Native freshwater fish habitat restoration

CASE STUDY 5

Fish habitat device trials
in the Waikato Region

In many rural and urban streams, channel straightening and removal of native riparian vegetation has greatly reduced fish habitat diversity and cover, while regular stream maintenance (especially aquatic weed removal) provides ongoing ecosystem disturbance. This case study summarises the results of several different fish habitat devices trialled to enhance instream habitat in degraded waterways.

Location:

Trialled in urban and rural Waikato streams.


Longfin eel

photo © EOS Ecology


Giant kōkopu

photo © EOS Ecology

Objectives:

- Rural and urban streams were historically managed primarily for drainage and conveyance of flood waters, with aesthetics and freshwater habitat often a secondary consideration in the urban environment.
- Several within-bank and within-channel fish habitat devices have been trialled by Waikato Regional Council, with the broad goal of enhancing habitat and native fish diversity.
- A common objective of fish habitat structures is to provide a safe refuge for a variety of native fish, with a focus on species that are typically nocturnal or cover-reliant, e.g., longfin eels (*Anguilla dieffenbachii*), shortfin eels (*Anguilla australis*), giant kōkopu (*Galaxias argenteus*), and bullies (*Gobiomorphus* spp.).

Application

instream cover

This case study is part of a series providing information about techniques used to restore native freshwater fish habitat in New Zealand rivers and streams.

Some techniques are still in their trial phase, and not all techniques have been confirmed effective. Resource consent or other permissions may be required to undertake works. We recommend you seek advice before applying any of these techniques onsite.

Department of Conservation *Te Papa Atawhai*

Restoration project team:

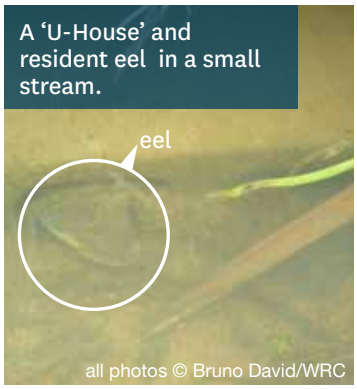
Waikato Regional Council *Te Kaunihera ā Rohe o Waikato*

Stream & River Consult

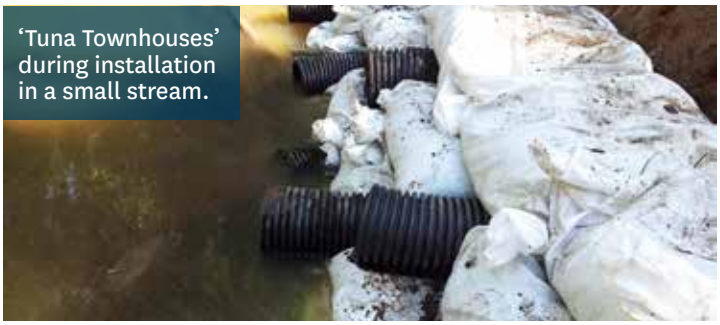
This information was summarised from a draft report provided by Bruno David, Waikato Regional Council. The pallet shelters shown here were designed by Stream and River Consult in Belgium.

Restoration methods:

Rear view of the 'U-House'.



A 'U-House' and resident eel in a small stream.



'Tuna Townhouses' during installation in a small stream.

'Kōkopu Condo' under construction. The white rods with red tape are attached to antennae installed to detect condo use by fish implanted with Passive Integrated Transponder (PIT) tags.

Kōkopu Condos at the base of the engineered bank are 2 m long and have no chamber.

The bottom view of an instream fish shelter, made from a recycled wooden pallet, prior to installation.

An installed instream fish shelter, covered with coconut matting, plants, and large rocks.

1.

The concrete cinder block and Novaflo™ 'U-House' is particularly suited to small streams where there is limited opportunity to dig up the banks, and is placed either in the bank or instream. It is constructed of two concrete cinder blocks joined end to end and with a 160 mm diameter Novaflo™ pipe threaded through the cinder block holes and doubled over into a 'U' shape). The U-shape bend is an important component of the design, as it provides a potential escape route for small fish that may be predated by larger fish.

2.

Multi-storey 'Tuna Townhouses' can be used in stream banks where space permits. These are similar to the basic cinder block U-House, but comprise longer U-shaped lengths of 110 mm diameter Novaflo™ positioned on the outside of bends between layers of construction material (instead of cinder blocks), such as riprap, gabion baskets or earth bags. The purpose is to provide multiple habitat portals across a range of flows.

