

Earthquake Effects on the Fish and Invertebrates of the Avon River

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Presentation Summary



- » **The Upper Avon River**
 - Fishing Sites & Results
 - Invertebrate Sites & Results
- » **Earthquake Effects on the Upper Avon River**
- » **The Lower Avon River**
 - STUDY 1: INVERTEBRATES**
 - Cage Experiment
 - Cage Sites & Results
 - STUDY 2: FISH & INVERTEBRATES**
 - Survey Sites
 - Survey Fish & Invertebrate Results
- » **Earthquake Effects on the Lower Avon River**

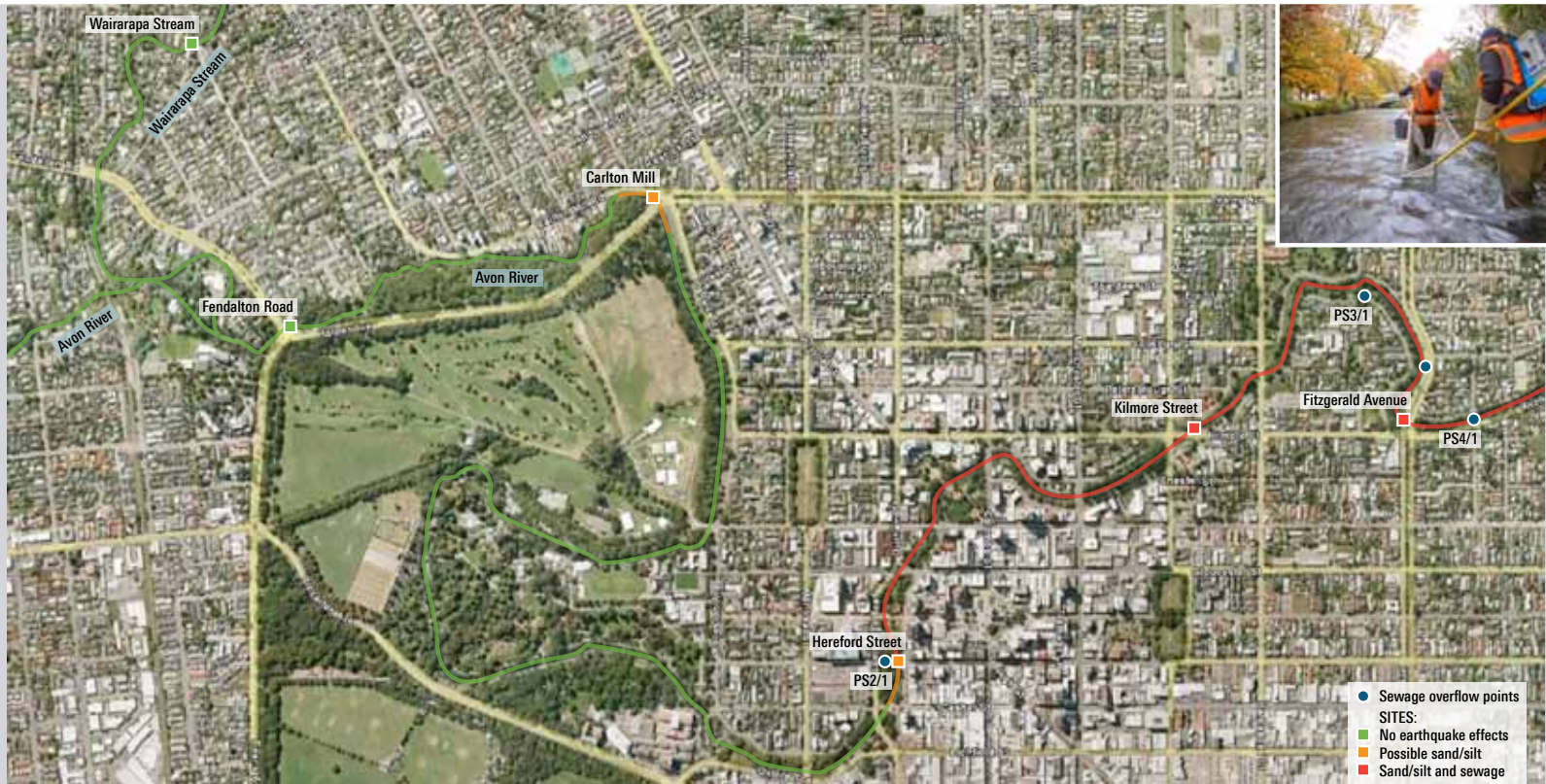
The Upper Avon River



- » **Upstream of Fitzgerald Avenue Bridge**
- » **Generally wadeable**
- » **Can use standard sampling methodologies**
- » **More pre-earthquake fish and invertebrate data than lower Avon**
- » **Enabled us to revisit sites for which we had pre-earthquake information**

