INTEGRATED CATCHMENT MANAGEMENT for the Motueka River

Linking sediment generation in the Motueka River to its impacts in Tasman Bay

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CAWTHRON

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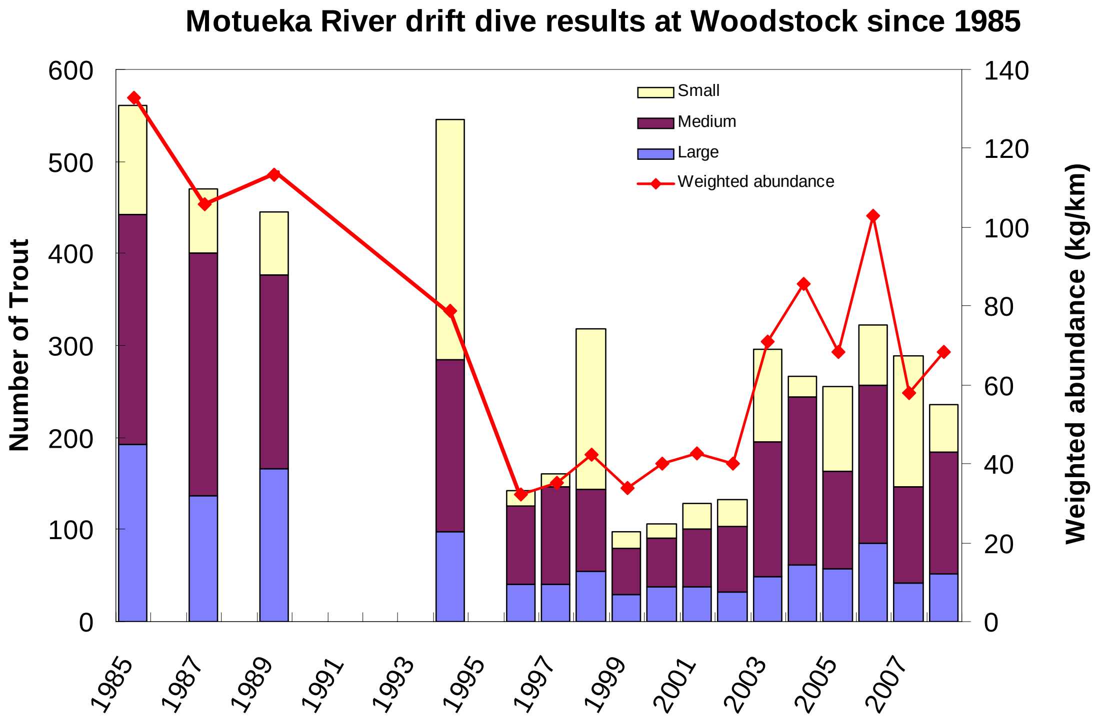
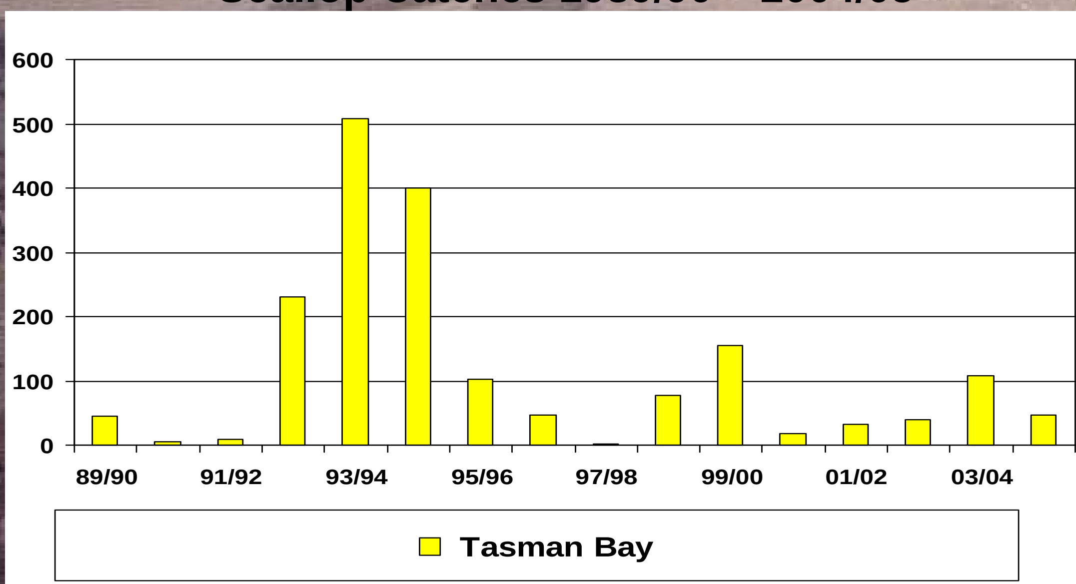
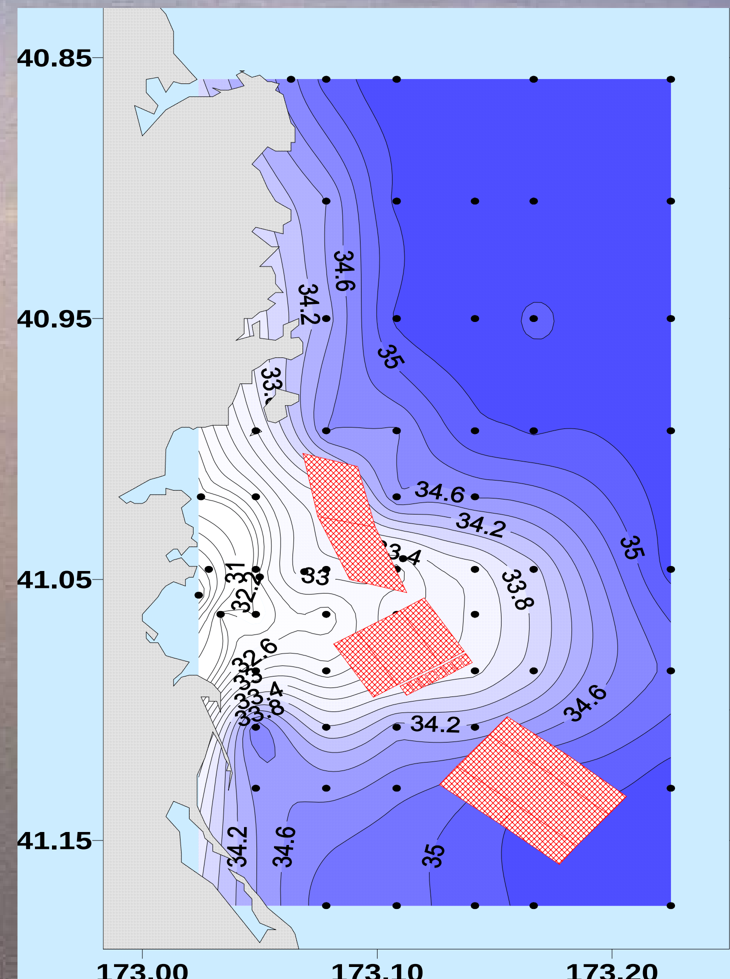
Decline in trout numbers in the river in the mid-1990s



