The Motueka River Plume Ecosystem

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How to get there

1. Identify the spatial extent, composition and functional behavior of the Motueka RPE

2. Identify catchment connections
   a. Implications for coastal resources

3. Predict (model) the effects of changes in land use practices on ecosystem function/coastal resources

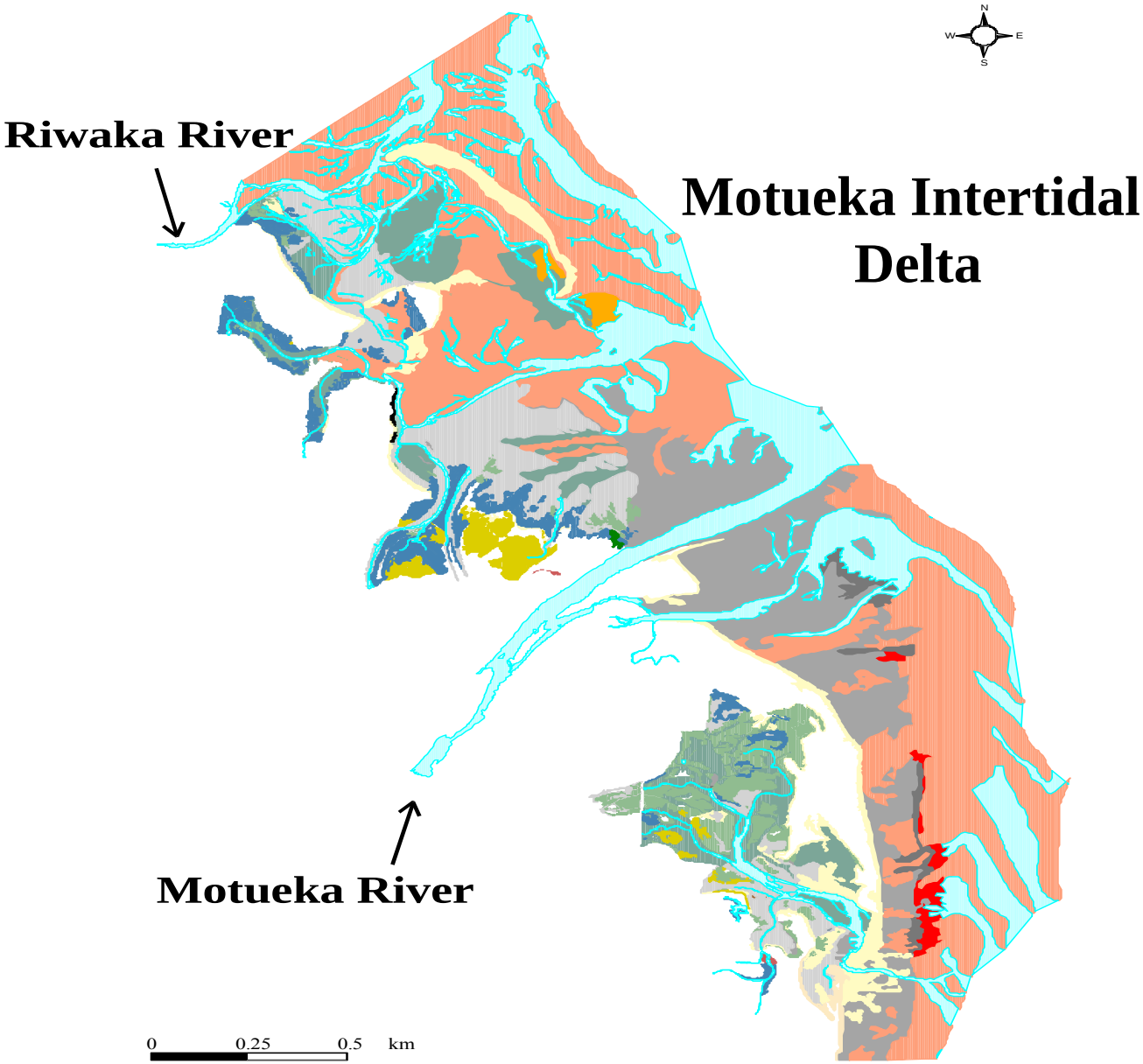
Work to date describes:

- Delta habitat structure (GIS maps of inter- and subtidal habitats)
- Stratification (water column stability)
- Nutrient structure, nitrogen sources and sinks (seabed denitrification is estimated to be roughly 4 times the total freshwater nitrogen inflow to Tasman Bay)
- Phytoplankton and benthic microalgal biomass and production (E. to W. gradients, seasonal and interannual variation)
- Sediment effects
- Seawater circulation patterns and plume physical behavior (coastal hydrodynamic circulation model)