UPPER AVON RIVER

Fishing Sites



- » Resampled six previously fished sites two months after 22 Feb 2011
- » Along an upstream-downstream impact gradient

UPPER AVON RIVER

Fishing Results



COMMON BULLY



UPLAND BULLY



SHORTFIN EEL



LONGFIN EEL



BLUEGILL BULLY



GIANT BULLY



BROWN TROUT



YELLOW EYED MULLET

UPPER AVON RIVER

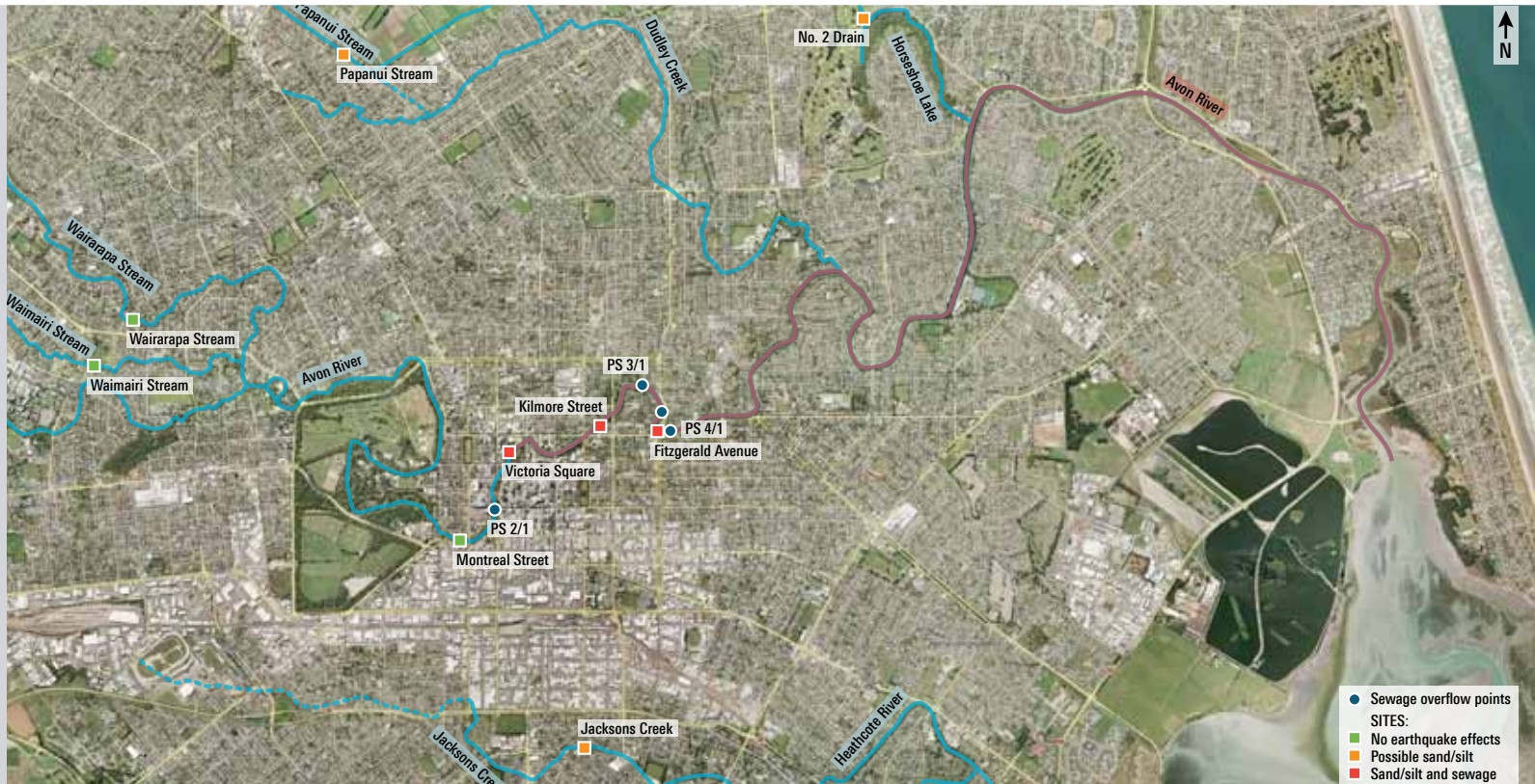
Fishing Results

- » After EQ the three CBD sites showed decline in common bully and increase in shortfin eel
 - » EQ effect or natural variation?
- » Decline in CPUE at the three CBD sites affected by silt and/or sewage
 - » Implies a reduction in fish abundance
 - » But still plenty of fish present
- » No evidence of mass reductions in abundance or species present
 - » But bluegill bully declined at Kilmore St
- » BUT our site selection was constrained by previous studies
 - » May have been more severe impacts at other locations



