Project: **Freshwater quality, quantity and health**

Leader: Roger Young (Cawthron Institute, roger.young@cawthron.org.nz, (03) 548 2319)

Collaborators: Karen Shearer, John Hayes, Anna Crowe, Aaron Quarterman (Cawthron Institute)
Rob Smith, Joseph Thomas, Neil Tyson (Tasman District Council)
Les Basher, Chris Phillips, Garth Harmsworth (Landcare Research)
Neil Deans, Lawson Davey (Fish & Game NZ – Nelson-Marlborough region)
Martin Rutledge (DoC)
Rebekah Eyles (University of Otago)
Rob Davies-Colley, John Nagels, Murray Hicks (NIWA)

Issues: Does land use and geology influence water quality and stream health? How much water can be abstracted from small streams before important values are compromised? Is fine sediment the cause of the perceived decline in the trout fishery? Do fish move to escape from low flows? If so, what are the cues for movement? Can we predict the effects of land use change on freshwater ecosystem health?

Objectives:

- Understand the factors controlling water quality and stream health
- Produce a tool to help manage water abstraction from small streams
- Measure the impact of sediment on stream health
- Determine catchment-wide patterns of fish movement and an understanding of the cues for these movements
- Develop models capable of predicting impacts of different scenarios on freshwater ecosystem health

Progress and Outputs:
Monthly water quality sampling carried out at 23 sites throughout the catchment. Ongoing quarterly sampling at these sites carried out by TDC. Results presented to community reference group and at several national conferences. Draft paper prepared for publication.

Stream invertebrates sampled at 46 sites around the catchment to determine ecosystem health. Results presented to community reference group, ICM AGM, and at an international scientific conference. Draft paper prepared for publication.

Trials of simple methods for predicting change in water depth, velocity and width with flow carried out in the Rainy, Tadmor and Brooklyn. Comparisons with more detailed habitat assessment show reasonable agreement. Report prepared and distributed to stakeholders, article published in popular magazine, results presented to community reference group.

Implications: Geology and land use appear to be the main factors controlling water quality and ecosystem health in the Motueka River. Some water quality variables, such as conductivity and pH, are primarily influenced by geology, while others such as nutrient and pathogen concentrations reflect differences in land use. In contrast, water temperature, suspended sediment and clarity appear to be controlled by both geology and land use. Hot spots of pathogen contamination were identified, which has led to action from land owners and TDC to reduce inputs to waterways.

According to the stream invertebrate communities found at the sampling sites, the majority of the Motueka River ecosystem is in good health. Sites in the headwaters are particularly healthy, while there are some concerns in the lower tributaries. Streams draining Ultramafic geology in the headwaters are characterized by low invertebrate densities and diversity, while streams draining native forest on the other geological types in the catchment appear to be relatively similar. Comparisons of pastoral, exotic forest and native forest sites on Moutere Gravel and Separation Point Granite terrains indicated that native forest sites were consistently healthier than pastoral streams. Interestingly, exotic forest streams draining Separation Point Granite had high quality invertebrate communities (similar to native forest), while those draining Moutere Gravels were more degraded and similar to pastoral streams. To some extent this is the opposite of what we expected given the concerns about erosion from Separation Point granites. However, significant amounts of fine clays are washed into Moutere Gravel streams after rainfall and may affect stream invertebrate communities.

Erosion of granite produces large quantities of coarse sand, but perhaps sand is not so damaging to invertebrate communities, or alternatively only gets into streams during extreme rainfall events or after major land disturbance. An alternative explanation for these results could relate to low flows prior to our sampling, which may have been more severe in water-short Moutere Gravel areas and particularly in streams draining water-hungry exotic forest.

Preliminary testing of simple methods of predicting changes in in-stream habitat with flow have shown that these techniques have some promise. An alternative approach involving 2-dimensional stream bed measurements is also being examined to see if simple desk-top only predictions might also be possible given a 'library' of river bed types.

Future Directions: Over the next 9 months we will be focusing on techniques for predicting changes in small-stream habitat with flow. We will also be investigating if cultural and landscape values can be incorporated into these tools. A review of sediment impacts will also be conducted along with a review of fish movements in response to low flows. These reviews will provide a basis for future studies on catchment-wide fish movements using radiotagging (and perhaps chemical tracing techniques) and on sediment impacts.