Potential effects on shellfish resources in Tasman Bay

- Scallop Catches 1989/90 – 2004/05

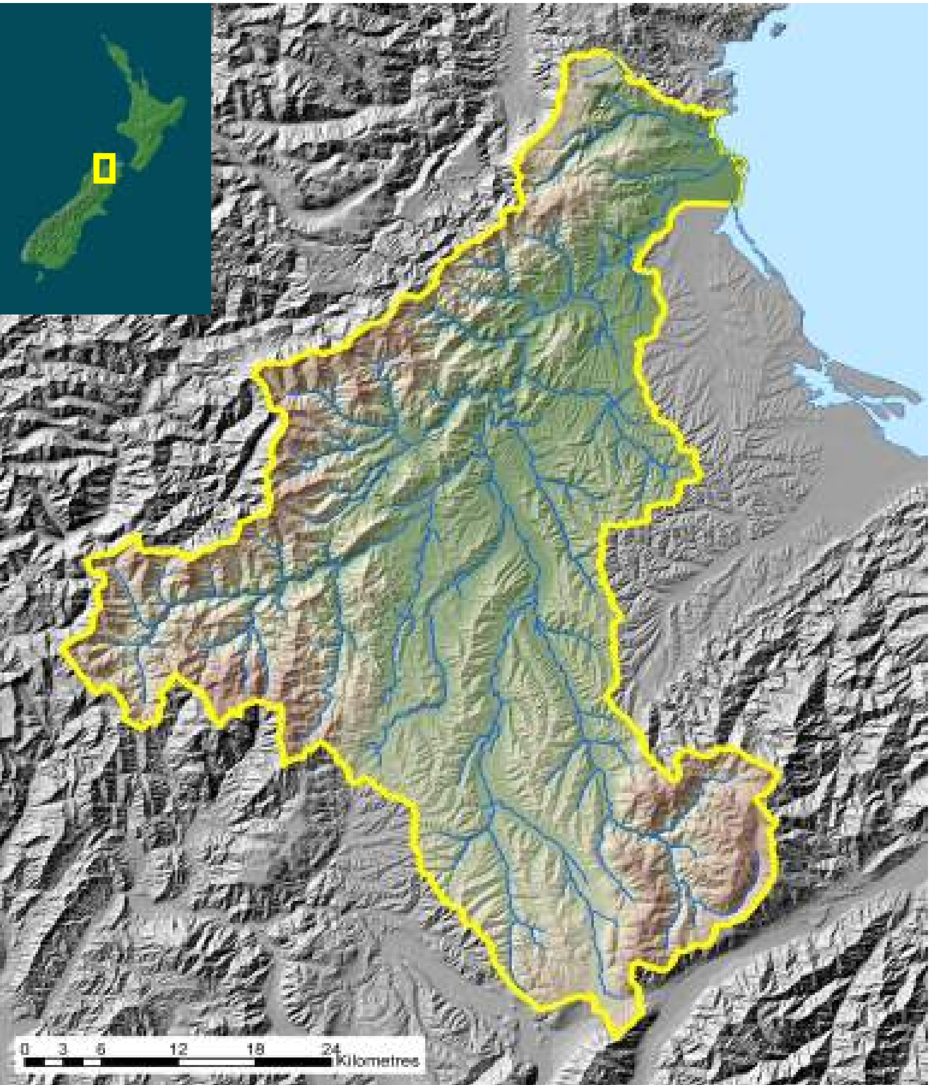




Outline

- Sediment signature of a localised extreme erosion event
- Influence of a localised low frequency storm event on
  - ➢long-term sediment yield
  - ➢downstream impacts
    - ✓sediment yield
    - ✓source of elevated Ni and Cr in river plume sediments
- Spatial extent of the river plume depositional footprint based on sediment metal signatures
- Seabed infauna communities within and outside of plume area
- Management implications

