopted in Ireland is harmonised with our Ecoregion neighbours, in particular with Northern Ireland. This is in keeping with the ethos of WFD.

### **WP7: Barriers to Migration**

Following consultations with Regional Fisheries Boards, the impact of in stream structures impeding or delaying the passage of migratory species was highlighted as important in the assessment of risks associated with Freshwater Morphology. Work Package 7 was subsequently added to the POMS Study brief.

A Case Study on the Nore Catchment in Counties Kilkenny and South Tipperary is being undertaken by the Southern Regional Fisheries Board. This involves walkover surveys of each river in the catchment and risk assessing each structure in terms of its impassibility.

The remit of this Work Package is to use this Case Study to develop a protocol by which other RBDs can assess their catchments with respect to barriers to migration.

## **PROGRESS TO DATE**

### **WP1: Data collection, literature review and benchmarking**

The first Literature Review report has been completed and approved. This work package will be continuously revisited throughout the life of the POMS Study as further studies and research documents are published.

In terms of best practice measures, we are also reviewing what is already being done in Ireland to improve how practises such as watercourse maintenance are carried out. It is clear that the focus of this work has already become more environmentally friendly. For example, practices such as one-bank working minimise impact on the river channel when clearing them to minimise flood risk in rural areas.



**Modern Approaches to River Maintenance**

### **WP2: Channelisation Recovery Assessment**

Central Fisheries Board are playing a significant role in this work package 2 and are undertaking collation and analysis of their electrofishing datasets for selected case studies.

Electrofishing data has also been collected within Northern Ireland. A fisheries specialist has been appointed to analyse and interpret both fish and associated biological data to assess the

recovery trends in channelised rivers. This work package is due for completion in September 2007.

### **WP3: Identification of Pilot Waterbodies**

This work package has been completed. A range of pilot waterbodies have been selected for fieldwork using the following criteria:

- OPW drainage scheme sites categorised as “probably at risk” due to channelisation but all other pressures were insignificant
- OPW drainage scheme sites categorised as “probably at risk” or “at risk” due to intensive land use pressures but all other pressures were insignificant
- High Status Sites but with observed deviation from this due to physical changes in previous Irish research
- Provisionally designated Heavily Modified Water Bodies
- Sites with high vegetation quality
- Sites where enhancement measures have been implemented

### **WP4: Identification of Fieldwork Requirements**

Given the uncertainty associated with the Article 5 risk assessment for channelisation, the highest risk applied was “probably at risk”; this now needs to be refined. The fieldwork requirements have been identified following a review of the methods being trialled in the UK.

The method developed by the Scottish and Northern Ireland Forum for Environmental Research (SNIFFER) is currently being used in Scotland as a tool to support regulatory decisions on engineering activities on rivers. This method is called the Morphological Impact Assessment System (MImAS). A similar tool of the same name is under development for lakes. The North South Share Project (NS SHARE) facilitated the development of a second morphological assessment method called the Rapid Assessment Technique (R.A.T). Lastly, the River Habitat Survey method is an established procedure used in the UK to record and monitor habitat modifications. All three methods are field based; however the MImAS tool incorporates the field survey within an overall regulatory process.

GIS based methods to extract significant features such as habitats; vegetation and sedimentation from aerial imagery are being developed for Ireland. If such methods can be developed to meet WFD monitoring and classification requirements, and to track morphological change over time, they could be fundamental to rolling out morphology assessment on a national basis.

### **WP5: Fieldwork and Risk Assessment Refinement**

The fieldwork programmes have been developed as follows:

***Fieldwork 2006:***

- Trial of the MImAS, R.A.T and RHS field techniques on 35 sites selected from the list of pilot waterbodies to determine if and how they can be applied to Irish rivers.
- Corresponding biological quality surveys using EPA's macroinvertebrate kick sampling method for comparison with morphological results.

This programme has been completed including morphology fieldwork, data analysis, validation against expert judgement, and evaluation.

***Aerial Survey, Feature Extraction and GIS based analysis:***

- Capture of detailed aerial imagery with a minimum ground resolution of 25cm and associated GIS analysis to determine the feasibility of predicting morphological status remotely.
- Each pilot waterbody identified in Work Package 3 at the beginning of the Study has been selected for image acquisition.

This contract is underway with the majority of aerial images now captured. A rapid selection tool has been developed to aid the extraction of relevant morphological features which can inform the development of a remote sensing method.

***Fieldwork 2007***

- Classification of "likely high status" sites throughout Ireland to determine if the morphological condition supports a "high status" classification
- Further collection of morphological pressure data for use in the refinement of risk assessment thresholds with respect to channelisation and intensive land use pressures
- Expand biological surveys to include macrophytes as well as macro-invertebrates

This contract is to be procured in June 2007 with fieldwork taking place during July and August 2007.

**WP6: Tool Development**

It is intended that the findings of the various fieldwork surveys, including the aerial imagery acquisition will inform the development of a management response framework for freshwater morphology.

So far, preliminary work on developing methods to assess the type of a channel in terms of its flow regime, altitude, slope and geology has begun. This will provide an underlying basis for the overall tool development.

#### **WP7: Barriers to Migration Assessment**

The technical Steering Committee approved this additional work package for inclusion within the POMS Study in November 2006. Since then a series of meetings have been held with Central Fisheries Board and representatives from the Southern and South Western Regional Fisheries Board to discuss how the case study being undertaken on the Nore Catchment can be applied nationally.

Following consultation with members of the Steering Committee and Central Fisheries Board it has been recommended that the use of GIS technology and national electrofishing data can be used in combination with the Nore Catchment survey information to generate a method by which catchments that require further investigation can be identified. This is now under development.

#### **ANY EARLY INDICATIONS OF RESULTS / CONCLUSIONS.**

The outcome of the first phase of fieldwork is that the R.A.T method is the most appropriate technique for classification. It is most conducive to being undertaken alongside biological surveys which will be used to monitor ecological status. The R.A.T trials identified the approach as a “bottom – up” approach whereby the impacts to flow regime and vegetation are recorded and used to assign morphological condition.

However, it is important to undertake assessments that will allow the change in morphological condition to be monitored over time and assess the pressures that can impact on morphological condition. This is necessary to control the physical changes imposed on our waters and to prevent deterioration in overall status. Early indications suggest that a pressure based assessment such as MImAS is most appropriate for this. Further investigative fieldwork will concentrate on collecting the right data that will enable the refinement of thresholds and inform tool development.

The analysis carried out so far on the detailed aerial images has provided a useful insight into the capabilities of remote sensing capabilities for predicting morphological condition. Metrics such as slope, valley confinement, sinuosity, sedimentation, vegetation structure, plan form, flood plain connectivity and riparian zone features can be found using a combination of the aerial images and GIS data.



It is expected that a remote sensing approach will be recommended for national application, with appropriate field assessment techniques employed for classification, and to collect data that will continually ground truth, update and inform the remote sensing tool over time.