Delta habitat structure

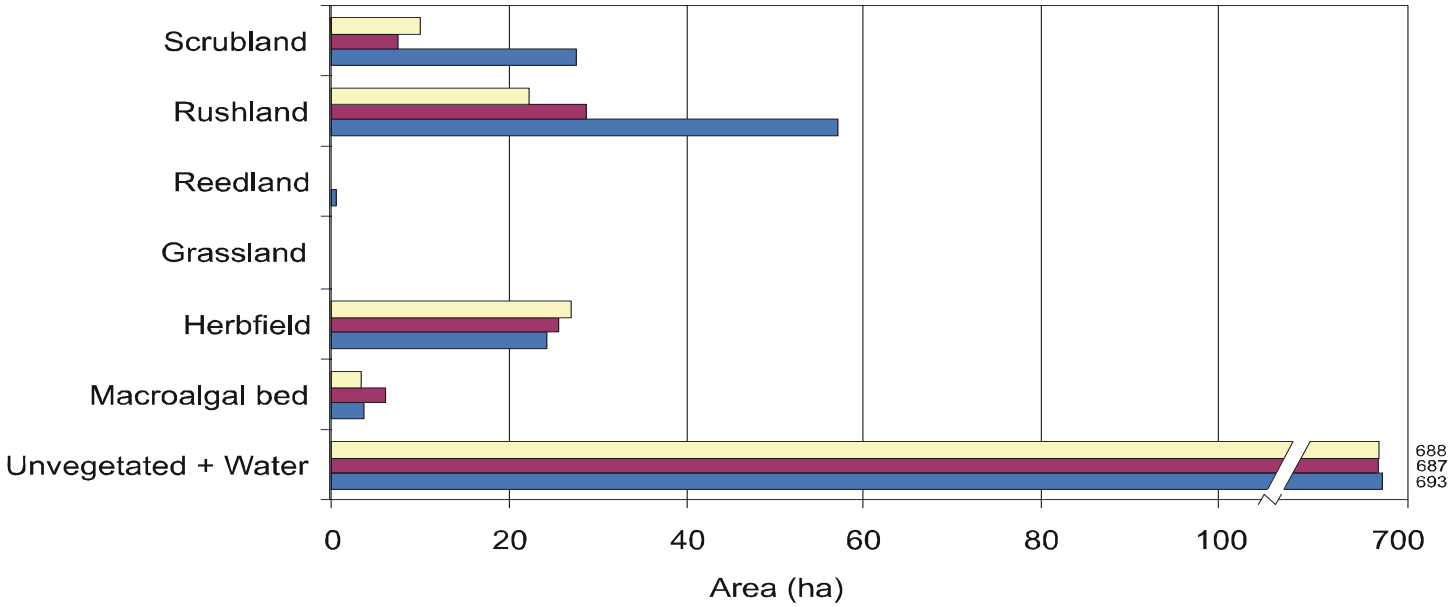
Structural GIS Layers

Total Area = 529 ha



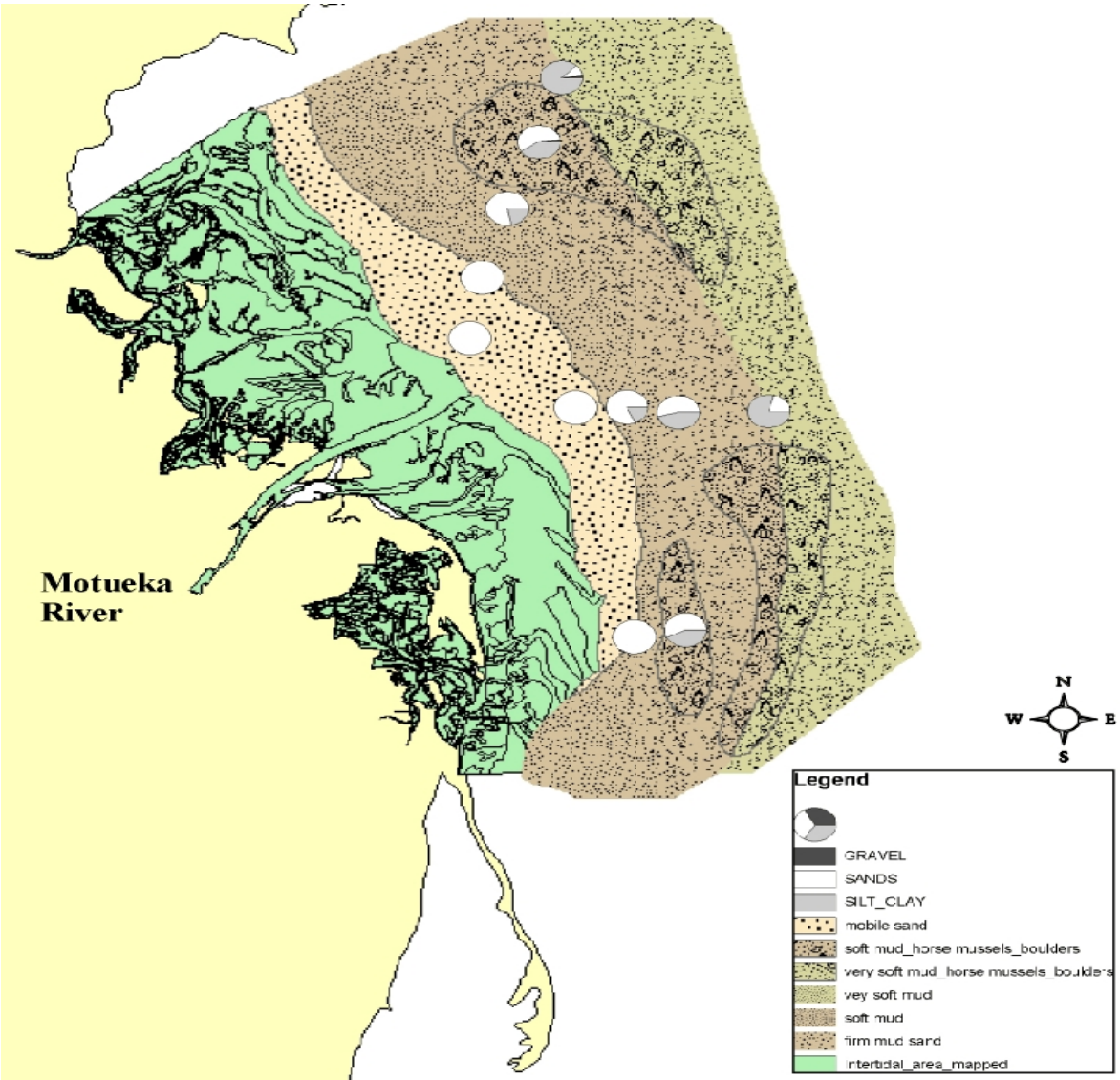
Changes since 1947

Comparison of selected structural class habitats of the Motueka intertidal delta 2001, 1986, 1947



Impacts to fish and fish habitat

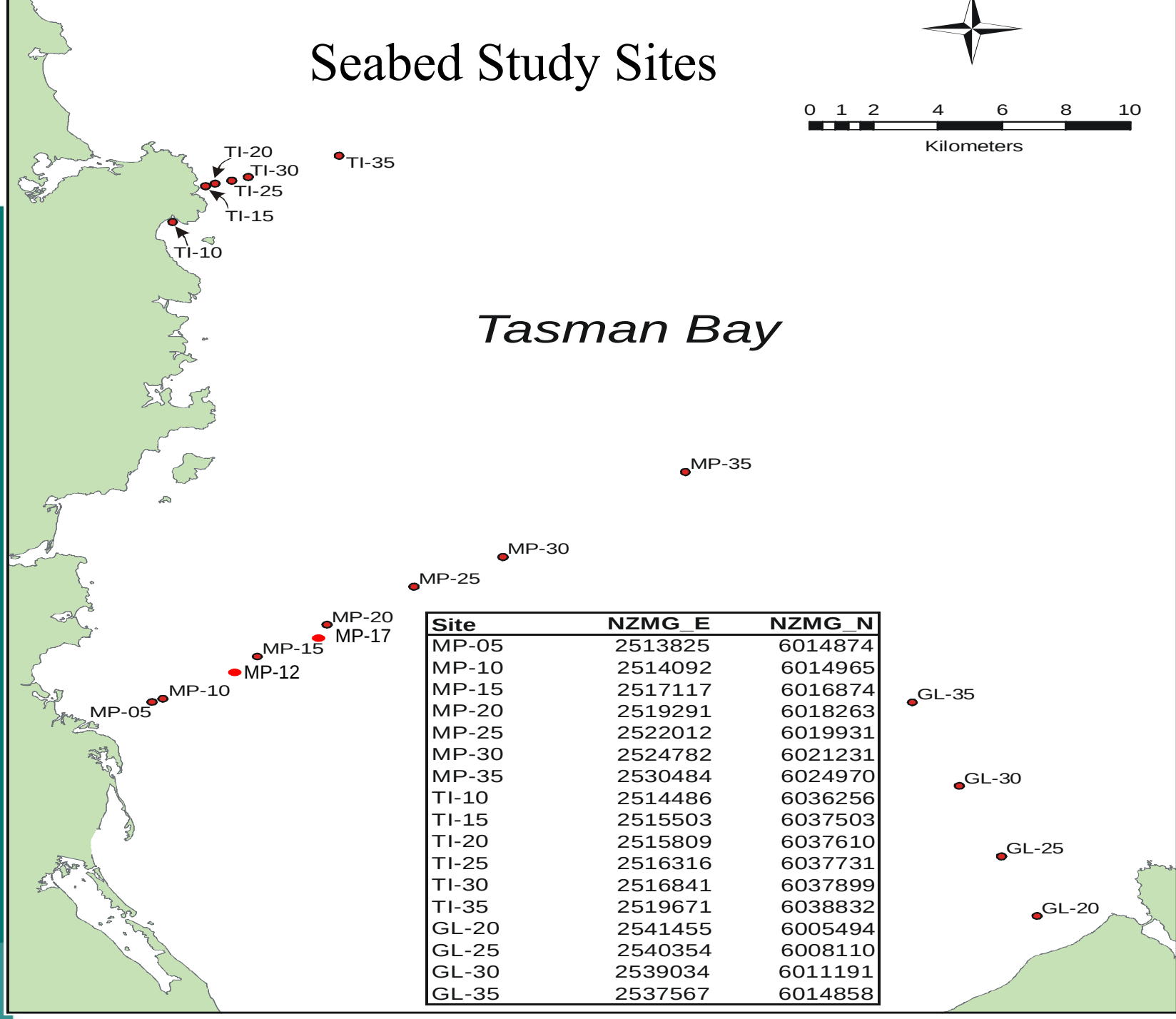
Subtidal habitat areas (total mapped = ~1500 ha)