Catchment description



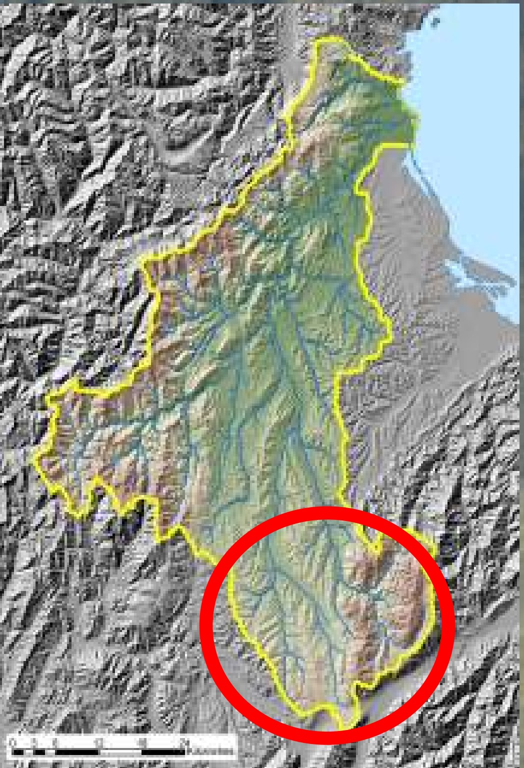
- 2075 km^2
- complex geology
  - basement rocks
  - Moutere gravel
  - alluvium
- <1000-3500 mm annual rainfall
- 3 main land uses
  - indigenous
  - pine forest
  - pastoral grassland
- main stem 110 km
- mean flow 82 cumecs
- ~62% of freshwater into Tasman Bay
- river plume >70 km^2

March 2005 storm

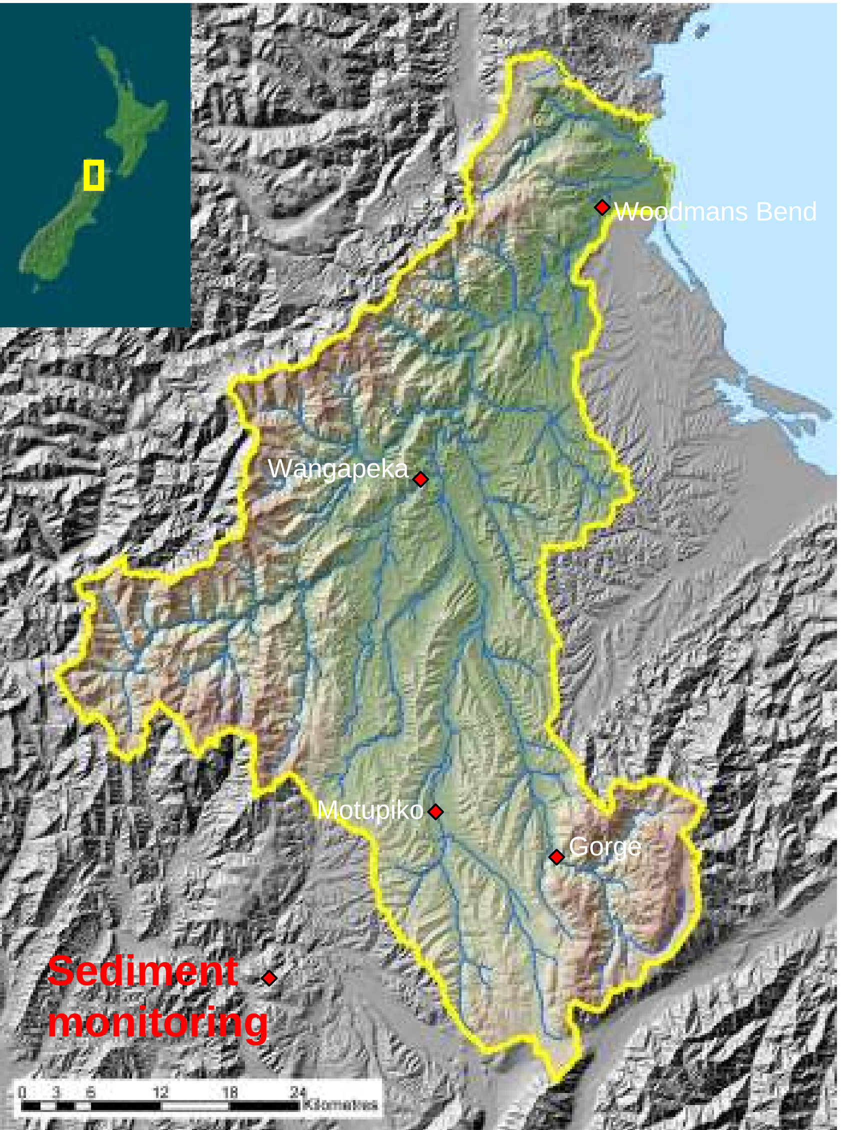
Rainfall - c.170 mm, most in c.4 hrs

Recurrence interval
- 1:50 for both rainfall/flow at source
- mean annual flood at coast