UPPER AVON RIVER

Invertebrate Sites



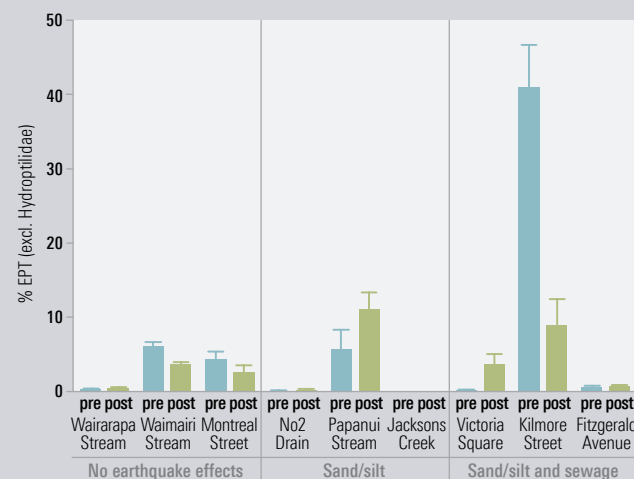
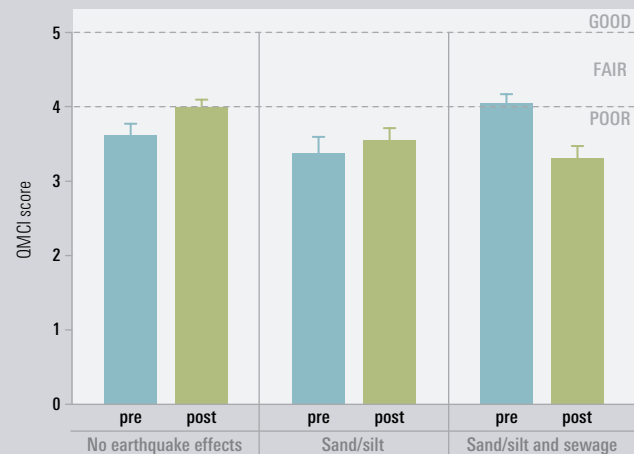
- » Resampled nine sites with pre-EQ aquatic invertebrate data two months after 22 Feb 2011
- » Three impact categories

UPPER AVON RIVER

Invertebrate Results



- » Fine sediment depth increased at all sand/silt and sand/silt + sewage sites.
- » Generally only a few cms but still enough to potentially smother habitat
- » QMCI did decline for the sand/silt + sewage impact category
- » The one dramatic change that was likely an earthquake affect
 - » Large decrease in sensitive taxa at the Kilmore St site (mostly the caddisfly *Pycnocentroides*)
- » BUT our site selection was constrained by previous studies
 - » May have been more severe impacts at other locations

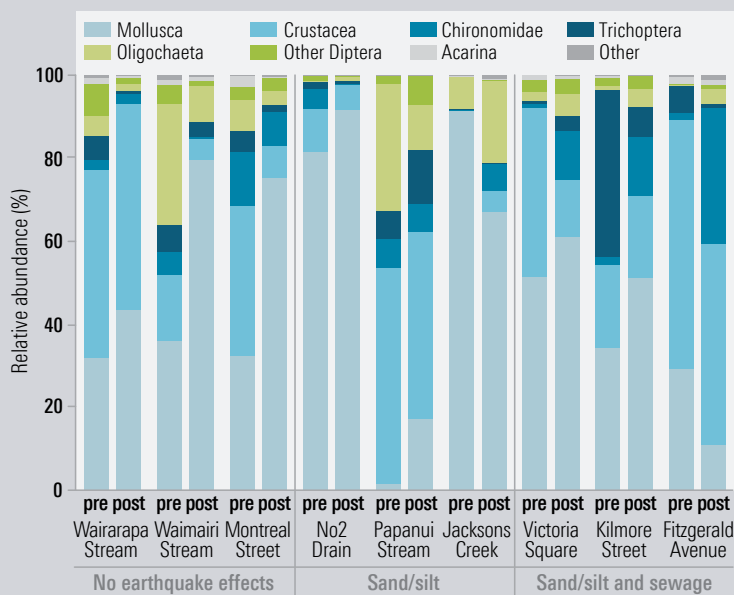


UPPER AVON RIVER

Invertebrate Results



- » Most of the community changes were relatively minor shifts in the relative abundance of the dominant taxa



Earthquake Effects on the Upper Avon River



- » No dramatic changes to fish or invertebrates present that could be attributed to EQ
- » Decline in relative abundance of bluegill bully & caddisflies at Kilmore St site
 - » result of EQ-related sediment?
- » But remember this survey constrained by location of sites
 - » did not necessarily sample the worst affected parts of the river

What About the Lower Avon River?