Delta →plume (land-river-sea links)

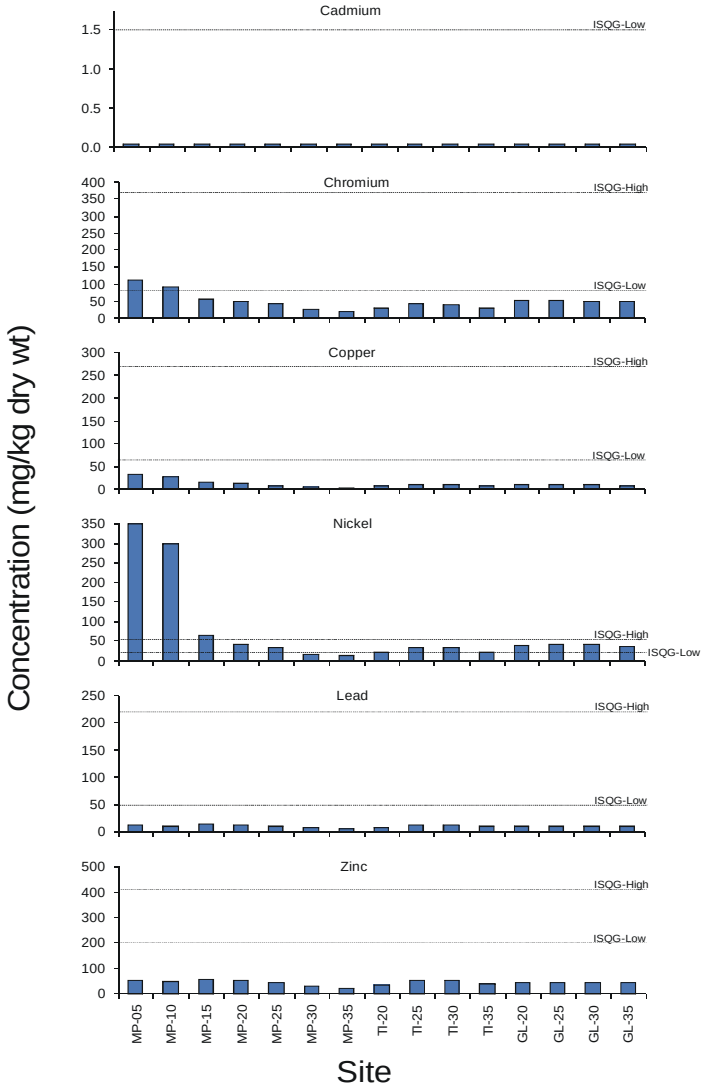
- Fine scale assessment of indicators of condition/health of seabed habitats
  - Sediment texture
  - organic matter Q & Q (bioavailability and food web uptake)
  - Nutrients (TN & TP)
  - Trace metals (Cd, Cr, Cu, Ni, Pb, Zn)
  - Animals (infauna community structure)
  - Plants (microalgae, seaweeds)