April 2005 - highly elevated Ni and Cr levels in the Motueka River delta

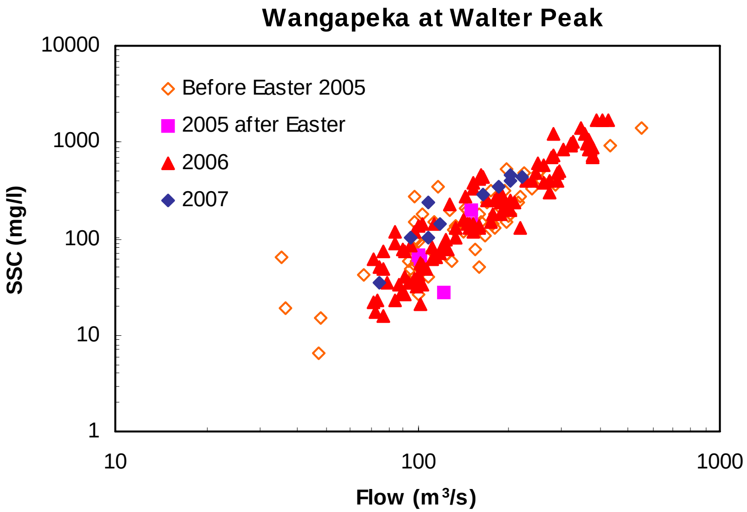


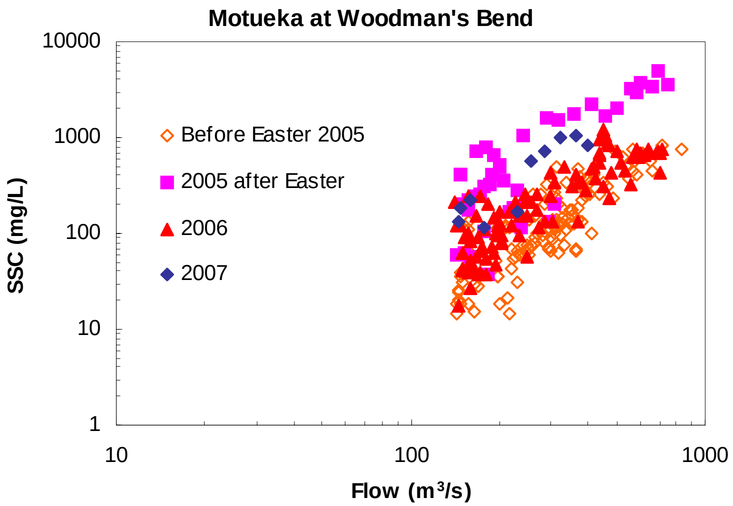
Methods - sediment yield

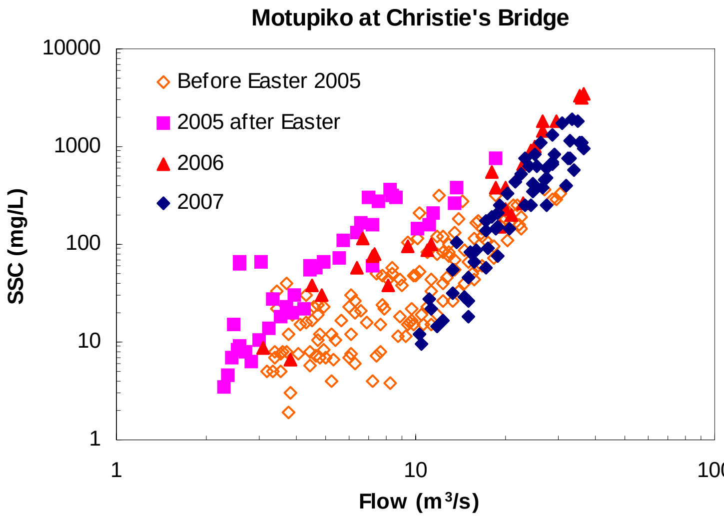


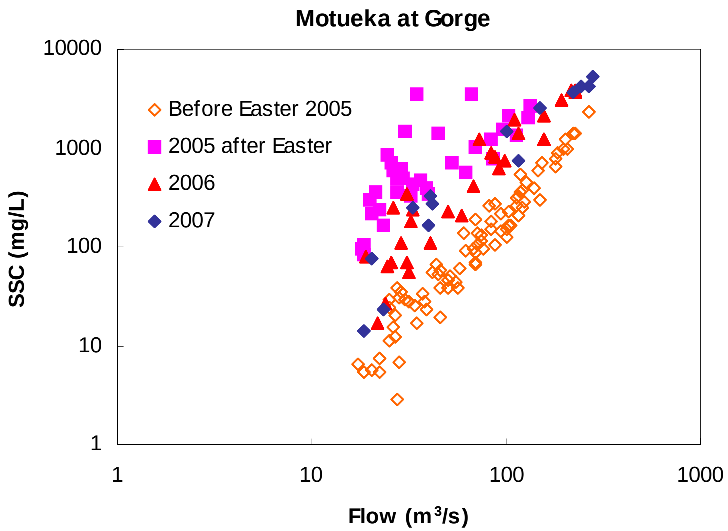
- continuous record of turbidity
- auto samplers and manual sampling to define turbidity - SSC relationship
- use this to generate time series of SSC and combine with flow record to estimate SSY