- » **Downstream of Fitzgerald Avenue Bridge**
- » **Generally non-wadeable & difficult to sample**
- » **Standard sampling methods of limited use**
- » **Little pre-EQ fish and invertebrate data**
- » **BUT this section received the bulk of direct sewage and sediment inputs**

LOWER AVON RIVER

Two Separate Studies



» **STUDY 1: INVERTEBRATES**

An invertebrate cage experiment 2.5 months after 22 Feb 2011

» **STUDY 2: FISH & INVERTEBRATES**

A comprehensive fish and invertebrate survey of the lower Avon in Dec 2011, 10 months after 22 Feb 2011

LOWER AVON RIVER: STUDY 1: INVERTEBRATES

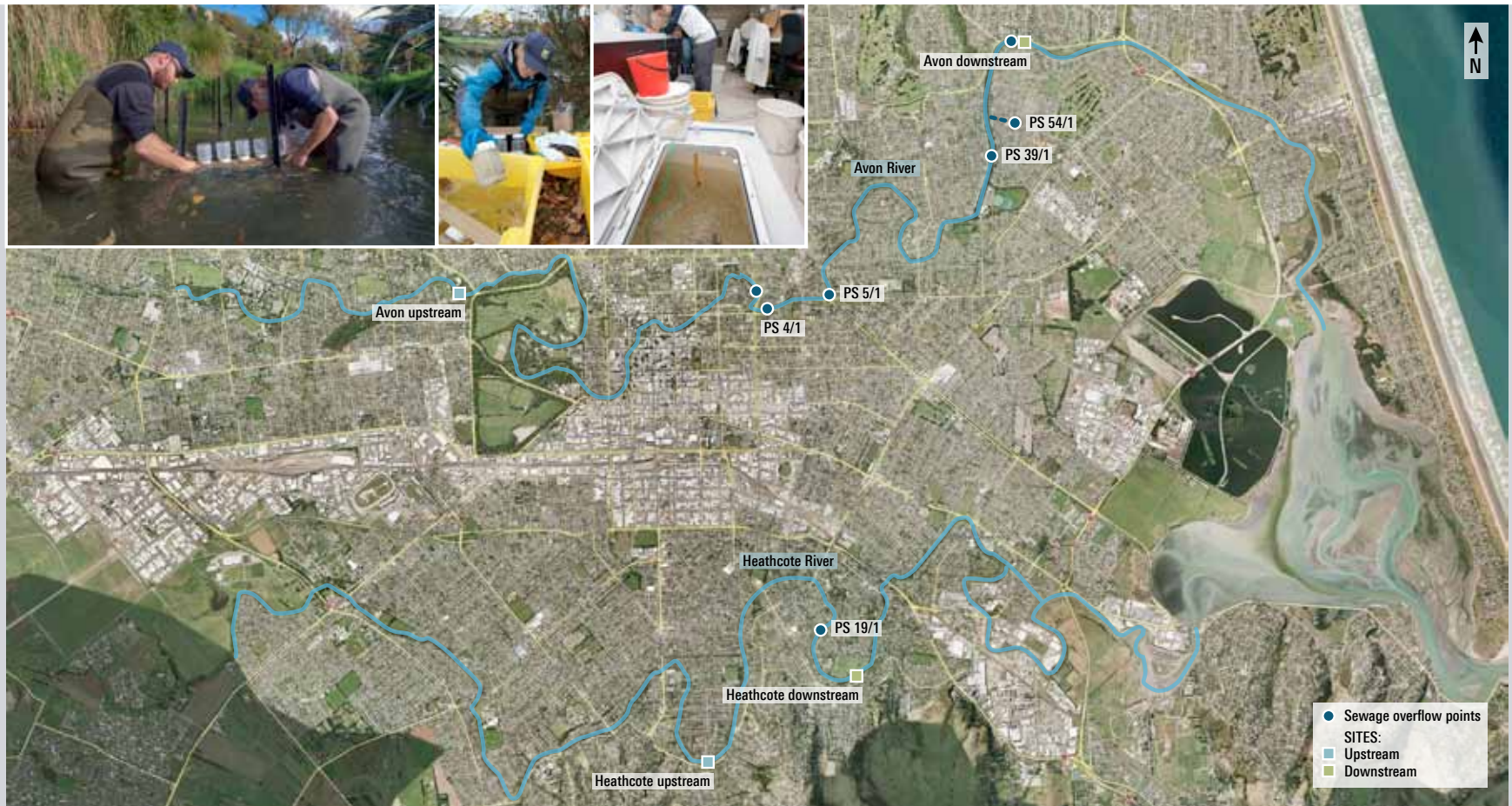
Cage Experiment

- » Compared survival of caged invertebrates upstream and downstream of sewage overflows
 - » At 2, 6, and 12 days
- » Three common animals;
Potamopyrgus (snail),
Paracalliope (amphipod), &
Paratya (shrimp)
- » Also done in Heathcote River