Seabed Study Sites

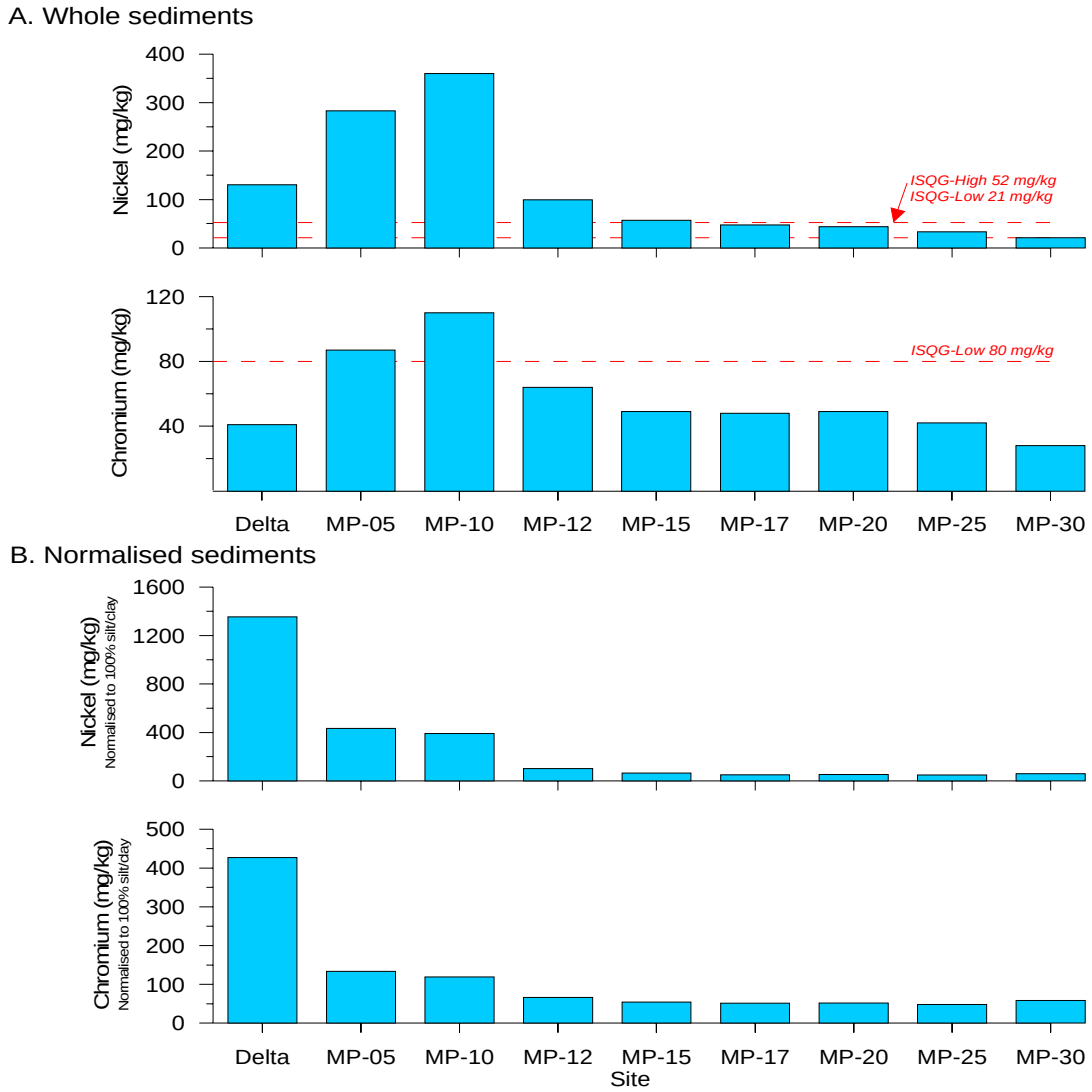


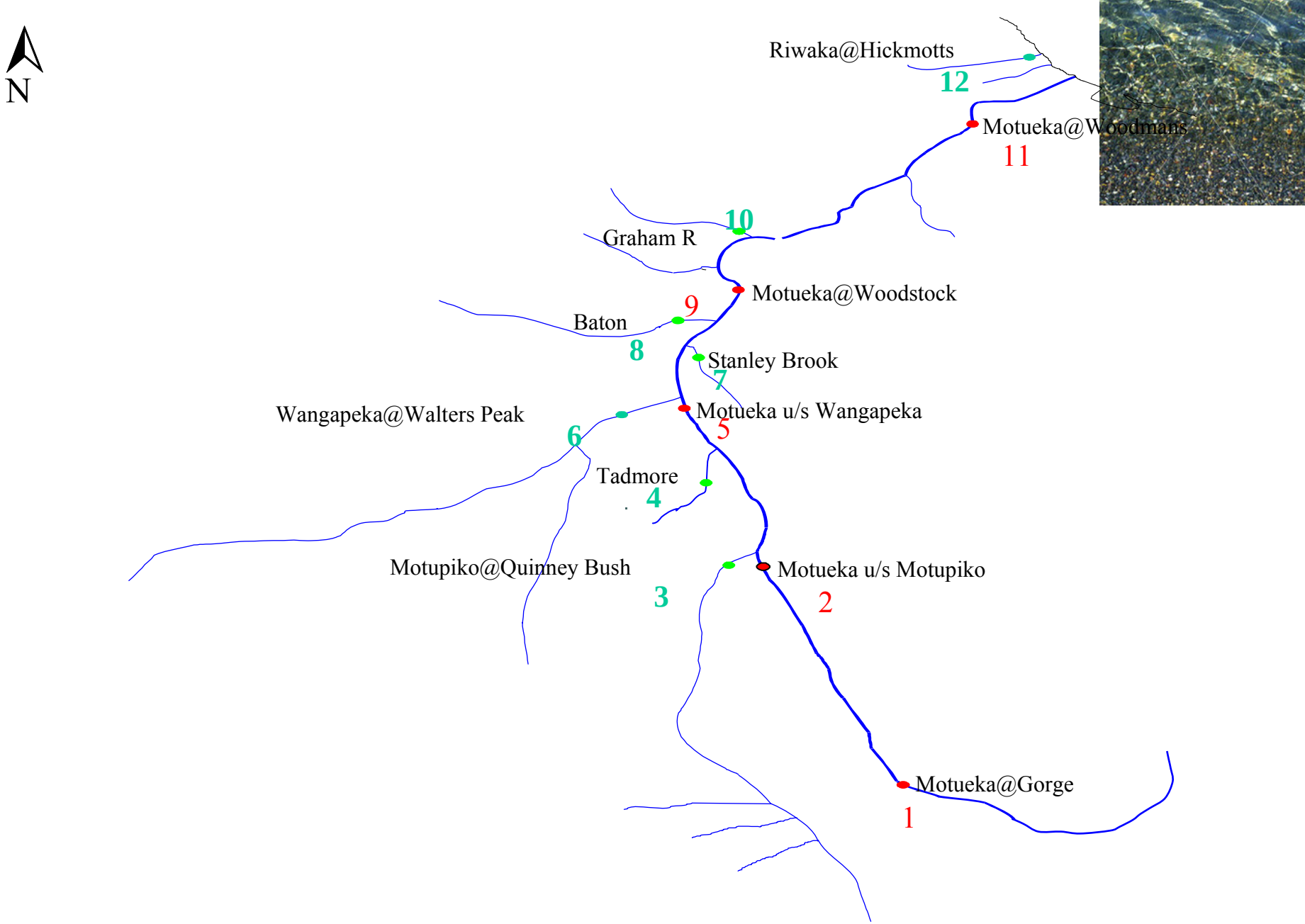
Site	NZMG_E	NZMG_N
MP-05	2513825	6014874
MP-10	2514092	6014965
MP-15	2517117	6016874
MP-20	2519291	6018263
MP-25	2522012	6019931
MP-30	2524782	6021231
MP-35	2530484	6024970
TI-10	2514486	6036256
TI-15	2515503	6037503
TI-20	2515809	6037610
TI-25	2516316	6037731
TI-30	2516841	6037899
TI-35	2519671	6038832
GL-20	2541455	6005494
GL-25	2540354	6008110
GL-30	2539034	6011191
GL-35	2537567	6014858

Metals concentrations of Tasman Bay sediments (20-22/4/05)

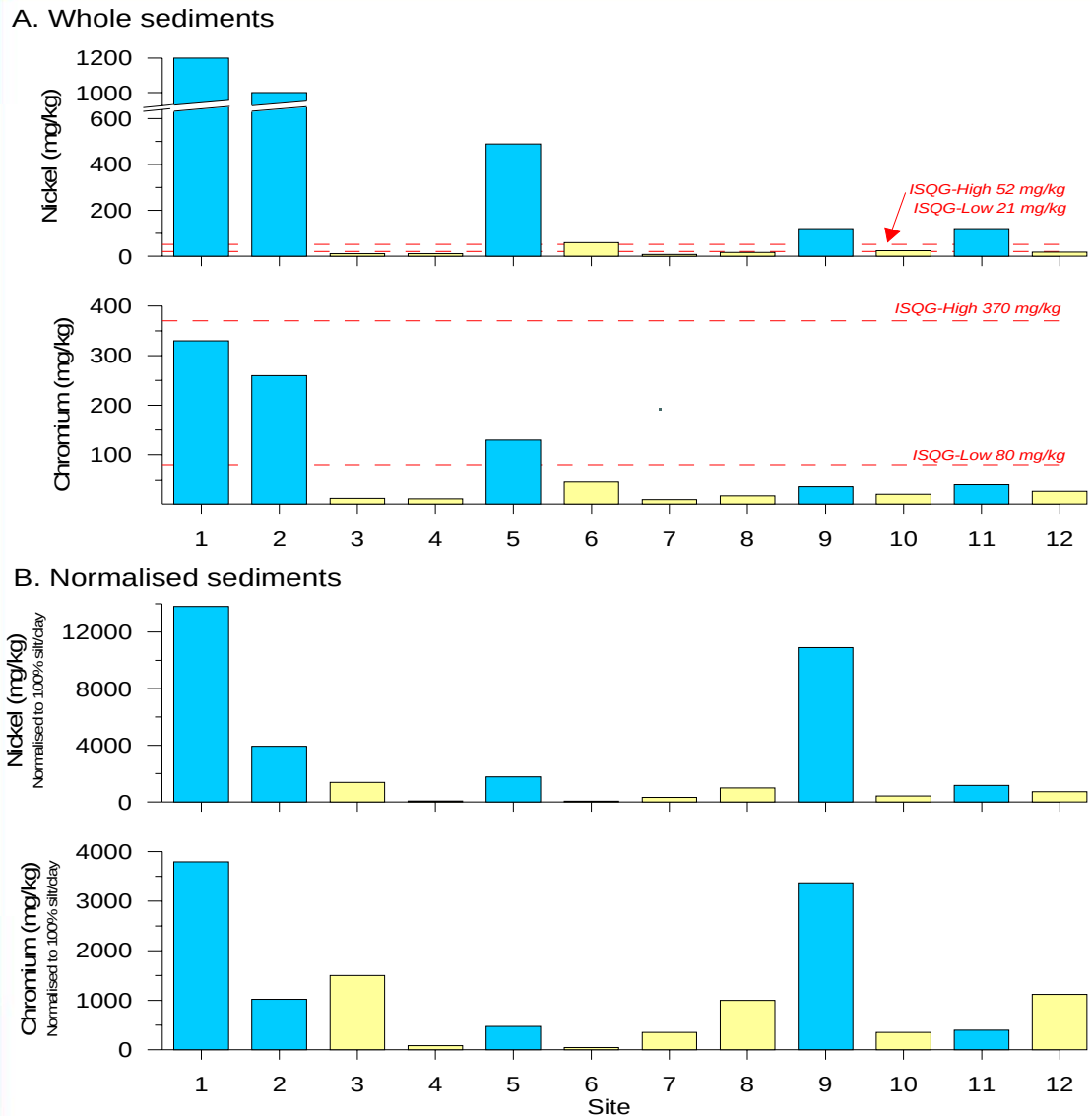


Chromium and nickel concentrations of Motueka River plume sediments (25 July 2005); A, whole sediments, B, normalised to 100% silt/clay.