Sediment rating relations

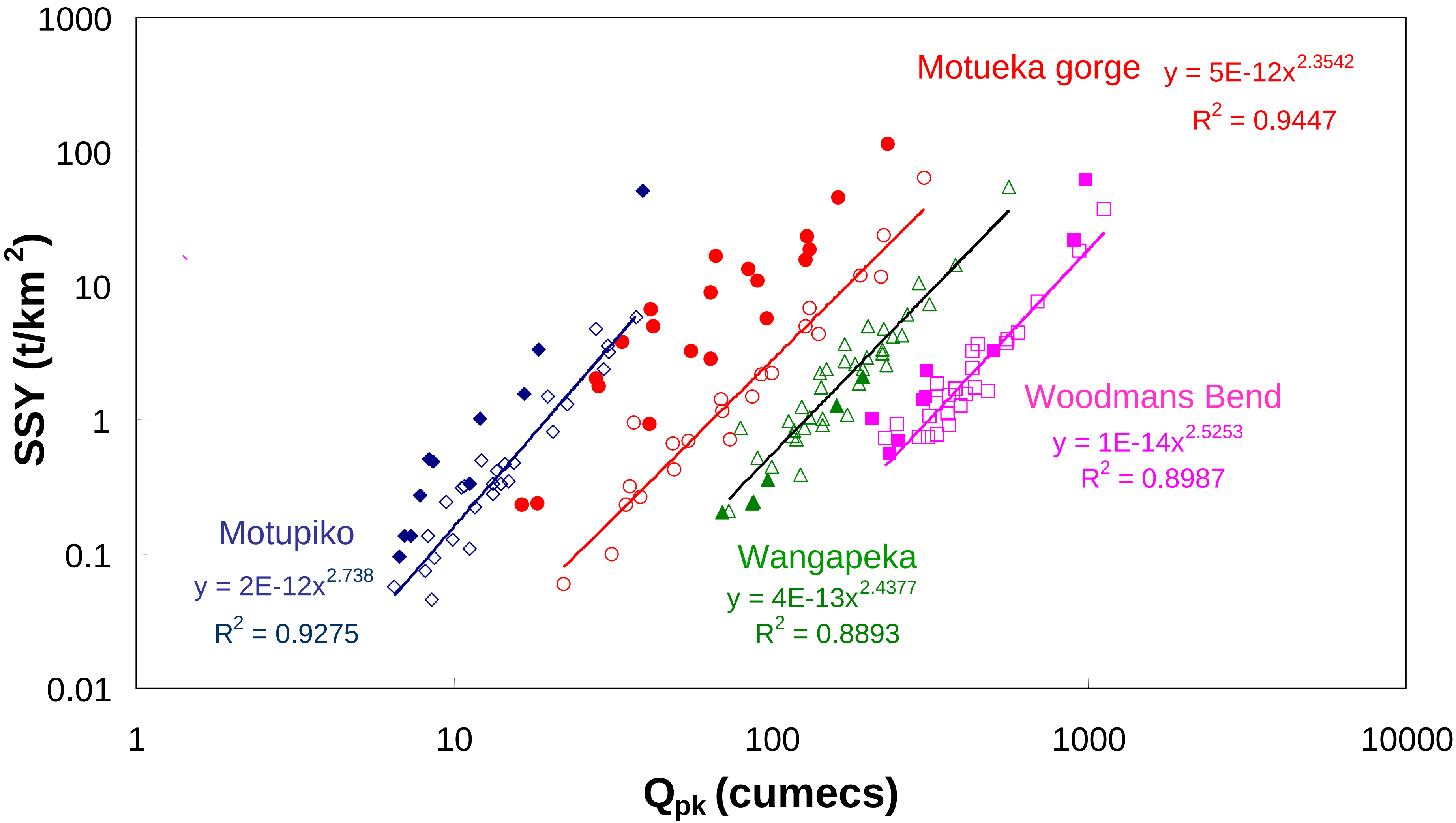




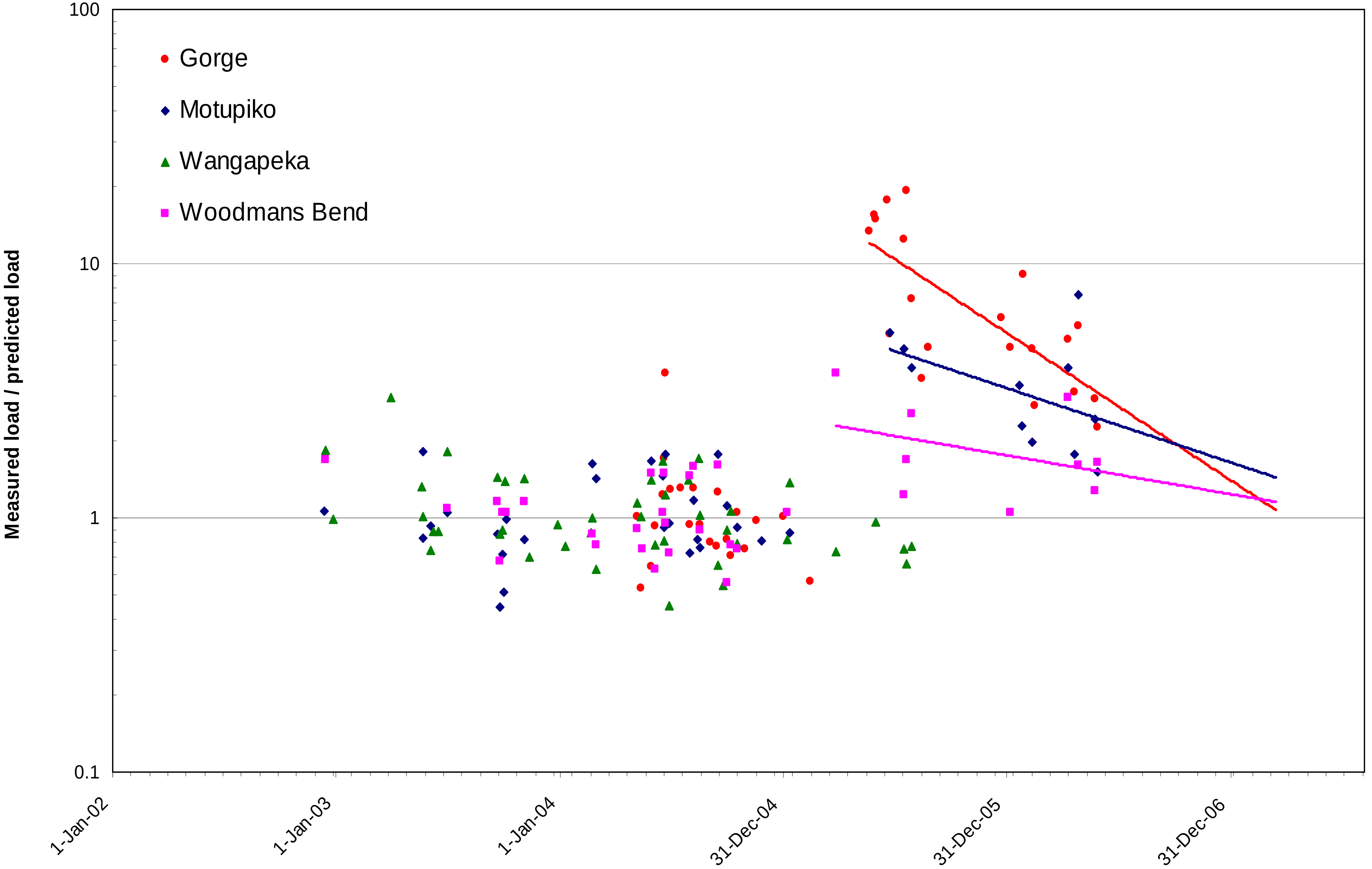




Storm SSY vs peak flow



Effect of March 2005 flood on event loads

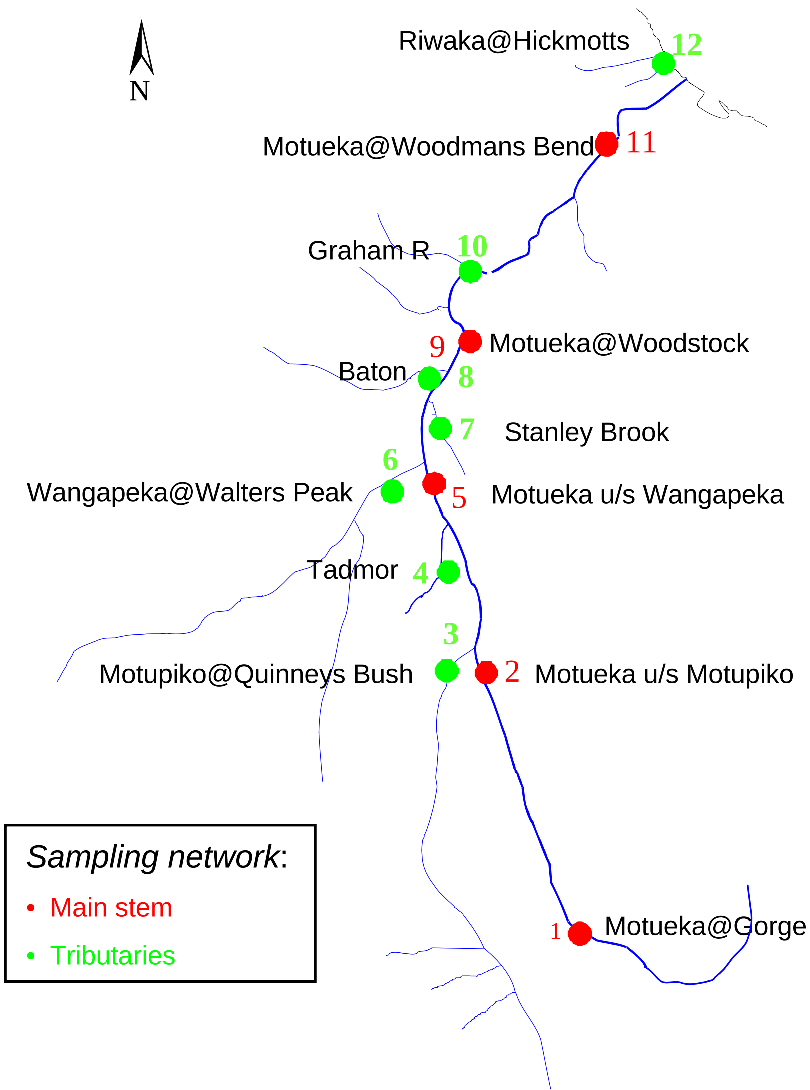


Effect on long-term sediment yield

- large events trigger an erosion threshold and affect the relationship between SSY and peak flow
- can take account of the impact of low frequency events by embedding in the sediment response function some dependence on recent erosion-triggering events
- sediment yield highly sensitive to extreme events that perturb “normal” erosion regime

  e.g. Motueka gorge
  - normal 94 t km-^{2} y^{-1}
  - large events 519 t km^{-2} y^{-1}
- large events have spatially extensive and temporally persistent effect on sediment yield