LOWER AVON RIVER: STUDY 1: INVERTEBRATES

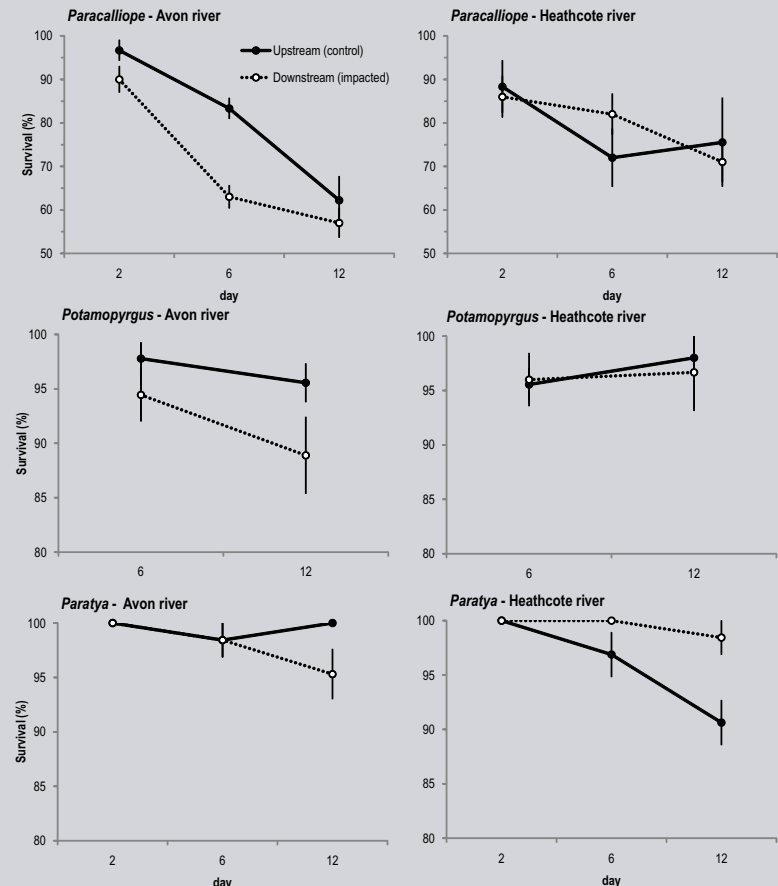
Cage Sites



LOWER AVON RIVER: STUDY 1: INVERTEBRATES

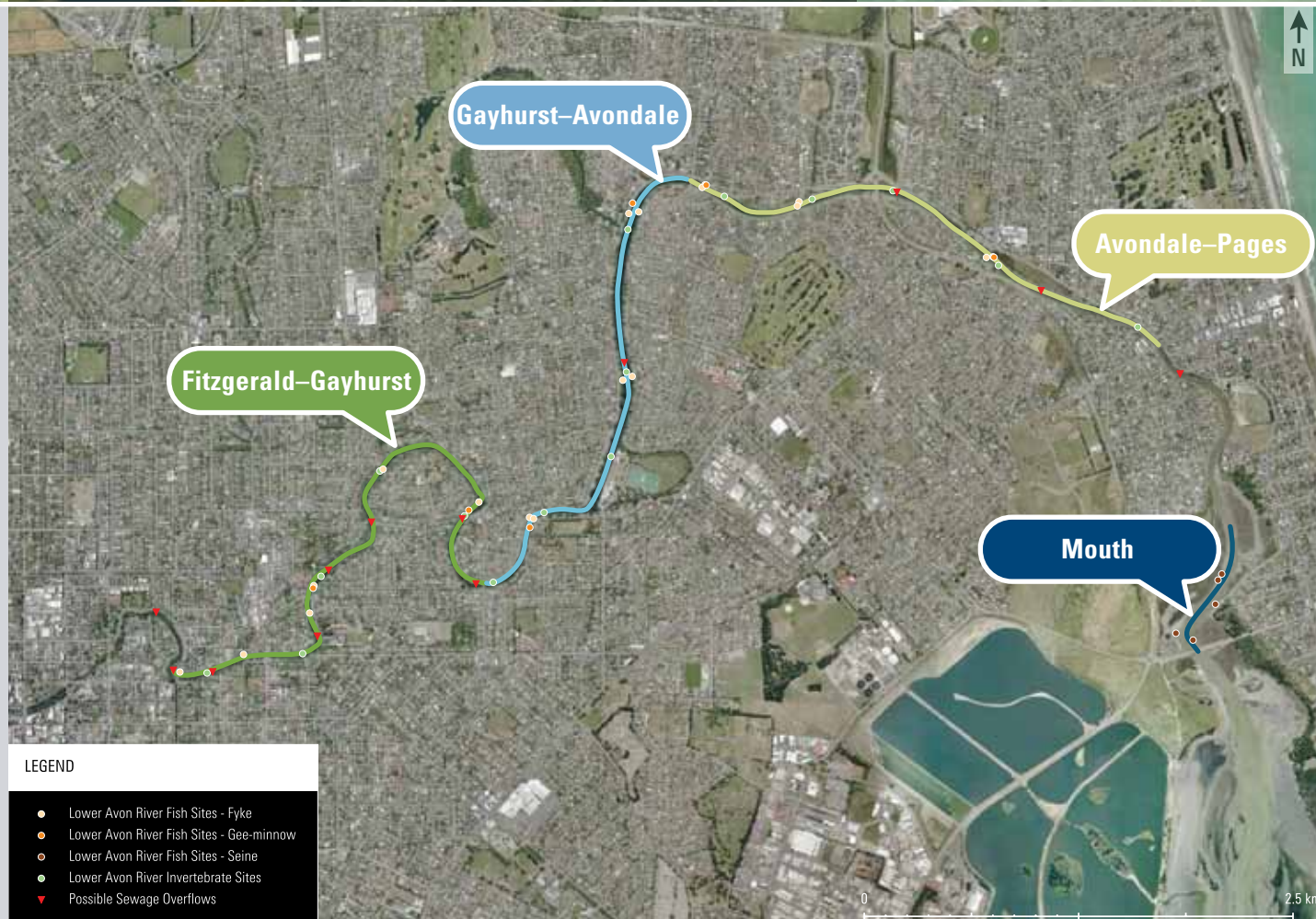
Cage Results

- » Decline in survival of all three taxa in Avon but no impact in Heathcote
- » Measured ammonia and dissolved oxygen during experiment
- » In lower Avon River
 - » Ammonia above ANZECC (2000) 99% level at times
 - » Dissolved oxygen low below 4 mg/L for most of experiment
- » Water quality impacts of sewage overflows may have stressed or killed some animals in lower River