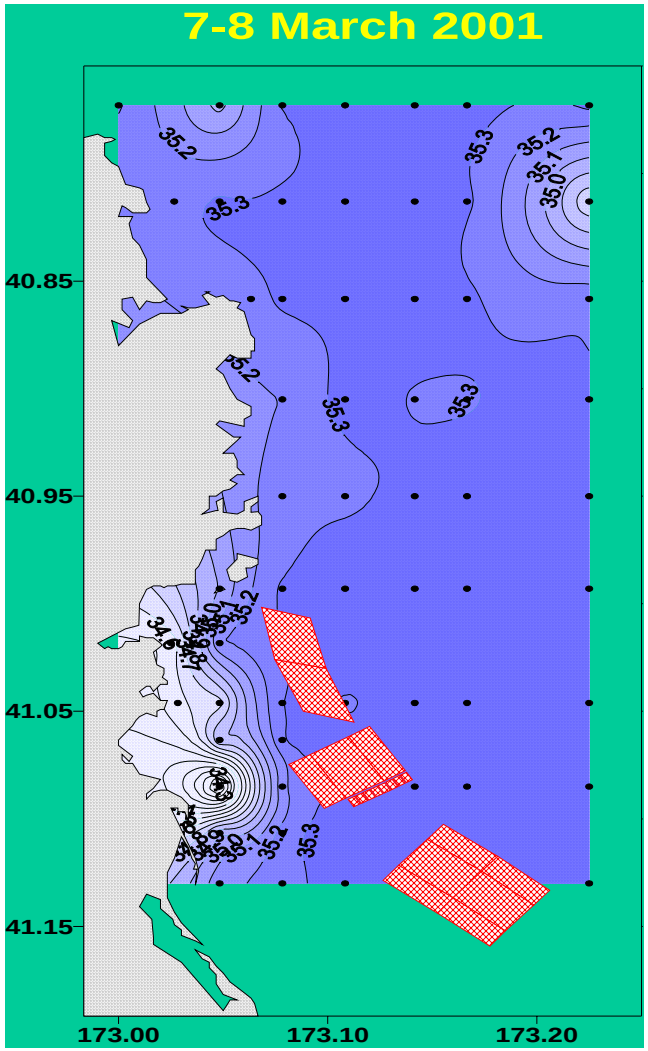


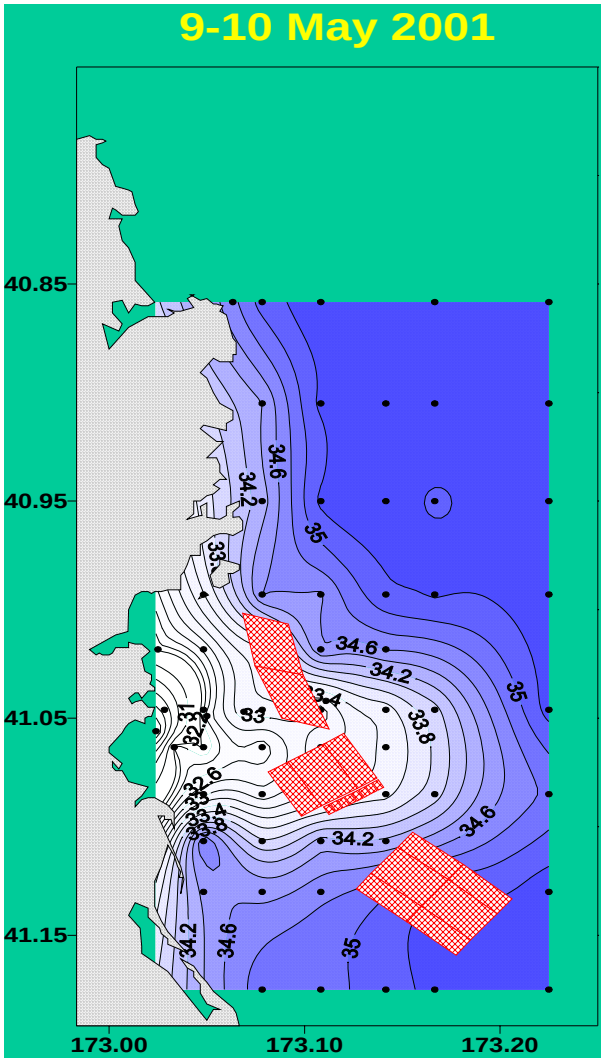

N
Riwaka@Hickmotts
12
Motueka@Woodmans
11
10
Graham R
Motueka@Woodstock
9
Baton
8
Stanley Brook
7
Wangapeka@Walters Peak
Motueka u/s Wangapeka
5
6
Tadmore
4
Motupiko@Quinney Bush
Motueka u/s Motupiko
3
2
Motueka@Gorge
1

Chromium and nickel concentrations of Motueka River margin sediments (29/6/05).

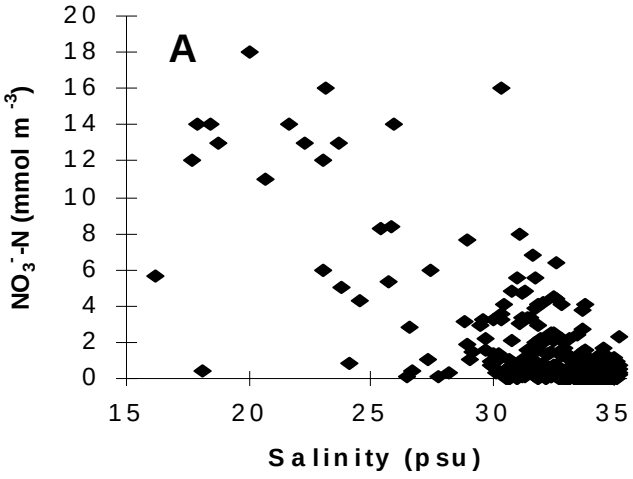


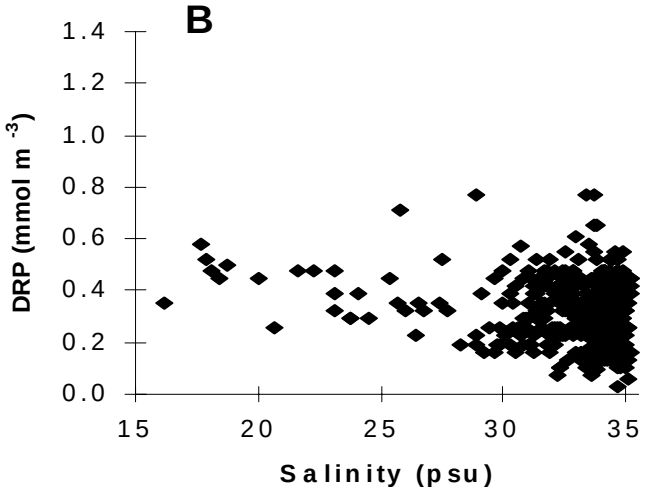
Stratification (water column stability)