3.

The larger scale 'Kōkopu Condo' comprises a thicker-walled 450 mm diameter FarmBoss™ pipe connected to a concrete chamber buried in the bank approximately 6 m from the flowing stream. The purpose is to provide more space for fish and act as a larger refuge. Kōkopu Condos have also been used without chambers, with geotextile fabric at the bank end to prevent sediment entry. The example shown has 2 m long FarmBoss™ pipes embedded just above a protective rock toe that are crammed with wood to provide a range of different sized nooks and crannies for different native fish species.

4.

In addition to within-bank habitat devices, recycled pallets have been modified to create low profile in-channel fish habitat. The Pallet Shelter has wooden pegs added at the entrance to promote juvenile fish survival by restricting access by large fish and birds. It is weighed down with paving stones and held in place with a central reinforcing steel rod with a top pin. Unlike the other habitat devices, the Pallet Shelter has a natural bed below it (i.e., the bottom pegs and added edges rest on the stream bed). The addition of coconut matting and soil on top means plants can be added to the Pallet Shelter, increasing its habitat value, as well as helping it blend in to the stream environment.

Monitoring methods summary:

Fish occupancy of the habitat devices has been assessed using several methods, including visual observation using underwater photographs and video, and use of Passive Integrated Transponder (PIT) tags.

Outcomes:

Observations using underwater cameras revealed that four out of six cinderblock U-Houses were occupied by eels within one week of deployment in Gibbons Creek, in urban Hamilton. Bullies were also observed using the U-Houses. However, over two years, half of the Gibbons Creek U-Houses became occluded with sediment, rendering them unusable by fish.

Larger-diameter Kōkopu Condos placed in Managakotukotu Stream were also well-used by eels. Figure 1 shows that eels frequented the Kōkopu Condo throughout the monitoring period in 2013 to 2015. In total, six different PIT-tagged eels explored the device since its instalment, although one individual longfin eel used the device far more frequently than any other tagged fish, accounting for 60% of PIT reader records.

PIT-tagging revealed repeated use of within-channel Pallet Shelters placed in Gibbons Creek and Bankwood Stream in the Waikato. As with the U-Houses, shelters were occupied soon after installation, with tagged fish detected in two of the four shelters within two weeks of installation. Thirteen checks over a 9 month period in 2014–2015 showed the Pallet Shelters were frequently used by giant kōkopu, shortfin eel, and longfin eel (Table 1). Monitoring revealed that both the top and bottom parts of the shelters were repeatedly used by tagged eels and giant kōkopu. As with the Kōkopu Condos, repeated use of the Pallet Shelters by particular individuals was common. However, habitat use was not exclusive; one of the shelters recorded the presence of two tagged fish occupying the shelter at the same time on five of the checks (i.e., 39% of the 13 checks).

