Lessons Learnt 005

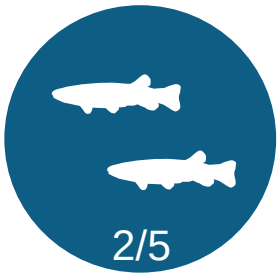
Fish Friendly Gate installation at Whakatane's Awatapu Lagoon facilitates upstream fish passage

March 2020 V2

This case study forms part of a series that provides key information and guidance about how to potentially improve a fish passage barrier in a New Zealand waterway.

While providing fish passage is advantageous to most fish, removing or remediating a barrier can also affect fish populations by introducing invasive species to new areas.

STRUCTURE TYPE



IMPROVEMENT RATING*

What was the problem?

Following the diversion of the Whakatane River (Bay of Plenty) in 1970, two top-hinged tide-gated culverts were installed at the intersection of the Awatapu Lagoon and the new river path.

The gates restricted tidal flushing, which contributed to the accumulation of weeds in the lagoon upstream. Moreover, fish accumulating below the structures indicated that the gates were acting as a barrier to fish passage.

The restriction of upstream movement of whitebait through the Awatapu Lagoon to reach Wainui Te Whara waterways was of particular concern, as juvenile fish need to get to upstream habitats to mature.

Figure 1. Top-hinged tide-gated culverts at the Awatapu Lagoon with Fish Friendly gate attachments installed (2012. Photo: Kelly Hughes)

What was the solution?

In 2012, fish friendly gates (FFG; ATS Environmental Ltd) were installed onto both tide-gates (Figure 1), with the aim of reducing upstream weed growth and facilitating fish passage upstream. The basic function of the FFG is to delay the closing of the tide gate on the incoming tides to allow fish to migrate upstream for longer. The FFG is a cantilever weighted stainless steel arm that is bolted to the head wall to hold the culvert flap open for longer and delay closing when the water is rising.

While benefits to weed management in the lagoon in the years following FFG installation were obvious, the impact of the new installations on improved upstream fish passage was uncertain.

To investigate whether the addition of the FFG improved fish passage, one of the FFGs was temporarily removed, and upstream moving fish numbers were compared between culverts with and without the influence of a FFG during September and October 2014, at a variety of tidal stages (Figure 2).

Figure 2. Large Southland sock nets were placed at the upstream end of culverts to capture any fish moving upstream (2012. Photo: Kelly Hughes)

* Improvement rating: 2/5 Some improvement in upstream or downstream passage and for some species life stages over the entire barrier

Monitoring results

Monitoring showed that the installation of FFGs allowed increased passage for common bully (*Gobiomorphus cotidianus*), freshwater shrimp (*Paratya* sp.) and whitebait, and allowed giant bully *(Gobiomorphus gobioides)* and adult inanga (*Galaxias maculatus*) passage upstream, which were not recorded in the culvert without FFGs (Figure 3).