Methods – river and plume geochemistry

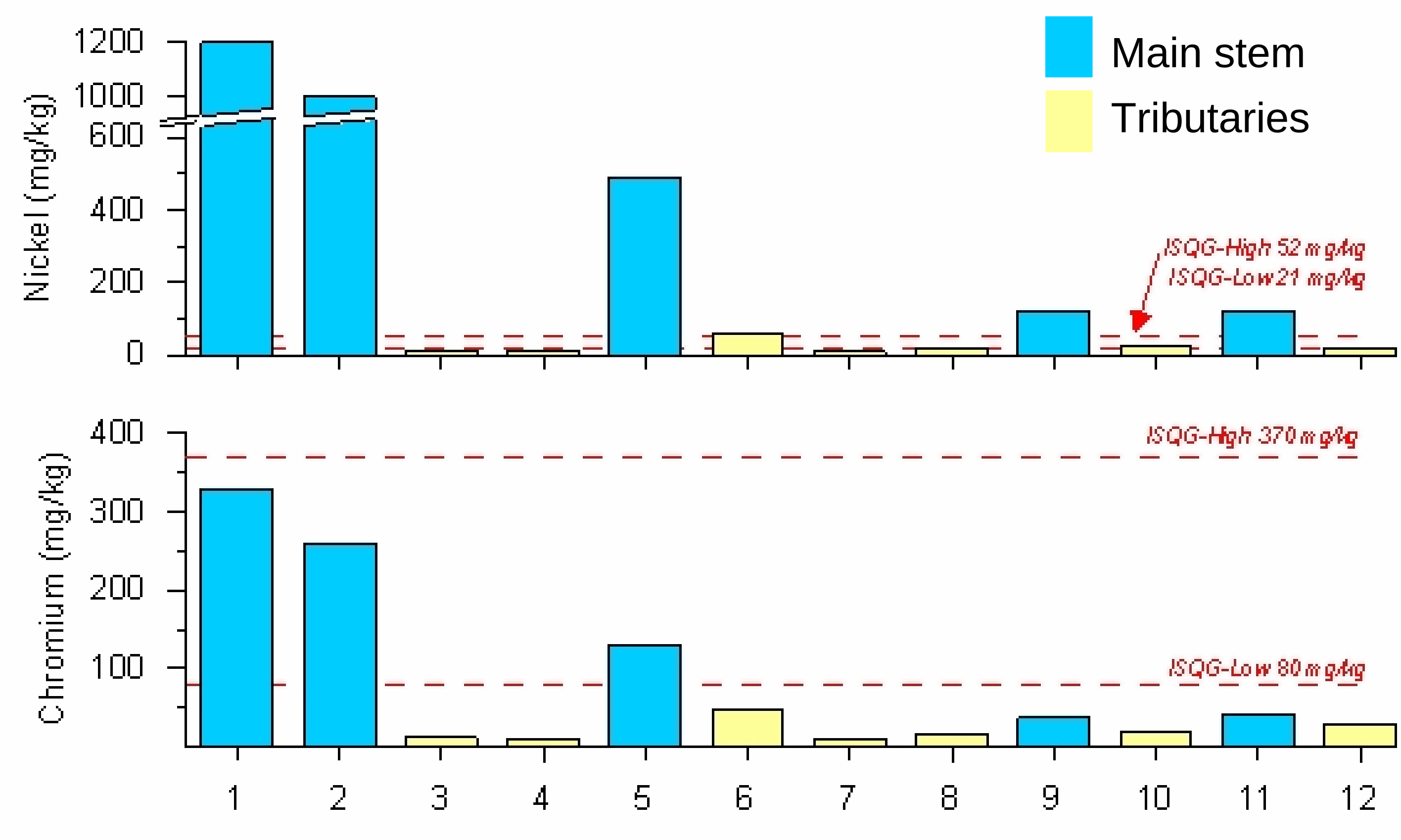


- stream samples to trace catchment source, marine samples to determine extent of influence
- analyzed for metal concentrations (Al, Ba, Cr, Cu, Ni, Pb, Sr, V, Cd) by ICP-OES or ICP-MS
- compared to ANZECC (2000) metal concentration guidelines
- infauna cores: organisms retained on 0.5mm mesh.

River Margin Sediments:

Ni up to 20 times ANZECC (2000) guideline levels for “probable” biological effects

Cr up three times guideline levels for “possible” biological effects



Upstream

Downstream

Plume sediments- elevated Ni & Cr

ANZECC (2000) low 21 mg/kg

high 52 mg/kg

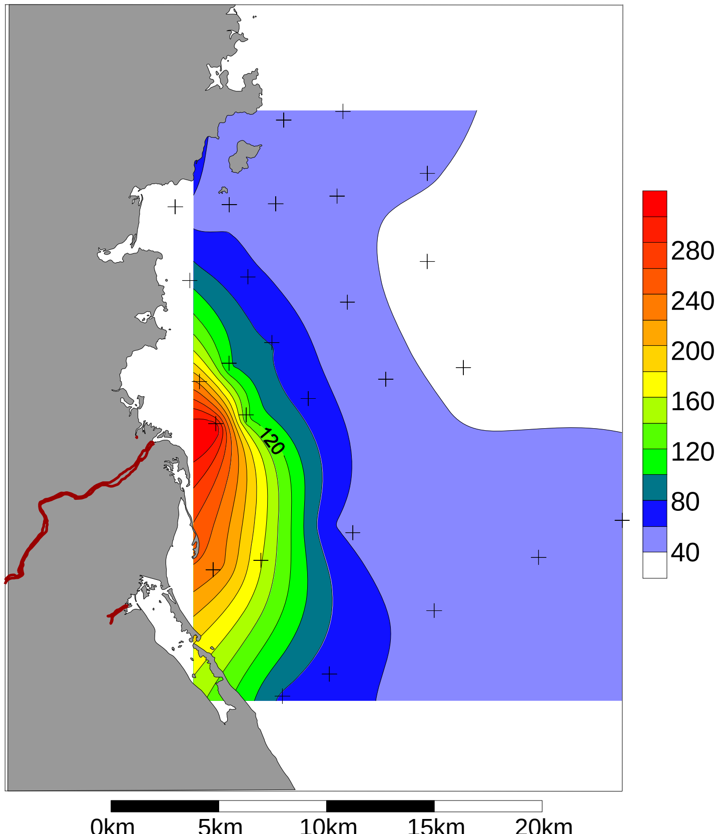
- >6 times greater than the level required to produce "probable" biological effects.