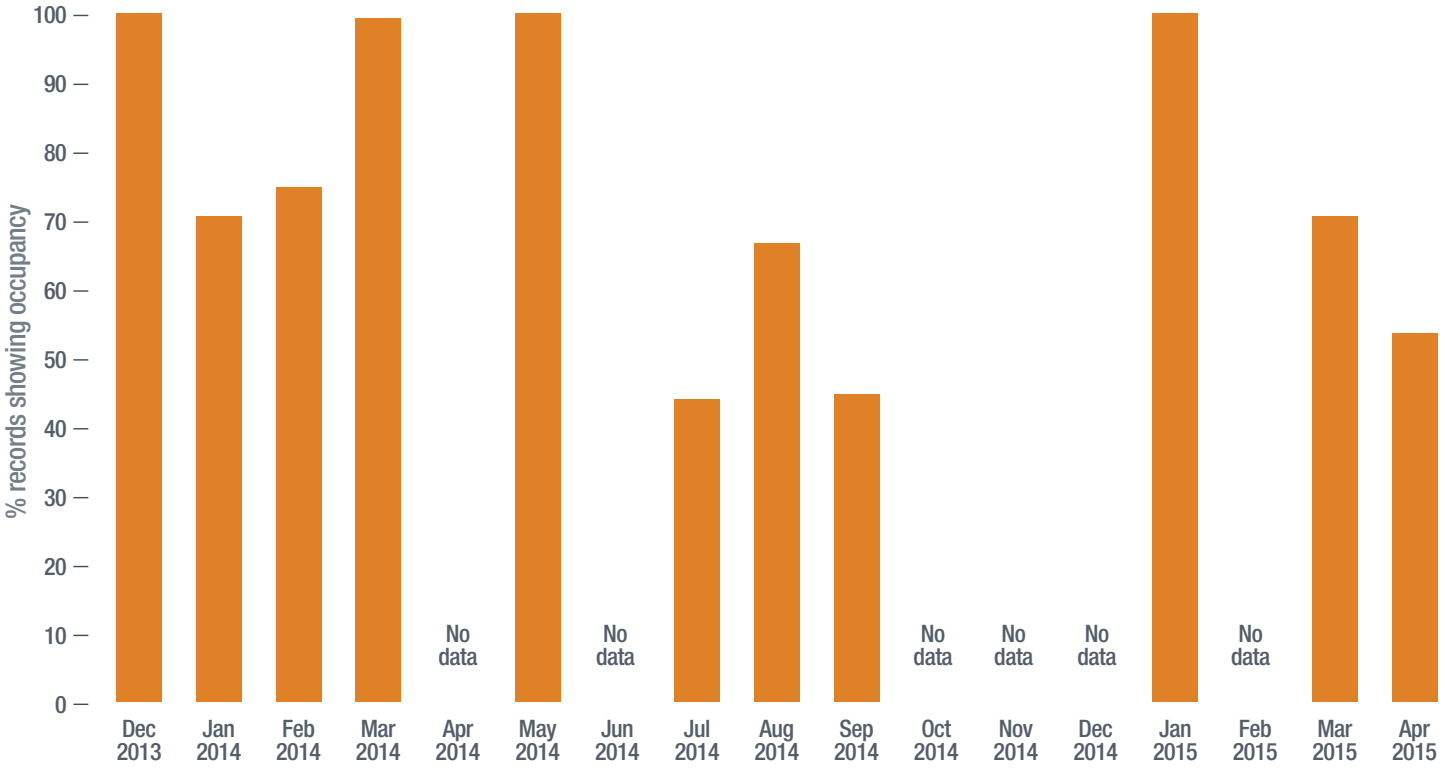


FIGURE 1: Occupancy history of the Mangakotukotu Stream Kōkopu Condo.

TABLE 1: Occupancy history of Pallet Shelters in Gibbons Creek from August 2015 to May 2016 (n=13 checks).

FISH TAG NUMBER	SPECIES	DETECTIONS	OCCUPANCY
512571	Longfin eel	3	23%
557638	Shortfin eel	6	46%
553510	Giant kōkopu	2	16%
536616	Giant kōkopu	7	54%

An eel using a cinderblock U-House in an urban stream

OTHER LEARNINGS:

- Sediment blockage was an issue for some habitat devices, such as the lower tiers of the Tuna Townhouses. Device placement needs to carefully consider natural patterns of stream erosion and deposition. Sediment blockage could be reduced by placing boulders or similar features immediately upstream to increase scour and reduce sediment deposition around the device opening. Alternatively, more devices could be added to ensure a subset of openings are always accessible for use.
- All relevant design components need to be clearly labelled in the design specification. This was highlighted recently in a Christchurch urban stream, where the design specification for a cinder block and Novaflo™ habitat device did not clearly show the required bend in the pipe, so the contractor mistakenly installed them without the U-bend. Luckily, this was spotted and corrected before the new bank alignment was completed. Based on this experience, it may be helpful to clearly refer to the smaller devices with U-bends as either cinder block or townhouse-style 'U-Houses', to differentiate them from 'Kōkopu Condos', which are straight and wider.
- Numerous councils are using this technology in stream restoration settings, and habitat devices are being used as a form of mitigation in resource consents, but there is currently very little data on their overall ecological benefit or long-term maintenance requirements. Thus, while these habitat devices show considerable potential, their efficacy as a mitigation tool should not be over-sold.
- Based on the territorial and dominance hierarchy tendencies of species such as eels and kōkopu, particularly when habitat is limited, the cost of these habitat devices can be quite high for minimal 'improvement'. As such, Waikato Regional Council is now trialling wider and more complex covered bank cut outs (i.e., engineered undercut banks with natural bed) that are likely to support a greater diversity and size range of fish and habitat. They are also investigating creating a series of these more complex bank cut outs to establish whether the carrying capacity of fish in a reach can be increased. Examples of similar undercuts recently installed in Canterbury are provided in Case Study 7.
- For new and future urban subdivisions it is important to ensure that catchment hydrology models allow streams to retain natural habitat for fish, rather than replacing it with artificial habitat in streams that are not degraded.

FURTHER INFORMATION:

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www.streamandriver.com/products

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