



Integrating Groundwater Modelling and River Ecology

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o Groundwater modelling in Upper Motueka

 Predicts surface water-groundwater (SW-GW) exchange

o Cold upwelling groundwater

• Refuge for aquatic life during low flows



Study area







Groundwater-river modelling





Model predictions

 Predicts location and magnitudes of exchanges between river and groundwater





Model predictions







Variations in SW-GW exchange will affect thermal patterns in the river

 Diel fluctuations in temperature: Gaining < losing reaches
Maximum daily temperature: Gaining < losing reaches



Methods



- 8 data loggers:
 - 3 gaining reaches
 - 3 losing reaches
 - 1 spring
 - 1 groundwater bore
- Logging 30 min intervals from early 2006









Tadmor (gain) vs. Tapawera Bridge (loss)





ICM1 (gaining) vs. ICM3 (losing)







o Differences greatest during baseflow

- Highest relative contribution of GW
- Differs between sites

How much does GW contribute to SW? –Simple mixing models



Mixing model on temperature data









 Mixing model suggests potential for 10-20% of water at site is from cold source (GW)

o As much as 0.5 m³/s

o 30% gain predicted by model for whole reach



Longitudinal surveys



o Drifted ~14 km of river

- spot readings
 - Pools
 - » Head, deep water, edges
 - Tributaries
 - Backwaters

Backwater

River: 20.9°C, 133 μS/cm, 11.31 mg/l (126% sat) Springs: 17.3°C, 107 μS/cm, 9.2 mg/l (96% sat)



Backwater

River: 20.5°C, 132 μS/cm, 10.39 mg/l (114.8% sat) Springs: 17.0°C, 132 μS/cm, 4.9 – 8.5 mg/l (56-88% sat)



Summary



Groundwater model

 patchy gaining and losing reaches (km+ scale)

Temperature loggers

- Up to 3.5°C difference between some gaining and loosing
- GW contributes c.10-20% of baseflow



Summary



Longitudinal survey

- No stratification
- Few obvious upwellings limited area
- Lateral springs
 - Up to ~3.5°C cooler than mainstem
 - Too shallow for trout
 - Abundant native fish





- Integration between disciplines has allowed data gathering of mutual benefit
- o Temperature data has and will add to understanding of groundwater-river interaction
- o Modelling beneficial for river ecology planning (and vice versa)