The Motueka River Plume Ecosystem

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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

![Bar chart showing the area (ha) for different habitats over three periods: 2001, 1986, and 1947.](image)
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)
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.
Chromium and nickel concentrations of Motueka River margin sediments (29/6/05).

A. Whole sediments

B. Normalised sediments
Stratification (water column stability)

7-8 March 2001

9-10 May 2001
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
Primary Production: Food for benthic filter feeders

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

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

On seabed 0.5 m 2 m

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

(a) (b)
Long term data collection

Golden Bay

Tasman Bay
Seawifs chlorophyll July 2003

Chla Data as at: 07-Jul-2003
Buoy-mounted data sensors

- Data transferred directly to Cawthron Network/Website
- PIC based control module & CDMA Modem (low power, low hardware cost, no external antennas or solar panels)

**Subsurface Buoys**
- FSI Current Meter:
  - Current Speed
  - Current Direction
  - Conductivity (Salinity)
  - Temperature
  - Depth

- Turner Fluorometer:
  - Chl-a
  - Temperature
  - Turbidity

**Not to Scale**
- Primary Anchor (45° Steel)
- Secondary Anchor
- Nylon Line
- Acoustic Pinger
- Data Cable
- Chain
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

- Total Suspended solids
- Inorganic
- Organic
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