LOWER AVON RIVER: STUDY 2: FISH & INVERTEBRATES

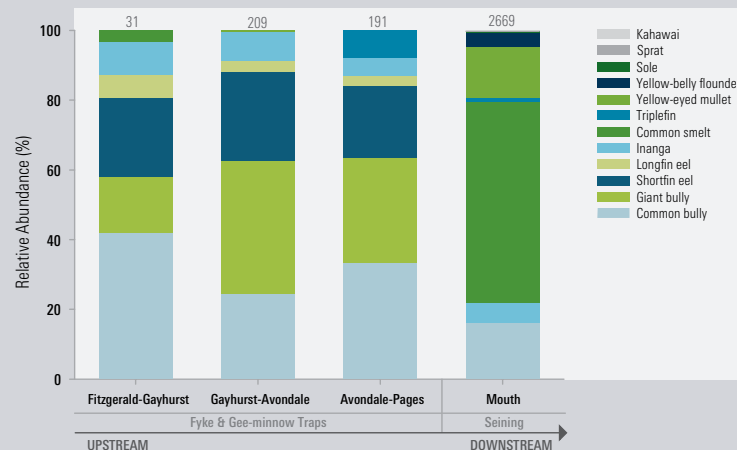
Survey Sites



LOWER AVON RIVER: STUDY 2: FISH & INVERTEBRATES

Survey Fish Results

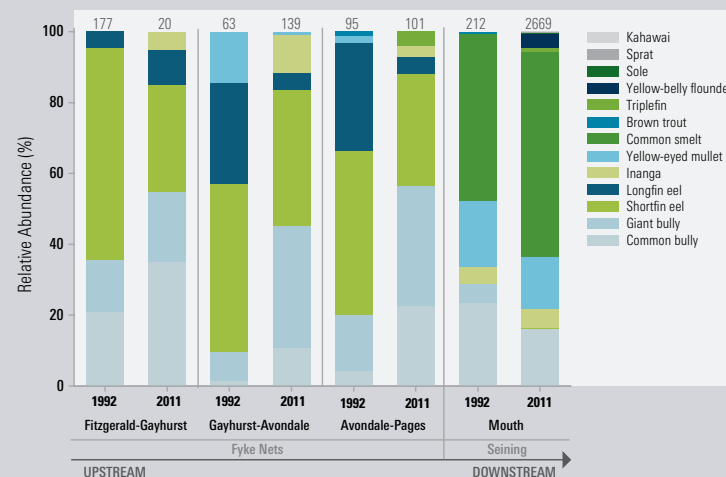
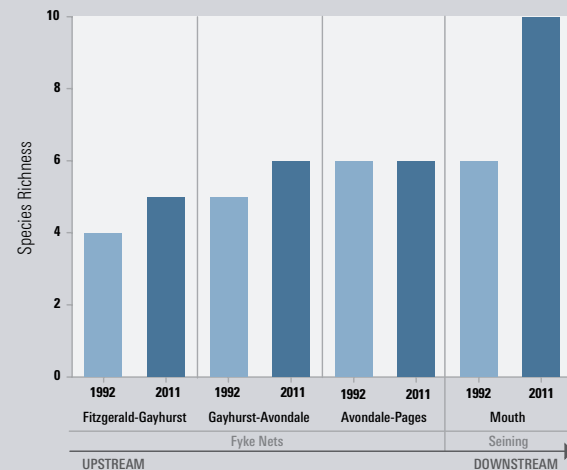
- » **Relative abundance distribution similar in three main river study sections**
 - » Dominated by common bully, giant bully, and shortfin eel
 - » But far fewer fish captured in upstream most section
- » **River mouth site has different assemblage**
 - » Different method (seining)
 - » Dominated by common smelt
- » **Despite earthquakes, fish diversity largely typical of spring-fed lowland river**



LOWER AVON RIVER: STUDY 2: FISH & INVERTEBRATES

Survey Fish Results

- » Historical comparison with data collected in 1991–1992 using same methods (Eldon & Kelly, 1992)
- » Species richness very similar, except at mouth (greater fishing effort in 2011 = more species captured)