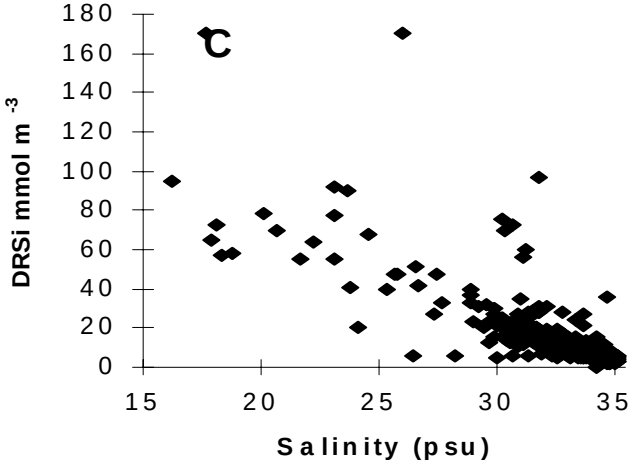




Nutrients vs salinity

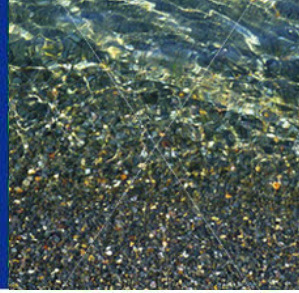






Highest dissolved nutrient concentrations associated with low salinities

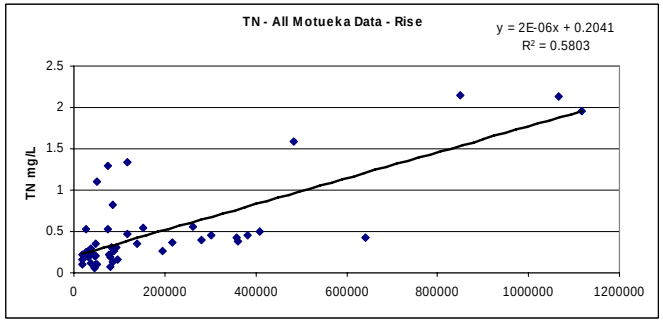
Nutrient discharge from the Motueka catchment



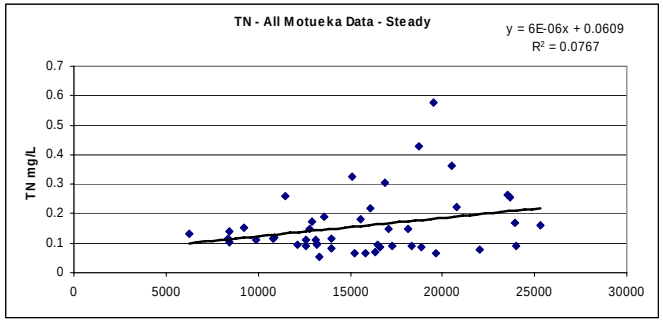
- Dissolved inorganic nitrogen (nitrate, nitrite and ammonia-N)
- Total nitrogen
- Dissolved reactive phosphorus
- Total phosphorus
- Dissolved reactive silicate
- Also looking at faecal indicator bacteria
- Will make similar calculations for suspended solids

River flow vs concentration

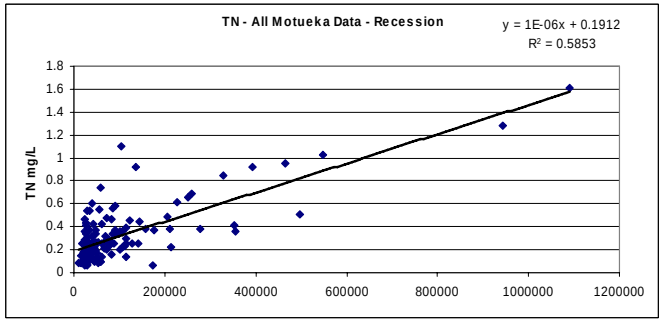
- Summer vs winter
- Steady (low) vs Rising vs receding flows



Steady



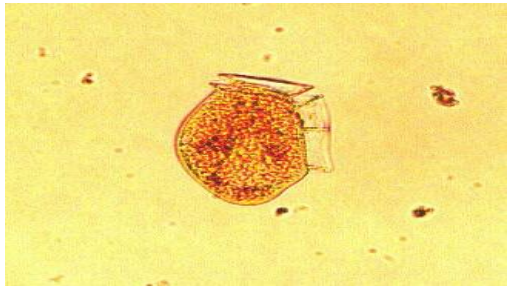
Rising



Receding

Primary Production: Food for benthic filter feeders

- Planktonic microalgae: Primary food component during phytoplankton blooms; *e.g.* the winter/spring diatom bloom and summer dinoflagellate blooms

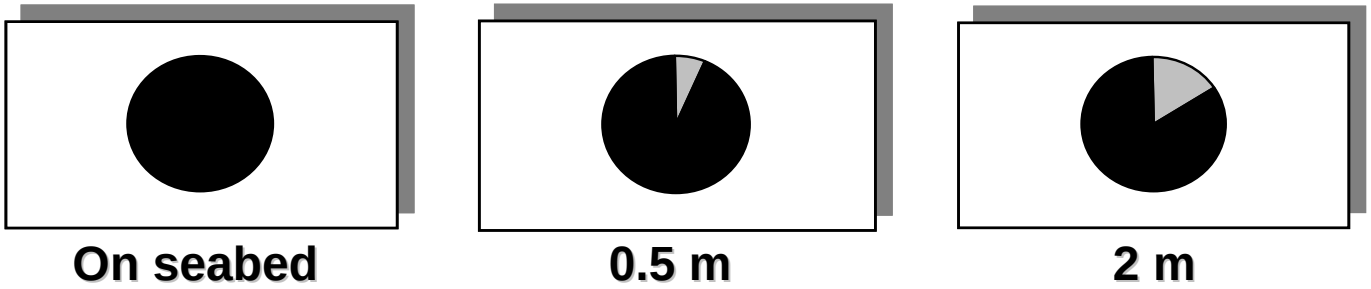


- Benthic microalgae: Primary food component during non-bloom periods. Maintenance die

What do Tasman Bay scallops eat?