ANZECC (2000) low 80 mg/kg

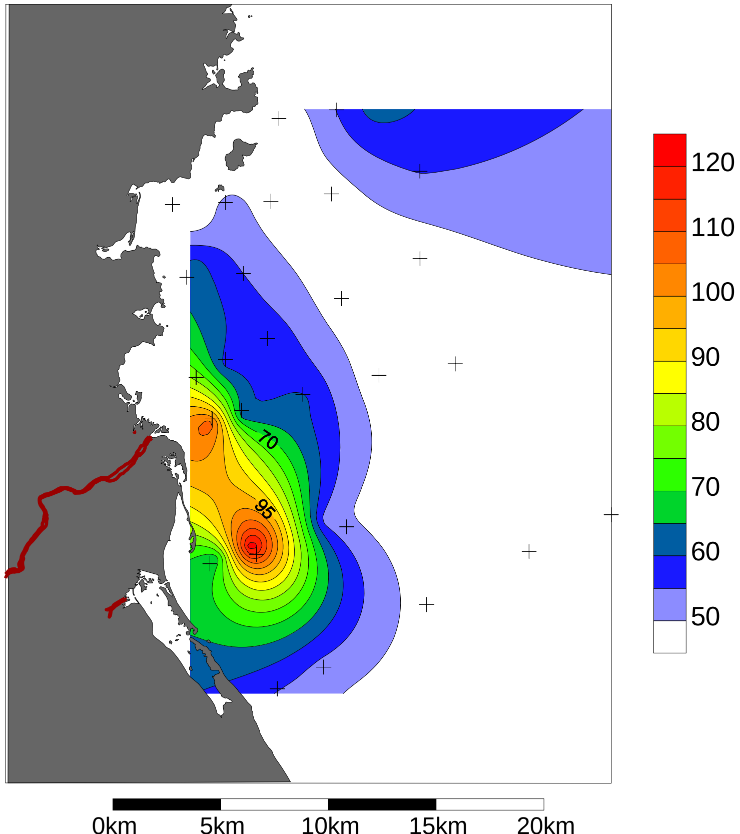
high 370 mg/kg

- >1.5 times greater than the level required to produce "possible" biological effects.
- Cu, Ba and V similar distribution

Ni concentrations (mg/kg)

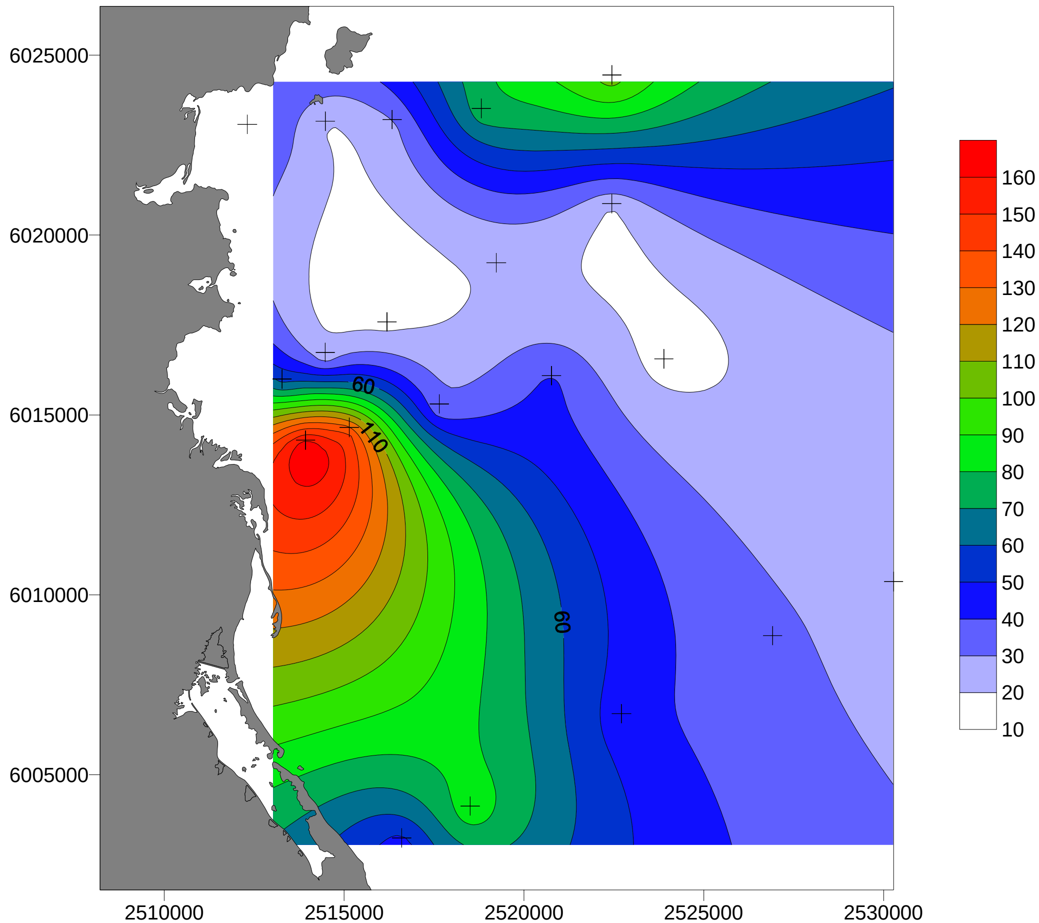


Cr concentrations (mg/kg)



Infauna communities

Total number of individuals per core



- **Highest abundance at sites closest to river mouth, but low diversity**
- **Mainly due to disturbance tolerant, opportunistic taxa**
- **Increased diversity at edge of metals plume**

Capitellid worm

Introduced bivalve

Conclusions

• Large events have spatially extensive and temporally persistent effect on sediment yield

• Sediment yield highly sensitive to extreme events that perturb "normal" erosion regime

normal	94 t km^{-2} y^{-1}
large events	519 t km^{-2} y^{-1}

• Plume area affecting around 70-90 km^2 of western Tasman Bay during "normal" flow conditions

• A natural catchment source of heavy metals-enriched sediments (significant increase in seabed metals concentrations after flood pulses)

• Increased abundance of opportunistic infauna species in sediments with high Ni and Cr concentrations

• Suspended sediments near the seabed can interfere with scallop feeding