- » Fish diversity and relative abundance broadly similar in 1992 & 2011
- » Notable differences
 - » Longfin eel decline
 - » Giant bully increase
- » Earthquakes do not appear to have had any major impacts on fish diversity or relative abundance

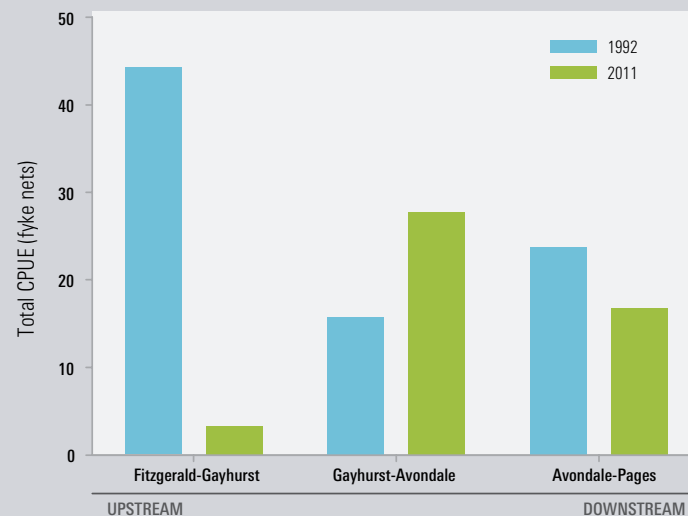


LOWER AVON RIVER: STUDY 2: FISH & INVERTEBRATES

Survey Fish Results



- » Catch per unit effort (CPUE) could be calculated for fyke net sampling
- » CPUE variable but most notably very low in 2011 in upstream-most site
 - » Is this earthquake related?
- » Did the earthquake degrade the fish habitat in the Fitzgerald-Gayhurst study section?
 - » Obvious patches of liquefaction deposits
 - » Extensive filamentous algae

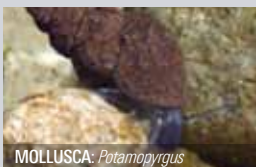
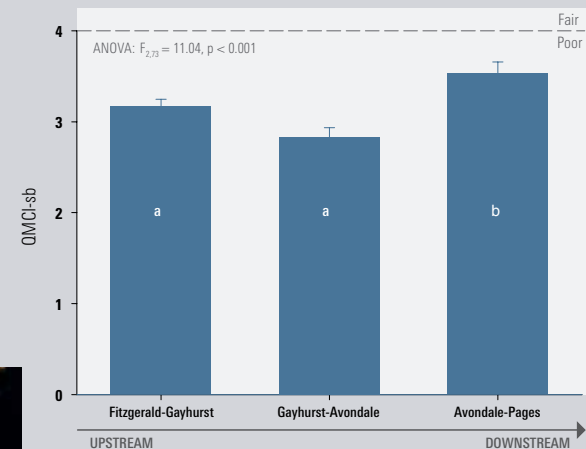
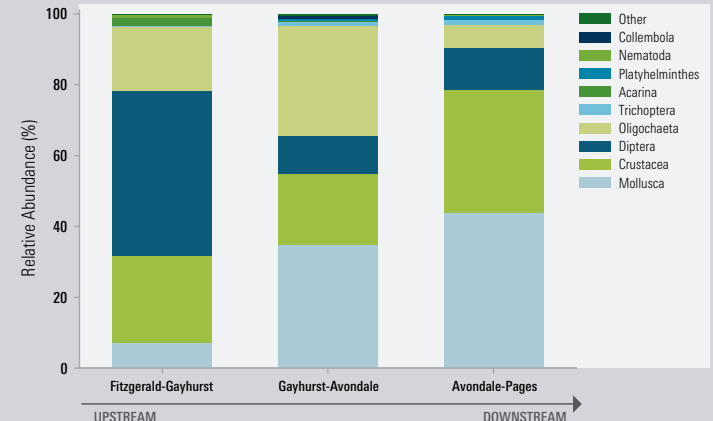


