

Monitoring migrant eel passage with a PIT tag system

Jacques Boubée

National Institute of Water & Atmospheric Research Ltd
PO Box 11-115 Hamilton
New Zealand
ph: 64 7 8567026
fax: 64 7 8560151
j.boubée@niwa.co.nz

www.niwa.co.nz

Abstract

The passage of migrant eels at a hydro-dam was monitored using a comprehensive PIT tag system. Results showed that migrant eels passed over the weir when it spilled during floods, but were able to find and use a small diameter bypass at other times. This suggests that a combination of spilling and small diameter bypasses would provide safe downstream passage over hydro-dams for a significant number of migrants. Some migrant eels continued to impinge on the screens or entered the intakes. Trials on means of preventing this, including electrifying the screens, are planned.

Introduction

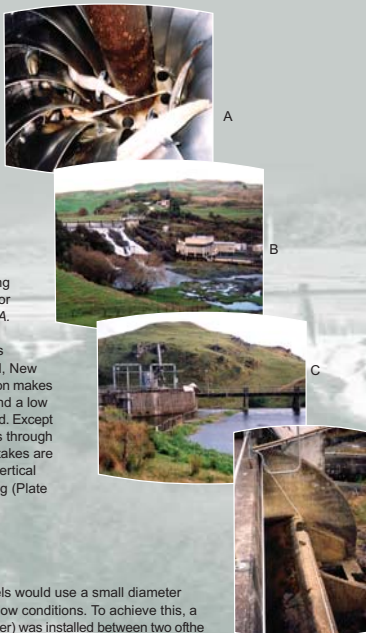
After spending several decades in fresh water, eels become sexually mature and need to migrate to the sea to spawn. Hydro-dams can block this migration, and many eels either impinge on the intake screens or are killed when passing through turbines (Plate A).

To develop ways of providing safe downstream passage for eels (*Anguilla australis* and *A. dieffenbachii*) trials were undertaken at Wairere Falls Power Station, North Island, New Zealand (Plate B). This station makes use of a natural waterfall and a low weir to provide a 19.6 m head. Except during floods, all flows pass through the turbines. The turbine intakes are currently protected with a vertical trash rack at 30 mm spacing (Plate C).

Aim

Aims of the study:

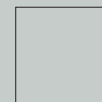
- Determine if migrant eels would use a small diameter bypass during normal flow conditions. To achieve this, a bypass (100 mm diameter) was installed between two of the intakes.
- Determine what proportion of migrant eels pass over the weir during floods.



Methods

In autumn 2002, 93 migrant eels were tagged with 32 mm PIT tags and a large antenna installed around one of the six 7 m wide x 2 m high spillways (Plate D). A net placed over the outlet of the small diameter bypass was used to monitor eel use.

The next year, antennae were installed around all six spillways, on the outlet of the bypass and in the two tailraces. After testing revealed that electrical interference reduced the detection range of 32 mm PIT tags to just 50 mm, in autumn 2003, 50 mm PIT tags were surgically implanted in 48 large migrant eels (> 1.2 kg). Another 41 smaller migrant eels were tagged with 32 mm transponders. As before, a net was placed over the outlet of the bypass to monitor use by eels.



50mm transponder used in 2003.
Note: glass case replaced with epoxy.

Results

- 544 migrant eels were recorded using the bypass in 2002, nine of which were tagged (Fig. 1A).
- Another eight tagged eels were recorded passing over the spillway equipped with an antenna (Fig. 1A).
- 31 (29 x 50 mm PIT and 2 x 32 mm PIT) tagged eels were recorded going over the spillways in 2003 (Fig. 1B).
- Out of the 553 migrant eels recorded using the bypass, none were tagged (Fig. 1B).
- Five small and one large tagged eel were recorded in the tailrace (presumably dead).
- Most of the eels passed over the spillways at night, but during high flows some were recorded passing in daylight (Fig. 2). The number of eels using each spillway was relatively even (Fig. 3).

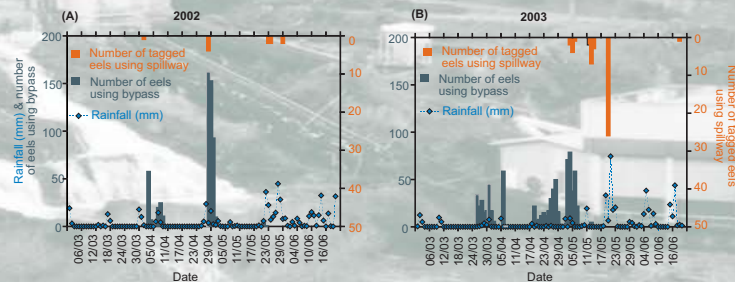


Figure 1. Migrant eels detected at Wairere Falls Power Station. (A) 2002 (B) 2003

Figure 2.

Diurnal pattern of tagged eels passing over the Wairere Falls Power Station spillways in 2003.

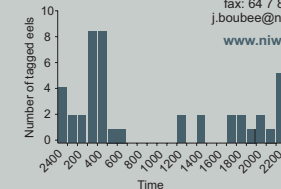
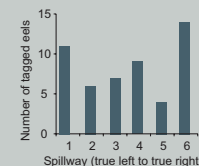


Figure 3.

Number of tagged eels recorded passing each of the six spillways in 2003.



Conclusions

- The PIT tag system successfully tracked migrant eel passage at Wairere Falls Power Station.
- When the weir is overtopped, a significant number of eels are able to pass downstream.
- At other times, eels searched for an outlet and were able to find and utilise the small diameter bypass.
- As eels search the entire dam face for an outlet, there may be advantages in installing more than one bypass.
- Provided eels can be excluded from intakes, a combination of spilling and small diameter bypasses would allow safe downstream passage for a significant number of migrants.

Well maintained narrow trash racks are currently the most effective means of protecting intakes, but preliminary observations indicate that it may be possible to prevent eels from entering intakes by electrifying the screens. Work in this area is planned.

Acknowledgments

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