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Automated Fish Identity and Counting System Improves Water Management

New cost-effective system provides high accuracy, near-real-time data needed for balancing water and fisheries resources

What Is The Problem?

A growing number of water resources facilities are managed within constraints associated with the presence of certain endangered fish species. These constraints are based on compromises between water and hydroelectric power demands and fisheries needs. As an example, water releases from dams are sometimes set to meet Endangered Species Act requirements when certain numbers of a type(s) of fish are present. In many cases, the timing of these releases is primarily based on historic dates instead of actual fish counts. Also, the need for facility modifications, such as fish screens and fish ladders, is often determined by identifying and counting fish.

Conventional methods for identifying and counting fish are by direct observation or performing manual counts from video images. These methods are labor-intensive and expensive, and can be inaccurate or unfeasible to conduct in turbid waters.

What Is The Solution?

With a private Brazilian Company, ByVision, Reclamation is adapting an automated fish identifier and counting system for use in the field. The Automated Fish Imaging (AFI) system will be capable of identifying and counting any fish species. It will identify up to four different species of fish at once and count the number of each species as they pass through a manmade or natural waterway on a near-real-time basis. The AFI system consists of a camera, lighting, digital video recorder or computer, and computer software. Continuous video images are analyzed using motion detection to filter out images without fish present. Images with fish present are then analyzed using computer vision software to count and identify fish (Figure 1). Based on initial tests, the AFI system species identification accuracy is 90-95%.



Figure 1 - Curimba image captured from video acquired at Igarapava Dam Fish Ladder, Minas Gerais, Brazil

Furthermore, the AFI system can be operated even with fish passage through turbid water where conventional methods cannot be employed or accuracy is relatively low.

Reclamation is currently working with ByVision, who owns the proprietary rights to the computer vision software component of the AFI system, to develop and commercialize an AFI system that can be adapted to many suites of species and ecosystems. Reclamation will maintain a technical assistance role, insuring the development of the AFI system in a manner that will meet water managers' needs.

What Are The Benefits Of This Solution?

The AFI system will provide an inexpensive and accurate way to identify and count fish. This will provide near-real-time information to water managers on the numbers of fish species of interest present that are needed to better manage water resources. Increased water deliveries and power production will result, and the associated demands will be met more reliably. Adverse fisheries impacts will be reduced resulting in economic, ecological, and cultural benefits.

Where Have We Applied This Solution?

The fish imaging hardware and motion detection software were deployed recently at a new fish ladder owned by Idaho Power. This system provided a test of the components needed to get large, consistent, and well-lit images and achieve a fish-image only data stream. The fish species targeted for passage by the fish ladder (rainbow trout) were effectively imaged and the motion detection software worked properly.

Future Development Plans

Reclamation will continue to provide technical biological information for adapting the AFI system software and tailoring it to distinguish fish species that are important to Reclamation operations (salmon, steelhead, etc.). Differentiation between adult and juveniles of certain species is also planned.

More Information

Additional information on the AFI system and other Reclamation Fisheries and Wildlife Resources Group projects is available at: <http://www.usbr.gov/pmts/fish/Capabilities.html>

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Collaborators

Reclamation's Science and Technology Program, Federal University of Minas Gerais, Brazil, ByVision, and the Fishery Foundation (CA).