Liquefaction and algae at Swanns Rd bridge

LOWER AVON RIVER: STUDY 2: FISH & INVERTEBRATES

Survey Invertebrate Results

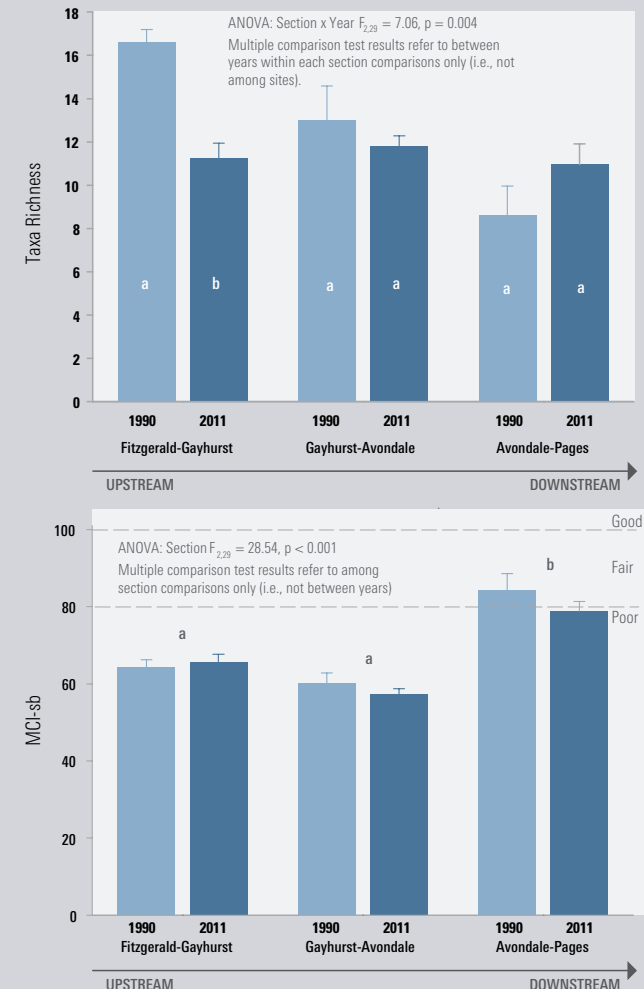
- » Overall 51 taxa found
- » Dominated by snails, crustaceans, fly-larvae, & worms
- » Typical lowland urbanised river fauna
- » QMCI-sb higher in downstream-most section but water quality still classified as 'poor'



LOWER AVON RIVER: STUDY 2: FISH & INVERTEBRATES

Survey Invertebrate Results

- » Some comparison can be made with data collected in 1989-1990 by Robb (1992)
 - » Limited as he didn't count animals
- » Robb found 33 taxa; we found 51 taxa
- » Taxa richness
 - » declined downstream in 1990 but in 2011 it remained similar in all study sections
 - » significant decline in the upstream-most section between 1990 & 2011
- » MCI-sb
 - » Similar between years
 - » Downstream-most site scored higher



Earthquake Effects on the Lower Avon River



- » Overall no great lasting declines in invertebrate & fish diversity or abundance observed
- » Probably a result of an aquatic fauna that is:
 - a. Already tolerant to a level of disturbance (most of the species present have persisted despite 100+ years of urbanisation)
 - b. Accustomed to sand/silt bottomed river (the lower Avon was mostly soft sediments before the earthquakes)
 - c. Resilient to earthquake impacts (able to rapidly recolonise parts of river where any die-offs occurred)
- » BUT there may have been some negative effects in months after earthquakes that the fauna has since recovered from
- » HOWEVER compared to early 1990s the upstream-most study section (Fitzgerald Ave to Gayhurst Rd) appears to have very few fish and a reduced number of invertebrate taxa
 - » Is this a result of the earthquakes?