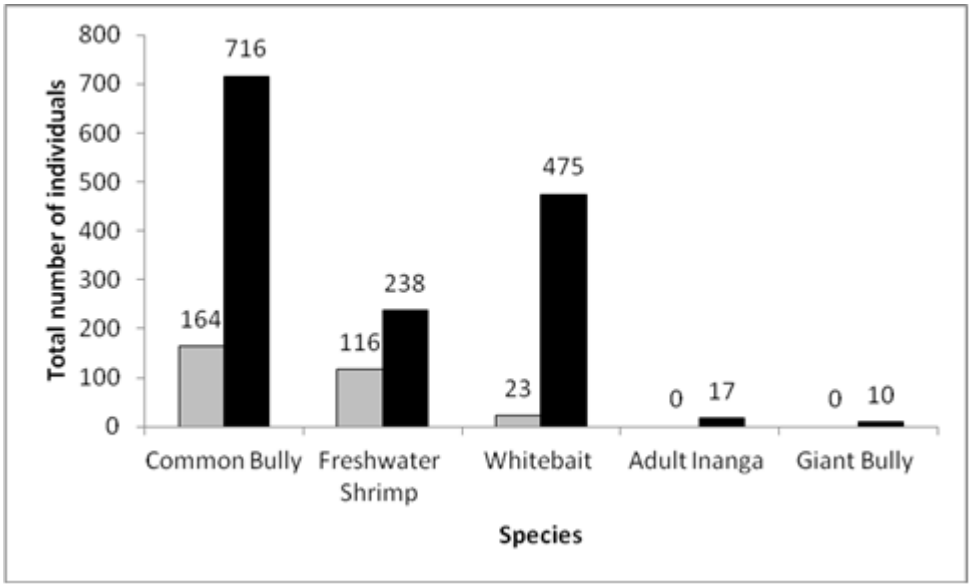


Figure 3. Total number of individuals of common bully, freshwater shrimp, whitebait, adult inanga and giant bully caught upstream of tide gates, without (light grey) and with (black) FFG influence during trapping at Awatapu Lagoon, Whakatane in September and October 2014.

Did it work?

Maybe. Despite increases in upstream fish passage, pooling of whitebait below the structures could still be observed following modification, suggesting that even with a FFG fish passage was still limited to some degree.

However, FFGs were found to enhance upstream fish passage past tide gates at this site. In particular:

- The opening duration of the tide gates was increased by 45 minutes and the opening gap doubled.
- The total number of species as well as abundance was greater. Over four times as many common bully, 20 times as many whitebait, and twice as many shrimp were able to negotiate their way upstream under FFG influence.
- Weak swimming fish species such as common bully and inanga were able to negotiate the FFG.
- Giant bully and adult inanga were only recorded successfully migrating upstream through the tide gates under FFG influence.

Downstream fish passage was not investigated in this study. However, floodgates generally are not thought to limit or restrict downstream passage as flaps are open at times when fish are likely to be moving.

Lessons learnt

1. The new tide gate operating regime and FFGs had minimal impact on flood risk (the gates original function), while having major ecological benefits.
2. Installation of FFGs are effective and can improve upstream passage of a variety of fish, including weak swimmers, past tide gates.
3. Even a small increase of opening duration and area (in this case a 45-minute increase in opening duration and doubling of opening gap) can increase upstream fish passage. FFGs are adjustable and

can be changed to increase or decrease the opening duration and gap to suit the situation and species present (Figure 4).

4. Other construction features of tide gates can influence fish passage. In this case, an overhang at the culvert mouth at low tide presented a barrier to fish despite the tide gate being open at this time. This meant that access and passage duration was reduced for upstream swimming fish. To overcome this problem, this tide gate should, ideally, be retrofitted to remove the current overhang. This will delay opening even further and remedy this fish passage issue.

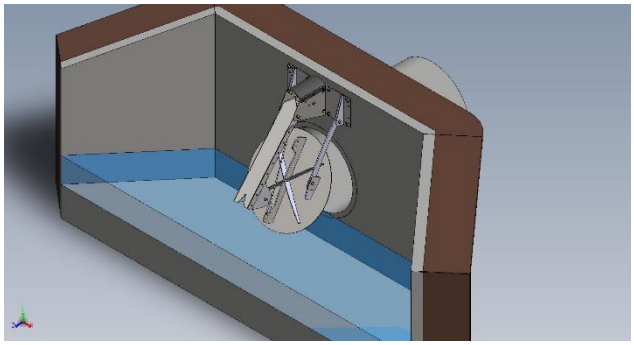


Figure 4. Fish friendly gate (FFG) attachment showing how it delays closing and stays open when the water rises (Source: Kelly Hughes)

For further information

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Reference:

Bocker, E. J. 2015: *Restoring connectivity for migratory native fish: investigating the efficacy of Fish Friendly Gates.* Unpublished MSc thesis, Massey University, Palmerston North, New Zealand.

This is a revised/updated version, original was published in July 2016.