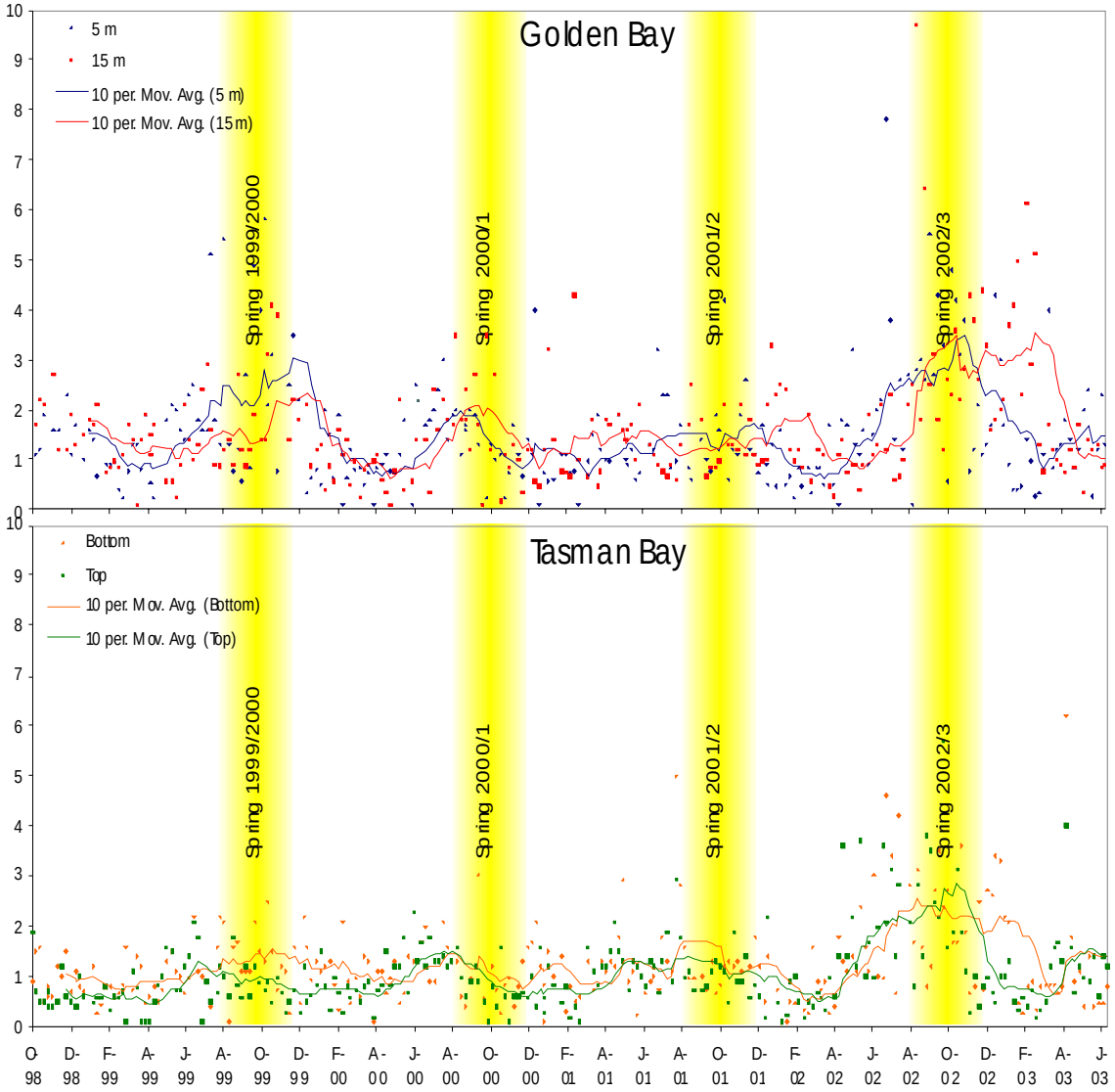
Comparison of scallops on the seabed with others held in cages above the seabed

% Benthic ■ vs planktonic ■ microalgae in scallop guts

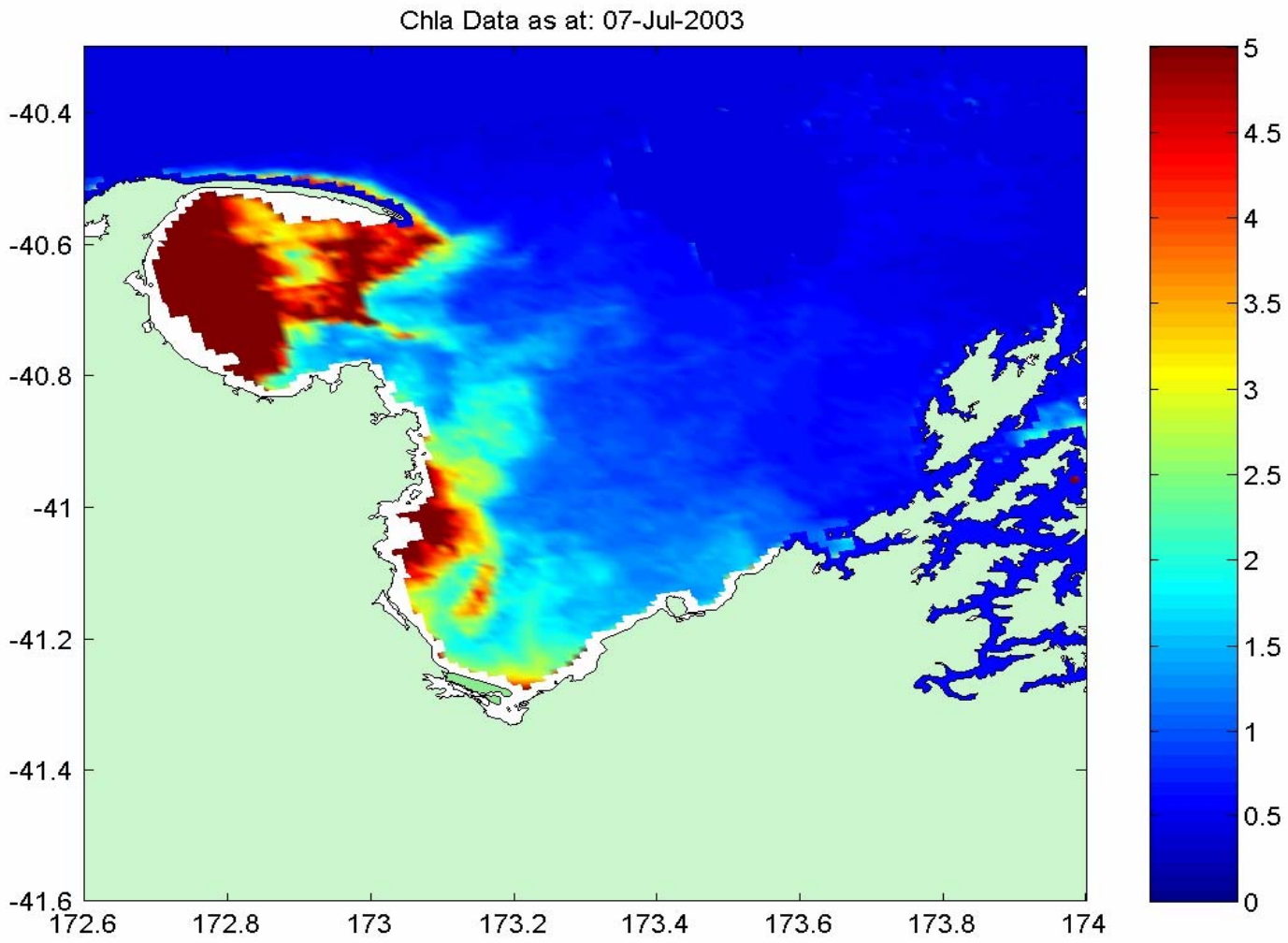


Analyses before (a) and during (b) a phytoplankton bloom (*Prorocentrum balticum*)

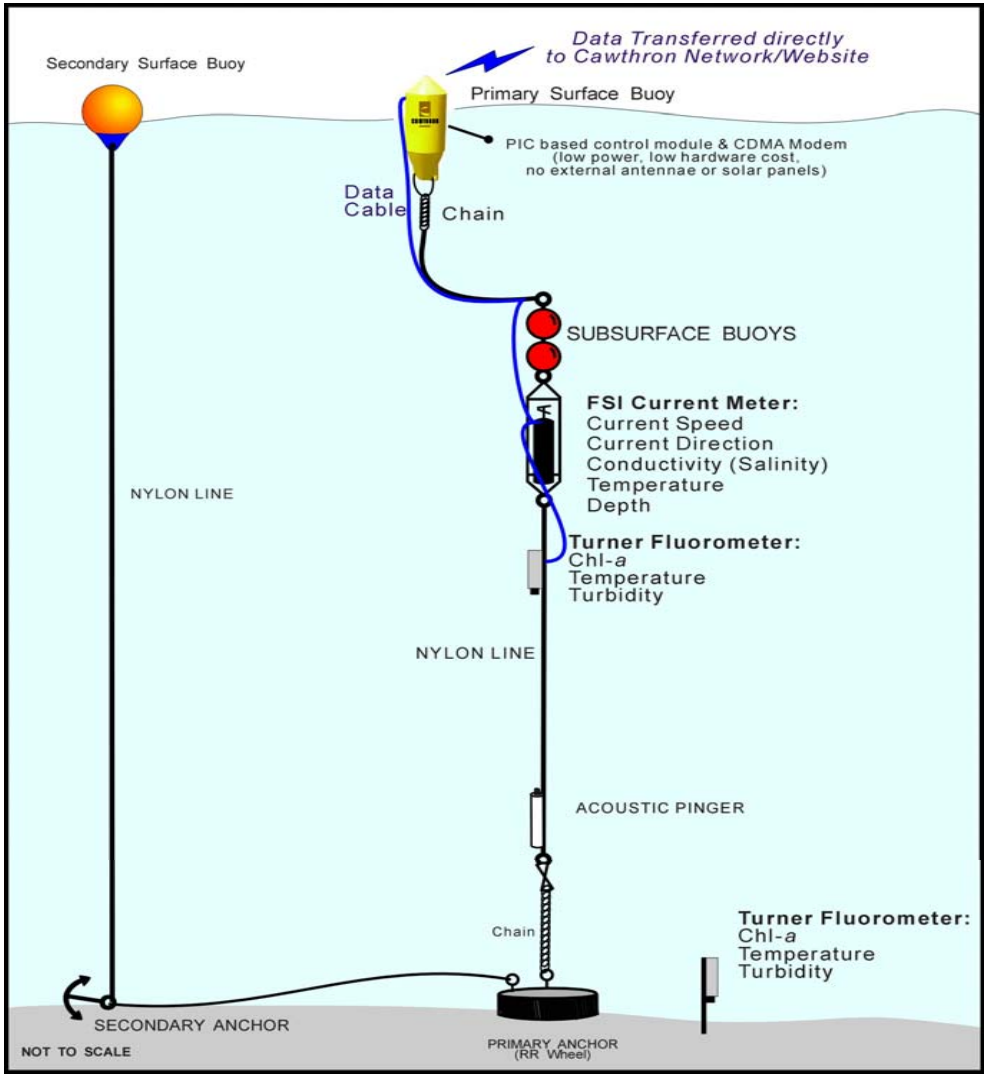
Long term data collection



Seawifs chlorophyll July 2003



Buoy-mounted data sensors



LT *in situ* data collection, satellite imagery, coastal models

- An integrated system of tools that can be used to assess and possibly forecast marine productivity

Uses…

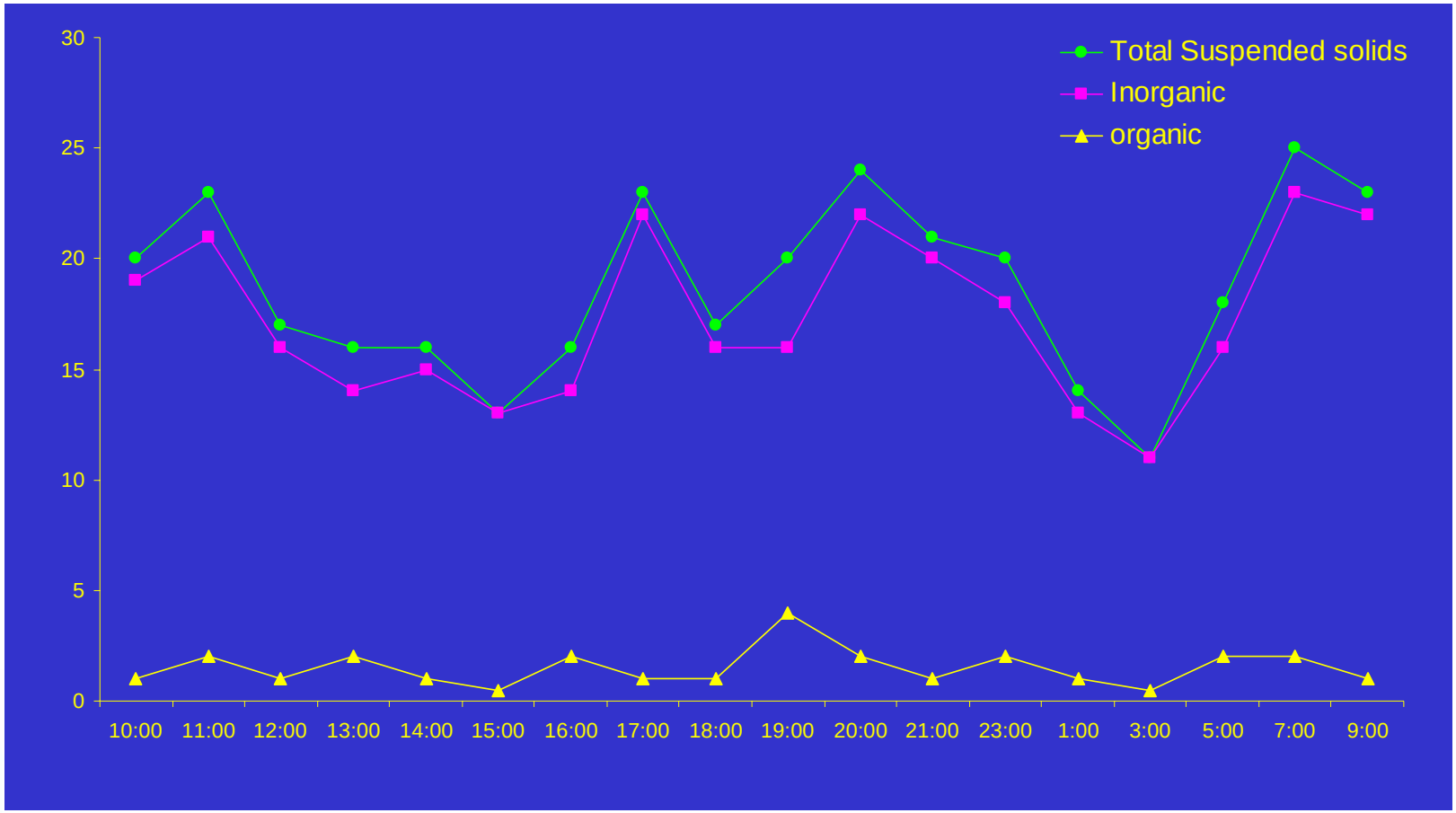
- Validation of ecosystem components of coastal model
- Management decisions based on real-time environmental conditions (e.g. where to focus scallop seeding efforts)
- Monitoring (e.g. storm effects, aquaculture effects)
- Predictions based on climate/weather forecasting

Sediment effects

- Near bottom high turbidity layer
  - Sediments delivered from the catchment during storm events.
  - Sedimentation and resuspension processes
  - Strong gradient (on a scale of centimeters) with water layers above
  - The proportion of inorganic/organic particles effects the nutritional value

Sediment effects

Suspended Solids (g/m³) content of near-bottom waters in Tasman Bay 24-25 Feb 1999



Coastal Models

- Nelson Bays hydrodynamic model
  - Simulations of plume behavior (SS salinity, sedimentation patterns)
  - Planned further simulations of SS and faecal coliform distributions based on calculated and theoretical delivery rates
  - NPZ components to enable simulations of nutrient effects

- Ecopath model
  - Interactions between mussel farms and fishery resources
  - Preliminary estimates of mussel farm ecological carrying capacity